NBER WORKING PAPER SERIES

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Working Paper 17321
http://www.nber.org/papers/w17321

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 2011

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NBER Working Paper No. 17321
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JEL No. E44,E5,G01,G1,G11,G14,G2,G21,G32,G33

ABSTRACT

A firm's termination generates bankruptcy costs. This may create incentives for a firm's owner to bail out a firm in bankruptcy and to curb the firm's risk taking outside bankruptcy. We analyze the role of such implicit guarantees in the context of financial institutions that sponsor money market mutual funds. Our identification strategy exploits a large, exogenous expansion in risk-taking opportunities of money market funds during the period of August 2007 to August 2008. We find that a fund's response to the expansion depends on its sponsor's ability to provide implicit guarantees: Funds sponsored by financial institutions with higher equity take on less risk than those sponsored by financial institutions with lower equity. Moreover, fund sponsors with higher equity are more likely to provide financial support to their funds during a market-wide run in September 2008. The difference in risk taking disappears once implicit guarantees by fund sponsors are replaced with an explicit government guarantee. Overall, our findings suggest that implicit guarantees may reduce, rather than increase, risk taking.

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A firm's termination generates bankruptcy costs. These bankruptcy costs can create incentives for the firm's owner, or third parties doing business with the firm, to bail out the firm if bankruptcy looms. The expectation of such bailouts is often referred to as an implicit guarantee; implicit, because the provider of the guarantee does not have to commit to bailing out the firm.

Implicit guarantees can have important consequences for firms' risk-taking decisions. From a theoretical perspective, there are two opposing effects: On the one hand, the provider of the guarantee may want to reduce risk taking to minimize the costs of a bailout. On the other hand, the beneficiary of the guarantee may want to increase risk taking because the guarantee provides protection on the downside. As a result, the overall impact of implicit guarantees on risk taking is ambiguous and remains an empirical question—one that we address in this paper.

Our research context is money market funds. Money market funds are mutual funds that invest exclusively in short-term debt instruments. The most important characteristic of these funds is that, contrary to other mutual funds, they use historical cost accounting, rather than market value accounting, to assess the value of their holdings. The benefit of this valuation approach is that money market funds can maintain a constant net asset value of $1 per share. This allows them to sell demand deposits that are considered almost as safe as bank deposits (or money) to outside investors. The downside of this valuation approach is that it exposes such funds to self-fulfilling runs a la Diamond and Dybvig (1983): If investors expect the market value of a fund's holdings to drop below its amortized cost, they may all redeem their shares at the same time, which can then trigger a drop in market value due to forced liquidation at fire-sale prices.

Implicit guarantees are the main mechanism used by money market funds to address the threat of self-fulfilling runs. These guarantees are provided by a fund's sponsoring financial institution, also called a fund sponsor. Contrary to bank deposits, the guarantee is not explicit, that is, sponsors have no contractual obligation to support a fund, but there is a strong expectation by fund investors that they do so.[1] This implicit arrangement between sponsors

[1]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

and investors has served the money market fund industry remarkably well. From the start of the first fund in October 1971 until September 2008, only one fund ever suffered a run.[2] As a result of the perceived safety, money market funds, also called "mutual funds for overnight surpluses", have grown to $3 trillion in assets under management by 2008. By comparison, in 2008 the entire U.S. equity mutual fund industry accounted for $3.7 trillion and the total value of overnight bank deposits issued by the U.S. commercial banking sector equaled $4 trillion.

Analyzing the effect of implicit guarantees on risk taking poses significant empirical challenges. First, by the very nature of being noncontractual, implicit guarantees are difficult to observe and quantify. Second, a firm's risk taking involves many different decisions, some of which are hard to measure. Third, the provision of implicit guarantees might be endogenous with respect to a firm's risk taking. We believe the money market fund sector is an ideal setting in which one can address these challenges. First, using data on sponsor's capital, we can measure the strength of implicit guarantees based on the ex-ante likelihood that a sponsor can provide a guarantee if called upon. Second, risk taking is a central element of money market funds' operations, the scope of which, in contrast to a regular corporate setting, we can quantify using novel data on weekly fund portfolios and fund returns. Third, and most importantly, we can use a natural experiment that allows us to use the cross-sectional variation in fund sponsors' ability to provide implicit guarantees.

Our natural experiment relies on a large, exogenous expansion in risk-taking opportunities of money market funds. Money market fund regulation requires funds to invest solely in short-term debt securities that satisfy strict safety criteria such as short maturity, high credit rating, and sufficient liquidity. Before August 2007, as shown in Figure 1, the spread between the average yield on eligible securities and that on Treasury Bills was at most 25 basis points, which made the securities almost as safe as short-term government debt. At the same time, such a small spread provided little scope for extra risk taking. However, starting in August 2007 the risk

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)).

[2]In 1994, a small money market fund, Community Bankers Money Fund, broke the buck, that is, its net asset value dropped below $1 down to 96 cents, because of its exposure to the Orange County bankruptcy.

of eligible securities increased because the collateral and liquidation values underlying money market instruments deteriorated due to the U.S. subprime mortgage crisis. As a result, the spread between the most risky eligible securities and Treasury Bills increased five-fold to 125 basis points, which greatly enhanced the scope for risk taking. Money market funds had strong incentives to boost their returns by taking on more risk because the flows from money market investors were highly sensitive to return differentials across funds.

To identify the impact of implicit guarantees, we exploit differences, over time and across funds, in fund sponsors' abilities to provide guarantees. Before August 2007, sponsors were generally expected to have access to capital markets to prevent runs on their funds. However, as a result of the subsequent new risk-taking opportunities, it became apparent that stopping a run would require significantly higher capital outlays and only sponsors with sufficient financial strength would be able to provide support.

In our tests, we use a sponsor's financial strength before August 2007 as a measure of the strength of a fund's implicit guarantees. Specifically, we measure such strength using the value of sponsor's equity. We use sponsor's equity before August 2007 because it is unlikely to be chosen in anticipation of a fund's risk-taking behavior. The reason is that all money market funds are sponsored by mutual fund organizations that are either independent or affiliated with a large financial institution and the choice of affiliation is an important determinant of a sponsor's financial strength. This choice usually occurs years prior to the (unexpected) change in risk-taking opportunities and is based primarily on characteristics of the entire mutual fund organization of which money market funds are only a small part.

Our main result is best illustrated with a tale of two funds: the Reserve Primary Fund ("Reserve Primary") and the Columbia Cash Reserves Fund ("Columbia Cash"). Before August 2007, both funds had comparable values of assets under management and charged similar management fees. The main difference between the two funds was that Reserve Primary was managed by an independent mutual fund company with effectively no equity and Columbia Cash by a mutual fund company owned by Bank of America with total equity of $57.1 billion.

As shown in Figure 2, the returns on both funds roughly matched the industry average up to August 2007. Starting in August 2007, however, the returns on the two funds diverged sharply: Relative to the industry average, the return on Reserve Primary increased by about 40 basis points, while the return on Columbia Cash decreased by about 20 basis points. The return differential triggered significant flows: Reserve Primary tripled its assets under management from $20 billion in August 2007 to $60 billion in August 2008, while assets under management of Columbia Cash declined from $30 billion to $20 billion. Figure 3 illustrates that the return differential was entirely driven by changes in the funds' holdings after August 2007: Reserve Primary increased its holdings of risky assets from 0% to 60%, while Columbia Cash decreased slightly its holdings of risky assets.

We attribute the difference in the risk-taking behavior between Reserve Primary and Columbia Cash to the differential abilities of their sponsors to provide implicit guarantees after August 2007. Consistent with this interpretation, we find that the sponsors of the two funds reacted differently when runs eventually occurred. On September 16, 2008, the Reserve Primary Fund lost about 1% of its portfolio value due to its direct exposure to Lehman's bankruptcy, which triggered a run on the entire money market fund industry. During the run, Reserve Primary's sponsor scrambled to support its fund but was unable to do so; at the same time, money market funds of Columbia Management Group received jointly a $600 million bailout from its sponsor.

To confirm that the tale of two funds is representative of all money market funds, we turn to evidence from panel-based regression analysis. At the outset, we restrict our sample to institutional prime money market funds, which are funds that invest in non-government securities and are sold exclusively to institutional investors. We focus on these funds because we do not expect the subprime crisis to have an economically meaningful effect on funds that invest solely in government securities and because, in contrast to retail investors, we expect institutional investors to react promptly to yield differentials across funds. In general, these funds represent the majority of assets under management in the money market fund industry.

We first assess the benefits of taking risk by estimating the relationship between fund flows

and fund past returns. We find that a one-standard-deviation increase in fund returns raises subsequent weekly flows by 0.6%, or equivalently fund size by 36.4% per year. This result is independent of a sponsor's financial strength, which suggests that all funds faced similar incentives to boost their portfolio returns.[3]

Subsequently, we examine the impact of a sponsor's financial strength on risk taking. Our primary measure of financial strength is the size of a sponsor's equity, which we interpret as an empirical proxy for a sponsor's ability to provide substantial financial support at a short notice. We measure risk using four proxies: (1) the fund return relative to Treasury Bills (spread); (2) the share of risky assets holdings (holdings risk); (3) the sum of squared risky asset shares (concentration risk); and (4) the weighted average maturity of fund holdings (maturity risk).

We find that a one-standard-deviation increase in the natural logarithm of a sponsor's equity reduces spread by 3.5 basis points, holdings risk by 3.4 percentage points, concentration risk by 2.7 percentage points, and maturity risk by 2.8 days after August 2007. This result is economically significant in that each respective effect accounts for 15%, 18%, 16%, and 23% of the cross-sectional standard deviation of each risk measure. We do not find a statistically or economically significant impact of equity on these risk measures prior to August 2007. Consistent with the importance of guarantees, we further find that a sponsor's equity predicts financial support: A one-standard-deviation increase in equity increases the likelihood that a sponsor announces a bailout in the week after Lehman's bankruptcy by 12.5 percentage points. These results strongly suggest that implicit guarantees reduce risk taking of money market funds.

One possible concern with our results is that, even if sponsor's equity were not chosen to accommodate risk taking, equity might be correlated with other (unobserved) sponsor characteristics that directly affect risk taking. For example, sponsor's equity is a proxy for a sponsor's affiliation with a large financial institution and this affiliation might be correlated with other sponsor characteristics, such as the quality of risk management, risk aversion, investment style,

[3]Such "yield chasing" by fund investors is consistent with recent models of neglected risks and costly learning (e.g., Gennaioli, Shleifer and Vishny (2011)). This type of a model applies quite well to our context, given that fund investors experienced a 35-year period without significant runs.

or access to private information. These variables would explain our results to the extent that the unobserved sponsor characteristic affects risk taking after (but 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 introduce another dimension along which we can compare funds, the distinction between institutional and retail funds. Our analysis so far 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 is much weaker for these funds and, as a result, the impact on such funds' risk taking should be smaller. This prediction is specific to our economic mechanism of implicit guarantees 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 a sponsor's equity has almost no effect on risk taking of retail funds. This result supports our interpretation that the differences in risk taking across funds are due to differences in the scope of implicit guarantees provided by their sponsors.

In another attempt of validating our identification strategy, we exploit the time-series variation in the importance of implicit guarantees. Following the run on money markets in September 2008, the government introduced an explicit government guarantee program for all money market fund deposits, which effectively replaced sponsors' implicit guarantees. Consequently, if the presence of implicit guarantees causes the differences in risk taking, we should expect no differences in risk taking after the government guarantee was announced. This is indeed what we find: After the announcement, the differences in risk taking across funds gradually disappeared.

We further confirm the robustness of our results in a series of additional tests. First, we find that managerial compensation is similar across sponsors with different equity values. Any differences in managers' quality or managerial monetary incentives are thus unlikely to explain our results. Second, we perform our analysis using the sponsor's affiliation with a large financial institution and the its external credit rating as alternative measures of implicit guarantees and find that the results are similar. Third, our results remain unchanged when we control for

relative assets size of prime funds within a fund family, which suggests that the sponsor type does not simply proxy for the reputation costs of money market distress. Fourth, our results hold if we include managerial tenure as an additional control variable, which indicates that managerial career concerns are not an important driver of our findings. Fifth, our effects are slightly stronger for larger fund companies, which is consistent with the general observation that large funds are more involved in active risk management. Last, we show that all our results are robust to excluding outliers.

Overall, our paper's main message is that implicit guarantees can reduce risk taking because the provider of the guarantee internalizes the expected bailout cost. This finding stands in contrast to those broadly discussed in other, mostly theoretical studies, which predict increased risk taking in the presence of implicit guarantees. We argue that the reason behind such differences stems from differences in the underlying information structure. While the risk-taking predictions derived in other studies are largely dependent on the asymmetric information (moral hazard) problem between the manager and the guarantee provider, in our paper, the risk-taking behavior is largely driven by the asymmetric information between the fund sponsor and outside fund investors. We believe both effects can be plausible and which one dominates depends on the observability of risk taking and the monitoring incentives of the provider.

Our study makes contributions to several strands of the literature. To the best of our knowledge, ours is the first paper to offer systematic and direct empirical evidence on the role of implicit guarantees inside financial institutions. More generally, we present an account of corporate support within organizations. In this regard, our paper is related to a study by Gopalan, Nanda and Seru (2007) which examines the impact of financial support offered by headquarters of Indian business groups to their divisions. Their study, however, is not about implicit guarantees, and their focus is on ex-post outcomes rather than on ex-ante decisions.

From a theoretical perspective, our work is related to a voluminous literature that has studied the impact of financial strength on allocation of resources within financial institutions. This literature considers the role of so-called balance sheet amplifiers in generating distress. The

main sources of variation in financial strength addressed by these studies are leverage, credit constraints, and limited capital. An excellent summary of the main ideas offers Krishnamurthy (2010). We extend this literature by analyzing empirical implications of differences in financial strength for risk-taking behavior.

A separate strand of literature examines the role of mutual funds within larger financial complexes. Ritter and Zhang (2007) show that lead underwriters allocate hot initial public offerings to affiliated funds. Massa and Rehman (2008) argue that information flows within financial conglomerates affect asset holdings of their equity mutual funds. Chen, Goldstein and Jiang (2010) examine runs in the context of equity mutual funds. More specific to our empirical context is a small literature on the workings of money market funds. Notable contributions in this group include Christoffersen (2001), Christoffersen and Musto (2002), Kacperczyk and Schnabl (2010), and Squam Lake Group (2011). Relative to these studies, ours is the first one to emphasize the role of implicit guarantees and their impact on risk-taking decisions.

Finally, our study parallels contemporaneous empirical literature on the impact of the recent financial crisis on money markets. Gorton (2009) and Gorton and Metrick (2009) investigate the impact of the crisis on the pricing of repo contracts. Brunnermeier (2009) studies the freeze in the market for asset-backed commercial paper. Kacperczyk and Schnabl (2010) investigate the relative role of demand and supply sources and their consequences for the commercial paper market. Krishnamurthy and Vissing-Jorgensen (2010) investigate the role of macroeconomic conditions in the pricing of Treasuries relative to corporate bonds. Cornett, McNutt, Strahan and Tehranian (2011) examine the impact of banks' funding liquidity on credit supply. Acharya, Schnabl and Suarez (2009) study the incentives for issuing asset-backed commercial paper.

The rest of the paper proceeds as follows. In Section 1, we lay out the theoretical foundations for our empirical tests. In Section 2, we describe our research setting. Section 3 describes the data. In Section 4, we discuss our identification strategy and present main empirical results, and in Section 5 we study their robustness to alternative explanations. Section 6 concludes.

1 Hypothesis Development

Theoretical literature in finance and economics emphasizes two mechanisms through which any guarantee may affect risk taking. While the implications of these theories are applicable to many settings, in this section, we discuss their importance in the context of money market funds. Notably, the two mechanisms generate different predictions regarding risk taking largely because they make different assumptions about the underlying information structure.

The first mechanism relies on the information asymmetry (moral hazard) between the guarantee provider and the fund manager. The main driving force is that the provider of the guarantee cannot perfectly observe the fund manager's risk-taking decisions. To the extent that the manager's expected compensation increases in risk taking, the manager may be willing to take on more risk as she is protected by the guarantee. Put differently, the expectation of future bailouts encourages risk taking among managers.

A substantial empirical literature documents the importance of such moral hazard for risk-taking decisions. The literature focuses on explicit and implicit guarantees provided by the government to the banking sector. Keeley (1990) finds that the combination of deposit insurance and lower bank charter values leads to risk shifting among commercial banks. Saunders, Strock and Travlos (1990) show that stockholder-controlled banks take on more risk than manager-controlled banks. Esty (1997) finds that stock thrifts take on more risk than mutual thrifts because of limited monitoring by depositors. Kelly, Lustig and Van Nieuwerburgh (2011) show that during the financial crisis of 2008 the price of put options on individual member banks increased more than the price of a put option on a financial sector index, consistent with the idea that the provision of systemic guarantees is priced by investors.

Despite its intuitive appeal, we believe that the moral hazard problem delineated above is unlikely to explain risk taking in money market funds. The reason is that a given security's asset class and its return—both being good measures of risk for most money market instruments—are readily observable outcomes. As a result, the provider of a guarantee (fund sponsor) can easily monitor a fund manager's risk taking and effectively mitigate the degree of risk-shifting

behavior.[4] Moreover, fund sponsors are likely to lay off any fund manager contributing to a negative outcome such as a run, which effectively eliminates managers' downside protection.

The second mechanism focuses on the information asymmetry between the guarantee provider and the fund investors. The main assumption behind this mechanism is that, in their interpretation of the observed fund returns, fund investors do not fully account for any differences in risk, resulting, for example, from differences in strength of implicit guarantees provided by a fund sponsor. In general, one explanation of such behavior could be that the expected benefit of learning such information is low relative to the cost of acquiring such information (Dang, Gorton and Holmstrom (2009)). Alternatively, investors may neglect risks which are not salient to them given the absence of negative events from past data (Gennaioli and Shleifer (2010) and Gennaioli et al. (2011)).

Empirical evidence supports the apparent lack of risk adjustment among investors. For example, Kacperczyk and Seru (2007) show that investors' fund flows react to funds' raw returns even after controlling for any differences in the funds' risk-adjusted returns. Also, Chevalier and Ellison (1997)) show that the flow-performance relationship for equity mutual funds is convex, which suggests that fund investors might evaluate their funds in a rank-based fashion and not just based on risk-adjusted returns. Finally, several observers suggested that investors did not sufficiently account for risk in the run-up to the financial crisis of 2007–2009 (e.g., Jarrow, Li, Mesler and van Deventer (2007), Gerardi, Lehnert, Sherlund and Willen (2008)).

We argue that the behavior of money market fund investors might have exhibited a similar lack of risk adjustment. First, until the recent financial crisis, fund investors had little experience with runs given the industry's lack of runs 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 research sponsor's ability to support funds, any investors that worry about the risks of money market funds are likely to choose other

[4]Our multiple private conversations with money market fund managers and their sponsors suggest that one of the specific characteristics of the money market industry is a high degree of transparency inside the organization in the process of information transmission between manager and fund sponsor.

investment products, such as banks deposits.

Based on the above, we posit in our empirical tests the lack of risk adjustment among fund investors and analyze its impact on risk taking. Specifically, if investors do not adjust for differences in sponsors' ability to provide guarantees, we should expect investors to choose funds without regard to the fund sponsor's financial strength. This leads us to our first hypothesis.

Hypothesis 1. *If fund investors do not adjust for the fund sponsor's financial strength, then the flow-performance relationship should be independent of the sponsor's financial strength.*

We next evaluate the fund manager's optimal investment strategy given that investors do not adjust for the sponsor's ability to provide guarantees. To focus on this mechanism, we assume away a moral hazard problem between the fund sponsor and the fund manager.

To gain an intuitive understanding of our idea, consider two types of sponsors: The first one has no capital and thus no ability to provide an implicit guarantee; the second one has access to unlimited capital and thus can provide a guarantee if called upon. Assume that a fund's franchise value at risk is large enough such that a fund sponsor is willing to provide a guarantee ex post. Also, assume that risk taking increases the cost of providing support in case of a run.[5]

Given the assumptions, we now trace risk-taking responses given a positive probability of a large-scale run on the industry. The sponsor type with unlimited capital would internalize the cost of providing support but the sponsor type without capital would not. As a result, the sponsor type with unlimited capital would reduce risk taking relative to the sponsor type without capital. We summarize this result in our second hypothesis.

Hypothesis 2. *Risk taking should decrease in a sponsor's financial strength.*

The above mechanism relies on the assumption that sponsors with higher financial strength

[5]Note that depositors may run even if they expect to receive the full value after a fund sells off its entire asset holdings because depositors may suffer negative liquidity shocks during the sell-off (Bernardo and Welch (2004)).

are more able to provide support if a run occurs. This assumption is testable in case of a run on the industry. This leads us to our third hypothesis.

Hypothesis 3. *If a run occurs, the likelihood of providing support is increasing in the sponsor's (ex-ante) ability to provide guarantees.*

We conclude this section with two general observations. First, our empirical result can be also interpreted as a form of asset substitution (or risk shifting). While sponsors with no capital neglect the cost of a run and maximize a fund value conditional on survival, sponsors with unlimited capital internalize the cost and optimally maximize their funds' value. Hence, the sponsor's equity plays the same role as the owner's equity in a standard model of asset substitution.

Second, risk taking by sponsors with unlimited capital need not be socially efficient. For example, if sponsors with unlimited capital benefit from government guarantees that lower their costs of capital, then the implicit guarantees may be mispriced and in turn affect the funds' risk taking. However, such mispricing would not affect our main cross-sectional prediction that sponsors with no capital increase risk relative to sponsors with unlimited capital. The economic force behind this result is due to the fact that sponsors with unlimited capital internalize the costs of runs and the sponsors' costs of capital only affect the relative size of this effect.

2 Context: Money Market Funds

2.1 Primer on money market funds

Money market mutual funds (henceforth, 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 market 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 money market 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 market funds is that, contrary to bank deposits, investments in money market funds are generally not insured by the government. Although money market funds seek to preserve the value of their assets at $1 per share, it is still possible that fund investors could realize losses on their investments. Such losses could result from changes in interest rates or from defaults of individual securities.

To limit risks of money market funds, their holdings 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, the regulation requires short-term debt to be of high credit quality. For example, the regulation 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 money market funds account for 84.5% of all assets under management in the money market fund industry.

As of January 2007, there were 473 taxable money market funds holding assets worth $1.95 trillion. About one-third were Treasury funds, which only hold government debt, government-backed agency debt, and repurchase agreements. The remaining two-thirds were prime funds that also invest in non-government assets. In January 2007, the largest asset class held by prime funds was commercial paper, accounting for $634 billion or 32.5% of total asset holdings. The

other asset classes were government debt and government-backed agency debt ($585 billion), repurchase agreements ($390 billion), bank obligations ($297 billion), and other assets ($45 billion) (Kacperczyk and Schnabl (2010)).

Most large money market funds are geared towards institutional investors. In Table 1, we present summary information for the 20 largest institutional prime funds as of January 2007. At that time, these funds accounted for a total of $491 billion worth of assets. The largest fund was the JP Morgan Prime Money Market Fund with assets under management equal to $88.4 billion, followed by Columbia Cash Reserves and BlackRock Liquidity funds, which were about half the size. The last fund on the list, Evergreen Institutional Money Market Fund still managed a considerable $15.8 billion worth of assets. On average, institutional prime 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 the total of financial commercial paper, structured securities, bank obligations, and repurchase agreements—accounted for 91.4% of money market fund assets.

In addition, Table 1 provides information about the funds' sponsors: their equity values, credit ratings, and organizational form, that is, whether a fund sponsor is independent or affiliated with a commercial bank, investment bank, or insurance company. Among the largest 20 funds, an equal number was independent or had an affiliation. The largest sponsor in terms of equity value was Bank of America, followed by JP Morgan, and Deutsche Bank.

2.2 Money market funds during the financial crisis

2.2.1 Change in risk-taking opportunities

Money market funds played an important role during the financial crisis of 2007–2009. Prior to August 2007, fund regulation effectively prevented the funds from investing in risky assets. As a result, since its origins in the 1970s, money market funds invested in similar assets and paid similar returns. However, starting from August 2007, a number of events changed the risk-taking opportunities of money market funds. 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 Paribas 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 basis points 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 market 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 money market instruments that were perceived as risky—bank obligations, floating-rate notes, and commercial paper. At the same time, the rates of asset classes that were perceived as safe, such as Treasuries, repurchase agreements, and bank deposits, remained at much less elevated levels.

Figure 1 presents evidence of this sudden change in relative asset returns. From January 2005 to July 2007, all asset classes had returns of about 15 to 25 basis points higher relative to those of Treasury Bills and agency debt, with no significant differences across asset classes. However, beginning with August 2007, the returns on risky asset classes started to increase rapidly with a peak in March 2008 when we observe relative returns of up to 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, starting in August 2007, we observed a clear divergence in returns across risky and safe asset classes.[6]

Notably, the observed variation in returns on risky and safe asset classes coincided with key

[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 interaction terms capture the monthly return relative to that of Treasury Bills and agency debt.

events during the financial 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 to risky asset classes 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 financial crisis, such as the LIBOR-OIS spread, exhibited similar time-series patterns as did the returns on risky asset classes of money market funds. Based on the above evidence, we conclude that the start of the financial crisis in August 2007, provided money market funds the opportunity to invest in riskier assets.

2.2.2 Tale of two funds: Reserve Primary Fund and Columbia Cash Reserves

We illustrate possible reactions to this change with an example of two funds: the Reserve Primary Fund (RPF) and the Columbia Cash Reserves (CCR). Between the two, RPF was particularly well known in the industry because of its owner, Bruce Bent, the founder of the first money market fund in the 1970s. Until July 2007, both funds had about $25 billion of assets under management and charged similar management fees. In what follows we present the evolution of each fund's returns, fund assets, and holdings over the period from July 2006 to August 2008.

In Figure 2, we present the returns on both funds relative to the industry average. Prior to August 2007, the returns roughly matched the industry average. However, starting in August 2007, the relative returns on the two funds diverged sharply: Relative to the industry average, the return on RPF increased by about 50 basis points, while at the same time the return on CCR decreased by about 30 basis points. The return differential triggered significant money flows: RPF tripled its assets under management, from $20 billion in August 2007 to $60 billion in August 2008, while CCR's asset value declined, from $30 billion to $20 billion.

The observed differences in both returns and fund flows were largely a consequence of the differences in the underlying fund portfolios, especially after August 2007. Figure 3 shows that

RPF increased its holdings of risky assets from 0% to 60% while it reduced its exposure to safe Treasury Bills and repurchase agreements from 40% to 10%. In contrast, CCR actually decreased its holdings of risky assets slightly and kept the same level of safe Treasury Bills and repurchase agreements.

We argue that the difference in the risk taking between RPF and CCR can be attributed to the differential ability of their sponsors to provide implicit guarantees after August 2007. While RPF was managed by an independent mutual fund company with almost no equity, CCR was managed by a mutual fund company sponsored by Bank of America whose equity, as of January 2007, equaled $57.1 billion dollars. As a result, it seems plausible that CCR was more likely to obtain sponsor support for its fund. As it turns out, the underlying difference was a crucial determinant of how each of the funds chose its own risk levels and how each of them absorbed the shocks related to bankruptcy of Lehman Brothers.

2.2.3 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 in Lehman's commercial paper. By May 2008, the fund additionally increased its Lehman's holdings to $775 million, which at that time accounted for about 1% of its holdings.

On September 15th, 2008, Lehman Brothers declared bankruptcy. Its failure triggered a panic in financial markets and lead to a credit market freeze. As a direct 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 out $10.8 billion in redemptions and faced about $28 billion of further 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 funds. Within a week, institutional investors reduced their investments in money market funds by more than

$172 billion. Among others, the sponsor of CCR, Bank of America, set aside $600 million to support its money market funds, which helped stabilize CCR's operations.

Eventually, many funds got distressed and the consequences of the industry collapse 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 market 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.

3 Data and Summary Statistics

Our study combines four data sources. First, we obtain data on the universe of taxable money market funds from iMoneyNet, which cover the period from January 2005 to December 2009 and include weekly fund-level data on returns, expense ratios (charged and incurred), holdings by asset class, and average maturities of fund holdings. Second, we complement the data using information from CRSP Mutual Fund Survivorship Bias Free Mutual Fund Database. Third, we use COMPUSTAT to construct measures of sponsors' support and collect information on fund manager characteristics. Fourth, we collect data on no-action letters issued by the SEC—an indication that a sponsor provided financial support to its fund. Altogether, we obtain a novel data set that, to the best of our knowledge, has not been used in academic research before.

Column (1) of Table 2 provides summary statistics for all prime institutional money market funds (henceforth, prime funds) as of January 2007. Our sample includes 146 prime funds. The average fund size is $6.1 billion and the average fund age is 12.7 years. We compute the annualized spread as the fund return net of expenses minus the return on the three-month Treasury Bills. The average spread is 22 basis points and the average expense ratio is 31 basis points. In terms of asset holdings, prime funds hold 3.5% in U.S. Treasuries and agency-backed debt, 11.2% in repurchase agreements, 3.1% in deposits, 13.3% in obligations, 22.2% in floating-rate notes, 30.7% in commercial paper, and 16.0% in asset-backed commercial paper.

Next, we divide fund sponsors into two groups based on their ability to provide implicit guarantees. Our primary measure of the ability to provide guarantees is the fund sponsor's equity. We compute equity as total equity reported in COMPUSTAT minus intangibles. We assign zero equity if we cannot match a fund sponsor to COMPUSTAT. We use other sources to confirm that fund sponsors with zero equity are private companies that are small and do not report to COMPUSTAT. In our robustness tests, we also use alternative measures of support, such as the sponsor's credit rating and whether a sponsor is affiliated with a commercial bank, investment bank, or insurance company.

Column (2) provides summary statistics for funds whose sponsors have equity values below the median value as of January 2007. Column (3) provides summary statistics for funds whose sponsors have equity values above the median value. We find that funds associated with both high and low-capital sponsors have similar fund characteristics and average asset holdings. The only difference is that funds sponsored by high-capital companies hold a slightly higher share of floating-rate notes and repurchase agreements and fewer bank obligations, though the differences are not statistically significant.

4 Empirical Strategy and Results

4.1 The choice of a sponsor's type

Any credible assessment of the impact of implicit guarantees on risk taking must address the problem that fund sponsors optimally choose whether to provide implicit guarantees. For example, some sponsors may be better at incentivizing fund managers to take on less risk, hence may be more willing to provide implicit guarantees. In this case, a simple comparison of funds sponsored by companies that provide implicit guarantees and funds sponsored by companies that do not provide guarantees does not represent the counterfactual of interest—namely, the level of risk taking for a given fund with and without implicit guarantees. In an ideal experiment, we would like to randomly assign implicit guarantees to funds and then analyze the causal impact

of the random assignment. In practice, funds might choose their types based on their relative costs and benefits, which could include access to private information, diversification of income revenues, incentive system for fund managers, and cross-selling of fund products.

An important advantage of our setting is that money market funds played a negligible role in most fund sponsors' structures prior to Summer 2007. In particular, money market funds typically constituted a small part of larger mutual fund families and the choice regarding the fund family's equity was likely independent of money market funds themselves. Since the inception of money market funds in the 1970s, all funds paid similar returns and there was little scope for exploiting private information or superior managerial ability. Indeed, money market 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 level of sponsor's equity was thus primarily driven by the characteristics of the entire mutual fund family of which money market funds were only minor consideration. In support of this claim, the summary statistics in Table 2 show that funds sponsored by mutual fund families with low equity were similar to funds sponsored by mutual fund families with high equity.

Given that money market funds look similar on an ex-ante basis, our empirical strategy relies on the differential response by sponsor's type to an exogenous change in risk-taking opportunities. Specifically, starting in August 2007, money market instruments became significantly riskier, which allowed more scope in funds' risk-taking choices. This change in riskiness of the instruments provided money market funds, usually constrained in their risk choices, with an opportunity to take on more risk.[7] Even though money market instruments experienced episodes of increased relative spreads in the past, it is fair to say that the change in risk-taking opportunities was largely unanticipated, at least around the period of August 2007. Hence, it is unlikely that the fund sponsor's capital was chosen in anticipation of the change in risk-taking opportunities.

Instead, we argue that differences in the ability to provide implicit guarantees affected the

[7]More generally, other studies, including Brunnermeier (2009), Gorton (2009), and Kacperczyk and Schnabl (2010) have documented significant increases in the riskiness of other asset classes over the same period.

observed risk choices. To test this hypothesis, we proceed in four steps. First, we estimate the impact of fund returns on fund flows, the relationship which speaks to the incentives of funds to take on more risk. Next, we present evidence on the role of implicit guarantees in risk-taking behavior. Further, we show that a fund sponsor's equity was indeed a good predictor of which funds received support from their sponsors during the market-wide run in September 2008. Finally, we provide a series of additional tests that support our baseline empirical results.

In all regressions, we pay particular attention to differences across sponsor types prior to August 2007. If sponsor type were not chosen with regard to risk taking of money market funds, then we should not observe any impact of implicit guarantees prior to August 2007. Hence, we expect neither absolute differences nor differential trends by sponsor type before August 2007.

4.2 Expansion of risk-taking opportunities

4.2.1 Relative returns to money market instruments

We document the change in risk-taking opportunities using data on fund holdings and fund returns. Specifically, we estimate the following regression model:

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

where $Spread_{i,t+1}$ is the annualized return (spread) of a fund i in week $t+1$, $Asset_{i,j,t}$ denotes a fund i's fractional holdings of asset category j at the end of week t, α_i denote fund-fixed effects, and μ_t denote week-fixed effects. The asset categories we consider include repurchase agreements, bank deposits, bank obligations, floating-rate notes, commercial paper, and asset-backed commercial paper. The omitted category is Treasury Bills and government agency debt. $X_{i,t}$ is a vector of fund-specific controls that includes the natural logarithm of fund size (*Log(TNA)*), fund expenses (*Expenses*), fund age (*Age*), fund flows (*Flows*), and the natural logarithm of the fund family size (*Log(FamSize)*). Our coefficients of interest are β_j, which measure the return of money market instrument j in week $t+1$ relative to that of Treasury Bills and agency assets.

We estimate the regression model separately for the *post*-period from August 2007 to August 2008 and the *pre*-period from July 2006 to July 2007. The post-period starts with the beginning of the subprime crisis in August 2007 and ends immediately 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 model. We choose to report our estimation results separately for the pre and post-period because the results help us validate our identification strategy which asserts no difference in risk taking in the pre-period. For most results, we also report relevant coefficients from estimating the standard difference-in-differences regression model to assess statistical significance of our findings. In all regression models, we allow for the flexible correlation of error terms within funds by clustering the standard errors at the fund level.

Columns (1) and (2) of Table 3 report the pre and post-period results for the model without fund-fixed effects. We find that risky asset classes experience 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 85 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 13 basis points. We find similar effects for other risky asset 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 15 basis points higher than the return on a fund fully invested in Treasury and agency assets, both in the pre and post-period. We obtain similar results for other safe asset classes.

One possible concern with the results is that funds with large holdings of risky asset classes might be also riskier along other unobserved dimensions. For example, 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 period.

We find quantitatively and qualitatively similar results, as reported in columns (3) and (4). For example, the return on a fund fully invested in bank obligations would have been 92 basis points higher than the return on a fund fully invested in Treasury and agency assets. In contrast, the comparable differential would have been only 17 basis points in the pre-period. Hence, our findings are unlikely to be driven by unobserved fixed fund characteristics.

Overall, these results suggest that money market funds did experience a large exogenous expansion in risk-taking opportunities. The expansion was large in the sense that the returns on risky asset classes relative to safe ones were five-fold 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. The issuers were directly exposed to the subprime crisis and their instruments therefore commanded higher risk premia. Hence, starting in August 2007, funds were given a choice of whether to invest in risky or safe assets.[8]

4.2.2 Flow-performance relationship

The main incentive for a fund to increase risk is to raise its income. This happens because risk taking increases returns, which in turn translate into greater fund inflows. Given that money market funds earn a fixed percentage of assets under management, fund inflows lead to a higher fund income. This model of competition has been widely documented in studies of equity mutual funds. These studies usually find that past performance is one of the strongest predictors of fund flows to equity funds (e.g., Chevalier and Ellison (1997)).

[8]We note that overall issuance of riskier asset classes 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. Importantly, our focus is on the variation in holdings *across* funds. While the majority of money market funds decreased their holdings of risky asset classes, some funds, such as the Reserve Primary Fund, increased their holdings.

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:

$$FundFlow_{i,t+1} = \alpha + \beta Spread_{i,t} + \gamma \mathbf{X_{i,t}} + \varepsilon_{i,t+1} \tag{2}$$

where $FundFlow_{i,t+1}$ is the percentage increase in fund size from week t to week $t+1$ accounting for earned interest, $Spread_{i,t}$ and X are defined as in (1). Our coefficient of interest is β, which measures the sensitivity of fund flows to fund past returns. We allow for correlation of error terms within funds by clustering observations at the fund level.

Table 4 reports the results. Columns (1) and (2) show the results separately for the pre and post-period for the model without fund-fixed effects. We find that during the post-period a one-standard-deviation increase in fund returns increases subsequent fund flows by 0.6% per week, or equivalently a fund size by 32% per year. In contrast, we find no statistically significant effect of fund past returns on fund flows during the pre-period. To rule out the possibility that our results are driven by unobserved time-invariant fund-specific attributes correlated with fund spreads, in columns (3) and (4), we additionally report the pre and post-period results for the model with fund-fixed effects. The flow-performance relationship is even larger: by 2.6 times in the post-period; again, we observe no impact on flows during the pre-period.

The incentives to take risk may also be shaped by differences in flows that funds with different levels of equity receive conditional on their performance. In particular, if funds sponsored by companies with high capital receive more flows because they provide implicit guarantees, 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 *Log(Equity)*. If investors incorporate guarantees in their investment decisions, we should expect the coefficient of *Log(Equity)* to be positive.

We find that, conditional on fund performance, the level of the sponsor's equity does 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 equity capital.

We also examine whether the observed change in the sensitivity of flows to performance depends on the sponsor's ability to provide implicit guarantee. To this end, we extend our empirical model in (2) by including interaction terms of fund spread and the natural logarithm of a fund sponsor's equity. 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. Hence, the benefits to having a greater fund performance in terms of greater fund inflows do not differ significantly across the sponsors' types.

In sum, the results support our premise that there was little scope to increase fund returns in the pre-period, but a large incentive to take on more risk in the post-period and the ability to attract flows was not driven by the underlying differences in the scope of implicit guarantees.

4.3 Implicit guarantees and risk taking

We now study the response of different fund sponsors to the change in risk-taking opportunities. In particular, we compare risk-taking behavior of funds sponsored by companies with high equity to that of funds sponsored by companies with low equity capital. Our hypothesis is that firms with higher equity are more likely to provide implicit guarantees to their money market funds and the existence of such guarantees decreases the funds' incentives to take on risk. To this end, we estimate the following regression model:

$$Risk_{i,t+1} = \alpha + \beta Log(Equity)_i + \gamma \mathbf{X_{i,t}} + \varepsilon_{i,t+1} \tag{3}$$

where $Log(Equity)_i$ is the natural logarithm of a fund sponsor's total equity as of January 2007. X_{it} is a vector of control variables that is identical to the one we use in equation (1). Our regression model also includes week-fixed effects, which account for any time differences in aggregate fund flows or macroeconomic conditions driving the risk-taking decisions of different fund sponsors. Since $Log(Equity)_i$ is specific to the fund sponsor, it is possible that 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, which measures the impact of a sponsor's equity on risk taking.

We use four measures of risk ($Risk_{it}$). The first measure is *Spread*, which is the weekly 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 its portfolio risk. One potential problem with using this measure, however, 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. This could also happen in our setting since the relative returns on individual assets changed significantly between the pre and post-period.

To account for such mechanical changes in portfolio riskiness, we propose three other measures. Our second measure is *Holdings Risk*, defined as a weekly fraction of risky assets in a fund portfolio. Our definition of risky assets is motivated by the results in Table 2 and includes obligations, floating-rate notes, commercial paper, and asset-backed commercial paper: All four asset classes have significantly higher returns in the post-period than do the other asset classes.

Our third measure, *Concentration Risk*, measures a tilt of money market funds towards specific asset classes. To the extent that individual asset classes might carry their own idiosyncratic risk, concentrating funds in a few asset classes increases fund risk. Our measure of concentration follows that in Kacperczyk, Sialm and Zheng (2005) and is calculated as a sum of squared weights of main asset classes in the fund portfolio. The low levels of the measure indicate low concentration risk and high levels of the measure indicate high concentration risk.

Our fourth measure, *Maturity Risk*, is the average maturity of assets in a fund portfolio, observed weekly. In general, funds with greater maturities of their assets would be considered more risky. 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-period. 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 July 2006 and August 2008, we estimate the coefficient β from the regression model (3) on *Log(Equity)*. Panel A of Figure 4 presents the results for *Spread*. We find no visible differences in the impact of sponsors' equity on spreads prior to August 2007 but, starting August 2007, we observe a large negative effect of *Log(Equity)* on spread. Panel B reports the results for *Holdings Risk*, Panel C for *Concentration Risk*, and Panel D for *Maturity Risk*. Again, we observe a similar pattern in loadings on equity as for spread.

We present the regression results in Table 5. For the post-period, we find that a one-standard-deviation increase in a sponsor's equity reduces fund spreads by 3.5 basis points, holdings risk by 3.4 percentage points, concentration risk by 2.7 percentage points, and average maturity by 2.8 days. The results are statistically significant. They are also economically significant: A one-standard-deviation increase in *Log(Equity)* corresponds to a 15% drop in spread relative to the cross-sectional standard deviation of fund spread. The respective quantities for holdings risk, concentration risk, and maturity risk account for 18%, 16%, and 23%. In contrast, we find no statistically significant impact of equity on any of the risk measures in the pre-period. These results suggest that implicit guarantees provided by fund sponsors reduce risk taking in the post-period.

4.4 Evidence on redemptions and sponsor support

We estimate the effect of sponsors' equity on the ex-post provision of implicit guarantees. Specifically, we examine financial support provided by fund sponsors during the one-week period after the start of the run in September 2008 but prior to the introduction of the Federal Deposit Insurance of money market fund assets.

We first test whether sponsors with more equity are more likely to offer financial support to their money market funds. To this end, we estimate a regression model in which the response

variable measures whether a fund sponsor provides support:

$$Support_{i,t+1} = \alpha + \beta Log(Equity)_i + \gamma \mathbf{X_{i,t}} + \varepsilon_{i,t+1} \tag{4}$$

where *Support* takes a value of one if the fund sponsor offered support to its fund and zero, otherwise. Information on fund support is based on the no-action letters filings from SEC and is further appended with hand-collected data from newspaper accounts and individual funds' press releases. X is a vector of control variables that includes *Log(TNA)*, *Age*, *Expenses*, *Log(Family Size)*. Our coefficient of interest is β.

We present the estimation results in columns (1) and (2) of Table 6. Consistent with our hypothesis, we find a positive and statistically significant effect of the sponsor's equity on the probability of receiving financial support: a one-standard deviation increase in sponsor's equity increases the likelihood of providing support by 12.5 percentage points. This finding confirms our premise regarding the sponsor's role in providing guarantees to the money market fund industry.

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

$$Redemptions_{i,t+1} = \alpha + \beta Log(Equity)_i + \gamma \mathbf{X_{i,t}} + \varepsilon_{i,t+1} \tag{5}$$

where *Redemptions* is the change in a fund size between September 18 and September 25, 2008. *Log(Equity)* and X are defined as before. Our coefficient of interest is β. We expect this coefficient to be negative since investors are less likely to run on funds that receive financial support from their sponsors.

In Table 6, columns (3) and (4), we present the results from estimating the regression model for the cross section of funds. We find a negative and statistically significant effect of sponsors' equity on a subsequent size of redemptions.

4.5 Do unobserved sponsors' characteristics explain risk choices?

In our conceptual framework, we posit that the sponsor's equity has a significant impact on its funds' risk-taking decisions. However, our effect might be driven not by differences in the sponsor's ability to provide guarantees, but rather by unobserved differences in investment styles or manager ability across fund families, which in turn might be correlated with the sponsor's level of equity. For example, a fund sponsored by Fidelity Management Company, a low-capital company, might be willing to take more risk than a fund sponsored, by Bank of America, a high-capital 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-period. 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.

4.5.1 Evidence from retail money market funds

Although we believe such differences are not *a priori* 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 the 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. Hence, even though sponsors of retail and institutional funds have the same unobserved characteristics, we expect a difference in their risk taking in the post-period.

We begin our analysis with estimating the flow-performance relationship for retail funds, separately for the pre and post-period, with and without fund-fixed effects. Panel A of Table 7 presents the results. Consistent with our premise, we find that the flow-performance relationship

is quite weak for the sample of retail funds in both periods. The effect is also not driven by the ability of fund sponsors to provide support. Hence, the risk-taking incentives for retail funds are smaller than they are for institutional funds.

Building on this result, we further compare risk taking across fund sponsors, separately for institutional and retail funds using the setting of Table 5. Our primary interest is on the post-period estimation. We present the results in Panel B of Table 7. In the table, the results for institutional funds mirror those in Table 5 and are presented merely for ease of comparison.

The results for the two groups of funds are quite striking. While we observe statistically and economically significant differences with respect to equity for institutional funds, these differences are almost zero for retail funds. For two out of four risk measures, the differences in coefficients on *Log(Equity)* between retail and institutional funds are statistically significant at the 5% level of statistical significance.

Overall, the observed patterns in risk taking across funds with different scope of guarantees are unlikely to be driven by differences among fund management companies along some unobserved characteristics, such as managerial information quality, style, or risk aversion, that are correlated with the level of sponsors' capital.

4.5.2 Evidence from the government's post-Lehman intervention

Another direct test of our identification strategy relies on yet another, exogenous change in the importance of implicit guarantees. In particular, following the default of Lehman Brothers in September 2008, the market experienced a run on the entire money market fund industry. Since the likely consequences of this run were severe, the government decided to save the entire money market industry and extend explicit guarantees to all money market funds and their investors. Effectively, for the duration of the guarantee, which lasted over a year, this intervention eliminated the need for implicit guarantees. Notably, 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.

To evaluate this hypothesis, we revisit the risk regression model in Table 5 and extend our analysis to November 2009. We now consider three periods: July2006–July 2007, August 2007–August 2008, and January 2009–November 2009. We do not include the data for the quarter immediately following Lehman's default because the process of implementing explicit guarantees really did not take place until the end of 2008.[9] Also, many financial markets were very illiquid right after the default, so any adjustment of risk on the side of the funds was quite difficult to accomplish. Our empirical strategy involves estimating the risk-taking regression model using a difference-in-differences approach, in which *Log(Equity)* is interacted with two indicator variables: *Post*, equal to one for the period August 2007–August 2008, and zero, otherwise; and *Post-Lehman* equal to one for the period January 2009–November 2009, and zero, otherwise. In line with our hypothesis, we should observe a zero effect of *Log(Equity)* 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 8. Consistent with our hypothesis, we find that the coefficient of *Post-Lehman* is close to zero for three out of four measures of risk. This result suggests that the role of implicit guarantees has become negligible once the government rolled out an explicit support for all funds, which confirms that implicit guarantees played an important role in the post-period.

5 Additional Evidence

In this section, we provide additional results that offer support to our main hypothesis.

5.1 Alternative measures of implicit guarantees

In our analysis, we use *Log(Equity)* to measure the ex-ante likelihood of providing implicit guarantees to a money market fund. One can think of this measure as a strength of a sponsor's

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

balance sheet. Another way to think of financial strength is to consider the ability of a fund sponsor to provide financial support at a very short notice. This could be done by moving resources from other parts of the company or by raising capital externally. In this section, we explore the robustness of our results to proxies that reflect the alternative ways of measuring a sponsor's financial strength.

Our first measure proxies for the ability to channel resources from other parts of the company quickly. We argue that fund sponsors with banking and insurance divisions might be more likely to offer implicit guarantees to their funds because they have access to retail deposits and short-term funding markets, which allows them to access resources at a short notice to support funds in distress.[10] An example of such a company would be Bank of America. In contrast, fund sponsors without banking or insurance divisions have little access to such resources as they exclusively focus on managing funds on behalf of their clients. An example of such a company would be Reserve Primary.

Our second 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 a 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 repeat our analysis in Table 5 using two following variables. *Conglomerate* is an indicator variable equal to one if a fund sponsor includes other non-fund divisions (commercial and investment banking or insurance), and zero if a fund sponsor is an independent mutual fund company. Likewise, *Credit Rating* is an indicator variable equal to one if the fund sponsor has a credit rating of AA or higher and zero, otherwise. Empirically, both *Conglomerate* and *Credit Rating* are positively correlated with *Equity* which supports our view that they are good proxies for the strength of a sponsor's support. Consistent with our hypothesis, we expect funds sponsored by conglomerates, or by companies with better credit ratings, to take less risk.

We present the results in Table 9 for all measures of risk, separately for the pre and post-

[10]This effect is even stronger if banks receive additional deposit inflows during times of financial distress, as documented by Gatev and Strahan (2006).

period. Panel A presents the results for the specification with *Conglomerate*, and Panel B for the specification with *Credit Rating*. Consistent with our hypothesis, we find that companies with greater diversity or with better credit ratings take on less risk on average, and especially so during the post-period. The results are both statistically and economically significant. This finding lends further support to our general prediction that fund sponsors' capacity to provide implicit guarantees determines risk-taking decisions of their money market funds.

5.2 Do differences in managerial compensation explain risk choices?

A possible explanation for our results could be that fund managers or fund management companies with more equity have different compensation levels; as such, they have different incentives to take on risk. For example, if managers of funds sponsored by high-equity companies had lower compensation levels, one could imagine that such managers would have greater incentives to take risk to increase their funds' assets under management. We evaluate this hypothesis formally by relating the value of a fund's compensation to *Log(Equity)* of its fund sponsor. We use two different measures of compensation: *Total Compensation*, calculated as a product of fund size and its expense ratio, *Expenses* which is a percentage fee charged by the fund on its assets.

The results of this estimation, presented in Panel A of Table 10, do not support the hypothesis that differences in risk can be attributed to differences in managerial compensation. If anything, we observe the opposite effect: High-equity funds on average have higher compensation levels, though this result is statistically insignificant and economically small. More generally, this result suggests that firms with an ability to extend support do not charge additional fees for providing guarantees to their fund investors, which is consistent with our view that fund flows are fairly unresponsive to the guarantee provision.

5.3 Controlling for reputation costs of a fund family

Another reason why we find the relationship between a sponsor's equity and its funds' risk taking could be due to differences in reputation costs among fund families. In particular, money market funds which are part of larger fund families may be less likely to take on risk simply because they face potentially higher reputation costs due to runs on the entire fund family. To the extent that these reputation costs correlate with fund sponsorship we could obtain our results. We evaluate this possibility by estimating the regression model in (3) with additional controls for reputation costs of the fund family:

$$Risk_{i,t+1} = \alpha + \beta Log(Equity)_i + \gamma Reputation + \theta \mathbf{X} + \varepsilon_{i,t+1} \tag{6}$$

where *Reputation* denotes potential reputation costs. We measure reputation cost using ratios of the size of prime money market funds within a fund family to the size of other styles within family: equity, bonds, balanced, and other styles. We also consider relative-size ratios of prime funds to all money market funds and retail funds to all money market funds.

We present the estimation results in Panel B of Table 10 for *Spread* in the post-period sample. Controlling for various reputation cost variables does not significantly alter the qualitative and quantitative aspects of our analysis. The regression coefficients of *Log(Equity)* remain negative and statistically significant at the 1% level of statistical significance. Also, the coefficients of various reputation cost controls are small and statistically insignificant. Hence, our results are unlikely to be explained by differences in reputation costs among different fund sponsors.

5.4 Do differences in career concerns explain risk choices?

We also examine whether differences in risk between different sponsors' types can be explained by differences in career concerns of the fund managers in these companies. We proxy for the degree of such career concerns with the managers' tenure inside their fund companies. For example, Chevalier and Ellison (1997) argue that young managers may have greater incentives

to take on risk. To the extent that such young managers work for funds sponsored by companies with low equity, one could explain differences in risk taking using the career-concerns story.

We evaluate this possibility by directly controlling for manager tenure in the regression model in Table 5. We report the results in Panel C of Table 10. We find no support for the career-concerns hypothesis. If anything, the risk-taking results become slightly stronger, both statistically and economically, against the alternative explanation.

5.5 Further robustness

In our last robustness test, we examine whether our findings are sensitive to the following three screens of the sample. First, the workings of money market funds often depend on the size of the fund company. Anecdotally, large funds are often considered to be more concerned with active risk choices, while smaller funds are often considered to be simple cash-parking vehicles that do not engage in active risk-management strategies. Hence, one would expect our results to be stronger for large funds. To this end, we estimate the regression model in Table 5 for the subsample of funds with assets under management over $10 billion, the value which is close to the average size of money market funds in our sample. Panel D of Table 10 presents the results for the post-period. We find that the risk effect indeed becomes stronger, though not by much.

The second 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 no equity, our results might be driven by just one observation: the Reserve Primary Fund. To ensure the robustness of our results, we exclude the fund from our sample and re-estimate the regression model in Table 5 on the restricted sample. Panel E of Table 10 presents the results for the post-period. We find no significant difference in magnitude of the coefficients of *Log(Equity)*, which suggests that our results are not merely driven by the RPF observation.

Finally, we assess whether the results on risk taking can be explained by the possible differences in volatility of fund net flows. To the extent that such volatility proxies for differences in

investors' risk aversion and is possibly correlated with sponsors' equity, including volatility of flows in our risk regression models should affect the coefficient of equity. Our measure of volatility is based on the time series of weekly fund flows over the preceding six-month period. The results, presented in Panel F of Table 10, suggest that any cross-sectional differences in volatility of flows are unlikely to explain our results. The coefficient of *Log(Equity)* is not affected by the inclusion of the volatility variable; if anything, it actually becomes slightly stronger. More broadly, the results suggest that any potential differences in the risk aversion of fund investors are unlikely to explain our results, which is consistent with our earlier evidence on institutional vs. retail funds.

6 Concluding Remarks

We study the impact of implicit guarantees on risk taking by money market mutual funds. Using the change in relative risks of money market instruments as an exogenous shock to the risk-taking opportunities of the funds, we find that funds sponsored by companies with little ability to provide support took on more risk relative to funds sponsored by companies with greater ability to provide such support starting August 2007, but not before. Consistent with our explanation, we further show that funds whose sponsors have more equity experienced smaller outflows and were more likely to provide financial support during a market-wide run in September 2008.

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 individual firm level though the direction of the effects may actually reverse.

We want to emphasize one possible difference between ours and previous studies. While prior settings largely focus 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 anticipate more exciting research to be done along these lines.

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Table 1: Summary Statistics of Institutional Prime Money Market Funds

This table provides information for the 20 largest institutional money market funds ranked by assets under management in January 2007. *Fund Name* is the name of the fund, *Assets* is Assets under Management (in $ Billion), *Sponsor Name* is the name of the fund sponsor, *Equity* is total equity of the sponsor (in $ billion), *Congl.* indicates whether the fund sponsor is affiliated with a commercial bank, investment bank, or insurance company, and *Rating* is the fund sponsor's S&P credit rating (NR indicates that a fund has no S&P rating).

Fund		Sponsor			
Name	Assets (in $ Billion)	Name	Equity	Congl.	Rating
JPMorgan Prime Money Market Fund	88.4	JP Morgan	55.8	Y	A+
Columbia Cash Reserves	41.3	Bank of America	57.1	Y	AA-
BlackRock Liquidity	34.4	Blackrock	-0.4	N	A+
Fidelity Institutional Money Market Fund	27.7	Fidelity	0.0	N	NR
Goldman Sachs FS Prime Obligations	27.1	Goldman Sachs	30.1	Y	AA-
Morgan Stanley Institutional Liquidity	26.3	Morgan Stanley	32.0	Y	A+
Dreyfus Institutional Cash	25.5	Dreyfus	5.0	Y	A+
Columbia Money Market Reserves	22.0	Bank of America	57.1	Y	AA-
Federated Prime Obligations	22.0	Federated	0.0	N	NR
AIM STIT Liquid Assets	21.5	AIM Advisors	0.0	N	NR
Merrill Lynch Premier Fund	19.8	Blackrock	-0.4	N	A+
DWS Money Market Series	18.6	Deutsche Bank	32.2	Y	AA-
Northern Institutional Diversified Assets	17.3	Northern Trust	3.4	Y	AA-
Merrill Lynch Institutional Fund	17.3	Blackrock	-0.4	N	A+
Reserve Primary Fund	16.9	Reserve Primary	0.0	N	NR
Citi Institutional Liquid Reserves	16.8	Legg Mason	-0.3	N	AA+
Fidelity Prime Fund	16.7	Fidelity	0.0	N	NR
Fidelity Money Market Trust	16.6	Fidelity	0.0	N	NR
Dryden Core Investment Fund	16.0	Prudential	21.7	Y	A
Evergreen Institutional Money Market Fund	15.8	Wachovia	29.7	Y	A+

Table 2: Summary Statistics of Institutional Prime Money Market Funds

Our sample covers all U.S. institutional prime money market funds registered with the Securities and Exchange Commission as of 1/1/2007. We aggregate all share classes by fund. Equity measures tangible equity of the fund sponsor. Low (High) Equity includes all the funds with tangible equity below (above) the median value of equity. The fund characteristics are assets under management (TNA), spread, fund age, and annual expenses. The holdings include the percentage of fund assets invested in U.S. Treasury and agency-backed paper, repurchase agreements, bank deposits, bank obligations, floating-rate notes, commercial paper and asset-backed commercial paper. The fund sponsor characteristics are the share of sponsors that are affiliated with a conglomerate and the share with a credit rating of "AA" or higher.

Sponsor Capital	All	Low Equity	High Equity
	(1)	(2)	(3)
Fund Characteristics			
TNA ($mil)	6,052	5,074	7,031
	(10,367)	(7,555)	(12,547)
Spread (annualized %)	0.22	0.21	0.22
	(0.43)	(0.22)	(0.56)
Age (years)	12.7	14.0	11.4
	(6.4)	(6.8)	(5.7)
Annual Expenses (%)	0.31	0.34	0.28
	(0.19)	(0.20)	(0.20)
Holdings			
U.S. Treasury & Agency	3.5	3.6	3.4
	(8.6)	(8.2)	(8.9)
Repurchase Agreements	11.2	11.6	10.7
	(15.5)	(15.3)	(15.7)
Bank Deposits	3.1	2.5	3.7
	(5.3)	(4.7)	(5.8)
Bank Obligations	13.3	15.6	11.0
	(13.9)	(16.2)	(10.6)
Floating-Rate Notes	22.2	18.8	25.7
	(17.0)	(16.6)	(16.9)
Commercial Paper	30.7	34.2	27.1
	(23.8)	(25.0)	(22.1)
Asset-backed CP	16.0	13.6	18.4
	(17.1)	(15.1)	(18.6)
Fund Sponsor			
Conglomerate	0.57	0.20	0.93
	(0.50)	(0.41)	(0.25)
Rating >=AA	0.38	0.09	0.47
	(0.49)	(0.50)	(0.29)
Observations	146	73	73

Table 3: Return by Asset Class

The sample is all institutional prime money market funds. The dependent variable is the spread computed as the weekly 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, and asset-backed CP (omitted category is U.S. Treasury and agency). Fund Characteristics are fund assets, expense ratio, fund age, fund flows, and fund family size. All regressions include week-fixed effects. Columns (3) and (4) include fund-fixed effects. Columns (1) to (3) are restricted to the period 8/1/2007-8/31/2008 (*Post* period). Columns (2) and (4) are restricted to the period 7/1/2006-7/31/2007 (*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)
Asset Class				
$Repurchase\ Agreements_{i,t}$	0.131*	0.148***	0.374**	0.240*
	(0.075)	(0.035)	(0.154)	(0.123)
$Bank\ Deposits_{i,t}$	0.154	0.185***	0.133	0.289**
	(0.253)	(0.043)	(0.248)	(0.132)
$Bank\ Obligations_{i,t}$	0.853***	0.130***	0.923***	0.172
	(0.076)	(0.035)	(0.164)	(0.113)
$Floating\text{-}Rate\ Notes_{i,t}$	0.811***	0.209***	0.773***	0.212
	(0.073)	(0.036)	(0.218)	(0.136)
$Commercial\ Paper_{t}$	0.565***	0.135***	0.636***	0.279**
	(0.073)	(0.031)	(0.219)	(0.125)
$Asset\text{-}backed\ CP_{i,t}$	0.765***	0.169***	0.784***	0.271**
	(0.077)	(0.029)	(0.181)	(0.132)
Fund Characteristics				
$Log(TNA)_{i,t}$	0.005	0.002	0.032*	-0.005
	(0.004)	(0.001)	(0.017)	(0.008)
$Expense\ Ratio_{i,t}$	-0.895***	-0.978***	-0.283	-0.547***
	(0.030)	(0.011)	(0.287)	(0.138)
$Age_{i,t}$	-0.002	-0.007*	-0.077***	-0.033*
	(0.010)	(0.004)	(0.022)	(0.018)
$Flows_{i,t}$	0.028	0.020***	-0.016	0.023**
	(0.025)	(0.008)	(0.021)	(0.012)
$Log(FamSize)_{i,t}$	0.006	0.003**	0.006	0.003**
	(0.005)	(0.001)	(0.005)	(0.001)
Constant	1.195***	0.086***	1.430***	-0.169***
	(0.007)	(0.002)	(0.013)	(0.004)
Week-Fixed Effects	Y	Y	Y	Y
Fund-Fixed Effects	N	N	Y	Y
Observations	7,717	7,585	7,717	7,585
R-squared	0.93	0.82	0.95	0.83

Table 4: Performance and Fund Flows

The sample is all institutional prime money market funds. Columns (1), (3), and (5) are restricted to the period from 8/1/2007 to 8/31/2008 (*Post* period). Columns (2), (4), and (6) are restricted to the period from 7/1/2006-7/31/2007 (*Pre* period). The dependent variable is net fund flow computed as the percentage change in total net assets from time *t* to time *t+1*. The independent variables are the weekly annualized spread from *t* to *t-1*, fund assets, expense ratio, fund age, and fund family size. In columns (5) and (6), additional independent variables are the sponsor's equity and the interaction of the weekly spread and the sponsor's equity. All columns include week-fixed effects. Columns (3) and (4) include fund-fixed effects. For columns (1)-(2) and columns (3)-(4), we report the coefficient of the interaction of the weekly spread and a post period indicator variable from a difference-in-differences estimation. For columns (5)-(6), we report the coefficient of the triple-interaction of weekly spread, a post period indicator variable, and equity from a difference-in-differences estimation. The standard errors are clustered at the fund level (double-clustered at fund-level and week for difference-in-difference estimation). ***, **, * 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$_{i,t}$	0.010**	-0.001	0.026***	-0.001	0.020**	-0.007
	(0.004)	(0.003)	(0.010)	(0.004)	(0.009)	(0.012)
Log(Equity)$_i$*Spread$_{i,t}$					-0.001	0.001
					(0.001)	(0.001)
Log(Equity)$_i$					0.002	0.000
					(0.001)	0.000
Log(TNA)$_{i,t}$	-0.002***	-0.001***	-0.088***	-0.074***	-0.003***	-0.002***
	(0.001)	0.000	(0.007)	(0.015)	(0.001)	(0.001)
Expense Ratio$_{i,t}$	0.000	-0.018***	-0.055	-0.059	-0.004	-0.020***
	(0.005)	(0.005)	(0.043)	(0.088)	(0.007)	(0.006)
Age$_{i,t}$	0.000	-0.001	-0.004	-0.003	0.001	0.000
	(0.001)	(0.001)	(0.006)	(0.010)	(0.001)	(0.001)
Log(FamSize)$_{i,t}$	0.000	0.001**			0.000	0.001*
	(0.001)	0.000			(0.001)	0.000
Week-Fixed Effects	Y	Y	Y	Y	Y	Y
Fund-Fixed Effects	N	N	Y	Y	N	N
Observations	7,725	7,592	7,725	7,592	7,725	7,592
R-squared	0.02	0.01	0.11	0.07	0.02	0.01
Spread$_{i,t}$*Post$_t$	0.011**		0.028***			
	(0.005)		(0.010)			
Spread$_{i,t}$*Post$_t$* Log(Equity)$_i$					-0.002	
					(0.001)	

Table 5: Sponsor's Capital and Risk Taking

The sample is all institutional prime money market funds. The dependent variables are: the weekly annualized spread (*Spread*); the fraction of assets held in risky assets (*Holdings Risk*); the sum of squared asset shares (*Concentration Risk*), and average asset maturity (*Maturity Risk*). *Log(Equity)* is the natural logarithm of the fund sponsor's equity. All other independent variables are defined in Table 3. All regressions include week-fixed effects. Columns (1), (3), (5), and (7) are for the period from 8/1/2007 to 8/31/2008 (*Post* period) and columns (2), (4), (6), and (8) are for the period from 7/1/2006 to 7/31/2007 (*Pre* period). We report the coefficient of the interaction of equity and *Post* from the corresponding difference-in-differences estimation at the bottom of the table. The standard errors are clustered at the fund level (double-clustered at fund-level and week for difference-in-difference estimation). ***, **, * represent 1%, 5%, and 10% significance, respectively.

	$Spread_{i,t+1}$		$Holdings\ Risk_{i,t+1}$		$Concentration\ Risk_{i,t+1}$		$Maturity\ Risk_{i,t+1}$	
Period	Post	Pre	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Log(Equity)_i$	-0.019***	0.000	-0.018**	0.002	-0.015*	-0.003	-1.542*	-0.646
	(0.006)	(0.002)	(0.008)	(0.010)	(0.009)	(0.011)	(0.792)	(0.630)
$Log(TNA)_{i,t}$	0.022**	0.004***	0.017*	0.008	-0.004	-0.013	0.150	0.506
	(0.010)	(0.001)	(0.010)	(0.013)	(0.007)	(0.011)	(0.697)	(0.668)
$Expense\ Ratio_{i,t}$	-0.825***	-0.980***	0.153*	0.194*	0.060	0.087	10.392*	9.799*
	(0.058)	(0.013)	(0.082)	(0.104)	(0.061)	(0.092)	(5.558)	(5.040)
$Age_{i,t}$	-0.005	-0.008	-0.002	0.000	0.010	0.015	0.003	-0.960
	(0.020)	(0.005)	(0.023)	(0.021)	(0.019)	(0.019)	(1.379)	(1.155)
$Flow_{i,t}$	-0.056*	0.019**	-0.041	-0.101***	-0.026	-0.035	-1.337	-5.630**
	(0.031)	(0.008)	(0.028)	(0.030)	(0.024)	(0.024)	(1.828)	(1.511)
$Log(FamSize)_{i,t}$	0.021**	0.005**	0.013	0.015	-0.005	-0.001	1.108*	0.581
	(0.010)	(0.002)	(0.011)	(0.013)	(0.008)	(0.011)	(0.633)	(0.592)
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	7,717	7,585	7,717	7,585	7,717	7,585	7,717	7,585
R-squared	0.89	0.81	0.11	0.07	0.052	0.064	0.13	0.89
$Log(Equity)_i * Post_t$	-0.019***		-0.020***		-0.012*		-0.896**	
	(0.006)		(0.007)		(0.006)		(0.403)	

Table 6: Post-Lehman Support and Redemptions

The sample is all institutional prime money market funds active in August 2008. The dependent variable in columns (1) and (2) is 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 bankruptcy ((9/18/2010-9/25/2010), and zero otherwise. The dependent variable in columns (3) and (4) is total redemptions (fund outflows) in the period in the week after the Lehman bankruptcy. All independent variables are as in Table 5. Standard errors are clustered at the sponsor level. ***, **, * represent 1%, 5%, and 10% significance, respectively.

	Support		Redemptions	
Sample	All	>10bn	All	>10bn
	(1)	(2)	(3)	(4)
$Log(Equity)_i$	0.065***	0.091*	-0.016**	-0.031**
	(0.024)	(0.049)	(0.006)	(0.011)
$Log(TNA)_{i,t}$	0.000	-0.068	0.025***	0.000
	(0.018)	(0.150)	(0.006)	(0.046)
Expense $Ratio_{i,t}$	-0.039	-0.011	-0.042*	-0.103
	(0.064)	(0.221)	(0.024)	(0.075)
$Age_{i,t}$	0.151	0.413	-0.108**	-0.171*
	(0.172)	(0.258)	(0.047)	(0.082)
$Log(FamSize)_{i,t}$	-0.055	-0.522	-0.039	-0.084
	(0.068)	(0.414)	(0.033)	(0.083)
Constant	-0.692	-2.176	0.149	1.209**
	(0.431)	(2.249)	(0.145)	(0.512)
Observations	140	30	140	30
R-squared	0.180	0.319	0.257	0.322

Table 7: Institutional vs. Retail Funds

The primary sample is retail prime money market funds. **In Panel A**, we examine the flow-performance relationship for retail prime money market funds (similar to Table 4). The sample is all retail prime money market funds. The dependent variable is net fund flow computed as the percentage change in total net assets from time *t* to time *t+1*. The independent variables are the weekly spread in period from *t* to *t-1*, fund assets, expense ratio, fund age, and fund family size (coefficients not shown in the table). In columns (5) and (6), additional independent variables are the sponsor's equity and the interaction of the weekly spread and the sponsor's equity. All columns include week-fixed effects. Columns (3) and (4) include fund-fixed effects. Columns (1), (3), and (5) are for the period from 8/1/2007 to 8/31/2008 (*Post* period). Columns (2), (4), and (6) are for the period from 7/1/2006 to7/31/2007 (*Pre* period). . For columns (1)-(2) and columns (3)-(4), we report the coefficient of the interaction of the weekly spread and a post period indicator variable from a difference-in-differences estimation. For columns (5)-(6), we report the coefficient of the triple-interaction of weekly spread, a post period indicator variable, and equity from a difference-in-differences estimation. The standard errors are clustered at the fund level (double-clustered at fund-level and week for difference-in-difference estimation). ***, **, * represent 1%, 5%, and 10% significance, respectively.

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	0.001	0.003	0.002	0.004	0.005
	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.004)
Log(Equity)$_i$*Spread$_{i,t}$					0.000	0.000
					0.000	(0.001)
Log(Equity)$_i$					0.000	-0.001*
					0.000	0.000
Controls	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y
Fund-Fixed Effects	N	N	Y	Y	N	N
Observations	5,872	6,018	5,872	6,018	5,872	6,018
R-squared	0.043	0.024	0.117	0.065	0.044	0.024
Spread$_{i,t}$*Post$_t$	0.001		0.002			
	(0.003)		(0.003)			
Spread$_{i,t}$*Post$_t$* Log(Equity)$_i$					0.000	
					(0.001)	

In Panel B, we compare risk taking of institutional and retail money market funds from 8/1/2007 to 8/31/2008 (*Post* period). The dependent variables are: the weekly annualized spread (*Spread*); the fraction of assets held in risky assets (*Holdings Risk*); the sum of squared risky asset shares (*Concentration Risk*), and average maturity (*Maturity Risk*). The independent variables are defined in Table 5. All regressions include week-fixed effects. Columns (1), (3), (5), and (7) are restricted to retail funds and columns (2), (4), (6), and (8) are restricted to institutional funds. We report the coefficient of the interaction term of equity and an indicator variable for institutional funds from the corresponding difference-in-differences estimation at the bottom of the table. The standard errors are clustered at the fund level (double-clustered at fund-level and week for difference-in-difference estimation). ***, **, * represent 1%, 5%, and 10% significance, respectively. . ***, **, * represent 1%, 5%, and 10% significance, respectively.

Panel B: Sponsor's Capital and Risk-Taking

	$Spread_{i,t+1}$		$Holdings\ Risk_{i,t+1}$		$Concentration\ Risk_{i,t+1}$		$Maturity\ Risk_{i,t+1}$	
	Retail	Institutional	Retail	Institutional	Retail	Institutional	Retail	Institutional
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Log(Equity)_i$	-0.003	-0.019***	0.006	-0.018**	-0.008	-0.015*	1.04	-1.542*
	(0.014)	(0.006)	(0.015)	(0.008)	(0.017)	(0.009)	(1.012)	(0.792)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	5,869	7,717	5,866	7,717	5,866	7,717	5,866	7,717
R-squared	0.873	0.89	0.18	0.11	0.131	0.052	0.094	0.13
$Log(Equity)_i$*$Institutional_t$	-0.016		-0.024**		-0.007		-2.575***	
	(0.012)		(0.013)		(0.015)		(0.995)	

Table 8: Capital and Risk Taking After Government Guarantee

The sample is all institutional prime money market funds. We estimate the same difference-in-differences regression as in Table 5 for the period from July 2006 to November 2009. We drop the month of the Lehman bankruptcy and the quarter immediately after the Lehman bankruptcy to focus on risk taking after a short adjustment period. We interact our main variable of interest with an indicator variable for the Post period (July 2007 to August 2008) and the Post-Lehman period (January 2009 to November 2009). The regressions include the control variables specified in Table 5 (coefficients not shown). Standard errors are double-clustered at the sponsor-level and week. ***, **, * represent 1%, 5%, and 10% significance, respectively.

	$Spread_{i,t+1}$	$Holdings\ Risk_{i,t+1}$	$Concentration\ Risk_{i,t+1}$	$Maturity\ Risk_{i,t+1}$
	(1)	(2)	(3)	(4)
$Log(Equity)_i$	0.000	0.002	-0.003	-0.646
	(0.002)	(0.009)	(0.011)	(0.623)
$Log(Equity)_i*Post_t$	-0.019***	-0.020***	-0.012**	-0.896**
	(0.006)	(0.007)	(0.006)	(0.403)
$Log(Equity)_i*Post\text{-}Lehman_t$	-0.011	0.008	0.018**	-0.083
	(0.013)	(0.009)	(0.009)	(0.647)
Controls	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y
Observations	21,084	21,084	21,084	21,084
R-squared	0.938	0.139	0.088	0.159

Table 9: Sponsor's Financial Strength and Risk Taking – Robustness

We estimate the regression model in Table 5, replacing the variable *Log(Equity)* with two alternative measure of sponsor's financial strength. **In Panel A**, we measure financial strength using an indicator variable, *Conglomerate*, equal to one if a fund sponsor is affiliated with a commercial banking, investment banking, or insurance, and zero otherwise. **In Panel B**, we measure financial strength using an indicator variable, *Credit Rating*, equal to one if the sponsor has a credit rating of AA or higher and zero, otherwise. All regressions include the same control variables as in Table 5 (coefficients now shown). We report the coefficient of the interaction term of the financial strength variable and an indicator variable for the post period the corresponding difference-in-differences estimation at the bottom of the table. The standard errors are clustered at the fund level (double-clustered at fund-level and week for difference-in-difference estimation).. ***, **, * represent 1%, 5%, and 10% significance, respectively.

Panel A: Conglomerate

	$Spread_{i,t+1}$		Holdings $Risk_{i,t+1}$		Concentration $Risk_{i,t+1}$		Maturity $Risk_{i,t+1}$	
Period	Post	Pre	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Conglomerate_{i,t}$	-0.052**	-0.004	-0.057*	-0.013	-0.060**	-0.025	-2.188	-1.25
	(0.025)	(0.005)	(0.031)	(0.031)	(0.030)	(0.035)	(2.725)	(2.012)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	7,717	7,585	7,717	7,585	7,717	7,585	7,717	7,585
R-squared	0.904	0.975	0.104	0.067	0.062	0.067	0.097	0.083
$Conglomerate_{i,t}$*$Post_t$	-0.047**		-0.044**		-0.035*		-0.938	
	(0.023)		(0.022)		(0.021)		(1.764)	

Panel B: Credit Rating

	$Spread_{i,t+1}$		Holdings $Risk_{i,t+1}$		Concentration $Risk_{i,t+1}$		Maturity $Risk_{i,t+1}$	
Period	Post	Pre	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rating >=AA	-0.121**	-0.001	-0.106**	-0.003	-0.099**	-0.050	-7.785	-3.929
	(0.047)	(0.004)	(0.049)	(0.064)	(0.045)	(0.047)	(5.254)	(5.263)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	7,717	7,585	7,717	7,585	7,717	7,585	7,717	7,585
R-squared	0.906	0.975	0.111	0.066	0.063	0.069	0.122	0.09
Credit $Rating_{i,t}$*$Post_t$	-0.120***		-0.102		-0.049		-3.856	
	(0.044)		(0.071)		(0.057)		(2.537)	

Table 10: Alternative Explanations – Robustness

In Panel A, the dependent variable is the weekly managerial compensation, defined as a product of fund size and its expenses (total compensation) or as a percentage value of fund assets charged as expenses. The independent variables are defined in Table 5. All regressions include week-fixed effects. Columns (1) and (3) are restricted to the period 8/1/2007-8/31/2008 (*Post* period) and columns (2) and (4) are restricted to the period 7/1/2006-7/31/2007 (*Pre* period). **In Panel B**, the sample is all institutional prime money market funds from August 2007 to August 2008 (*Post* period). The dependent variable is the weekly annualized fund spread. Independent variables are *Log(Equity)*, the ratio of prime funds assets relative to equity funds assets, bond fund assets, balanced fund assets, and total fund assets, respectively. All other controls are as in Table 5. **In Panel C**, the dependent variables are: the weekly annualized spread (*Spread*); the fraction of assets held in risky assets (*Holdings Risk*); the concentration of the fund assets (*Concentration Risk*); and the value-weighted average maturity of fund assets (*Maturity Risk*). The independent variables are the natural logarithm of tangible equity of the fund sponsor and the natural logarithm of the portfolio manager tenure at the fund. All other controls are as in Table 5. **In Panel D**, we repeat the estimation in Table 5 for funds with assets under management over $10 billion. **In Panel E**, we eliminate the Reserve Primary Fund in the estimation of Table 5. **In Panel F**, we repeat the estimation in Table 5 and control for the quarterly standard deviation of fund flows.

Panel A: Managerial Compensation

	Total Compensation$_{i,t+1}$		Expenses$_{i,t+1}$	
	Post	Pre	Post	Pre
Log(Equity)$_i$	-0.034	-0.037	-0.005	-0.01
	(0.039)	(0.035)	(0.011)	(0.011)
Controls	Y	Y	Y	Y
Observations	7,723	7,596	7,723	7,596
R-squared	0.91	0.92	0.16	0.18

Panel B: Controlling for Sponsor Characteristics

	$Spread_{i,t+1}$ (Post)					
	(1)	(2)	(3)	(4)	(5)	(6)
$Log(Equity)_i$	-0.018***	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Prime/Equity Fund Assets	0.006					
	(0.009)					
Prime/Bond Fund Assets		0.000				
		(0.001)				
Prime/Balanced Fund Assets			0.000			
			0.000			
Prime/Other Fund Assets				0.033*		
				(0.017)		
Prime/Money Funds					0.026	
					(0.072)	
Retail/Money Funds						0.025
						(0.048)
Controls	Y	Y	Y	Y	Y	Y
Observations	7,603	7,717	6,982	7,717	7,717	7,717
R-squared	0.91	0.91	0.91	0.91	0.91	0.91

Panel C: Management Tenure

	$Spread_{i,t+1}$		$Holdings\ Risk_{i,t+1}$		$Concentration\ Risk_{i,t+1}$		$Maturity\ Risk_{i,t+1}$	
Period	Post	Pre	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Log(Equity)_i$	-0.022***	0.000	-0.025***	-0.010	-0.019*	-0.014	-1.723**	-0.763
	(0.006)	(0.002)	(0.008)	(0.007)	(0.010)	(0.011)	(0.785)	(0.678)
$Tenure_{i,t}$	-0.002	0.000	-0.004	-0.002	-0.002	-0.001	-0.144	-0.123
	(0.002)	0.000	(0.003)	(0.002)	(0.002)	(0.002)	(0.134)	(0.121)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,183	1,683	2,183	1,683	2,183	1,683	2,183	1,683
R-squared	0.965	0.994	0.172	0.217	0.133	0.276	0.262	0.223
$Log(Equity)_i$*$Post_t$	-0.022***		-0.015**		-0.005		-0.960**	
	(0.006)		(0.007)		(0.006)		(0.429)	
$Tenure_{i,t}$*$Post_t$	-0.002		-0.002		-0.001		-0.020	
	(0.002)		(0.002)		(0.001)		(0.119)	

Panel D: Large Funds (>$10 billion)

	$Spread_{i,t+1}$		$Holdings\ Risk_{i,t+1}$		$Concentration\ Risk_{i,t+1}$		$Maturity\ Risk_{i,t+1}$	
Period	Post	Pre	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Log(Equity)_i$	-0.022***	0.001	-0.021*	-0.009	-0.013	-0.015	-2.225**	-0.694
	(0.005)	(0.001)	(0.011)	(0.008)	(0.008)	(0.011)	(0.989)	(0.926)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,183	1,683	2,183	1,683	2,183	1,683	2,183	1,683
R-squared	0.965	0.994	0.172	0.217	0.133	0.276	0.262	0.223
$Log(Equity)_i*Post_t$	-0.023***		-0.012*		0.002		-1.530**	
	(0.006)		(0.006)		(0.006)		(0.613)	

Panel E: Excluding Reserve Primary Fund

	$Spread_{i,t+1}$		$Holdings\ Risk_{i,t+1}$		$Concentration\ Risk_{i,t+1}$		$Maturity\ Risk_{i,t+1}$	
Period	Post	Pre	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Log(Equity)_i$	-0.019***	0	-0.018**	0.002	-0.015	-0.003	-1.531*	-0.646
	(0.006)	(0.002)	(0.008)	(0.010)	(0.009)	(0.011)	(0.775)	(0.630)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	7,640	7,529	7,640	7,529	7,640	7,529	7,640	7,529
R-squared	0.909	0.975	0.096	0.063	0.058	0.064	0.131	0.088
$Log(Equity)_i*Post_t$	-0.019***		-0.020***		-0.012*		-0.885**	
	(0.006)		(0.007)		(0.006)		(0.389)	

Panel F: Controlling for Volatility of Fund Flows

	$Spread_{i,t+1}$		$Holdings\ Risk_{i,t+1}$		$Concentration\ Risk_{i,t+1}$		$Maturity\ Risk_{i,t+1}$	
Period	Post	Pre	Post	Pre	Post	Pre	Post	Pre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Log(Equity)_i$	-0.019***	0	-0.019**	0	-0.015*	-0.004	-1.652**	-0.72
	(0.006)	(0.002)	(0.008)	(0.009)	(0.009)	(0.010)	(0.731)	(0.569)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Week-Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	7,682	7,552	7,682	7,552	7,682	7,552	7,682	7,552
R-squared	0.91	0.975	0.145	0.119	0.074	0.108	0.171	0.129
$Log(Equity)_i*Post_t$	-0.020***		-0.021***		-0.013*		-0.987**	
	(0.006)		(0.008)		(0.007)		(0.404)	

Figure 1: Assets Holdings and Spread

We implement the regression in Table 3 for the period from January 2006 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*), and respectively. Each point represents the return relative to the omitted category (*Treasury bills and agency debt*) measured in percentage points.

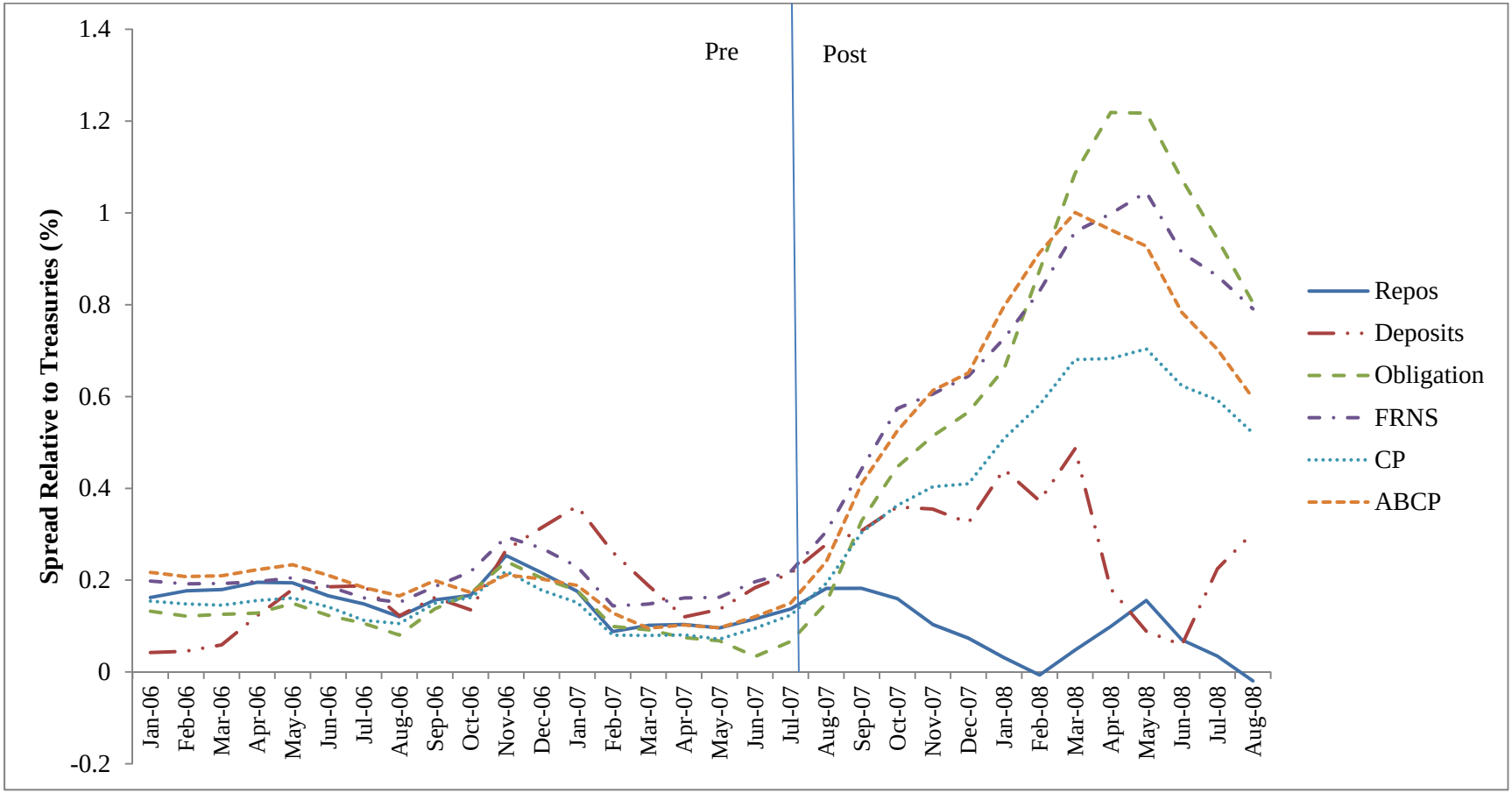
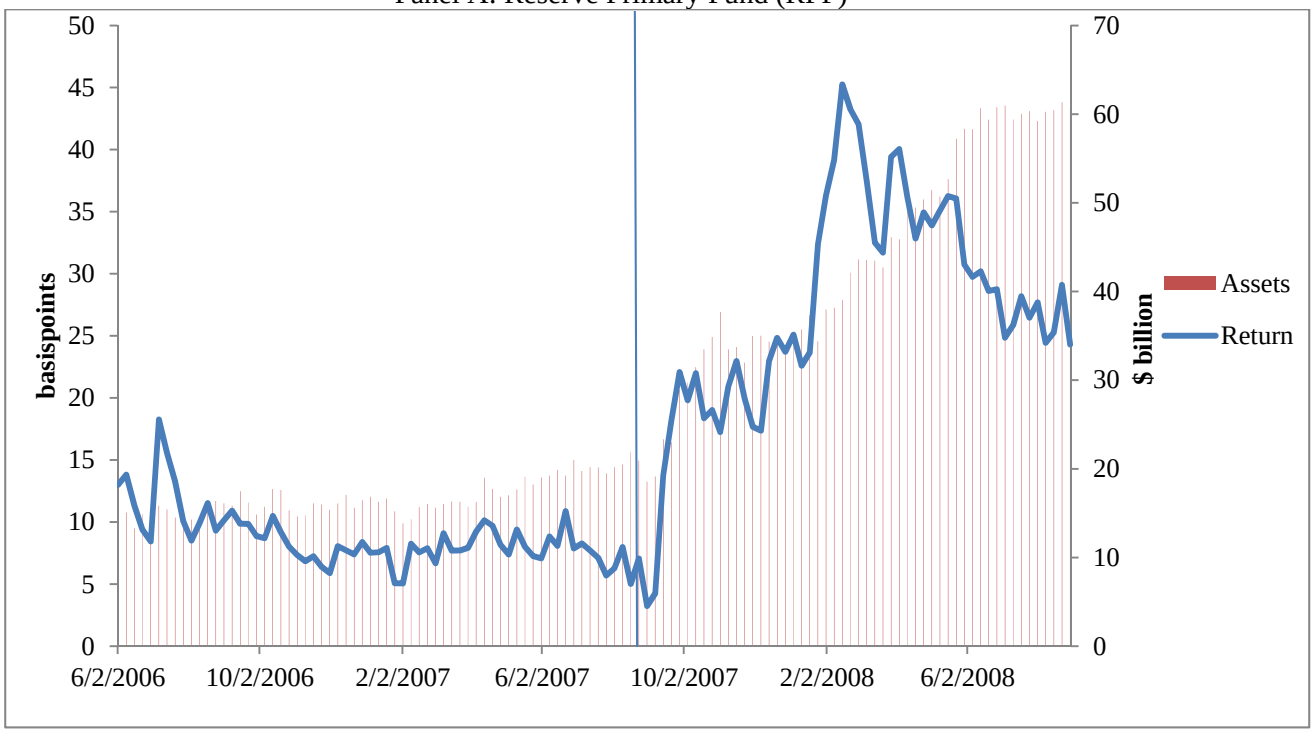


Figure 2: Relative Performance and Assets: RPF vs. CCR

This figure plots weekly total assets and the industry-adjusted spread of the Reserve Primary Fund (Panel A) and Columbia Cash Reserves (Panel B) from January 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.

Panel A: Reserve Primary Fund (RPF)

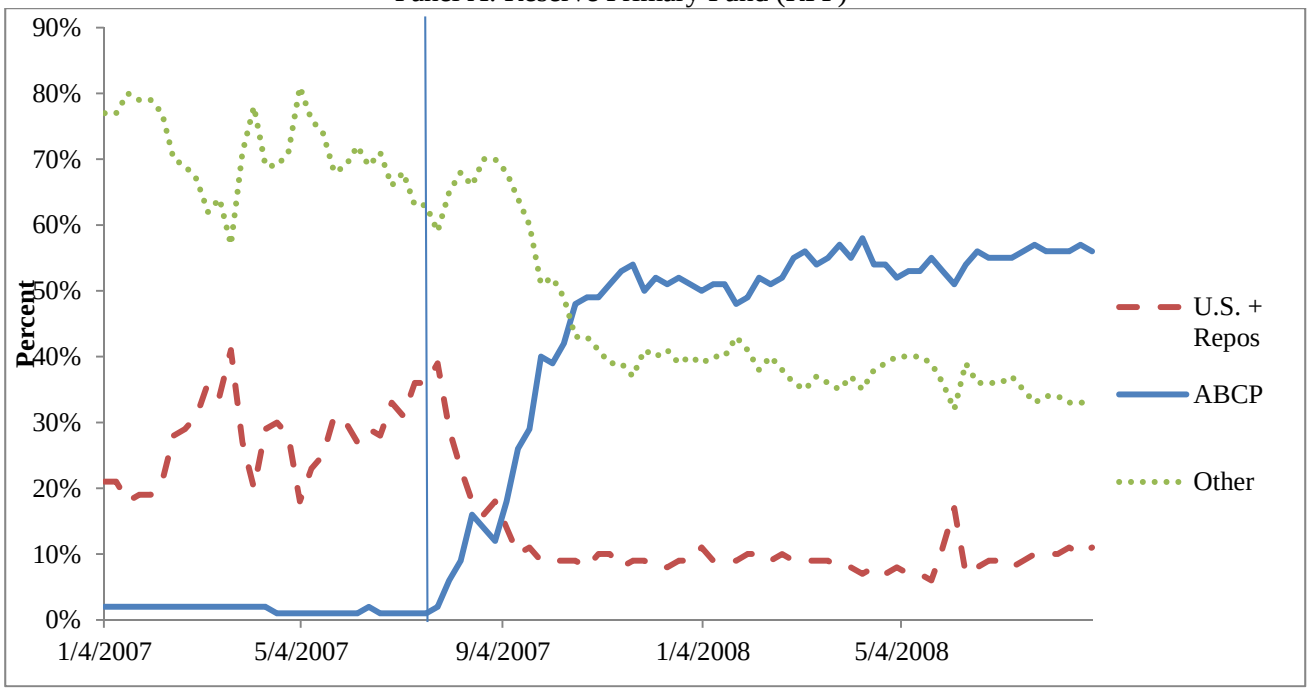


Panel B: Columbia Cash Reserves (CCR)

Figure 3: Assets Holdings: RPF vs. CCR

This figure plots weekly holdings of the Reserve Primary Fund (Panel A) and the Columbia Cash Reserves Fund (Panel B) from January 2007 to August 2008. U.S. + Repos is the share of assets invested in U.S. Treasures, U.S. agency-debt, and repurchase agreements. ABCP is the share invested in asset-backed commercial paper. Other is the share invested in other securities: bank obligations and floating rates notes.

Panel A: Reserve Primary Fund (RPF)

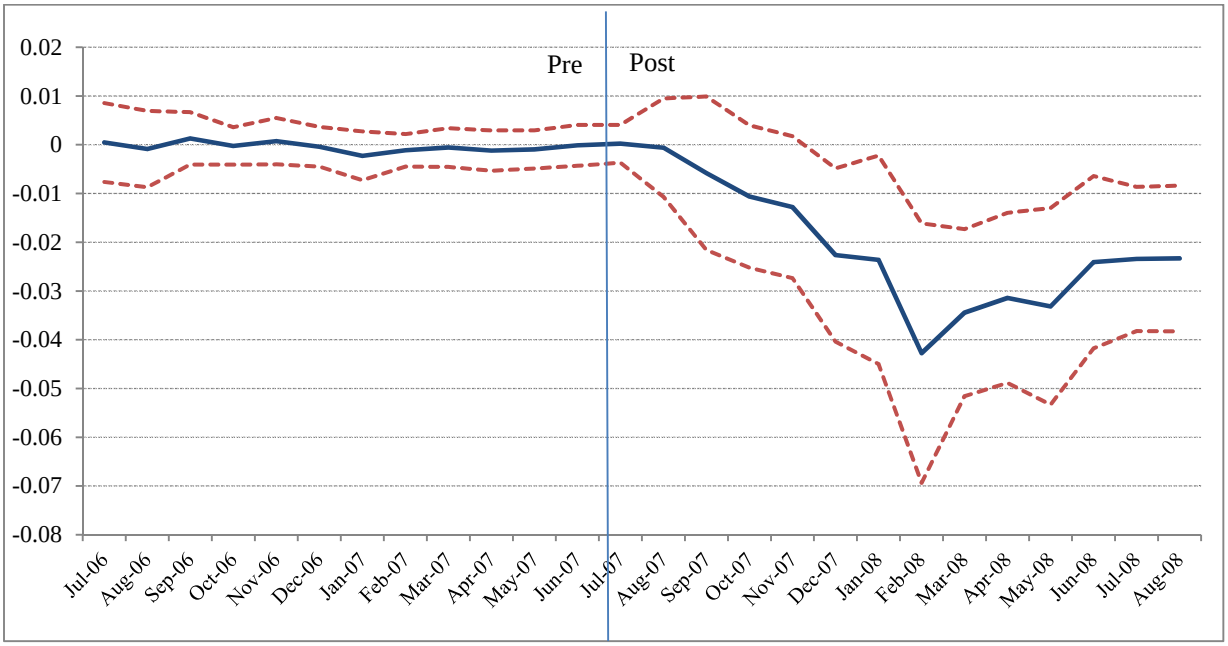


Panel B: Columbia Cash Reserves (CCR)

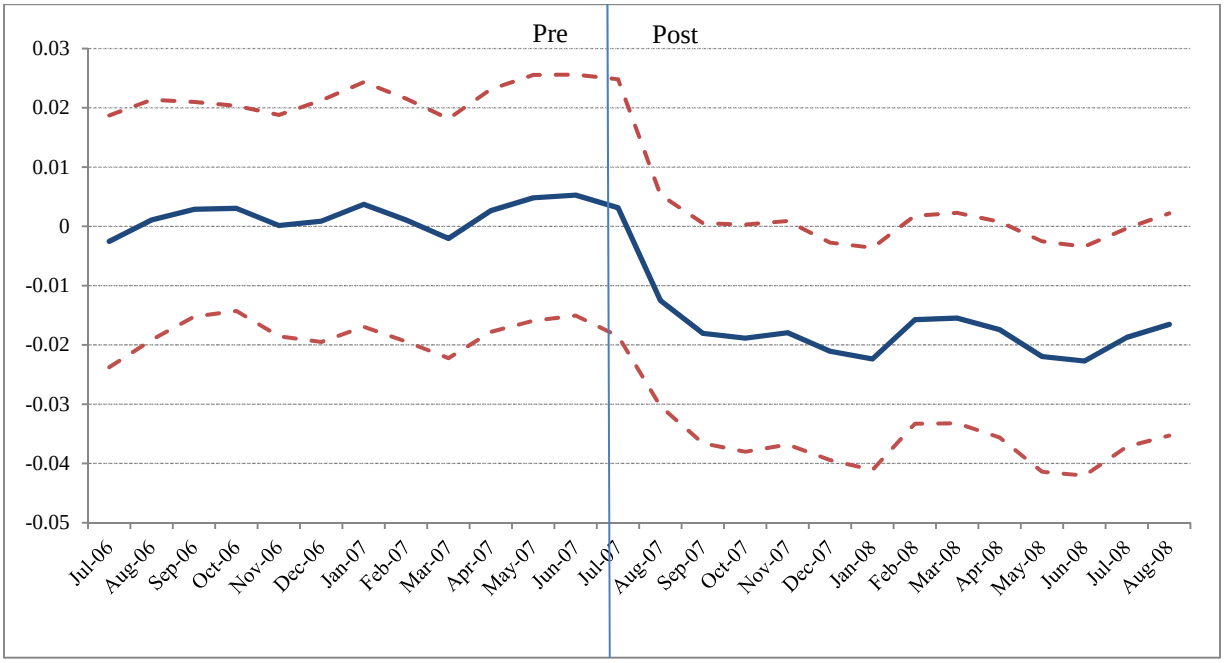
Figure 4: Implicit Guarantees and Risk Taking

Each of the four panels below plots interaction coefficients from an OLS regression. The dependent variable is the respective risk measure: spread, holdings risk, concentration, and maturity. The main independent variable is the interaction of the fund sponsor's equity and monthly indicator variables. We control for all other variables defined in Table 5.

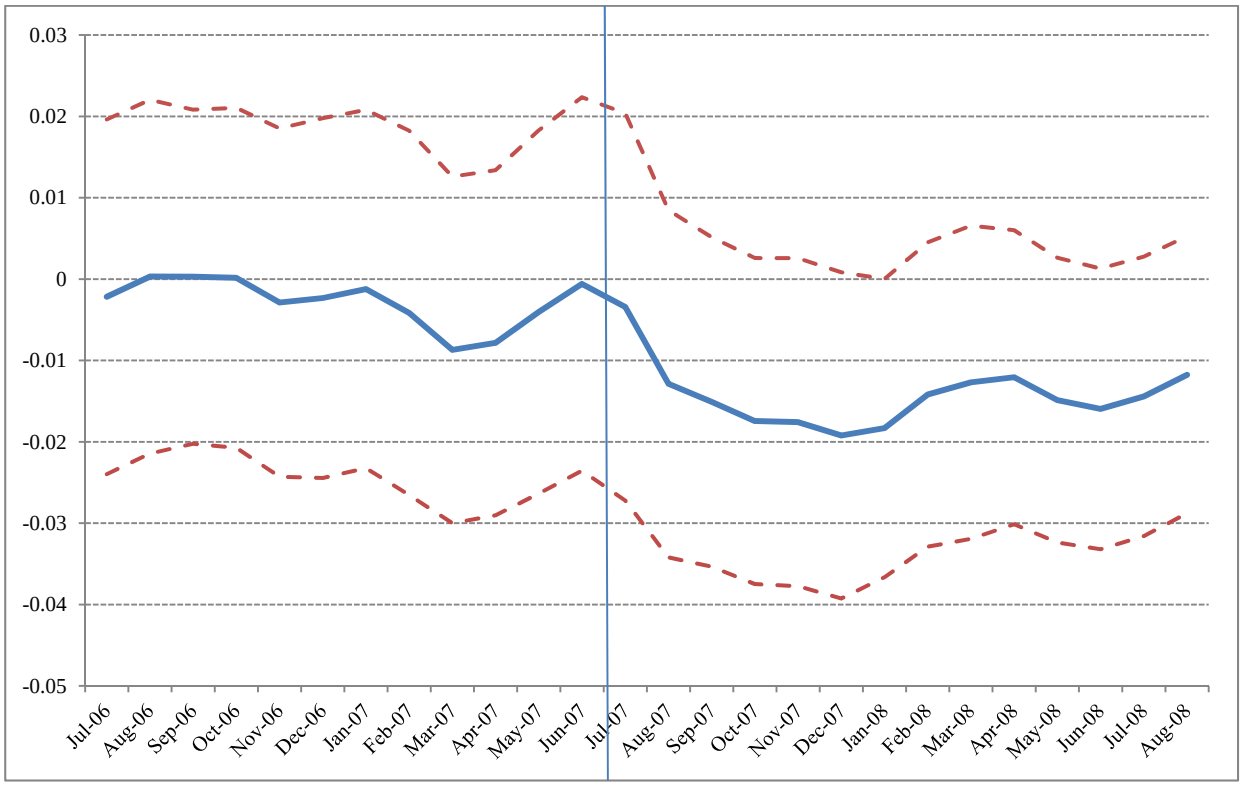
Panel A: Spread



Panel B: Holdings Risk



Panel C: Concentration Risk



Panel D: Maturity Risk