How Safe are Money Market Funds?

Marcin Kacperczyk* **Philipp Schnabl†**

This draft: December 2012‡

Abstract

We examine the risk-taking behavior of money market funds during the financial crisis of 2007-2010. We find that: (1) money market funds experienced an unprecedented expansion in their risk-taking opportunities; (2) funds had strong incentives to take on risk because fund inflows were highly responsive to fund returns; (3) funds sponsored by financial intermediaries with more money fund business and greater financial strength took on more risk; (4) funds suffered runs as a result of their risk taking. This evidence suggests that money market funds lack safety because they have strong incentives to take on risk when the opportunity arises and are vulnerable to runs.

*Department of Finance Stern School of Business and NBER, New York University, 44 W. 4th Street, New York, NY 10012; mkacperc@stern.nyu.edu.

†Department of Finance Stern School of Business, CEPR, and NBER, New York University, 44 W. 4th Street, New York, NY 10012; schnabl@stern.nyu.edu.

‡We thank Viral Acharya, Anat Admati, Ashwini Agrawal, Geraldo Cerqueiro, Alex Chinco, Jess Cornaggia, Peter Crane, Martijn Cremers, Kent Daniel, Itamar Drechsler, Darrell Duffie, Andrew Ellul, Mark Flannery, Itay Goldstein, Harrison Hong, Ravi Jagannathan, E. Han Kim, Sam Lee, Patrick McCabe, Holger Mueller, Stefan Nagel, Yihui Pan, Lasse Pedersen, Amiyatosh Purnanandam, Uday Rajan, Alexi Savov, David Scharfstein, Amit Seru, Andrei Shleifer, Laura Starks, Philip Strahan, and seminar participants at the NBER Summer Institute, AFA Conference, CEAR Conference, CEPR Gerzensee, Chicago Booth/Deutsche Bank Symposium, Chile Finance Conference, Napa Conference on Financial Markets Research, Paul Wooley Conference on Financial Intermediation, Texas Finance Festival, UBC Summer Finance Conference, Utah Winter Finance Conference, Boston College, Harvard University, Indiana University, MIT Sloan, National Bank of Poland, New York University, Oxford University, Philadelphia Federal Reserve, University of Illinois at Urbana-Champaign, University of Michigan, University of Nottingham, University of Toronto, University of Warwick, and Western Asset Management for helpful comments. This paper has been formerly distributed under the title: "Implicit Guarantees and Risk Taking".

I Introduction

Money market funds have been at the center of attention during the financial crisis of 2007-2010. Following the bankruptcy of Lehman Brothers in 2008, a well-known fund—the Reserve Primary Fund—suffered a run due to its holdings of Lehman's commercial paper. This run quickly spread to other funds, triggering investors' redemptions of more than $300 billion within a few days of Lehman's bankruptcy. Its consequences appeared so dire to financial stability that the U.S. government decided to intervene by providing unlimited insurance to all money market fund depositors. The intervention was successful in stopping the run but it transferred the entire risk of the $3 trillion money market fund industry to the government.

This turmoil in the money fund industry came as a surprise to most market participants. Prior to the run, investors regarded money funds as a low-risk investment that was almost as safe as cash. Indeed, for most of their history, money funds had invested in safe assets and had generated returns similar to those of U.S. Treasuries. However, during the early part of the financial crisis the average fund return increased relative to that of U.S. Treasuries. As shown in Figure I, the return was 15 basis points before August 2007, and increased to 90 basis points after August 2007. Moreover, the cross-sectional dispersion in fund returns increased from less than 30 to over 150 basis points. This sudden increase in the level and the dispersion of fund returns suggests that the underlying asset risk of the funds changed fundamentally.[1]

In this paper, we ask two questions: How risky are money market funds? And what explains the cross-sectional variation in risk across funds? The answers to these questions are important for at least two reasons. First, money funds are large financial intermediaries that are crucial to financial stability in the United States. They are the largest provider of short-term financing in the economy, similar in size to the entire sector of equity mutual funds, and also the largest provider of liquidity to corporations, issuing about the same amount of demand deposits as the

[1]The crisis had also a wide-reaching impact on other parts of money markets, such as the repo market (Gorton and Metrick (2009)); unsecured and asset-backed commercial paper (Brunnermeier (2009), Kacperczyk and Schnabl (2010), Acharya, Schnabl and Suarez (2012)); Treasuries market (Krishnamurthy and Vissing-Jorgensen (2010)); and banks' funding liquidity on credit supply (Cornett, McNutt, Strahan and Tehranian (2011)).

entire U.S. commercial banking sector. Second, money funds are sponsored by large financial companies that also offer other mutual funds and financial services. Thus, understanding their safety and risk-taking incentives can shed light on the risk of other parts of the financial system.[2]

Our analysis delivers four main results. First, money funds experienced an expansion in their risk-taking opportunities starting August 2007. Money market fund regulation requires funds to invest exclusively in highly rated, short-term debt securities. As shown in Figure II, the spread between eligible money market instruments and U.S. Treasuries was at most 25 basis points prior to August 2007, thus leaving little scope for risk taking. However, starting from August 2007, the collateral and liquidation values underlying some instruments started to decline due to the U.S. subprime mortgage crisis. As a result, the spread between risky instruments, such as unsecured bank obligations, and safe instruments, such as U.S. Treasuries, increased from 25 to 125 basis points. Hence, for the first time since their origin in the 1970s, money funds had a choice to invest in assets with a substantial risk premium relative to safe government securities.[3]

Second, money market funds had strong incentives to take on risk. Our analysis reveals that fund flows are highly responsive to past returns: A one-standard-deviation increase in fund returns raises annualized fund assets by 46%. This effect is economically large given that money funds charge their investors a fixed share of assets under management. The relationship is robust to including various controls, such as fund age, expenses, assets size, fund-flow volatility, family size, and fund-fixed effects. Also, the relationship is stronger after August 2007 and coincides with the expansion in risk-taking opportunities taking place after the start of the crisis.

Third, we examine risk taking using weekly data on the universe of institutional prime funds.[4] Our empirical proxies for fund risk are: (1) the share of risky assets holdings, proxied by fund investments in bank obligations, net of the share in safe assets holdings, proxied by holdings of

[2]Money funds have been discussed in Christoffersen (2001), Christoffersen and Musto (2002), Kacperczyk and Schnabl (2010), McCabe (2010), Squam Lake Group (2011), Wermers (2011), and Strahan and Tanyeri (2012).

[3]Historically, there were other periods during which the returns on risky money fund instruments were elevated for short periods. However, none of the episodes lasted for more than a few weeks.

[4]We focus on these funds because we do not expect the subprime crisis to have an economically meaningful effect on Treasury funds, which invest solely in government securities, and retail funds, whose investors tend to react slowly to any yield differentials across funds.

Treasuries and repos (holdings risk); (2) the value-weighted maturity of fund holdings (maturity risk); (3) the fund return relative to that of Treasury Bills (spread).

We find that two observable fund characteristics predict funds' risk taking. The first characteristic is the extent to which a fund sponsor has interests in businesses (business concerns) other than money funds. Such business concerns should reduce risk taking because we expect a fund sponsor to suffer large costs if its money fund fails. The costs are typically reputational in nature, in that an individual fund's default generates negative spillovers to the fund sponsor's remaining operations. In practice, we expect these costs to be either outflows from other mutual funds managed by the same sponsor or a loss of business in the sponsor's commercial banking, investment banking, or insurance operations.

We find strong evidence that an increase in a sponsor's business concerns reduces funds' risk taking. A one-standard-deviation increase in a sponsor's mutual fund assets other than institutional prime money market funds as a share of total assets (*Fund Business*) reduces holdings risk by 3.6 percentage points, maturity risk by 2.3 days, and spread by 3.0 basis points. This result is economically significant in that each respective effect accounts for 14.5%, 18.9%, and 18.3% of the cross-sectional standard deviation of each risk measure. Also, if a fund sponsor is affiliated with a financial conglomerate involving a commercial bank, investment bank, or insurance company (*Conglomerate*), then risk drops by 27.1%, 13.9%, and 44.7% of the cross-sectional standard deviation of each risk measure. In contrast, we do not find any impact of these measures on fund risk before the financial crisis.

The second characteristic that predicts risk taking is a fund sponsor's financial strength. The direction of the relationship with risk taking is theoretically ambiguous. On the one hand, higher financial strength may increase risk taking because the sponsor has the option to limit negative spillovers by bailing out failing funds. On the other hand, higher financial strength may reduce risk taking if a fund sponsor expects to bail out failing funds under all circumstances.

We find that greater financial strength increases risk taking. We estimate this relationship separately for financial conglomerates and independent asset managers because this allow us to

use financial strength proxies that are particularly suited for each sponsor type and because a fund's affiliation with a conglomerate may be correlated with business concerns. For financial conglomerates, a one-standard-deviation reduction in the natural logarithm of a sponsor's CDS price increases holdings risk by 6.6 percentage points, maturity risk by 4.9 days, and spread by 3.9 basis points. This result is statistically and economically significant in that each respective effect accounts for 26.6%, 40.1%, and 23.1% of the cross-sectional standard deviation of each risk measure. Likewise, for independent asset managers we find that having a credit rating increases holdings risk by 8.2 percentage points, maturity risk by 1.7 days, and spread by 7.8 basis points.[5]

Fourth, we examine the run on money market funds after Lehman's bankruptcy. We focus on the one-week period after Lehman's bankruptcy because the run stopped after the government provided unlimited deposit insurance to all funds. We find that sponsors with more business concerns suffered smaller runs and were more likely to provide financial support (even after controlling for risk taking before the run). Moreover, funds with more business concerns were more likely to exit the industry, consistent with the notion that negative expected spillovers are larger for this group. Among the funds that remained in business, we find that some funds changed their names to incorporate their sponsors' names, which suggests that sponsors aimed to make their support more salient after the run. These results suggest that money funds are vulnerable to runs and fund sponsors adjust their fund offerings because of the run.

We conduct several robustness tests. One possible concern is that, even if a sponsor's business concerns and financial strength were not chosen to accommodate risk taking, these measures might be correlated with other (unobserved) sponsor characteristics that directly affect risk taking. For example, they may be correlated with a sponsor's quality of risk management, risk aversion, investment style, or access to private information. These variables would explain our results to the extent that the unobserved sponsor characteristics affect risk taking after (but

[5]Our finding complements work on the effect of bailouts on risk taking, which has examined the role of deposit insurance and bank charter (Keeley (1990)), managerial control (Saunders, Strock and Travlos (1990)), monitoring by depositors (Esty (1997)), and provision of systemic guarantees (Kelly, Lustig and Van Nieuwerburgh (2011)).

not before) August 2007. This may be the case if, for example, the quality of risk management matters for risk taking only in times of greater risk-taking opportunities.

To address this concern, we study the differences between institutional and retail funds. Our analysis focuses on funds offered to institutional investors; yet, the same sponsors also offer funds to retail investors. Retail funds constitute a useful placebo group because the flow-performance relationship for this group is smaller and thus their risk-taking incentives are weaker. This prediction is specific to our economic mechanism of business concerns and does not apply to other mechanisms that could explain risk taking, such as the quality of a sponsor's risk management. Indeed, we find that sponsors' business concerns have no effect on the risk taking by retail funds.

In another test, we exploit the time-series variation in the likelihood of runs. Following the run on money markets in September 2008, the government introduced unlimited deposit insurance, which effectively replaced the sponsors' role in providing support. Thus, if the presence of negative spillovers causes the differences in risk taking, we should expect smaller differences in risk taking after the government guarantee was announced. This is exactly what we find.

Overall, our main message is that money market funds lack safety relative to other safe instruments, such as bank deposits or Treasury Bills, because they have strong incentives to take on risk when the opportunity arises but they are vulnerable to runs once the risk materializes.

The rest of the paper proceeds as follows. Section II describes our research setting. Section III summarizes the data. Section IV discusses the identification strategy and presents empirical results. Section V concludes.

II Institutional Setting: Money Market Funds

II.1 Primer on money market funds

Money market funds emerged in the 1970s as an alternative to bank deposits. At that time, bank deposits were highly regulated and paid lower interest rates than did money market instruments, which made money funds attractive to investors as they paid higher interest for taking on

comparable risks. Even though the regulation of bank deposits was eventually abolished, the size of the fund industry grew steadily over time up to $2.4 trillion at the beginning of 2007 (see Federal Reserve Flow of Funds Data).

An important characteristic of money funds is that, contrary to bank deposits, investments in the funds are not insured by the government. But, contrary to regular mutual funds, money funds seek to preserve the value of their assets at $1 per share. They do so by using historical cost accounting, rather than market value pricing, to assess the value of their holdings. This allows them to sell demand deposits that are considered almost as safe as bank deposits. The downside of this approach is that it exposes them to runs. If the market value of a fund's holdings is expected to drop below its amortized cost, investors tend to redeem their shares, which can exacerbate the market value drop due to forced liquidation at fire-sale prices. Also, funds may suffer losses on their investments because of changes in interest rates or individual securities' defaults.

To limit risks of money market funds, they have been regulated under Rule 2a-7 of the Investment Company Act of 1940. This regulation restricts fund holdings to short-term assets and prevents funds from purchasing long-term assets such as mortgage-backed securities, corporate bonds, or equity. Moreover, it requires short-term debt to be of high credit quality. For example, it limits commercial paper holdings to those that carry either the highest or second-highest rating from at least two of the nationally recognized credit rating agencies. Also, the regulation requires portfolio diversification: Money market funds must not hold more than 5% of their assets in securities of any individual issuer with the highest rating and not more than 1% of their assets in securities of any other individual issuer.

To provide an overview of the various money market instruments held by money market funds, we use data provided by iMoneyNet. These data are the most comprehensive source of money market funds' holdings. We focus on taxable funds because non-taxable funds hold tax-exempt instruments issued by state and municipal governments, which are not the focus of our study. Taxable funds account for 84.5% of all assets under management.

As of January 2006, there were 485 taxable funds, sponsored by 148 companies, holding assets worth $1.67 trillion. About $396 billion, or 23.8% of total assets, were held by Treasury funds, which only hold government debt, government-backed agency debt, and repurchase agreements. The remaining $1.26 trillion, or 76.2% of total assets, were held by prime funds that also invest in non-government assets. Among the prime funds, 57% were institutional funds and 43% were retail funds. The largest asset class held by prime funds was commercial paper, accounting for $325.3 billion, or 25.6% of total assets. The other asset classes were floating-rate notes ($265.9 billion), bank obligations ($235.3 billion), asset-backed commercial paper ($186.3 billion), repurchase agreements ($151.1 billion), government debt and government-backed agency debt ($62.5 billion), and bank deposits ($39.4 billion).

Most large funds are geared towards institutional investors. As of January 2006, the twenty largest institutional prime funds accounted for a total of $429 billion worth of assets. The largest fund was the J.P. Morgan Prime Money Market Fund with assets under management equal to $68.1 billion, followed by Columbia Cash Reserves and BlackRock Liquidity, which were about half the size. The last fund on the list, Dreyfus Institutional Cash Fund, still managed a considerable $12.6 billion. On average, the funds were well diversified across asset classes but highly exposed to risks in the financial industry as a whole. Assets originated by the financial industry—measured as a total of financial commercial paper, structured securities, bank obligations, and repurchase agreements—accounted for 91.4% of money market fund assets.

II.2 Money market funds during the financial crisis

II.2.1 Change in risk-taking opportunities

Money funds played an important role in the financial crisis of 2007–2010. Prior to August 2007, fund regulation effectively prevented the funds from investing in risky assets. As a result, money funds invested in similar assets and paid similar returns. However, starting from August 2007, a number of events changed the funds' risk-taking opportunities. On August 9, 2007, the French bank BNP Paribas halted withdrawals from its three funds invested in mortgage-

backed securities and suspended calculation of their net asset values. Even though defaults on mortgages had been rising throughout 2007, the suspension of withdrawals by BNP had a profoundly negative effect on money market assets. Within one day, the interest rate spread of overnight asset-backed commercial paper over the Fed funds rate rose from 10 to 150 basis points, possibly because investors became concerned about the credit quality and liquidation values of collateral underlying money market instruments and stopped rolling over these instruments.

Even though money funds suffered almost no losses from impaired asset-backed commercial paper because these assets were effectively insured by commercial banks, going forward, it became clear that liquidation values of money market instruments were lower and that new issuances had to offer higher risk premia. Similar increases in risk premia also built up in other instruments that were perceived as risky—bank obligations, floating-rate notes, and commercial paper. At the same time, the rates of assets that were perceived as safe, such as Treasuries, repurchase agreements, and bank deposits, remained at much less elevated levels.

Figure II presents evidence of the sudden change in relative asset returns.[6] From January 2005 to July 2007, all asset classes had returns of about 15 to 25 basis points relative to those of U.S. Treasuries and agency debt. However, beginning with August 2007, the returns on risky asset classes started to increase rapidly with a peak in March 2008 when relative returns reached 125 basis points. After March 2008, the returns started to decline but still remained at a high 60 basis points as of August 2008. Over the same period, the returns on safe asset classes remained constant at around 20 basis points or even declined. In sum, the start of the financial crisis in August 2007 provided money funds with the opportunity to invest in riskier assets.[7]

[6]The returns on individual asset classes are not directly observable to us, but we can impute them using fund-level data on returns and holdings. To this end, we regress fund returns on interaction terms of indicator variables for each asset class and month-fixed effects plus standard controls. For each asset class, the corresponding interaction term captures the monthly return relative to that of U.S. Treasuries and agency debt.

[7]The observed variation in returns on risky and safe assets coincided with key events during the crisis. First, the expansion in risk-taking opportunities occurred at the same time as did the run on asset-backed commercial paper in August 2007. Further, the peak in returns of risky assets happened at the same time as the near-bankruptcy of the investment bank Bear Stearns. Finally, the decline in relative returns prior to August 2008 and the sudden spike in September 2008 (not shown in the Figures) matched market conditions around the Lehman's bankruptcy. Indeed, common indicators of market distress during the crisis, such as the LIBOR-OIS spread, exhibited similar time-series patterns as did the returns on risky asset classes of money funds.

II.2.2 Tale of two funds: Reserve Primary Fund and Fidelity Institutional Prime

We illustrate the response to these risk-taking opportunities with an example of two funds: the Reserve Primary Fund (RPF) and the Fidelity Institutional Prime (FID). The RPF was particularly well known in the industry because its owner, Bruce Bent, was the founder of the first money market fund. Until July 2007, each fund managed about $25 billion in assets and charged similar management fees. In what follows, we present the evolution of each fund's returns, assets, and holdings over the period from August 2006 to August 2008.

In Figure III, we present the returns of both funds relative to the value-weighted industry average. Prior to August 2007, the returns of the two funds roughly matched the industry average. However, starting in August 2007, the relative returns diverged sharply: The return on RPF increased by about 50 basis points while the return on FID stayed constant. The return differential triggered significant differences in money flows. Relative to the average asset growth of all institutional prime funds, RPF increased its assets under management by 140%, while FID's assets value grew only by 40% by August 2008.

The observed differences in both returns and fund flows were largely a consequence of the differences in the underlying fund portfolios after August 2007. Figure IV shows that RPF increased its holdings of risky assets from 0% to 60% while it reduced its exposure to U.S. Treasuries and repurchase agreements from 40% to 10%. In contrast, the share of risky assets held by FID remained steady in 2008.

We argue that the difference in risk taking between RPF and FID can be largely attributed to the difference in their sponsors' non-money market fund business. While RPF was managed by an independent fund company with almost no other funds under management, FID's manager—Fidelity—sponsored a large number of mutual funds and thus faced a significant concern of negative spillovers from FID to its other funds. In fact, as of January 2006 the share of other fund business in Fidelity's operations equaled 93.9%. As it turns out, the underlying difference in the negative spillover risk was a crucial determinant of how each fund chose its own risk levels and how each of them absorbed the shocks related to the Lehman Brothers' bankruptcy.

II.2.3 Collapse of the Reserve Primary Fund and money market fund runs

One of the important assets among RPF's holdings was commercial paper issued by Lehman Brothers. According to quarterly SEC filings, RPF had no holdings of Lehman's commercial paper prior to August 2007, but by November 2007 the fund had purchased $375 million worth of Lehman paper. By May 2008, the fund further increased its Lehman's holdings to $775 million, which at the time accounted for about 1% of its holdings.

On September 15, 2008, Lehman Brothers declared bankruptcy. Its failure triggered a panic in financial markets and led to a credit market freeze. As a result of the bankruptcy, the net asset value of RPF fell below $1 per share. The revelation of the fund's exposure to Lehman's risk triggered an immediate run on the fund. On September 16, 2008, the fund was forced to pay $10.8 billion in redemptions and faced $28 billion of additional withdrawal requests. The fund's sponsor did not have sufficient financial resources to guarantee payments and was forced to halt redemptions. The run on RPF quickly spread to other money funds. Within a week, institutional investors reduced their investments in money funds by more than $172 billion.

Eventually, several funds became distressed and the consequences of the redemptions became dire. To stop the run on funds, on September 19, 2008, the U.S. Department of the Treasury announced an explicit deposit insurance covering all money fund investments made prior to Lehman's bankruptcy. This announcement stopped the run and redemption requests receded shortly after. However, the announcement meant that the U.S. government had effectively insured the credit risk of $3 trillion in fund assets holdings.

III Data and Summary Statistics

Our study makes use of six data sources. First, we obtain data on the universe of taxable money market funds from iMoneyNet, which cover the period from January 2005 to September 2011 and include weekly fund-level data on returns, expense ratios (charged and incurred), average maturity, holdings by asset class, and fund sponsor. Second, we complement the data with

information from the CRSP Mutual Fund Database, especially assets under management by the same fund sponsor. Third, we use COMPUSTAT and companies' websites for information on fund sponsor characteristics. Fourth, we use S&P RatingsXpress, Lehman Brothers' Bond Database, COMPUSTAT, and companies' websites to collect data on credit ratings. Fifth, we gather data on sponsors' CDS prices come from Datastream. Sixth, we collect data on no-action letters issued by the SEC—an indication that a sponsor provided financial support to its fund. For funds with multiple share classes, we eliminate the duplicated funds and compute the fund-level variables by aggregating across the different share classes.[8] Altogether, we obtain a novel data set that, to the best of our knowledge, has not been used in academic research before. Additional details on the data collection and data construction are presented in the Appendix.

Column (1) of Table I provides summary statistics for all institutional prime money funds (henceforth, prime funds) as of January 2006. Our sample includes 148 funds. The average fund size is $4.9 billion and the average fund age is 10.6 years. We compute the annualized spread as the fund return (before expenses) minus the return on the one-month Treasury Bill. The average spread is 6.9 basis points and the average expense ratio is 32 basis points. In terms of assets holdings, funds hold 32.0% in commercial paper, 19.8% in floating-rate notes, 13.5% in repurchase agreements, 13.4% in asset-backed commercial paper, 12.2% in bank obligations, 6.0% in U.S. Treasuries and agency-backed debt, and 3.2% in deposits.

Next, we divide fund sponsors into two groups based on the size of their business concerns. Our primary measure of business concerns is *Fund Business*, defined as the sponsor's total mutual fund assets (excluding prime funds) as the share of total sponsor's fund assets. The idea behind this measure is that fund families with more assets under management in non-money market funds have more at stake in case their money market fund faces distress.

Column (2) provides summary statistics for funds whose sponsors have *Fund Business* above

[8]In our data, some funds offer both retail and institutional share classes. Institutional shares are generally larger; hence, we classify a fund as institutional if it offers at least one institutional class and as retail if it does not offer institutional share classes. As a robustness check, we also estimate our main regressions for funds that offer only institutional shares. The coefficients are stable and remain statistically significant (albeit standard errors slightly widen because of the reduction in observations).

the median value of 81.6% as of January 2006, and column (3) for funds whose sponsors have the values below the median. Funds associated with sponsors of both high and low business concerns are similar in terms of their characteristics. The only difference is that funds sponsored by firms with high business concerns are on average more likely to be part of financial conglomerates. In fact, the affiliation with a conglomerate (i.e., commercial bank, investment bank, or insurance company) defines our second measure of business concerns (*Conglomerate*). This measure complements our first measure in that it captures the broader idea of a franchise value at stake, as is the case for financial conglomerates. The downside of that measure is that it ignores the variation in business concerns within each sponsor type. In our tests, we therefore use both measures bearing in mind that each one captures a slightly different type of cross-sectional variation in the data.[9]

IV Empirical Strategy and Results

IV.1 Determinants of sponsors' risk-taking incentives

This section analyzes the risk-taking incentives of money funds. In general, the incentives depend on the shape of a fund's payoff function, which in turn is determined by the benefits and costs of risk taking. On the benefit side, funds typically experience large inflows as a result of high returns. On the cost side, excessive risk taking can trigger a run on a fund. If there is a run, fund sponsors have the option, but not the obligation, to support failing funds. Hence, fund sponsors have a kinked payoff function with the kink point being the payoff if a sponsor chooses *not* to support a failing fund.[10] We expect that funds with a more convex (less concave) payoff function take on more risk once the opportunity arises.

[9] We also considered another measure of business concerns that additionally accounts for the size of the sponsor's total assets, which is especially important for financial conglomerates. However, this measure implicitly assumes that both fund assets and other types of assets carry equal weight in the sponsor's business concerns, which makes its interpretation slightly problematic. Our results nevertheless remain unchanged.

[10] In our tests, we assume that a fund's sponsor can set a fund's risk. In doing so, we abstract from agency problems between the fund sponsor and fund manager. We believe this assumption is plausible in the money fund industry because a fund's portfolio risk is observable and there is little scope for manager skill in portfolio choice.

Importantly, fund sponsors face additional costs if they choose not to bail out failing funds, which reduces the convexity of the payoff function. Specifically, many investors expect fund sponsors to provide financial support to their funds in case of a run. Even though fund sponsors have no contractual obligation to do so, they may find it optimal because of negative spillover costs to other parts of the sponsor's business. Such costs are typically reputational in nature, in that an individual fund's default could generate outflows from other mutual funds managed by the same sponsor, or a loss of the sponsor's general business.[11]

We analyze the effect of such negative spillover costs on risk taking. We expect that the costs should depend on two factors: the loss in sponsor business due to a run in case of a spillover (business concerns) and the likelihood of a spillover, which depends on the sponsor's ability to avoid a run through a bailout (financial strength). In our empirical tests, we examine whether fund sponsors' concerns over their non-money fund business reduce their funds' risk and whether financial strength affects their willingness to invest in risky assets.[12]

Our hypothesis requires that investors do not fully anticipate the importance of negative spillovers in fund choices and thus they do not completely risk adjust returns based on sponsor characteristics. There are several reasons why this assumption can be justified in the context of money funds. First, until the recent financial crisis, fund investors had little experience with runs given the absence of such events in the past. Second, since fund investors are small relative to fund size in which they invest, they suffer from a free-rider problem in acquiring information about the fund safety. Third, rather than scrutinize sponsors' willingness and ability to support funds, investors that worry about the risks of money funds are likely to choose other investment products, such as banks deposits.[13]

[11]This expectation is evident in an investor alert by the Financial Industry Regulatory Authority (FINRA), which states: 'Typically, there has been an expectation that when a money market fund reaches a point where it might break the buck, the investment management firm that sponsors the fund will take action to infuse the fund with cash so that the fund can maintain a stable NAV of $1.00 per share.' (FINRA (2010)).

[12]In our framework, we interpret the extent of business concerns and financial strength as empirical proxies for the convexity of the fund sponsor's payoff function. We focus on these variables because both are featured prominently in industry studies on money funds. However, there might be other variables that affect the fund's payoff function. Hence, our framework is an example of how variation in the payoff function affects risk taking.

[13]This evidence is consistent with theoretical models that show that the expected benefit of learning such information is low relative to the cost of acquiring such information (Dang, Gorton and Holmstrom (2009)). It

An important advantage of our setting is that money funds played a negligible role in shaping most fund sponsors' structures prior to August 2007. They typically constituted a small part of larger fund families and the choice regarding the fund family's organization profile was likely independent of money funds themselves. Further, money funds paid similar returns and there was little scope for exploiting private information or superior managerial ability. In other words, money funds were considered a low-fee, low-cost business that invested in safe assets and was offered in conjunction with other, more profitable funds. The degree of sponsors' incentives was thus primarily driven by the characteristics of the entire mutual fund family of which money funds were only a minor consideration. In support of this claim, Table I shows that funds sponsored by firms with low business concerns—one of the determinants of risk taking—were similar to funds sponsored by firms with high business concerns.

IV.2 Expansion of investment opportunities

We document the change in opportunities to take risk using weekly data on fund holdings and fund returns in the following regression model:

$$Spread_{i,t+1} = \alpha_i + \mu_t + \beta_j Holdings_{i,j,t} + \gamma \mathbf{X_{i,t}} + \varepsilon_{i,t+1} \tag{1}$$

where $Spread_{i,t+1}$ is the annualized return before expenses minus the risk-free rate of fund i in week $t+1$, $Holdings_{i,j,t}$ denotes fund i's fractional holdings of asset category j in week t, α_i denotes fund-fixed effects, and μ_t denotes week-fixed effects. The asset categories include repurchase agreements, bank deposits, bank obligations, floating-rate notes, commercial paper, and asset-backed commercial paper. The omitted category is Treasuries and government agency debt. $X_{i,t}$ is a vector of fund-specific controls that includes the natural logarithm of fund size (*Log(Fund Size)*), fund expenses (*Expense Ratio*), fund age (*Age*), and the natural logarithm of the fund family size (*Log(Family Size)*). Our coefficients of interest are β_j, which measure the

is also consistent with models in which investors neglect risks which are not salient to them given the absence of negative events from past data (Gennaioli and Shleifer (2010) and Gennaioli, Shleifer and Vishny (2011)).

return on money market instrument j in week $t+1$ relative to that of Treasuries and agency assets.

We estimate the regression model separately for the *post* period from August 2007 to August 2008 and the *pre* period from January 2006 to July 2007. The post period starts with the subprime crisis in August 2007 and ends right before the market-wide run in September 2008. We do not include observations during the run and the period thereafter because subsequent government interventions significantly altered risk-taking incentives. Our estimation strategy is akin to estimating a standard difference-in-differences regression model. Specifically, the difference in the coefficients of interest, β_j, between the post and pre period is identical to the coefficient one would obtain from estimating such a model.[14] In all regressions, we allow for flexible correlation of error terms within funds by clustering standard errors at the fund level.

Columns (1) and (2) of Table II report the pre-period and post-period results. We find that risky asset classes have significantly larger returns in the post period relative to those in the pre period, whereas safe asset classes have similar returns during both periods. For example, in the post period, the return on a fund fully invested in (risky) bank obligations would have been 87 basis points higher than the return on a fund fully invested in (safe) Treasury and agency debt. The comparable differential in the pre period would have only been 15 basis points. We find similar effects for other risky classes, such as floating-rate notes, commercial paper, and asset-backed commercial paper. In contrast, the return on a fund fully invested in (safe) repurchase agreements would have been 13 to 17 basis points higher than the return on a fund fully invested in Treasury and agency assets, both in the pre and post periods.

One possible concern with the results is that funds with large holdings of risky assets might be also riskier along other unobserved dimensions. These funds may choose the most risky assets within an asset class such that we would overestimate the average impact of holding riskier assets. To address this concern, we introduce fund-fixed effects, which account for any unobserved time-invariant fund characteristics within the pre or post periods.

[14] We choose to report our estimation results separately for the pre and post periods because the results help us to validate our identification strategy which asserts no difference in risk taking in the pre period.

We find quantitatively and qualitatively similar results, as reported in columns (3) and (4). The return on a fund fully invested in bank obligations would have been 93 basis points higher than the return on a fund fully invested in Treasury and agency assets. In contrast, the comparable differential would have only been 7 basis points in the pre period. Hence, our findings are not driven by unobserved time-invariant fund characteristics.

Overall, these results suggest that money funds experienced a large exogenous expansion in their risk-taking opportunities. The expansion was economically large in the sense that the returns on risky asset classes, relative to safe ones, were five folds larger after August 2007, compared to before. Moreover, the expansion was likely exogenous to money market funds as it was caused by financial distress among issuers of money market instruments and not by the funds themselves. Hence, starting in August 2007, funds were given a choice of whether to invest in risky or safe assets.[15]

IV.3 The flow-performance relationship

The main incentive for a fund to increase risk is to raise the fund's revenues. This happens because risk increases fund returns, which in turn translates into greater fund inflows. Given that money funds earn a fixed percentage of assets under management, fund inflows lead to a higher fund income.[16] We therefore assess the benefits of investing in riskier asset classes by estimating the sensitivity of fund flows to past returns using the following regression model:

$$\textit{Fund Flow}_{i,t+1} = \alpha_t + \beta \textit{Spread}_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t+1} \tag{2}$$

where $\textit{Fund Flow}_{i,t+1}$ is the percentage increase in a fund's i size from week t to week $t+1$ accounting for earned interest, winsorized at the 0.5% level; $\textit{Spread}_{i,t}$ and $X_{i,t}$ are defined as

[15]Note that the overall issuance of riskier assets declined over this period. For example, total asset-backed commercial paper outstanding dropped by almost 50%, from $1.3 trillion in August 2007 to $700 billion in August 2008 (Acharya et al. (2012)). Our focus is on the variation in holdings *across* funds. While the majority of funds decreased their holdings of risky assets, some funds, such as the Reserve Primary Fund, increased them.

[16]This model of competition has been documented in studies of equity mutual funds. These studies find that past performance is one of the strongest predictors of flows to equity funds (e.g., Chevalier and Ellison (1997)).

in (1). In addition, we include the volatility of fund flows, *Flow Volatility*$_{i,t}$, measured as the standard deviation of weekly fund flows over the previous quarter. We allow for correlation of error terms within funds by clustering observations at the fund level. Our coefficient of interest is β, which measures the sensitivity of fund flows to fund past returns.

Table III reports the results. Columns (1) and (2) show the results separately for the pre and post periods. We find that a one-standard-deviation increase in fund returns increases subsequent fund flows by 0.9% per week, or equivalently a fund size by 46% per year. This effect is economically large because it implies that a fund could increase its annual revenue by almost 50% by investing in risky assets.[17] Conversely, we find no significant effect of fund returns on flows in the pre period. To rule out the possibility that our results are driven by unobserved time-invariant fund-specific attributes correlated with fund spreads, we estimate the model with fund-fixed effects. The flow-performance relationship, in columns (3) and (4), is even larger: by 2.6 times in the post period; again, we observe no impact on flows in the pre period.

The decision to take risk may be also shaped by differences in flows that funds with different levels of incentives receive conditional on their performance. For example, if funds sponsored by companies with high business concerns receive more flows, one would expect them to be more willing to take relatively less risk since their compensation relies to a lesser extent on their performance. We test this hypothesis by estimating the flow-performance relationship while controlling for *Business Concerns*. If investors incorporate business concerns in their decisions, we should expect the coefficient of *Business Concerns* to be positive.

We find that—conditional on fund performance—the sponsor's business concerns do not affect fund flows. As before, we find a strong flow-performance relationship in the post period but not in the pre period. Hence, our results are unlikely to be driven by different responses of flows to the levels of business concerns.

We also examine whether the observed change in the sensitivity of flows to performance depends on the sponsor's willingness to provide implicit guarantee. To this end, we extend our

[17] A one standard deviation in fund returns is 65.9 basis points, which is less than the spread on risky asset classes as shown in Table II.

empirical model in (2) by including interaction terms of fund spread and business concerns. We present the results in columns (5)-(6). For both subperiods, we find that the coefficients of the interaction terms are statistically and economically insignificant for both measures of business concerns. Hence, the benefits to having better performance in terms of greater fund inflows do not differ significantly across the sponsor types.

IV.4 Business concerns and risk taking

We now study the response of different fund sponsors to changes in risk-taking opportunities. We first compare risk-taking behavior of funds sponsored by companies with high business concerns to that of funds sponsored by companies with low business concerns. We expect that greater concerns over non-money fund business decrease the funds' incentives to take on risk. To this end, we estimate the following difference-in-differences regression model:

$$Risk_{i,t+1} = \alpha + \mu_t + \beta_1 Business\ Concerns_{i,2006} + \beta_2 Business\ Concerns_{i,2006} * Post_t + \gamma X_{i,2006} + \varepsilon_{i,t+1} \tag{3}$$

where *Business Concerns*$_{i,2006}$ is a generic name for either *Fund Business* or *Conglomerate*. *Post* is an indicator variable equal to one for the post period and zero for the pre period. $X_{i,2006}$ is a vector of control variables that is identical to the one we use in equation (2). Both business concerns variables and other controls are measured as of January 2006, which mitigates the concern that fund risk choices are driven by changes in fund characteristics due to investment opportunity change. Our regression model also includes week-fixed effects (μ_t), which account for any time differences in aggregate fund flows or macroeconomic conditions driving the risk-taking decisions of different fund sponsors. Since *Business Concerns*$_i$ is a fund-sponsor attribute, risk taking within the same sponsor may be correlated across its funds. To address this concern, we cluster standard errors at the sponsor level. Our coefficient of interest is β_2.

We use three measures of risk ($Risk_{it}$), measured at a weekly frequency. The first measure, *Spread*, is the fund return, net of the Treasury Bill rate. In the context of money market funds,

spreads are a good measure of risk because there is little scope for managerial skill, which makes fund returns largely reflect fund portfolio risk. A potential problem with using this measure is that it may vary over time even though managers may not make any active changes in the risk profile of their portfolios, only because the returns on individual assets in the portfolio change.

To account for such mechanical changes in portfolio riskiness, we propose two other measures. *Holdings Risk* is a fraction of obligations net of repurchase agreements and Treasuries in a fund portfolio. As reported in Table I, repos and U.S. Treasuries are the safest asset classes and bank obligations are the riskiest asset class. *Maturity Risk* is the average maturity of assets in a fund portfolio. In general, funds with longer maturities of their assets would be considered riskier. We also studied implications of using the sensitivity of fund returns to changes in Treasury Bill rates (akin to duration risk). The measure is obtained from the fund-level time-series regression model in which the estimation is performed separately for the pre and post periods. The results are qualitatively similar to the ones we report below.

We begin with a nonparametric analysis of the observed effects. For each month between January 2006 and August 2008, we estimate the coefficient β from the cross-sectional regression model (3) for *Fund Business*. Panel A of Figure V presents the time series of estimates βs for *Holdings Risk*. We find no visible differences in the impact of *Fund Business* on portfolios' risk prior to August 2007, but starting from August 2007 the effect is negative and large. Panel B reports the results for *Maturity Risk*, and Panel C for *Spread*. Again, we observe similar patterns in loadings on *Fund Business* as for *Holdings Risk*.

Next, we present the results from the difference-in-differences model corresponding to the nonparametric analysis. In columns (1), (4), and (7) of Table IV, we show the results for the base-case model. For the post period, we find that a one-standard-deviation increase in *Fund Business* reduces *Holdings Risk* by 3.6 percentage points, *Maturity Risk* by 2.3 days, and *Spread* by 3.0 basis points. The results are statistically and economically significant: A one-standard-deviation increase in *Fund Business* corresponds to a 14.5% drop in *Holdings Risk* relative to the cross-sectional standard deviation of *Holdings Risk*. The respective quantities for *Maturity*

Risk and *Spread* are 18.9% and 18.3%. Similar results obtain for *Conglomerate*. In contrast, we do not find any statistically significant impact of business concerns on risk in the pre period.

Our results might be also driven by unobserved time-invariant differences among funds or fund sponsors that are correlated with business concerns. We address this issue by including sponsor-fixed effects, in columns (2), (5), and (8), and fund-fixed effects, in columns (3), (6), and (9). In all these specifications, we find no difference in the quality of our results.

IV.5 The role of financial strength

Our empirical analysis so far reveals the importance of business concerns as a driver of risk-taking decisions of money market funds. This result should be particularly strong if the bailout by fund sponsor is ex post optimal. However, the willingness to bail out the fund needs to be also contrasted with the sponsor's ability to do so. In particular, conditional on a given level of business concerns, one would expect funds with greater financial strength to take on more risk. In our setting, however, financial strength is likely correlated with business concerns and thus introducing each factor in separation would not help to establish the role of financial strength.

To allow for such separation we refine our empirical design. To this end, we analyze risk choices separately for funds sponsored by financial conglomerates and those sponsored by independent asset managers. By analyzing cross-sectional variation in risk within financial conglomerates, we can fix the business-concerns margin while varying the financial-strength margin. Likewise, by looking into independent asset managers, we can fix the financial-strength margin while varying the business-concerns margin.

Our measure of financial strength for conglomerates is the sponsor's CDS price. A higher CDS price indicates lower financial strength of the sponsor. Importantly, the correlation between CDS price and *Fund Business* is -30.7%. This implies that sponsors with greater financial strength (lower CDS) have larger business concerns. Given that we expect opposite signs on the two variables, it is unlikely that the CDS price incorrectly proxies for business concerns.[18]

[18]Several firms had no CDS price quotes going back to 2007. We thus measure CDS prices as of September 2008 to cover the largest possible sample.

Panel A of Table V presents the results from estimating the following difference-in-differences model for financial conglomerates:

$$Risk_{i,t+1} = \alpha + \mu_t + \beta_1 log(CDS)_i + \beta_2 log(CDS)_i * Post_t + \gamma X_{i,2006} + \varepsilon_{i,t+1} \quad (4)$$

In the model, we include interaction term between *log(CDS)* and *Post*, and *Fund Business* and its interaction with *Post* as control variables. Including this measure accounts for any additional degree of variation in business concerns that is unexplained by *Conglomerate*. The results show that the coefficient of *log(CDS)* is negative and statistically significant for all three measures of risk. At the same time, for two out of three risk measures the coefficient of *Fund Business*Post* is negative, but it is statistically significant only for *Spread*. The relatively weak power of our results is consistent with the notion that business concerns in financial conglomerates do not stem from asset management only.

In Panel B, we report the results for independent managers only. The key assumption underlying this test is that independent managers exhibit little variation in financial strength. We find that all three measures of risk are negatively correlated with *Fund Business*. While the premise of our test is similarity in financial strength, we additionally allow for any unexplained variation in sponsors' financial strength that is not captured by the affiliation with independent asset manager. Our measure of financial strength is a fund sponsor's credit rating. The reason why credit rating might be a good proxy for our purpose is that fund sponsors with good credit standing may be more able to access short-term funding markets and as such they may have more capacity to provide support. We measure rating quality with an indicator variable (*No Rating*) equal to one if the fund sponsor has no rating and equal to zero otherwise, that is, funds with no rating are deemed to have lower financial strength. We predict that the coefficient of the interaction term of *No Rating* and *Post* should be negative.[19]

We find that the coefficient of the interaction term is negative for all risk measures. However,

[19] We also explored the continuous version of ratings, while additionally assigning a low rating value for sponsors without rating. The results are similar.

it is statistically significant only for one measure. This result is not entirely surprising since our test was designed to eliminate much of the cross-sectional variation in financial strength and thus any unexplained variation in financial strength is likely to have low statistical power to explain variation in risk. Moreover, the correlation between *No Rating* and *Fund Business* is 32.4%. This implies that funds with greater financial strength have more business concerns, which makes it difficult to separately identify the two variables.

Overall, the results strengthen our interpretation that—conditional on financial strength—the degree of business concerns negatively affects risk taking and—conditional on similar business concerns—financial strength positively affects risk taking.[20]

IV.6 Post-Lehman analysis

In this section, we assess the cross-sectional variation in the response of fund investors and sponsors after Lehman's bankruptcy. In our first test, we examine the effect of business concerns on financial support provided by fund sponsors during the week after the start of the run in September 2008 but prior to the introduction of the Federal Deposit Insurance of money market fund assets. To illustrate the scale and scope of the support, in Table A.1 of Appendix, we provide detailed information about support arrangements established in the aftermath of Lehman's collapse. It is apparent that the support was not limited to a few funds but was rather a common incidence during that period. In brief, we observe 28 support events in the week following Lehman's default. Formally, we estimate the following regression model:

$$Support_i = \alpha + \beta Business\ Concerns_i + \gamma X_i + \varepsilon_i \tag{5}$$

[20] Although our explanation of risk taking mostly emphasizes the role of business concerns and financial strength, one could imagine other explanations of our findings, such as "conglomerate bureaucracy". In particular, stand-alone firms are known to respond more aggressively to changes in industry Q than do the divisions of a conglomerate. By the same token, an independent money fund may respond more strongly to an opportunity to rapidly grow its assets. While the lack of precise data on internal decision making inside fund organization makes it difficult to test this theory directly, one could also argue that the bureaucracy effect is related to business concerns and arises endogenously to protect fund sponsor's reputation from risk-taking behavior of an individual division.

where *Support* takes a value of one if the fund sponsor offered support to its fund, and zero, otherwise. *Business Concerns* is measured as before. X is a vector of control variables that includes *Log(Fund Size)*, *Age*, *Expense Ratio*, and *Log(Family Size)*, which are measured in the week prior to the run. We also include *Spread* to control for ex-ante differences in risk taking.

We present the estimation results in column (1) of Table VI. We find a positive and statistically significant effect of *Conglomerate* on the probability of receiving financial support: Funds affiliated with financial conglomerates are 29.4% more likely to receive financial support in the week after Lehman's bankruptcy. At the same time, we find no effect of *Fund Business* on support. These results suggest that financial conglomerates have greater financial ability and possibly larger business concerns to provide direct support to money market funds in distress.

Subsequently, we assess the impact of business concerns on fund redemptions. To this end, we estimate the following regression model:

$$Redemptions_i = \alpha + \beta Business\ Concerns_i + \gamma X_i + \varepsilon_i \tag{6}$$

where *Redemptions* is the change in a fund size between September 18 and September 25, 2008. *Business Concerns* and X are defined as in equation (5).

We present the estimation results in column (2). We find that funds whose sponsors have greater business concerns suffer smaller redemptions: A one-standard-deviation increase in *Fund Business* reduces redemptions by 3.4 percentage points, or by 32.0% of the average redemption. At the same time, we find a weaker effect of *Conglomerate* on redemptions. We also find that funds with higher ex-ante risk taking (captured by *Spread*), experience larger outflows.

Next, we evaluate the impact of business concerns on fund exit in the two years following October 1, 2009, which is the expiration date of the government guarantee program. We identify 16 instances of fund closures during that period, which we want to relate to reputation effects. We estimate the following regression model:

$$Exit_i = \alpha + \beta Business\ Concerns_i + \gamma X_i + \varepsilon_i \tag{7}$$

where *Exit* is an indicator variable equal to one if a fund exited the market between October 1, 2009 and September 30, 2011, and zero otherwise. *Business Concerns* and X are defined as in equation (5). The results in column (3) show that funds associated with conglomerates are more likely to exit the market following the run on the industry. In contrast, we find no evidence of such effect for *Fund Business*. The results suggest that, in response to adverse conditions in the industry, sponsors with greater business concerns at stake exit the market possibly to shield themselves from possible negative spillovers to other businesses.

Finally, we analyze the effect of business concerns on fund naming strategies. Prior to the run on money market funds some fund companies held names that were distinctly different from the names of their fund sponsors. However, in the aftermath of the run, some funds decided to change their names in a way that would closely reflect the underlying sponsor name. For example, Bank of America used to offer a fund named Columbia Cash Reserves, but this fund changed its name to Bank of America Cash Reserves in November 2009. We posit that funds with greater business concerns might be more likely to change their names because they want to signal to their investors the potential safety of their operations. Our sample includes eight such name changes over the period of two years.

To evaluate the hypothesis, we estimate the following regression model:

$$NameChange_i = \alpha + \beta Business\ Concerns_i + \gamma X_i + \varepsilon_i \tag{8}$$

where *Name Change* is an indicator variable equal to one if a fund changed its name to mimic its sponsor's name between October 1, 2009 and September 30, 2011, equal to minus one if the fund changed its name away from that of its sponsor,[21] and zero otherwise. *Business Concerns* and X are defined as before and measured as of October 2009. The results in column (4) show that funds with greater business concerns, as measured by *Fund Business*, are more likely to change their names following the run on the industry.

Overall, we find some evidence that concerns over possible loss of business might have played

[21] In our data, we observe only one instance of such a reverse name change.

an important role in the way fund investors and fund sponsors evaluated their funds in the aftermath of the run on money market fund industry.

IV.7 Do unobserved sponsor characteristics explain risk choices?

In our conceptual framework, we posit that a sponsor's business concerns and financial strength have a significant impact on its funds' risk taking. However, our effects might be driven not by differences in the sponsor's business concerns and/or financial strength, but rather by unobserved differences in investment styles or manager ability across fund families, which in turn might be correlated with business concerns and financial strength. For example, a fund sponsored by BlackRock, a small-concern company, might be willing to take more risk than a fund sponsored, by Bank of America, a large-concern company, due to its superior financial expertise or greater risk tolerance. To the extent that the variation in style or risk aversion among funds is permanent, our difference-in-differences estimator would account for any such differences. But our empirical approach might fail if the variation differentially affects risk taking in the pre and post periods. For example, fund sponsors may differ in their reactions to any changes in the quantity of risk, or in their propensities to take risk when risk-taking opportunities arise.

IV.7.1 Evidence from retail funds

Although we believe such differences are *a priori* not obvious, we conduct a more direct test, in which we identify the coefficients of interest off the differences between institutional and retail funds. To the extent that fund sponsors offer both retail and institutional fund portfolios to their investors, one would imagine that both types of portfolios, within the same fund sponsor, should have similar levels of risk as long as their risk-taking behavior is governed by sponsor-specific characteristics. However, retail investors react much less to differences in return differentials across funds; therefore, we expect a much smaller effect for retail funds even though sponsors of retail and institutional funds have the same unobserved characteristics. Given that retail funds have different asset base, we alter our previously used measure of business concerns and

introduce a new measure, *Retail Fund Business*, calculated as the sponsor's share of mutual fund assets other than retail prime money market funds in total sponsor's assets.

We begin our analysis with estimating the flow-performance relationship for retail funds, separately for the pre and post periods, with and without fund-fixed effects. Panel A of Table VII presents the results. Although we observe some effect of spread on fund flows in the pre period, we find that the flow-performance relationship is quite weak for the sample of retail funds in the post period, which is crucial for our analysis of risk taking. The effect is also not driven by business concerns of fund sponsors as evidenced from columns (5) and (6). Hence, the risk-taking incentives of retail funds are smaller than those of institutional funds.[22]

Building on this result, we further compare risk taking across fund sponsors, separately for institutional and retail funds using the setting of Table IV. We present the results in Panel B of Table VII. The results for the two groups of funds are quite striking. While we observe statistically and economically significant differences for institutional funds, these differences are insignificant for retail funds. If anything, the results go in the opposite direction.

IV.7.2 Evidence from the government's post-Lehman intervention

Our second identification strategy relies on yet another exogenous change in the importance of business concerns and financial strength. Following the default of Lehman Brothers in September 2008, money market funds experienced a run. Since the likely consequences of this run were severe, the government decided to save the entire money fund industry and extend explicit guarantees to all money funds and their investors. Effectively, for the duration of the guarantee, which lasted over a year, this intervention largely eliminated the risk of fund failure. Given that the government did not rescue the Reserve Primary Fund this guarantee was likely unexpected. Consequently, if the presence of implicit guarantees drives the observed differences in risk taking, we should expect that any pre-existing differences in risk-taking behavior among funds should be attenuated afterwards.

[22]This result has been independently established in a concurrent unpublished work by Wermers (2011).

To evaluate this hypothesis, we extend our analysis in Table IV to three periods: January 2006–July 2007, August 2007–August 2008, and April 2009–December 2010. We do not include the data for the two quarters immediately following Lehman's default because the process of implementing explicit guarantees really did not take place until the end of 2008.[23] Also, many financial markets were illiquid right after the default, so any adjustment of risk by the funds was difficult to accomplish. Our empirical strategy involves estimating the risk model, in which *Business Concerns* is interacted with two indicator variables: *Post*, equal to one for the period August 2007–August 2008, and equal to zero, otherwise; and *Post-Lehman* equal to one for the period April 2009–December 2010, and zero, otherwise. We expect a zero effect of *Business Concerns* in the pre period, a negative effect in the post period, and again a zero effect in the post-Lehman period.

We report the results in Table VIII. Per our hypothesis, the coefficient of *Post-Lehman* is close to zero for two risk measures. Hence, the importance of business concerns and financial strength has become negligible once the government rolled out an explicit support for all funds.

IV.8 Additional evidence

In this section, we discuss a number of additional results that lend support to our main results. While we provide full account of the results, numerical evidence is omitted for brevity.

One possible explanation for our results could be that fund managers or fund management companies differ in their compensation levels; hence, they have different incentives to take on risk. For example, if managers of funds sponsored by high-concern companies had lower compensation, such managers could have greater incentives to take risk to increase their funds' assets under management. We evaluate this possibility by relating the value of a fund's compensation to *Business Concerns*. We use two different measures of compensation: total compensation, calculated as a product of fund size and its expense ratio, which is a percentage fee charged by the fund on its assets. The results of this estimation do not support the idea that differences in

[23] Duygan-Bump, Parkinson, Rosengren, Suarez and Willen (2012) and Kacperczyk and Schnabl (2010) discuss the workings and exact timing of different government interventions.

risk can be attributed to differences in managerial compensation. If anything, we observe the opposite effect: High-concern funds, on average, have higher compensation levels. More generally, this result suggests that sponsors with ability to extend support do not charge additional fees for providing guarantees to their fund investors, in line with our view that fund flows are fairly unresponsive to the guarantee provision.

In another test, we explore the importance of outliers. Money funds in our sample exhibit a significant cross-sectional dispersion in their business concerns levels. In fact, quite a few funds display particularly low levels, largely because they specialize in the money market fund management. The presence of such cases raises the possibility that our results might be driven by a few extreme observations. We inspect the data using various scattered plots and find no good reason to believe that the outliers drive our results. Further, we exclude all fund observations with *Fund Business* below 50% and re-estimate the regression model in Table IV. The results remain qualitatively unchanged and if anything become quantitatively stronger.

The workings of money market funds often depend on the size of the fund company. Anecdotally, large funds are considered to be more involved in active risk choices, while smaller funds are considered to be simple cash-parking vehicles that do not engage in active risk-taking strategies. Hence, one would expect our results to be stronger for large funds. To this end, we estimate the regression model in Table IV for the subsample of funds with assets under management over $1 billion, the value often treated by practitioners as a cutoff for the fund to be considered large and important. We find that the risk effect indeed becomes stronger, though not by much.

Finally, a possible concern with our results relates to our motivating example. In particular, the case of the Reserve Primary Fund constitutes one of the most extreme risk-shifting behaviors among all fund sponsors. To the extent that RPF is sponsored by a company with small business concerns and little financial strength, our results might be driven by just one observation: the RPF. We exclude the fund from our sample and re-estimate the regression model in Table IV on the restricted sample. We find no significant difference in magnitude of the coefficients of *Business Concerns*; hence, our results are not merely driven by the RPF observation.

V Concluding Remarks

We study the determinants of risk taking by money market funds. We show that the financial crisis revealed that money market funds have strong incentives to take on risks if the opportunity arises and are vulnerable to runs if the risk materializes. Moreover, we find that observable fund characteristics predict funds' risk taking. Using the change in relative risks of money market instruments as an exogenous shock to the funds' risk-taking opportunities, we show that funds sponsored by companies with more money fund business and higher financial strength took on more risk. We further show that funds whose sponsors had less money fund business experienced smaller outflows, were more likely to provide financial support during a market-wide run in September 2008, and were more likely to exit the industry or change their names.[24]

We view our setting as a unique laboratory in which to study the microeconomic foundations of financial bailouts. Recent financial literature (e.g., Freixas, Loranth and Morrison (2007); Panageas (2010)) investigates the impact of government guarantees on risk-taking incentives. We argue that some of the macro effects may also have their counterparts at the mirco level.

We want to emphasize one possible difference between ours and previous studies. While prior settings largely focused on interventions in which guarantors do not have a direct stake in the company (e.g., government), in our study, guarantors have a stake in the company. What makes such a setting potentially interesting and novel is that incentive problems related to asymmetric information and moral hazard, typically present in the context of external guarantors, might be significantly altered in the presence of internal guarantors. We especially highlight the role of business concerns and financial strength as significant mitigating factors in risk-taking behavior.

More broadly, our results provide new insights into the role of short-term claimants in the modern theories of financial intermediation (e.g., Diamond and Rajan (2000); Diamond and Rajan (2001)). While these theories argue such claimants can mitigate intermediaries' incentives to take risk through the threat of runs, our results suggest that they may also exacerbate risk-

[24]The idea of tracing the impact of an exogenous crisis shock on money market funds has been also used in a recent paper by Chernenko and Sunderam (2012). Their results support our evidence and thus offer further robustness to our findings.

taking incentives through their return-chasing behavior. Exploring this tradeoff in more detail appears a fruitful area for future research.

References

Acharya, Viral, Philipp Schnabl, and Gustavo Suarez, "Securitization Without Risk Transfer," *Journal of Financial Economics*, 2012, *forthcoming.*

Brunnermeier, Markus, "Deciphering the Liquidity and Credit Crunch 2007-08," *Journal of Economic Perspectives*, 2009, *23(1)*, 77–100.

Chernenko, Sergey and Adi Sunderam, "Frictions in Shadow Banking: Evidence from the Lending Behavior of Money Market Funds," 2012. HBS Working Paper.

Chevalier, Judith and Glenn Ellison, "Risk Taking by Mutual Funds as a Response to Incentives," *Journal of Political Economy*, 1997, *105(6)*, 1167–1200.

Christoffersen, Susan E. K., "Why Do Money Fund Managers Voluntarily Waive Their Fees?," *Journal of Finance*, 2001, *56(3)*, 1117–1140.

___ **and David K. Musto**, "Demand Curves and the Pricing of Money Management," *Review of Financial Studies*, 2002, *15(5)*, 1499–1524.

Cornett, Marcia, Jamie McNutt, Philip Strahan, and Hassan Tehranian, "Liquidity Risk Management and Credit Supply in the Financial Crisis," *Journal of Financial Economics*, 2011, *101(2)*, 297–312.

Dang, Tri Vi, Gary Gorton, and Bengt Holmstrom, "Opacity and the Optimality of Debt for Liquidity Provision," 2009. Yale Working Paper.

Diamond, Douglas and Raghuram Rajan, "A Theory of Bank Capital," *Journal of Finance*, 2000, *55*, 2431–2465.

___ **and** ___ , "Liquidity Risk, Liquidity Creation and Financial Fragility: A Theory of Banking," *Journal of Political Economy*, 2001, *109*, 287–327.

Duygan-Bump, Burcu, Patrick M. Parkinson, Eric S. Rosengren, Gustavo A. Suarez, and Paul S. Willen, "How Effective Were the Federal Reserve Emergency Liquidity Facilities? Evidence from the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility," *Journal of Finance, forthcoming*, 2012.

Esty, Benjamin C., "Organizational Form and Risk Taking in the Savings and Loan Industry," *Journal of Financial Economics*, 1997, *44*, 22–55.

FINRA, "Treasury's Guarantee Program for Money Market Mutual Funds: What You Should Know," July 2010.

Freixas, Xavier, Gyongyi Loranth, and Alan D. Morrison, "Regulating Financial Conglomerates," *Journal of Financial Intermediation*, 2007, *16*, 479–514.

Gennaioli, Nicola and Andrei Shleifer, "What Comes to Mind," *Quarterly Journal of Economics*, 2010, *125 (4)*, 1399–1433.

___ , ___ , and Robert Vishny, "Neglected Risks, Financial Innovation, and Financial Fragility," *Journal of Financial Economics*, 2011, *forthcoming.*

Gorton, Gary and Andrew Metrick, "Haircuts," *Federal Reserve Bank of St. Louis Review*, 2009, *92*, 507–519.

Group, The Squam Lake, "Reforming Money Market Funds," 2011. Working Paper.

Kacperczyk, Marcin and Philipp Schnabl, "When Safe Proved Risky: Commercial Paper During the Financial Crisis of 2007-2009," *Journal of Economic Perspectives*, 2010, *24(1)*, 29–50.

Keeley, Michael C., "Deposit Insurance, Risk, and Market Power in Banking," *American Economic Review*, 1990, *80 (5)*, 1183–1200.

Kelly, Bryan, Hanno Lustig, and Stijn Van Nieuwerburgh, "Too-Systemic-To-Fail: What Option Markets Imply About Sector-wide Government Guarantees," 2011. Working Paper, New York University.

Krishnamurthy, Arvind and Annette Vissing-Jorgensen, "The Aggregate Demand for Treasury Debt," 2010. Working Paper, Kellogg School.

McCabe, Patrick, "The Cross Section of Money Market Fund Risks and Financial Crises," 2010. Working Paper, Federal Reserve Board.

Panageas, Stavros, "Bailouts, the Incentive to Manage Risk, and Financial Crises," *Journal of Financial Economics*, 2010, *95(3)*, 296–311.

Saunders, Anthony, Elizabeth Strock, and Nickolaos G. Travlos, "Ownership Structure, Deregulation, and Bank Risk Taking," *Journal of Finance*, 1990, *45 (2)*, 643–654.

Strahan, Philip and Basak Tanyeri, "Once Burned, Twice Shy: Money Market Fund Responses to a Systemic Liquidity Shock," 2012. Working Paper Boston College.

Wermers, Russ, "Money Fund Runs," 2011. Working Paper, University of Maryland.

Appendix: Data Construction

The main source of our data on money market funds is iMoneyNet. The iMoneyNet database covers the universe of money market funds. Every week all funds submit data on total assets, returns, expense ratios, and holdings by asset class. We confirm the full coverage by comparing the iMoneyNet data with the list of all funds based on SEC data. We also aggregate total assets and compare asset holdings to official asset holdings by the SEC. Both tests confirm that iMoneyNet covers the universe of money market funds. This finding is consistent with our understanding that the data are widely used across the money market fund industry and represent the primary source of information on money market funds. Most detailed and accurate information is available for the period from January 2005 to September 2011, which is the period of our analysis.

The data we obtain are reported at the share-class level. To ensure precision of our tests, we first check that all share classes are reported consistently throughout the data set (i.e., after a share class enters the data set and before a share class exists from the data set). We find that only 17 out of 1820 share classes have some missing data. Almost all missing data are from funds that report monthly for the first few months of their existence and later switch to weekly reporting. We use linear interpolation to generate weekly data for these funds. However, all results are robust to dropping these observations.

We subsequently focus on prime funds. We have 236,335 total observations (and 1030 share classes) for the period of our analysis. Since our main analysis is at the fund level, we need to aggregate the data across all share classes into one fund portfolio. For that reason, we use information about total fund assets that is provided next to share-class specific information and an indicator variable equal to one if a given share class is the fund's main share class and equal to zero for other share classes (this is our unique fund identifier). We perform several data checks to ensure that our aggregation process is accurate. First, we verify the fund identifier by comparing total weekly fund assets with the number obtained from adding weekly assets by share class for the subset of observations for which iMoneyNet reports total fund assets (174,706 observations). The asset data are reported in $100,000 increments and we check for deviations greater than $100,000. We only find 201 observations for which the deviation exceeds $100,000. Our results are robust to excluding these observations. Second, we test whether reported asset holding add up to 100%. We find 28 out of 236,335 observations for which asset holdings do not add up. Again, our results are robust to excluding these observations

We construct fund-level investor categories by aggregating all institutional and retail share classes at the fund-week level using the unique fund identifier. We obtain a total of 104,449 observations at the week-fund level. We label a fund as institutional if the fund has at least one institutional share class (47,959 observations). We label a fund as retail if there is no institutional share class (56,490 observations). Most of our analysis focuses on institutional funds over the period from January 2006 to August 2008 (19,998 observations). The main analysis is restricted to funds that remain in the data set throughout this period (19,097 observations).

Subsequently, we merge the iMoneyNet data to the CRSP Survivorship Bias Free Mutual Fund Database. The CRSP Mutual Fund data are at the monthly level and we therefore match at that frequency (any within-month variation is assumed constant). To perform the match, we use the share class NASDAQ identifier provided by iMoneyNet as our primary identifying variable. If the NASDAQ identifier matches to more than one observation in CRSP, we use the share class with the most assets in CRSP. For a small number of observations, iMoneyNet does not provide a NASDAQ identifier or the NASDAQ identifier is not reported by CRSP. In that case, we assign the same NASDAQ identifier based on other share classes of the same fund. If no other share classes have a valid NASDAQ identifier, we match the funds based on fund name. If there is no entry in CRSP, we match directly to the sponsor name based on fund's SEC filings in EDGAR. We are able to match all fund observations.

To calculate fund spread, we obtain data on weekly risk-free rate from Ken French's website. We also collect data on weekly Fed Funds rate from the Federal Reserve website. We match both data sets to iMoneyNet data.

We assign the sponsor based on CRSP data. CRSP data provides detailed information about asset management companies that sponsor the respective funds. Most funds have a fixed sponsor during our data period. However, in a few cases, fund sponsors might change, for example due to mergers. If the sponsor changes over the lifetime of a fund we assign to the fund the sponsor that was in charge of the fund as of the first week of January 2006. For all sponsors, we collect information on whether the sponsor is affiliated with commercial banks, investment banks, insurance companies, or is managed by an independent asset manager. We collect the information from COMPUSTAT, company websites, EDGAR, SEC filings, and press reports. We use at least two sources to ensure validity of this information. We ensure that all data are as of January 2006.

We obtain sponsor ratings from several data sources. We first match sponsor names to S&P RatingsXpress as of January 2006. Next, we match any unmatched sponsors to the Lehman Brothers' Bond Database. We ensure that both data sets provide the same information. We also double-check the information with the company website and press releases.

We gather sponsor CDS prices from Datastream. For that purpose, we search for each sponsor's name in Datastream and assign the corresponding CDS. We also consult other academic work on CDS to ensure that we find all sponsors with traded CDS.

Finally, we collect information on financial support from the SEC website. We collect all no-action letters posted in September 2008 or thereafter. We check with Peter Crane's industry blog to ensure that we cover all sponsors that provided bailouts. We collect information on the specifics of the bailouts based on the no-action letter and press releases. We report detailed information on sponsor bailouts in Table A.1.

Table A.1: Detailed Information on the Post-Lehman Support Arrangements

The columns include the fund company offered support, the sponsor company providing support, the support date, the reason for support, the values of distressed securities, the value of support, and additional remarks.

Fund Company	Sponsor	Support Date	Distress reason	Value of distressed assets	Support Value	Remarks
Dreyfus Cash Mgmt. Plus Inc.	BNY Mellon	10/20/2008	Lehman Brothers notes	$97.2M		Cash contribution necessary to maintain the fund value at 0.995
All Dreyfus Funds	BNY Mellon	10/20/2008	Distress of eligible assets			CSA (Cash contribution necessary to maintain the fund value at 0.995)
All Citizens Funds	BNY Mellon	10/20/2008	Distress of eligible assets			CSA (Cash contribution necessary to maintain the fund value at 0.995)
All General Funds	BNY Mellon	10/20/2008	Distress of eligible assets			CSA (Cash contribution necessary to maintain the fund value at 0.995)
Dreyfus Basic MMF	BNY Mellon	10/20/2008	Lehman Brothers notes	$45M		Cash contribution necessary to maintain the fund value at 0.995
Dreyfus LAP	BNY Mellon	10/20/2008	Lehman Brothers notes	$100M		Cash contribution necessary to maintain the fund value at 0.995
Dreyfus Worldwide Dollar MMF	BNY Mellon	10/20/2008	Lehman Brothers notes	$20M		Cash contribution necessary to maintain the fund value at 0.995
Russell MMF	Northwestern Mutual Life Ins.	10/20/2008	The entire fund			CSA (Cash contribution necessary to maintain the fund value at 0.995)
USAA MMF	USAA	10/22/2008	AIG notes	$81.96M		CSA USAA (Cash contribution necessary to maintain the fund value at 0.995)
Touchstone Invest. Trust Instit. MMF	Touchstone Advisors	10/22/2008	Morgan Stanley, Southtrust Bank, Wachovia notes	MS ($5.06M), ST ($1.4M), Wach. ($6.08M)		Cash contribution necessary to maintain the fund value at 0.995 (LOC by Western and Southern Life Insurance Company)
Touchstone Invest. Trust MMF	Touchstone Advisors	10/22/2008	Morgan Stanley, Southtrust Bank, Wachovia notes	MS ($5.1M), ST ($1.6M), Wach. ($4.07M)		Cash contribution necessary to maintain the fund value at 0.995 (LOC by Western and Southern Life Insurance Company)
Touchstone Variable Series MMF	Touchstone Advisors	10/22/2008	Morgan Stanley, Southtrust Bank, Wachovia notes	MS ($2.25M), Wach. ($1.5M)		Cash contribution necessary to maintain the fund value at 0.995 (LOC by Western and Southern Life Insurance Company)
Tamarack Prime MMF	Voyageur Asset Management	10/22/2008	The entire fund			Cash contribution necessary to maintain the fund value at 0.995 (LOC by RBC)
Tamarack Instit. Prime MMF	Voyageur Asset Management	10/22/2008	The entire fund			Cash contribution necessary to maintain the fund value at 0.995 (LOC by RBC)
RidgeWorth Prime Quality MMF	SunTrust Banks	10/22/2008	Lehman Brothers notes	$70M	$70M	Exchange of SunTrust Note for the Lehman note in the amount of $70M
Principal MMF	Principal Financial Group	10/22/2008	AIG notes			CSA (Cash contribution necessary to maintain the fund value at 0.995)
Principal Variable Contracts MMF	Principal Financial Group	10/22/2008	AIG notes			CSA (Cash contribution necessary to maintain the fund value at 0.995)
Morgan Stanley Funds	Morgan Stanley	10/22/2008	The entire fund			CSA (Cash contribution necessary to maintain the fund value at 0.995)
Active Assets Funds	Morgan Stanley	10/22/2008	The entire fund			CSA (Cash contribution necessary to maintain the fund value at 0.995)
Columbia MM Reserves	Bank of America	10/22/2008	The entire fund			CSA (Cash contribution necessary to maintain the fund value at 0.995)
ING LAP	ING Groep N.V.	10/22/2008	AIG notes	$46M		CSA (Cash contribution necessary to maintain the fund value at 0.995)
ING Classic MMF	ING Groep N.V.	10/22/2008	AIG notes	$28M		CSA (Cash contribution necessary to maintain the fund value at 0.995)
ING Instit. Prime MMF	ING Groep N.V.	10/22/2008	AIG notes	$46M		CSA (Cash contribution necessary to maintain the fund value at 0.995)
ING MMF	ING Groep N.V.	10/22/2008	AIG notes; Lehman notes	AIG ($8.5M), Lehman Brothers ($2M)		CSA (Cash contribution necessary to maintain the fund value at 0.995)
ING Brokerage Cash Reserves	ING Groep N.V.	10/22/2008	AIG notes	$8M		CSA (Cash contribution necessary to maintain the fund value at 0.995)
Western Asset Instit. MMF	Legg Mason	10/22/2008	Orion Finance. LLC notes (SIV)	$75M	$20M	CSA
Western Asset Instit. MMF	Legg Mason	10/22/2008	The fraction of fund	$452M		CSA (Cash contribution necessary to maintain the fund value at 0.9975)
Russell MMF	Northwestern Mutual Life Ins.	10/24/2008	Lehman Brothers notes	$403M		CSA (Cash contribution necessary to maintain the fund value at 0.995)

Footnote: CSA- Capital Support Agreement; POF- Prime Obligations Fund; DAP- Diversified Assets Portfolio; LAP- Liquid Assets Portfolio; LRP- Liquid Reserves Portfolio; POP- Prime Obligations Portfolio

Table I: Summary Statistics of Institutional Prime Money Market Funds

Our sample covers all U.S. institutional prime money market funds as of 1/1/2006. *Fund Business* (*FB*) is the sponsor's share of mutual fund assets other than institutional prime money market funds in total sponsor's assets. High (Low) FB includes all funds with *Fund Business* above (below) the median value of *Fund Business* (81.6%). Fund characteristics are spread, expenses, fund size, average portfolio maturity, age, family size, and a fraction of funds associated with financial conglomerates (in %). Holdings are the share of assets invested in Treasuries and agency paper, repurchase agreements, bank deposits, bank obligations, floating-rate notes, commercial paper, and asset-backed commercial paper. Cross-sectional standard deviations of the given characteristics are presented in parentheses.

	All	High FB	Low FB
	(1)	(2)	(3)
Fund Characteristics			
Spread (bp)	6.93	6.60	7.28
	(6.44)	(7.54)	(5.00)
Expense Ratio (bp)	31.64	32.40	30.81
	(19.10)	(18.43)	(19.90)
Fund Size ($mil)	4886	2981	6951***
	(8685)	(4833)	(11,169)
Maturity (days)	34.32	35.12	33.45
	(11.02)	(12.48)	(9.17)
Age (years)	10.61	10.43	10.81
	(4.75)	(5.53)	(3.75)
Family Size ($bil)	72.8	97.5	45.9**
	(149.1)	(200.9)	(39.2)
Fund Business	0.764	0.897	0.619***
	(0.198)	(0.064)	(0.192)
Conglomerate (in %)	39.9	44.2	35.2
	(49.1)	(50.0)	(48.1)
Portfolio Holdings			
U.S. Treasuries & Agency	0.060	0.072	0.048
	(0.109)	(0.120)	(0.095)
Repurchase Agreements	0.135	0.142	0.126
	(0.150)	(0.169)	(0.128)
Bank Deposits	0.032	0.021	0.044**
	(0.057)	(0.039)	(0.069)
Bank Obligations	0.122	0.111	0.135
	(0.126)	(0.120)	(0.132)
Floating-Rate Notes	0.198	0.192	0.204
	(0.162)	(0.168)	(0.156)
Commercial Paper	0.320	0.356	0.280**
	(0.224)	(0.252)	(0.182)
Asset-backed CP	0.134	0.106	0.164**
	(0.155)	(0.151)	(0.154)
Funds	148	77	71

Table II: Returns by Asset Class

The sample is all U.S. institutional prime money market funds. The dependent variable *Spread* is computed as the annualized return minus the Treasury Bill rate. Holdings variables are the share of assets invested in repurchase agreements, bank deposits, bank obligations, floating-rate notes, commercial paper (CP), and asset-backed CP (omitted category is U.S. Treasury and agency). Fund Characteristics are natural logarithm of fund size, expense ratio, fund age, and natural logarithm of fund family size. All regressions are at the weekly level and include week-fixed effects. Columns (3) and (4) include fund-fixed effects. Columns (1) to (3) cover the period 8/1/2007-8/31/2008 (*Post* period). Columns (2) and (4) cover the period 1/1/2006-7/31/2007 (*Pre* period). Standard errors are clustered at the fund level. ***, **, * represent 1%, 5%, and 10% significance, respectively.

	$Spread_{i,t+1}$			
Period	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)
Holdings				
$Repurchase\ Agreements_{i,t}$	13.015	17.762***	41.099**	11.652**
	(8.168)	(3.428)	(16.124)	(5.659)
$Bank\ Deposits_{i,t}$	1.990	17.040***	12.030	18.555***
	(26.656)	(3.936)	(25.266)	(6.913)
$Bank\ Obligations_{i,t}$	86.983***	15.382***	92.672***	6.994
	(8.035)	(3.494)	(17.672)	(4.931)
$Floating\text{-}Rate\ Notes_{i,t}$	81.602***	22.414***	87.255***	10.287
	(7.989)	(3.470)	(21.674)	(6.553)
$Commercial\ Paper_{t}$	58.502***	16.182***	70.678***	16.400***
	(8.002)	(3.274)	(23.470)	(5.745)
$Asset\text{-}backed\ CP_{i,t}$	75.565***	20.573***	82.345***	15.966**
	(8.402)	(3.155)	(18.917)	(6.233)
Fund Characteristics				
$Log(Fund\ Size)_{i,t}$	0.628	0.197**	3.790**	0.532
	(0.418)	(0.100)	(1.615)	(0.483)
$Expense\ Ratio_{i,t}$	10.020***	1.637*	82.207***	53.555***
	(2.967)	(0.956)	(26.479)	(11.616)
$Age_{i,t}$	-1.957	-0.47	-0.666	-0.601
	(1.470)	(0.491)	(0.551)	(0.453)
$Log(Family\ Size)_{i,t}$	0.553	0.174	6.863	0.261*
	(0.500)	(0.131)	(5.623)	(0.134)
Constant	65.190***	5.441	-43.076	-12.149
	(10.546)	(4.148)	(78.309)	(8.947)
Week-Fixed Effects	Y	Y	Y	Y
Fund-Fixed Effects	N	N	Y	Y
Observations	7,756	11,927	7,756	11,927
R-squared	0.94	0.79	0.95	0.80

Table III: Flow-Performance Relationship

The sample is all U.S. institutional prime money market funds. Columns (1), (3), and (5) cover the period from 8/1/2007 to 8/31/2008 (*Post* period). Columns (2), (4), and (6) cover the period from 1/1/2006-7/31/2007 (*Pre*-period). The dependent variable is *Fund Flow*, computed as the percentage change in total net assets from time *t* to time *t+1*, adjusted for market appreciation. Independent variables are the weekly annualized spread from *t* to *t-1*, natural logarithm of fund size, fund expense ratio, fund age, volatility of fund flows based on past 13-week fund flows, and natural logarithm of fund family size. In columns (5) and (6), additional independent variables are the interactions of *Spread* with *Fund Business* and *Conglomerate*. *Fund Business* is the sponsor's share of mutual fund assets other than institutional prime money market funds in total sponsor's assets. *Conglomerate* is an indicator variable equal to one if the fund sponsor is affiliated with a financial conglomerate, and zero, otherwise. All regressions are at the weekly level and include week-fixed effects. Columns (3) to (6) also include fund-fixed effects. Standard errors are clustered at the fund level. ***, **, * represent 1%, 5%, and 10% significance, respectively.

				Fund Flow$_{i,t+1}$		
Period	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)
Spread$_{i,t}$	0.013***	0.003	0.024***	0.000	0.026***	0.009
	(0.005)	(0.005)	(0.008)	(0.004)	(0.009)	(0.010)
Fund Business$_{i,2006}$*Spread$_{i,t}$					-0.003	-0.009
					(0.006)	(0.009)
Conglomerate$_{i,2006}$*Spread$_{i,t}$					0.000	-0.003
					(0.003)	(0.005)
Log(Fund Size)$_{i,t}$	-0.120**	-0.077***	-7.659***	-4.146***	-7.656***	-4.148***
	(0.051)	(0.029)	(1.341)	(0.720)	(1.344)	(0.720)
Expense Ratio$_{i,t}$	-0.551*	-1.276***	-2.720	-1.365	-2.737	-1.475
	(0.320)	(0.354)	(5.899)	(3.703)	(5.853)	(3.704)
Age$_{i,t}$	0.159	-0.078	0.015	0.715**	0.013	0.713**
	(0.180)	(0.149)	(0.322)	(0.323)	(0.322)	(0.323)
Flow Volatility$_{i,t}$	4.239*	2.476**	1.378	-0.213	1.328	-0.230
	(2.323)	(1.243)	(3.177)	(2.152)	(3.168)	(2.146)
Log(Family Size)$_{i,t}$	0.025	0.032**	0.530	0.042	0.523	0.045
	(0.023)	(0.014)	(1.239)	(0.126)	(1.246)	(0.127)
Week-Fixed Effects	Y	Y	Y	Y	Y	Y
Fund-Fixed Effects	N	N	Y	Y	Y	Y
Observations	7,808	11,984	7,808	11,984	7,808	11,984
R-squared	0.022	0.017	0.085	0.052	0.085	0.052

Table IV: Sponsor's Business Concerns and Risk Taking

The sample is all U.S. institutional prime money market funds for the period from 1/1/2006 to 8/31/2008. The dependent variables are: the fraction of assets held in risky assets, net of the riskless assets (*Holdings Risk*) in Columns (1)-(3), average portfolio maturity (*Maturity Risk*) in Columns (4)-(6); and the weekly annualized spread (*Spread*) in Columns (7)-(9). *Fund Business* is the sponsor's share of mutual fund assets other than institutional prime money market funds in total sponsor's assets. *Conglomerate* is an indicator variable equal to one if the fund sponsor is affiliated with a financial conglomerate, and zero, otherwise. Other independent variables are fund assets, expense ratio, fund age, and fund family size (coefficients not shown). *Post* is an indicator variable equal one for the period from 8/1/2007-8/31/2008, and zero, otherwise. All regressions are at the weekly level and include week-fixed effects. Columns (2), (5), (8) include sponsor-fixed effects and Columns (3), (6), and (9) include fund-fixed effects. Standard errors are clustered at the sponsor level. ***, **, * represent 1%, 5%, and 10% significance, respectively.

	Holdings Risk$_{i,t+1}$			Maturity Risk$_{i,t+1}$			Spread$_{i,t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fund Business$_{i,2006}$*Post$_t$	-18.271*	-21.216**	-19.562**	-11.436**	-12.572**	-11.886**	-15.040**	-15.473**	-14.218*
	(9.296)	(8.705)	(8.941)	(5.334)	(5.782)	(5.911)	(7.470)	(7.443)	(7.419)
Conglomerate$_{i,2006}$*Post$_t$	-6.774**	-5.573*	-6.319**	-1.664	-1.519	-1.701	-7.263***	-7.215***	-7.321***
	(3.018)	(2.885)	(2.962)	(1.722)	(1.750)	(1.762)	(2.429)	(2.424)	(2.428)
Fund Business$_{i,2006}$	-18.126			5.398			-2.764		
	(13.540)			(5.310)			(1.929)		
Conglomerate$_{i,2006}$	-6.539			-1.698			-1.212*		
	(4.233)			(1.938)			(0.655)		
Controls$_{i,2006}$	Y	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sponsor-Fixed Effects	N	Y	N	N	Y	N	N	Y	N
Fund-Fixed Effects	N	N	Y	N	N	Y	N	N	Y
Observations	19,097	19,097	19,097	19,097	19,097	19,097	19,097	19,097	19,097
R-squared	0.209	0.624	0.780	0.142	0.482	0.587	0.952	0.957	0.959

Table V: Sponsor's Capital and Risk Taking

The sample is all U.S. institutional prime money market funds for the period from 1/1/2006 to 8/31/2008. The dependent variables, *Fund Business*, and *Post* are defined in Table IV. All regressions include the same control variables as in Table IV (coefficients not shown). They are at the weekly level and include week-fixed effects and fund-fixed effects. Standard errors are clustered at the sponsor level. **Panel A** is restricted to funds that are affiliated with financial conglomerates. *Log(CDS)* is the natural logarithm of the sponsor's credit default swap (CDS) price. **Panel B** is restricted to funds that are affiliated with an independent asset manager. *No Rating* is an indicator variable equal one if the sponsor has a credit rating, and zero, otherwise. ***, **, * represent 1%, 5%, and 10% significance, respectively.

Panel A: Conglomerates			
	Holdings $Risk_{i,t+1}$	Maturity $Risk_{i,t+1}$	$Spread_{i,t+1}$
	(1)	(2)	(3)
$Log(CDS)_{i,2006}$*$Post_t$	-7.996***	-5.284**	-3.635*
	(1.914)	(2.295)	(2.037)
Fund $Business_{i,2006}$*$Post_t$	8.947	-15.941	-30.319***
	(11.985)	(12.203)	(8.736)
$Controls_{i,2006}$	Y	Y	Y
Week-Fixed Effects	Y	Y	Y
Fund-Fixed Effects	Y	Y	Y
Observations	7,587	7,587	7,587
R-squared	0.696	0.534	0.970
Panel B: Independent Asset Managers			
	Holdings $Risk_{i,t+1}$	Maturity $Risk_{i,t+1}$	$Spread_{i,t+1}$
	(1)	(2)	(3)
Fund $Business_{i,2006}$*$Post_t$	-38.616***	-10.006**	-22.413***
	(12.660)	(4.409)	(7.470)
No $Rating_{i,2006}$*$Post_t$	-8.249	-1.684	-7.777**
	(5.410)	(1.356)	(3.065)
$Controls_{i,2006}$	Y	Y	Y
Week-Fixed Effects	Y	Y	Y
Fund-Fixed Effects	Y	Y	Y
Observations	7,646	7,646	7,645
R-squared	0.715	0.671	0.968

Table VI: Post-Lehman Results

The sample is all U.S. institutional prime money market funds that were active from 1/1/2006 until 10/1/2009. In Column (1) the dependent variable is *Support*, an indicator variable equal to one if the fund's sponsor filed a no-action letter with the SEC in the week after the Lehman's bankruptcy (9/18/2008-9/25/2008), and zero otherwise (20 funds declared support). In Column (2) the dependent variable is *Redemptions* defined as total value of redemptions (fund outflows) in the week after the Lehman's bankruptcy (9/18/2008-9/25/2008). In Column (3) the dependent variable is *Exit*, an indicator variable equal to one if the fund was closed in the two years after the expiration of the government guarantee (10/1/2009), and zero otherwise (16 out of 105 fund closures). In Column (4) the dependent variable is *Name* an indicator variable equal to one if the fund name was changed to match the sponsor name, equal to zero if the name was unchanged, and equal to minus one if the fund name was changed to be different from the sponsor name (8 name changes). All independent variables are defined in Table III. In Columns (1) to (3), the independent variables are measured as of the week before the Lehman bankruptcy. In Column (4), the independent variables are defined as of the end of the government guarantee (10/1/2009). Standard errors are clustered at the sponsor level. ***, **, * represent 1%, 5%, and 10% significance, respectively.

	Support	Redemptions	Exit	Name Change
	(1)	(2)	(3)	(4)
Fund Business$_i$	-0.119	-0.160**	-0.156	0.334*
	(0.366)	(0.074)	(0.247)	(0.174)
Conglomerate$_i$	0.294**	0.001	0.243***	-0.018
	(0.133)	(0.029)	(0.079)	(0.101)
Spread$_i$	0.001	0.001**	0.001	0.000
	(0.002)	(0.000)	(0.001)	(0.002)
Log(Fund Size)$_i$	0.019	0.026***	-0.061**	0.023
	(0.015)	(0.007)	(0.030)	(0.018)
Expense Ratio$_i$	-0.019	-0.189***	-0.188	-0.216
	(0.185)	(0.055)	(0.207)	(0.504)
Age$_i$	-0.086	-0.024	0.07	0.012
	(0.083)	(0.031)	(0.059)	(0.067)
Log(Family Size)$_i$	0.03	0.015***	0.028*	-0.002
	(0.022)	(0.004)	(0.016)	(0.007)
Constant	0.273	-0.059	0.166	-0.369
	(0.444)	(0.182)	(0.360)	(0.389)
Observations	105	105	105	105
R-squared	0.189	0.389	0.135	0.053

Table VII: Evidence from Retail Funds

The sample is all U.S. retail prime money market funds for the period from 1/1/2006 to 8/31/2008. **In Panel A**, we examine the flow-performance relationship for retail prime money market funds (similar to Table III). **In Panel B**, we examine the relationship between business concerns and risk for retail prime money market funds (similar to Table IV).

Panel A: Flow-Performance Relationship

	Fund $Flow_{i,t+1}$					
Period	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)
$Spread_{i,t}$	0.002	0.006**	0.005*	0.004*	0.008	0.021***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.005)	(0.005)
Retail Fund $Business_{i,2006}$*$Spread_{i,t}$					-0.007	-0.015**
					(0.005)	(0.007)
$Conglomerate_{i,2006}$*$Spread_{i,t}$					0.001	-0.002
					(0.002)	(0.004)
$Controls_{i,t}$	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y
Fund-Fixed Effects	N	N	Y	Y	Y	Y
Observations	5,925	9,333	5,925	9,333	3,724	6,004
R-squared	0.043	0.022	0.093	0.072	0.110	0.076

Panel B: Business Concerns and Risk Taking

	Holdings $Risk_{i,t+1}$		Maturity $Risk_{i,t+1}$		$Spread_{i,t+1}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Retail Fund $Business_{i,2006}$*$Post_t$	15.071	15.712	3.482	2.682	-8.992	-8.850
	(13.917)	(14.104)	(6.465)	(6.323)	(14.178)	(14.405)
$Conglomerate_{i,2006}$*$Post_t$	7.108	7.219	-4.050	-3.920	-4.131	-4.238
	(5.913)	(5.970)	(2.535)	(2.635)	(5.305)	(5.403)
$Controls_{i,2006}$	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y
Sponsor-Fixed Effects	Y	N	Y	N	Y	N
Fund-Fixed Effects	N	Y	N	Y	N	Y
Observations	9,740	9,740	9,740	9,740	9,744	9,744
R-squared	0.74	0.77	0.60	0.63	0.91	0.91

Table VIII: Risk Taking After Government Guarantee

The sample is all U.S. institutional prime money market funds for the period from 1/1/2006 to 12/31/2010. We estimate the same regression models as in Table IV for the period from July 2006 to December 2010. We drop the month of the Lehman's bankruptcy and the quarter immediately after the Lehman's bankruptcy to focus on risk taking after a short adjustment period. We interact our main variables of interest with an indicator variable for the Post period (July 2007 to August 2008) and the Post-Lehman period (April 2009 to December 2010). All regressions include the control variables specified in Table IV (coefficients not shown). They are at the weekly level and include week-fixed effects. Columns (1), (3), and (5) include sponsor-fixed effects and Columns (2), (4), and (6) include fund-fixed effects. Standard errors are clustered at the sponsor-level. ***, **, * represent 1%, 5%, and 10% significance, respectively.

	Holdings $Risk_{i,t+1}$		Maturity $Risk_{i,t+1}$		$Spread_{i,t+1}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$Fund\ Business_{i,2006}$*$Post_t$	-22.140**	-19.507**	-12.419**	-11.856*	-14.629*	-13.566*
	(8.499)	(8.847)	(5.669)	(5.952)	(7.662)	(7.676)
$Fund\ Business_{i,2006}$*$Post\text{-}Lehman_t$	-23.677	-10.254	-10.171	-6.012	-3.341	-1.448
	(18.806)	(19.439)	(6.643)	(6.468)	(7.261)	(7.673)
$Conglomerate_{i,2006}$*$Post_t$	-5.439*	-6.447**	-1.391	-1.697	-7.391***	-7.555***
	(2.939)	(2.993)	(1.779)	(1.805)	(2.452)	(2.475)
$Conglomerate_{i,2006}$*$Post\text{-}Lehman_t$	-0.357	-3.156	-3.967	-4.901**	-3.270	-3.851
	(6.069)	(5.793)	(2.188)	(2.153)	(2.285)	(2.348)
$Controls_{i,2006}$	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y
Sponsor-Fixed Effects	Y	N	Y	N	Y	N
Fund-Fixed Effects	N	Y	N	Y	N	Y
Observations	28,449	28,449	28,449	28,449	28,409	28,409
R-squared	0.579	0.692	0.452	0.532	0.953	0.954

Figure I: Dispersion in Money Market Fund Yields

This figure plots the three-month rolling average money market fund yield for the period January 2002 to August 2008 for the universe of U.S. money market funds. The figure also plots the 5th and 95th percentile to show the dispersion of money market fund yields.

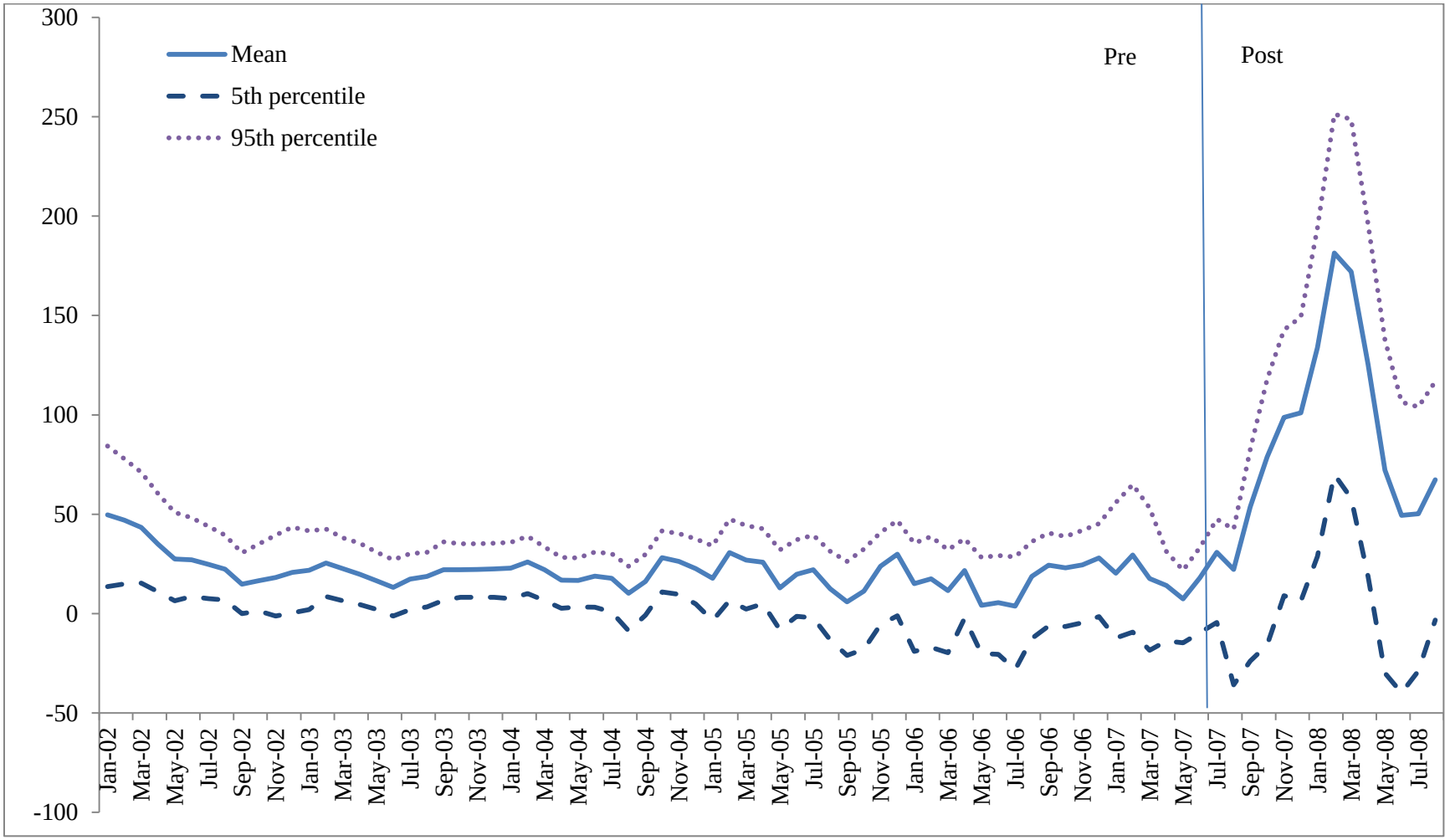


Figure II: Assets Holdings and Spread

We implement the regression model in Table III for the period from January 2005 to August 2008. Each point represents the three-month average of coefficients on the interaction between month-fixed effects and an indicator variable for repurchase agreements (*Repo*), bank deposits (*Deposits*), bank obligation (*Obligation*), floating rates notes (*FRNS*), commercial paper (*CP*), and asset-backed commercial paper (*ABCP*), respectively. Each point represents the return relative to the omitted category (*Treasuries and agency debt*) measured in percentage points.

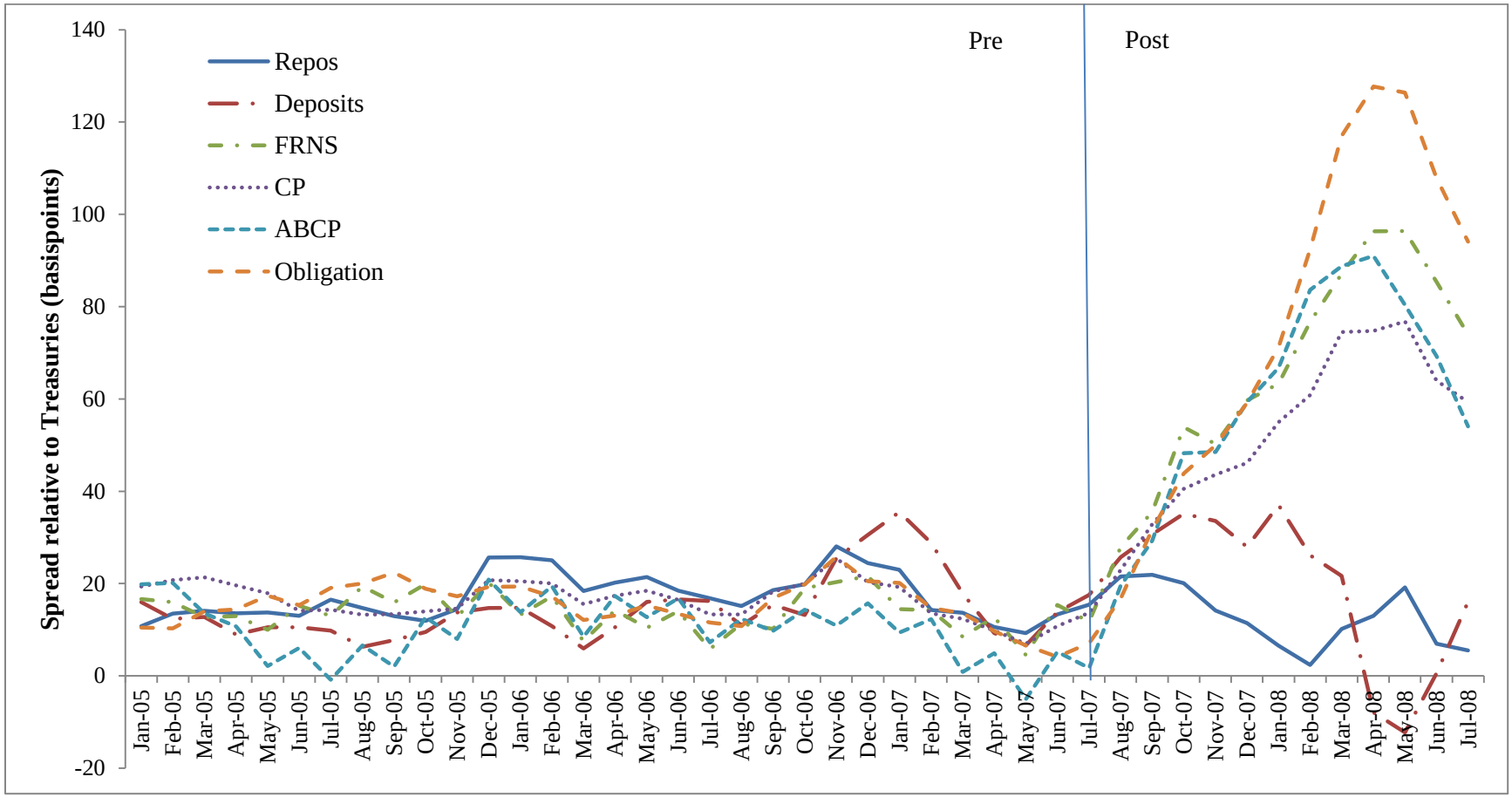
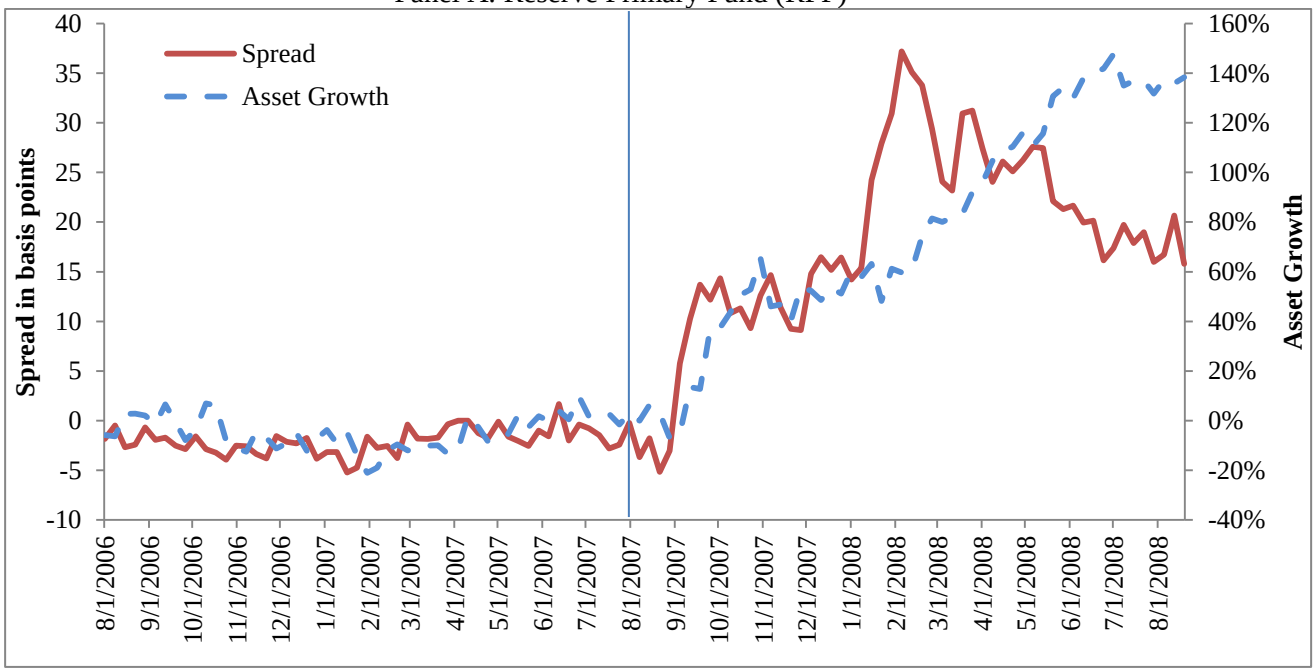


Figure III: Relative Performance and Assets: Reserve Primary vs. Fidelity Institutional Prime

This figure plots weekly industry-adjusted spread and industry-adjusted asset growth of the Reserve Primary Fund (Panel A) and the Fidelity Institutional Prime Money Market Fund (Panel B) from August 2006 to August 2008. The industry-adjusted spread is computed as a difference between each individual fund's spread and the value-weighted average spread of all institutional prime funds. The industry-adjusted asset growth is each individual fund's asset growth deflated by total asset growth of all institutional prime funds. We normalize asset growth to zero as of August 1st, 2008.

Panel A: Reserve Primary Fund (RPF)



Panel B: Fidelity Institutional Prime (FID)

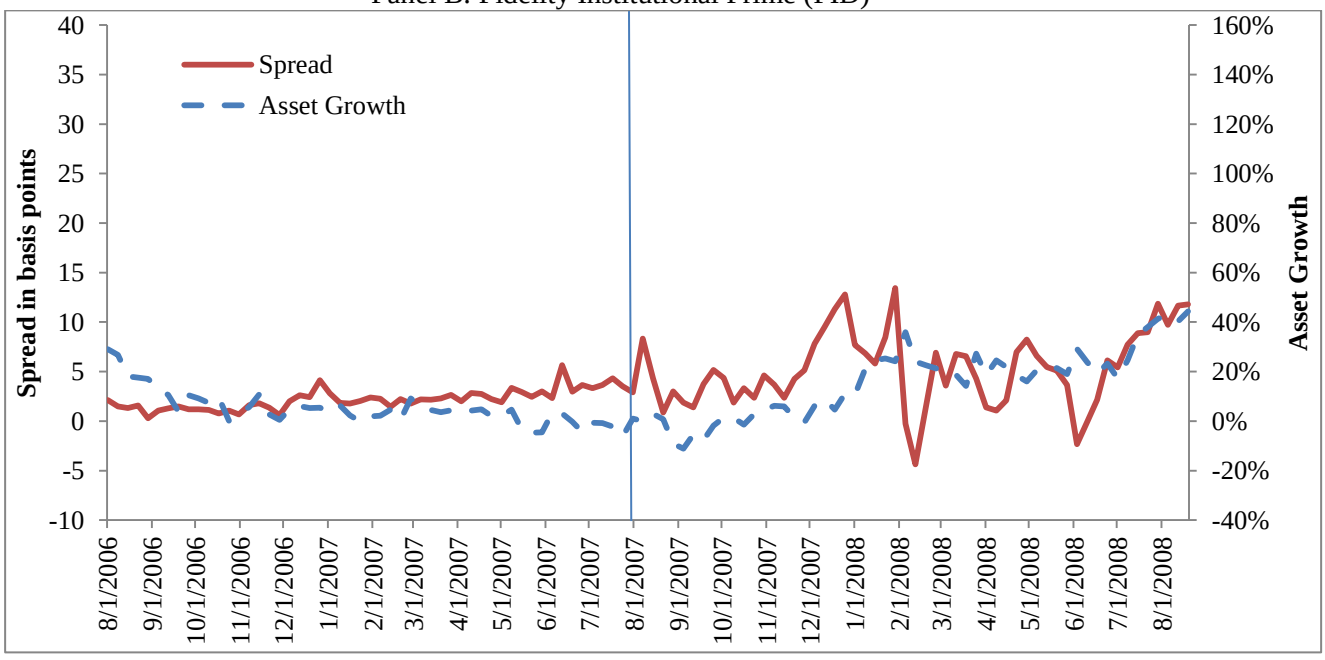
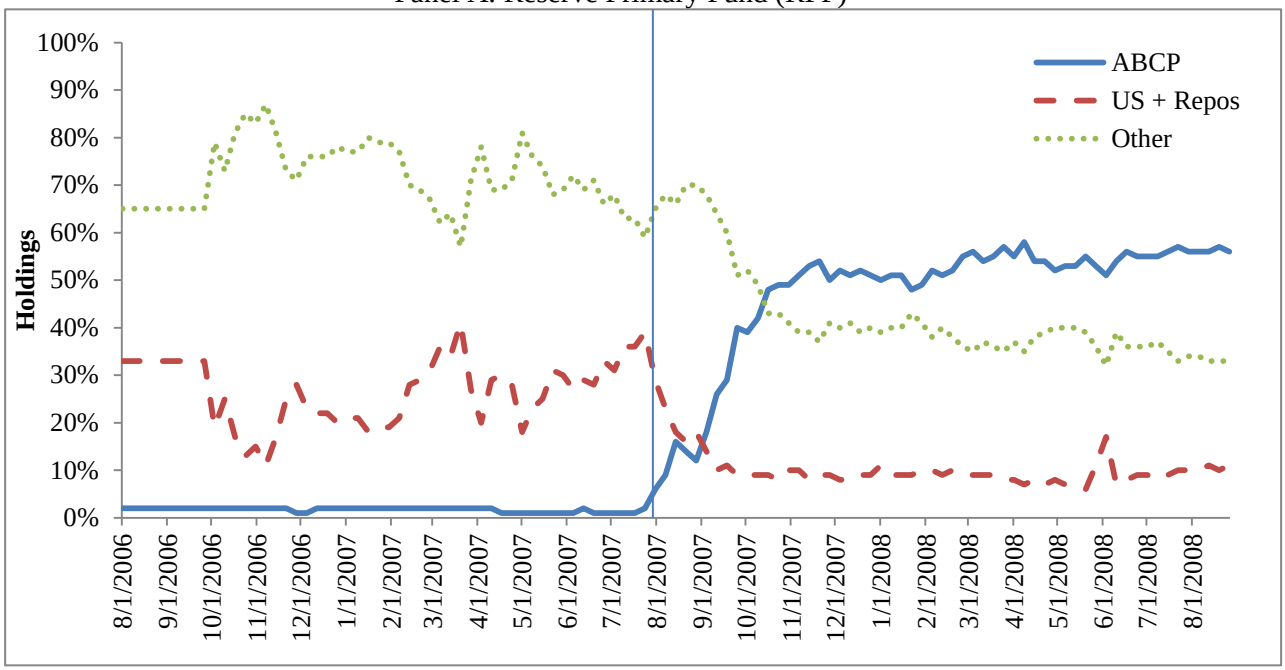


Figure IV: Assets Holdings: Reserve Primary vs. Fidelity Institutional Prime

This figure plots weekly holdings of the Reserve Primary Fund (Panel A) and the Fidelity Institutional Prime Money Market Fund (Panel B) from August 2006 to August 2008. U.S. + Repos is the share of assets invested in U.S. Treasures, agency-debt, and repurchase agreements. ABCP is the share invested in asset-backed commercial paper. Other is the share invested in other securities.

Panel A: Reserve Primary Fund (RPF)



Panel B: Fidelity Institutional Prime (FID)

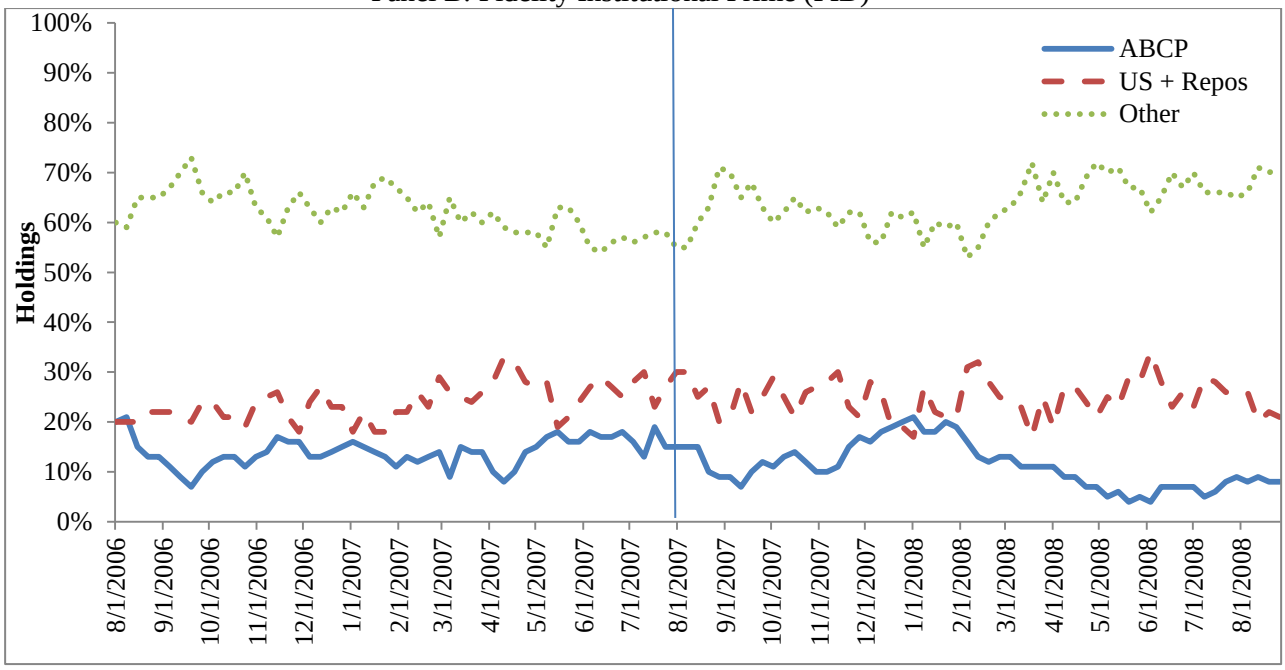
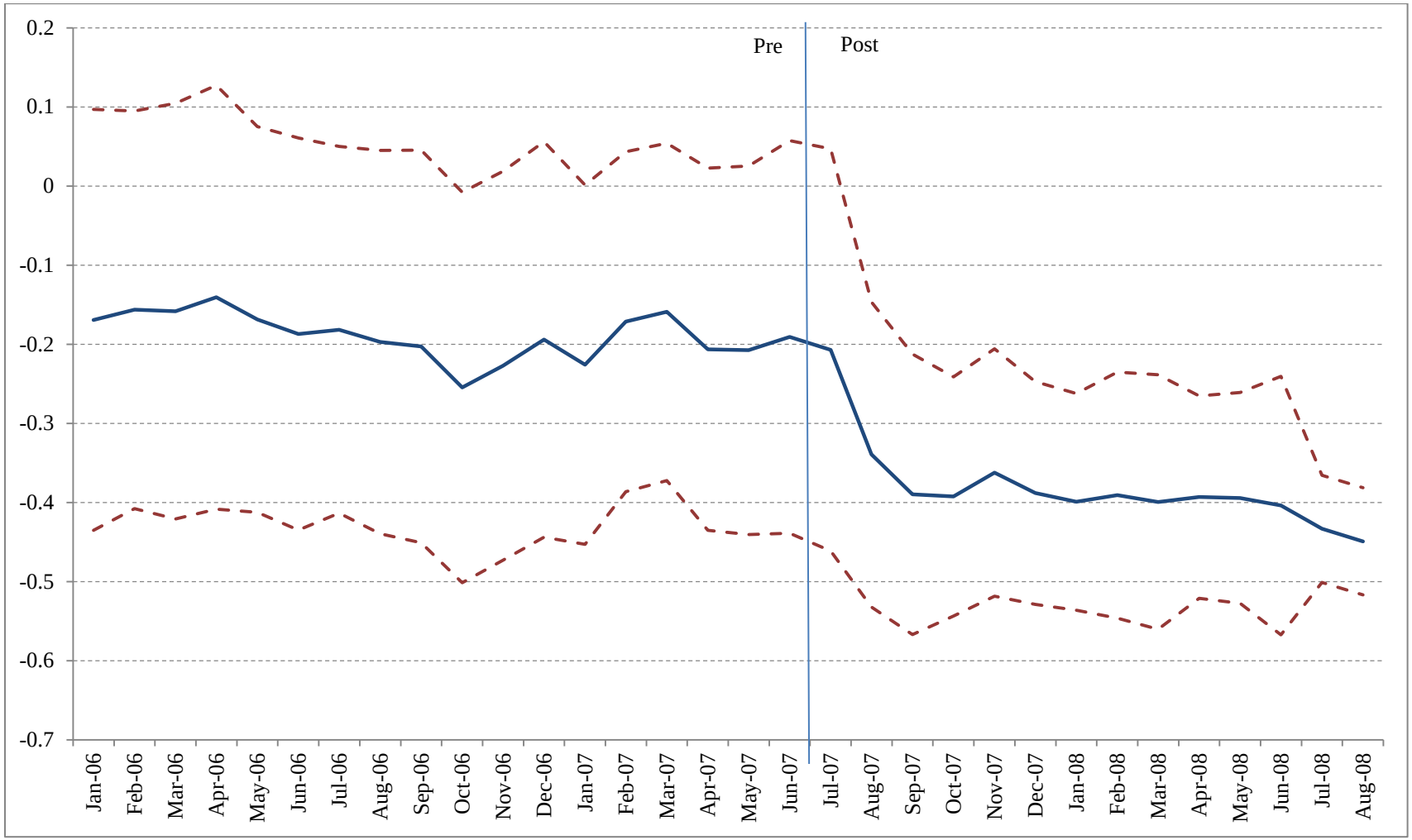


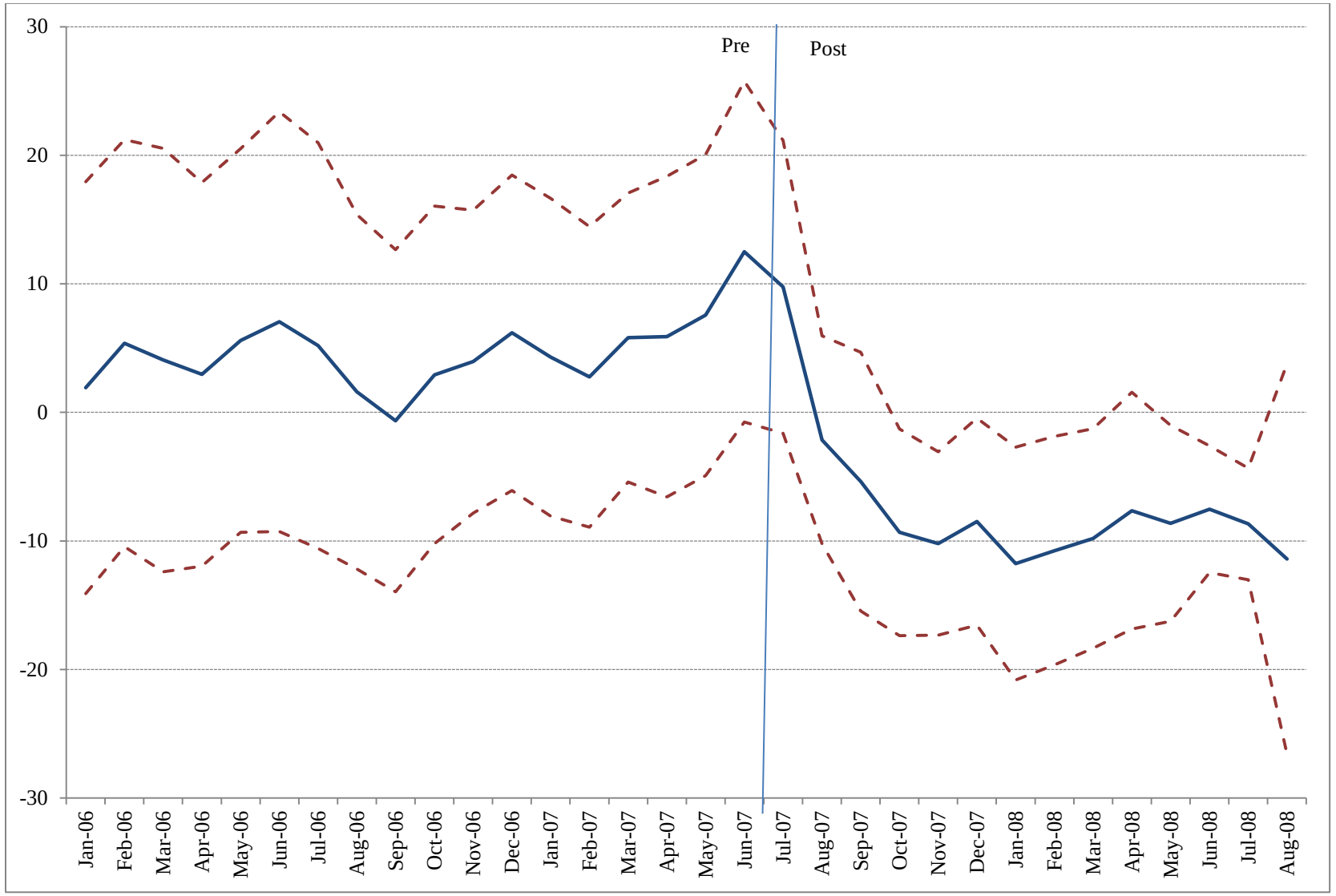
Figure V: Sponsor's Fund Business Concerns and Risk Taking

Each of the four panels below plots interaction coefficients from an OLS regression. The dependent variable is one of the three risk measures: holdings risk, maturity, and spread. The main independent variable is the interaction of the fund sponsor's share of other mutual fund assets relative to all total fund assets and monthly indicator variables. We include all control variables defined in Table IV.

Panel A: Holdings Risk



Panel B: Maturity Risk



Panel C: Spread