# Shadow Insurance? Money Market Fund Investors and Bank Sponsorship

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## Abstract

In this paper, we argue that bank-sponsored prime institutional money market funds (PI-MMFs) are different from non-bank-sponsored PI-MMFs. This difference can arise because the sponsoring bank holding companies (BHCs) can extend shadow insurance to ailing affiliated MMFs. We hypothesize that PI-MMFs price this shadow insurance through higher expense ratios. Indeed, after September 2008 when industry risk increased, expense ratios were seven basis points higher than those of non-BHC-sponsored MMFs. This increase is of similar size to the average deposit insurance premium charged by the FDIC in 2008. We also show, despite higher expense ratios, the redemptions in BHC-sponsored MMFs were lower in contrast to expectations of prior literature.

**JEL Classification:** G2, G21, G23, G28, H12, H81.

**Keywords:** bank, bank holding company, bank run, financial crisis, liquidity risk, money market fund, systemic risk, too big to fail.

## 1. Introduction

Bank holding companies (BHCs) often simultaneously operate both insured bank subsidiaries and uninsured nonbanks, such as insurance or brokerage subsidiaries, or hold non-operational subsidiaries, such as special purpose vehicles (SPVs). The Gramm-Leach-Bliley Act of 1999 accelerated BHCs' shift into nonbank businesses potentially giving them increased scope economies and allowing them to diversify into nonbank services. However, evidence has accumulated that nonbank activities lead to regulatory arbitrage and have negative spillover effects on commercial banks and the economy in general. Acharya, Schnabl, and Suarez (2013) show that BHCs extend implicit guarantees to the SPVs they create. Chernenko and Sunderam (2014) demonstrate that the risk-taking by money market funds can disrupt their short-term lending to creditworthy borrowers. Ferreira, Matos, and Pires (2018) argue that equity fund managers support affiliated banks' lending operations. Pogach and Unal (2018) provide evidence that BHCs protect their nonbanks from the pressures of external dividends by using the bank segment's internal dividends.

We add to this literature by examining the BHC sponsorship of money market funds (MMFs) that goes back to the early 1980s and is among the earliest nonbank affiliations of BHCs. Money market funds are established and sponsored either by bank holding companies (BHC-sponsored MMF) that can benefit from the government safety net or by financial institutions that are not part of the safety net (non-BHC-sponsored MMF). Our objective is to understand how BHC-sponsored MMFs are different from non-BHC-sponsored MMFs, and whether this affiliation creates regulatory arbitrage opportunities for the sponsoring BHC. Toward this end, we study three important attributes of sponsoring an MMF: the gross yield on the portfolio, the expense ratio, and redemptions.

Bank sponsorship can matter for investors because the fund management can benefit from an affiliation with a BHC. The BHC has relatively quick access to cheap and information-insensitive

funding sources through its insured bank subsidiaries, such as insured, brokered deposits or the discount window. Federal guidelines recognize the cross-subsidization within a BHC. For example, in its *Bank Holding Company Supervision Manual,* the Board of Governors of the Federal Reserve (Federal Reserve) acknowledges that the failure of a nonbank subsidiary has financial ramifications for the BHC, and thus the subsidiary can use bank resources to provide support to that subsidiary:[1]

> … Failure of a nonbank subsidiary may lead to a lack of confidence in the affiliated bank's ability to continue in business, which might precipitate a run on the bank's deposits. … Because the bank is usually the largest subsidiary, the holding company may attempt to draw upon the resources of the bank to aid the nonbank subsidiary.

Hence, investors could expect the BHC to provide support to its sponsored MMF when the fund's assets lose value, or the redemption activity is high. This expected support from a BHC can be more credible, and therefore more valuable, than the expected support from an otherwise similar, non-BHC. The non-BHC sponsor lacks access to relatively cheap funds, thereby giving the bank sponsor "deeper pockets." Pogach and Unal (2020) report that the credit spreads of new bond issues at BHCs were on average 20 basis points lower than other financial firms for the period from 1996 to 2002.

We test the hypotheses that BHC-sponsored MMFs are different from non-BHC- sponsored funds along two dimensions. In terms of pricing, BHC-sponsored MMFs can charge their institutional investors more than the non-BHC-sponsored MMFs to compensate for the implicit guarantee from their sponsors. We measure this value by examining the fund-level expense ratios and the net yields on assets. If investors value bank sponsorship, then they should accept a higher expense ratio for a given gross return, which means a lower net yield for BHC-sponsored MMFs. Second, if indeed

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[1] Board of Governors of the Federal Reserve System, 2016, "Bank Holding Company Supervision Manual," Division of Banking Supervision and Regulation, Section 4030.0.

investors expect the BHC sponsor to provide support when needed, they would be less likely to redeem their funds even if the net yields are lower. To examine this hypothesis, we contrast the redemptions decisions and net yields around the September 2008 Lehman Crisis between BHC-sponsored and non-BHC-sponsored MMFs.

In our analysis, we focus on the prime institutional shares of MMFs (PI-MMFs). There are two reasons for this emphasis. First, PI-MMFs are the most vulnerable to industry-wide runs on an MMF (Schmidt, Timmerman, and Wermers, 2016). Second, they are an important part of the shadow banking system and have a significant effect on the systemic risk of the aggregate financial system — as seen during the 2008 MMF Crisis. The size of BHC-sponsored PI-MMFs grew from a negligible percentage of the industry in 1986 to about 50%, $227 billion, of total PI-MMF industry assets by the turn of the century. These funds grew to $612 billion and as much as 52% of all institutional MMF assets by the end of 2007. Hence, sponsorship of PI-MMFs created an enormous implicit liability for BHCs.

We use the turmoil surrounding the failure of Lehman Brothers as an exogenous shock to the MMF industry. Lehman Brothers failed largely due to the collapse of the market for asset-backed commercial paper (ABCP). When Lehman Brothers filed for bankruptcy and, subsequently, when the Reserve Prime Money Market Fund broke the buck, massive and widespread outflows from PI-MMFs that totaled over $300 billion occurred during the week of September 15. The environment became riskier for the MMFs and their investors. Sponsorship support was critical for the funds to survive. We exploit this shock to the industry and examine how the two types of sponsored MMFs changed their expense ratios and how investors executed their redemptions in response to the heightened risk. To the extent that the value of the implicit insurance extended by the BHC sponsors is more valuable, we expect BHC-sponsored MMFs to charge higher fees after September 2008 to account for the higher value of the implicit insurance they provide. On the investors' side, they may perceive that the

BHC that sponsors the fund as providing a valuable form of implicit insurance. If that is the case, we should observe less redemption in BHC-sponsored MMFs than non-BHC-sponsored MMFs after controlling for asset characteristics.

Our results support these conjectures. Using a difference-in-differences analysis, BHC-sponsored MMFs earned 12 basis points less gross returns but charged 7 basis points higher expense ratios compared to non-BHC-sponsored MMFs during the period from October 2008 to March 2009 (post-crisis) relative to the period from March to August 2008 (pre-crisis). Given that the average expense ratio during the post-crisis period was 36 basis points, the 7 basis point difference is economically significant. Furthermore, it is within a basis point of the average deposit insurance premiums charged by the FDIC in 2008. Because of reduced gross yields and increased expense ratios during the same post-crisis period, investors' net yield was 12.4% lower at BHC-sponsored PI-MMFs.

Kacperczyk and Schnabl (2013) and Cherenkov and Sunderam (2014) show institutional investors are very sensitive to yield differences and that they move large sums of funds to gain additional returns of as little as 10 basis points. In addition, Christoffersen (2001) and Christoffersen and Musto (2002) provide evidence that there is a strong performance-flow relation, such that higher yielding funds attract more inflows. If these predictions are applicable, we should observe a massive withdrawal from BHC-sponsored MMFs given the lower net yields they offer. To assess the flow effect, we use a difference-in-differences to contrast the flow numbers between pre- and post-crisis periods for BHC- and non-BHC-sponsored funds. Our findings show that there is no material difference between these two periods. In other words, no material withdrawal occurred at BHC-sponsored MMFs despite the lower yields of these funds. This finding is in sharp contrast to the literature that analyzes the flow-performance relation during relatively calm periods.

The reported flow-performance findings have two alternative explanations. The first is that the BHC explicitly supports the MMF in times of crisis (e.g., through the purchase of depreciated assets at par value) and calms the fears of the institutional investors. Alternatively, the investors in MMFs behave such that they find the BHC's implicit guarantee credible and treat their funds as being safer, and are therefore less likely to redeem. In either case, however, the implication is that the value of the expected guarantee extended by the BHC is higher than the value of the guarantee extended by a non-BHC. Thus, investors treat BHCs as credible guarantors that assume the risk of the sponsored MMF. Lower net yields (and higher expense ratios) are then consistent with the argument that investors pay for such an implicit guarantee.

In sum, our findings show that BHC-sponsored MMFs operated as if they were under a government safety net during the sample period. They were not "shadow banks," in the sense that they lacked access to the government safety net. Instead, banks were operating in the shadows and extending a shadow insurance to institutional investors through affiliated money market funds. In return, the affiliated money market funds charged higher expense ratios. However, the BHCs had no reserve or capital requirements and paid no fees to the federal insurer against the risks they assumed because of their sponsorship of the fund. Thus, the bank-sponsors benefited from potential government support without bearing any additional costs, leading to regulatory arbitrage.

These results add to the findings of Acharya, Schnabl, and Suarez (2013). They provide evidence of regulatory arbitrage in which banks create SPV conduits and securitize loans. However, banks keep their sponsorship (guarantee) behind these securitized loans while getting relief from capital requirements. This sponsorship of SPVs and securitized loans is similar in spirit to the implicit guarantee extended by BHC-sponsors of PI-MMFs that contributed to the growth of PI-MMFs. Hence, our findings nicely complement those found in Acharya, Schnabl, and Suarez (2013).

We also add to the findings in Kacperczyk and Schnabl (2013). They show that participation in MMFs places important financial obligations on the sponsoring firms. Our results support their insight and show that BHCs face increased exposure to liquidity risk because of their affiliation with MMFs.

We organize the paper as follows: Section 2 provides the institutional background. In Section 3, we discuss the conceptual framework. Section 4 presents the data. Sections 5 and 6 provide the results of our empirical analyses. Section 7 concludes.

## 2.   Institutional background

MMFs, which were introduced in 1971, are structured as registered investment companies under the Investment Company Act of 1940. A management company (fund sponsor) can establish a new MMF as a separate legal entity. The management company can simultaneously operate many individual funds, and it can advertise them under a single brand name, such as *BlackRock* or *Fidelity*. The group of funds under a brand name are called a *fund complex*. A fund can issue share classes that can have different expense ratios or minimum investment requirements. They also often categorize share classes by investor type: *institutional* and *retail*. Institutional shares are for investors such as corporate treasuries, bank trust departments, corporations, and pension funds. These shares have higher minimum investment requirements and are associated with larger accounts. Retail shares are open to all investors — organizations and individuals (Morley, 2014 and Baklanova and Tanega, 2014).

Each institutional or retail MMF can have categories, such as *prime*, *government*, and *tax free*. Prime funds invest in short-term private debt instruments such as commercial paper, CDs, other bank obligations, repos, and corporate floating-rate notes. Government funds invest in US Treasury securities and in US government agency obligations such as government-funded enterprises. Tax-free funds invest in municipal securities.

Rule 2a-7 of the Investment Company Act of 1940 places restrictions on the liquidity, maturity, and credit risk of the assets held by an MMF, such that the fund assets have a relatively low risk exposure. Specifically, each asset held by an MMF must have a maximum maturity of one year, and the weighted average maturity of all assets held must be no longer than 60 days. A rating agency must rate 97% of all securities held by an MMF as being in the top two ratings categories. Funds cannot invest more than 5% of their assets in the securities of one issuer. Ten percent of portfolio assets must be in liquid instruments with daily availability, and 30% of portfolio assets must be in instruments having weekly availability. Also, MMFs cannot invest more than 5% of their assets in illiquid securities. Lastly, all MMF holdings must be denominated in US dollars.

Up until 2014, each share had a fixed price of $1 that was pegged to a fixed portfolio net asset value (NAV) of $1 per share. This fixed pricing was a pivotal fixture of the MMF industry from its start in 1971 through the crisis of 2008. Responding to the crisis of 2008, in 2014 the SEC abolished the stable per share NAV for the share prices of prime institutional funds and started requiring floating share pricing (see Securities and Exchange Commission, 2014.a, 2014.b).

Under the fixed-share-price regime, healthy MMFs that met the requirements of Rule 2a-7 calculated the value of their assets using the *amortized cost accounting* method. This method values each asset at its *historical* cost. The rule justifies the use of this method because it requires that MMF portfolio assets must be of high credit quality, high liquidity, and of short maturity. If an MMF's assets lose value so that the per share market value (its shadow price) drops below its historical per-share cost of $1 (below $0.995), the fund "breaks the buck" — it has become distressed. When a fund "breaks the buck," its board of directors can suspend redemptions to allow for an orderly liquidation.

The primary reasons for the deterioration of an MMF's assets include asset devaluation, asset default, an interest rate spike, or a liquidity event. "Breaking the buck" is a rare event. In the decades-

long history of MMFs, only two have broken the buck. These were Community Bankers US Government Fund in 1994 and the Reserve Primary Fund in 2008.

## 3. Conceptual Framework

MMF sponsors play a critical role in preventing a fund from "breaking the buck." Sponsors do not have an explicit legal obligation to provide support to their MMFs. However, they can implicitly guarantee to purchase assets that decline in value at par so that the MMF can meet mass redemption requests by its investors. Other forms of sponsor support include capital contributions, capital support agreements, letters of credit, and performance guarantees. Moody's (2010) provides examples of major sponsorship interventions and demonstrates that sponsors extended extensive instances of support in 1994 and 2008. Indeed, sponsor support played a pivotal role during the crisis of September 2008. The SEC estimates that from August 2007 to December 2008 almost 20% of all PI-MMFs received sponsor support (Securities and Exchange Commission (2009), page 20).

The central argument of our paper is that institutional investors price the sponsorship affiliation of an MMF and behave differently based on the identity of the sponsor. The sponsor has the incentive to support the ailing fund to prevent the negative spillover of an affiliate going bankrupt to the parent. Kacperczyk and Schnabl (2013) emphasize the importance of this negative spillover and argue that sponsors that have more non-money-market business at stake will run a less risky MMF business. They find that MMFs that are affiliated with financial conglomerates reduced their riskiness after August 2007 when MMFs' risk-taking opportunities changed. That month, the French bank BNP Paribas announced that they had frozen $2.2 billion of subprime funds and had barred investors from redeeming cash from the funds. Kacperczyk and Schnabl (2013) define a financial conglomerate as one that is formed by a commercial bank, investment bank, or insurance company.

We argue that this classification of financial conglomerate does not fully reflect the sponsor's access to readily available liquidity. We propose a classification in terms of BHC and non-BHC sponsored funds, rather than the financial and nonfinancial. This proposed classification provides a sharper assessment of the confidence provided to investors by the fund sponsors. This is because BHCs have access to information-insensitive and relatively cheap funding through their bank segments, which allows them to support their MMF affiliates much more effectively in times of crisis. Federal regulations also recognize the possibility of this cross-subsidization, as in the *Bank Holding Company Supervision Manual* (discussed more fully in the Introduction). Hence, we hypothesize that BHC sponsorship can be more valuable because of their "deep-pockets" relative to non-BHC sponsors (including insurance companies and investment banks). This funding advantage provides a form of liquidity insurance for investors. Consequently, we argue that investors will accept lower net yields from BHC-sponsored MMFs.

We use the difference in expense ratios between BHC- and non-BHC-sponsored MMFs as a proxy for the value of this guarantee while acknowledging and controlling for other factors that affect the expense ratio. This is a novel interpretation of the expense ratio. Expense ratios are the fees that investors pay to the fund company to manage the fund and are expressed as a percentage of the total fund assets. Fees for management and administrative services constitute the largest expense of funds followed by marketing and distribution. In addition, funds can charge investors for custodian and auditing fees as well as trustees' fees and expenses. A BHC-sponsored MMF can charge more for any of these components relative to a non-BHC-sponsored MMF to account for the implicit guarantee extended by the sponsor. Since a custodial fee and an equal administrative fee are ultimately reflected identically in the investors' realized returns, we focus on the sum total of these fees.

Higher expense ratios can generate more profits for the MMF and its BHC sponsor. However, an implicit sponsorship guarantee transfers risk away from the MMF and adds risk to the BHC and

its bank segment's financial health, because, ultimately, the sponsoring BHC bears the redemption risk of the MMF. Hence, understanding the risks posed by the BHC-sponsored MMFs can help identify the channels through which these so-called "shadow banks" can extend shadow insurance and extract subsidies from the safety net and potentially weaken financial stability.

However, other factors can influence the expense ratios. Of foremost importance is their use in determining the net yield to MMF investors. Because market conditions and portfolio holdings determine gross yield, fund managers can increase, lower, or waive expense ratios to give the investors acceptable yields. When interest rates are high, fund gross returns are high and MMFs can charge a higher expense ratio. In contrast, when interest rates are low, to compensate investors with reasonable net yields, MMFs can waive expense ratios. For example, while MMFs waived expense ratios during the 2009-2015 period when interest rates were at their record low levels, waivers were at their lowest level during the period from 2006 to 2008 when rates were still high (ICI Research Perspective, 2018). However, Christoffersen (2001) provides evidence that there is a relatively flat relation between MMF performance and waivers. In our empirical tests we use expense ratios net of waivers and reductions.

Expense ratios also depend on the minimum size of investment. Increasing the minimum size is associated with lower expense ratios. Schmidt, Timmerman, and Wermers (2016) argue that a higher minimum size has a lower expense ratio that is a proxy for investor sophistication. Because a larger investment means more "skin in the game", Schmidt, Timmerman, and Wermers (2016) claim that these investors will analyze the health of the fund more carefully than others and hence could be considered sophisticated. They provide evidence that there is a strong relation between expense ratios and minimum investments for prime share classes.

To minimize the confounding effects of differences in minimum sizes on expenses, we compare the expense ratios of BHC- and non-BHC-sponsored funds at different minimum balance

requirements. We control for the effects of market interest rates and investor sophistication when we compare the expense ratios of different sponsors. Our premise is that a fund that implicitly provides a higher guarantee because of its BHC affiliation will tend to charge a higher expense ratio, regardless of the minimum investment size.

## 3.1 Empirical strategy

The $350 billion contraction in the ABCP market in late 2008 cast doubts on the credit quality of many such short-term, AAA-rated asset categories (Covitz, Liang, and Suarez, 2009). PI-MMFs, which held such assets, experienced a significant credit event that reduced the value of their assets and brought them perilously close to breaking the buck. One of those funds, the Reserve Primary Money Market Fund, was not able to weather the storm because of its exposure to Lehman's commercial paper. On September 15, 2008, Lehman declared bankruptcy that caused a severe credit event on the Reserve Fund's assets. A day after Lehman's crisis, the Reserve Fund broke the buck on September 16, 2008, that then triggered the largest crisis in the history of the US MMF industry.[2] The collapse of the Reserve Fund sparked unprecedented mass withdrawals from PI-MMFs. From September 12 to October 1, 2008, PI-MMFs lost a total of $460 billion, which was 29% of industry assets.[3]

We compare gross yields, expense ratios, and net yields at funds with BHC and non-BHC sponsors of the fund complex before and after this shock to the industry. An examination of the differential reaction of BHC-sponsored and non-BHC-sponsored MMFs in terms of how they adjust their expense ratios and net yields can lead to important insights. One plausible reaction after the Lehman-Reserve-Fund episode is that funds could have lowered their expense ratios to stop investors

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[2] See Strahan and Tanyeri (2013), McCabe (2010), Investment Company Institute (2009), Securities and Exchange Commission (2009).

[3] We calculate this percentage from data provided by *iMoneyNet*. See Strahan and Tanyeri (2013) and McCabe (2010).

from redeeming their funds. Alternatively, funds could have increased their expense ratios because their sponsors had stepped in to support the ailing funds. Hence, examination of the differential reaction to this shock can show whether BHC-sponsored funds charged higher expense ratios regardless of the size of the investment. It is also instructive to test the differential reaction of investors in terms of their redemption decisions. This analysis can show whether investors react to changes in expense ratios before and after the crisis.

To provide a test of statistical significance we use a difference-in-differences specification to test the changes in our focal variables between BHC- and non-BHC-sponsored funds before and after September 2008 Lehman crisis. The specification is as follows:

$$Focal\ Variable_{j,t} = \gamma_1 Bank_j + \gamma_2 Post_t + \gamma_3 Post_t * Treated_j + \omega Controls_{jt} +$$

$$ShareClass_j + \varepsilon_{jt}, \quad (1)$$

where $j$ and $t$ denote the share class and the month, respectively. The focal variables are gross and net yields that are calculated as the 30-day gross compound yield, the expense ratio, and the outflow that are calculated as the percentage changes in total net assets. The variable *Bank* equals one for the BHC-sponsored funds and zero otherwise. *Post* is equal to one for October 2008–March 2009 and zero for March–August 2008. The month of September is excluded from the analysis. The difference-in-differences estimator, $\gamma_3$, is the coefficient for the product of the *Treated* and *Post* variables. This is the main coefficient of interest and measures the value of the focal variable after the Lehman collapse.

The vector of controls contains other variables that are correlated with the focal variables. One important control is the riskiness of the asset holdings. For this, we use two measures. The first is the weighted asset maturity (WAM), since assets with shorter maturities are easier to liquidate (McCabe, 2010). The second is the investors' perception of the liquidation values of the assets. Kacperczyk and Schnabl (2013) argue that investors perceive bank obligations, floating rate notes, and commercial

paper to have lower liquidation values. They classify US Treasury securities, repurchase agreements (repos), and bank-time deposits as assets with high liquidation values. We follow Kacperczyk and Schnabl (2013) and create a risky holdings variable as a proxy for portfolio riskiness. Two additional variables control for the size of the fund complex and the age of the fund. We should note that complex size and fund size are correlated. For our BHC-sponsored sample, the correlation between complex size and BHC size is 51% with significance at the 1% level.

In addition, when we estimate equation 1 for the expense ratio, we use the log of minimum investment as a proxy for investor sophistication (Schmidt, Timmerman, and Wermers, 2016). We estimate the regressions at the share-class level and cluster all standard errors at the fund level. We cluster at this level because all share classes within a fund have identical portfolios and are managed by the same fund manager. Thus, we expect estimation errors across share classes within the same fund to be correlated. Clustering at the fund level accounts for arbitrary correlation within funds.

## 4. Data

### 4.1 Data source

We use data from the *iMoneyNet* datasets that contain detailed historical information on individual US MMFs. Schmidt, Timmermann, and Wermers (2016) compare *iMoneyNet* data to statistics from the Investment Company Institute and find that *iMoneyNet* data cover about 93.5% of the total dollar value of US PI-MMFs.

We use three panel datasets: monthly, weekly, and daily observations. All three datasets record the total amount in each share class (share class assets). Each share class has an associated fund name.[4]

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[4] The *iMoneyNet* data calls total amount in each share class as "share class assets" and fund name as the "master class fund name".

In addition, the datasets contain the expense ratio, gross yield, and net yield for each share class. The weekly and monthly datasets have the asset composition of the funds' portfolios that comprises the weighted average maturity and the fraction of a fund's portfolio that is held in commercial paper, floating-rate notes, repos, bank deposits, non-deposit bank obligations, and US government securities.

**4.2 BHC Sponsorship Identification**

The critical aspect of our analysis is the identification of the fund sponsors in terms of BHC or non-BHC affiliation. The *iMoneyNet* datasets contain a binary bank identifier. However, this variable does not vary over time and are fixed at values corresponding to the last date in each *iMoneyNet* dataset.

To identify the sponsorship status of each fund complex, we manually match the name of each fund complex in our data to a BHC or non-BHC sponsor.[5] Specifically, we identify the MMF referenced by the fund complex's name. Then, we search the SEC filings and the business press to identify all ownership/sponsorship relations between the MMF and other financial institutions over our sample period. We define a fund complex as being *bank-sponsored* if it is affiliated with a BHC, a financial holding company (FHC) with a subsidiary commercial bank, or a commercial bank that is not a member of the BHC.[6] Thus, we correct the original bank sponsor identifier from *iMoneyNet* by adjusting it to be historically accurate.

Appendix A shows the fund complexes and the number of funds and share classes that are in our analysis. The last two columns show that the *iMoneyNet* identifier and the corrected identifier, respectively. As the appendix shows, in the case of 17 complexes, the *iMoneyNet* identifier requires modification. These changes fall into three categories. The first pertains to instances where the

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[5] We have used this matching information from Philip Ostromogolsky's work that spans the period of 1986-2016.

[6] The definition of commercial bank excludes the following types of institutions: industrial loan company, federal savings bank, savings and loan institution, savings and loan holding company, and credit union.

sponsoring firms changed their filing status to a BHC over the sample period. This change accounts for differences in two fund complexes and the eight funds within these complexes. They are Goldman Sachs and Morgan Stanley that were investment banks before the crisis and became BHCs shortly after the Lehman collapse. The *iMoneyNet* files carry these two sponsors only as BHCs whereas they should be non-BHCs up until their switch.[7] The second type is not an error, but a difference in usage. We consider a sponsor to have access to the *domestic* safety net if it has a domestic regulatory holder. For six complexes and nine funds, sponsors were recorded correctly as "BHCs" by *iMoneyNet*, but these BHCs lack a domestic regulatory holder. We treat a fund complex of a foreign bank as a non-BHC fund because these foreign banks do not have the same safety net advantages as US banks. In one case, we correctly identified a parent to be a domestic institution and changed its identification from a non-BHC to a BHC. The third and final type of difference is due to other data discrepancies. These apply to nine fund complexes and 21 funds within these complexes. In some cases, *iMoneyNet* codes private uninsured banks as a BHC, which does not match our usage.

### 4.3 Summary Statistics

In Table 1, we provide the average portfolio makeup of PI-MMFs overall and by BHC-type (bank or non-bank) for the months of June 2008 and December 2008. These two months are representative of the pre and post periods. We take June and December as representative months for the pre- and post-crisis periods. There are 345 distinct prime institutional share classes with 230 non-BHC-sponsored share classes and 115 BHC-sponsored share classes as of these two dates.

The first three columns of Table 1 pertain to June 2008. In terms of our focal variables, gross yield, expense ratio, and net yield, there is no difference on average between the BHC-sponsored and

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[7] In the case of Goldman Sachs, *iMoneyNet* shows some funds to be bank and some to be nonbank within the same complex. We consider all funds under Goldman Sachs to be nonbank sponsored while Goldman Sachs was not officially a BHC.

non-BHC-sponsored MMFs. With few exceptions, the portfolio characteristics of funds sponsored by BHCs and non-BHCs are statistically identical as of this date. In terms of measures of asset risk, including WAM, age, complex size, government debt (US Treasury and agency debt), repos, and BHC obligations, non-BHC and BHC sponsored funds are statistically indistinguishable. However, the compositions do vary in a few categories. First, BHC-sponsored funds hold significantly more time deposits, which stands to reason, though these holdings represent a relatively small component of total assets. The BHC-sponsored funds also hold less in floating rate notes (FRNs) than non-BHCs, though this difference is only marginally significant. The last difference is in the composition of their commercial paper holdings, where non-BHCs held significantly more ABCP than BHCs, 20% to 10%, while BHCs held more non-ABCP than non-BHCs, 29% to 22%. However, in aggregate, risky asset holdings do not statistically differ between BHC- and non-BHC-sponsored MMFs.

The last three columns of Table 2 provide the same information about portfolio composition for December 2008. The picture changes substantially after the fall of Lehman and the ensuing run on PI-MMFs. Markedly, funds sponsored by BHCs charge a significantly higher expense ratio of 44 basis points versus the 36 basis points charged by funds with non-BHC sponsors as of December 2008. This change is reflected as well in the significant difference in the net yield. Investors in BHC-sponsored funds received 136 basis points on average, while investors in funds that were not sponsored by BHCs received 153 basis points on average. In other words, while non-BHC sponsors kept their expense ratios unchanged relative to 2008, BHC sponsors showed a significant departure from the industry average and charged higher expense ratios and paid lower net yields to their institutional customers after the Lehman crisis. This observation provides the initial support to our hypothesis that these investors were willing to pay for BHC sponsorship when it was needed most immediately following the crisis. In terms of asset composition, both types of MMFs have similar portfolios and there is no statistical difference in the holdings of risky assets in aggregate.

**5. Do institutional investors value BHC sponsorship of MMFs?**

**5.1 Univariate analysis**

The main hypothesis of the paper is that because BHC-sponsored funds provide a more credible guarantee, institutional investors are willing to accept lower yields from their PI-MMFs. To test this hypothesis, we first examine the time-series behavior of the gross yield and the expense ratio for BHC-sponsored and non-BHC-sponsored funds during 2006-2010. Figure 1 displays the average gross yields for both types of funds. The vertical lines represent August 2007 and September 2008, respectively. August 2007 is the time when the French bank BNP Paribas announced that they were freezing $2.2 billion of subprime funds and were barring investors from redeeming cash from the funds. As we indicated earlier, Kacperczyk and Schnabl (2013) argue that August 2007 marks the time when the MMFs' opportunities had changed and their industry had phased into a riskier environment.

We observe that the average gross yields for BHC-sponsored and non-BHC-sponsored funds experienced a slight uptick immediately after August 2007 but the increase was not significant and there was no statistical difference between their average yields. Figure 1 also shows that shortly after August 2007, the gross yield offered by both types of funds declined dramatically until August 2008. This result is a direct consequence of the decline in short-term rates. The three-month yield on Treasury bills was 4.55% on September 4, 2007 and declined to 1.72% on September 2, 2008. However, shortly after September 2008, non-BHC-sponsored funds on average had gross yields slightly higher than the average gross yield offered by BHC-sponsored funds. This observation means that the immediate reaction of non-BHC-sponsored funds was to increase the gross yield possibly to prevent redemptions. The difference disappears in 2009 and thereafter.

Figure 2 displays the average expense ratios during the same period. We should note that the expense ratios for the 2006-2008 period are not confounded with fee waivers because, as indicated

above, fee waivers were at their lowest level during this period. We observe an interesting pattern. The BHC-sponsored PI-MMFs increased their expense ratios relative to non-BHC-sponsored PI-MMFs right around August 2007. However, the difference is not statistically significant. As September 2008 approached, we observe that BHC-sponsored funds further increased their expense ratios while non-BHC-sponsored PI-MMFs slightly decreased their expense ratios. Following September 2008 the expense ratios diverged sharply; the difference between the two types of funds reached its maximum as the BHC-sponsored funds charged higher rates on average by roughly 8 basis points by January 2009.

**5.2 Difference-in-differences analysis**

To provide further support for these observations, we control for fund characteristics and estimate a difference-in-differences between BHC- and non-BHC-sponsored funds before and after the Lehman crisis for gross yield, expense ratio, and net yields. We report the results in Table 2. Column 1 shows that BHC-sponsored funds earned significantly lower gross yields relative to non-BHC-sponsored funds post-Lehman (September 2008 – March 2009) than pre-Lehman (March – August 2008). As shown in Column 2, investors in BHC-sponsored PI-MMFs received a net yield that was 12 basis points lower than that of investors in non-BHC-sponsored funds following the Lehman failure. Given that the non-BHC-sponsored PI-MMFs average net yield was 153 basis points, the 12 basis points difference means that investors accepted an 8% lower net yield from BHC-sponsored PI-MMFs relative to non-BHC-sponsored funds. The major factor underlying this result was the higher expense ratios charged by the BHC-sponsored funds despite earning lower gross yields. Column 3 shows that the expense ratios are 7 basis points higher for BHC-sponsored MMFs, or 20% higher than the expense ratios that non-BHC-sponsored funds charged post-Lehman.

The control variables have the expected signs. The gross and net yields have positive correlations with Treasury yields. However, funds charge more on average when Treasury yields are low. This seemingly counterintuitive result is plausible given that the BHC-sponsored funds charge higher expense ratios throughout the declining interest rate environment. We also observe funds that held riskier holdings realized higher gross yields and, consequently, net yields. The riskiness of a fund's holdings did not affect the expense ratio. In a robustness check, we broke up the portfolio into its finest observable constituent parts[8] and estimated the same baseline regressions. Given the central role of ABCP in the financial crisis, it seems quite plausible that this variable, in particular, could have a direct impact on the results. We find that commercial paper, floating rate notes, bank obligations, and time deposits are all very significant and positive in gross yield and net yield, but not expense ratio. ABCP and repos are not significant for either. None of the additional portfolio components are important predictors of the expense ratio.

*iMoneyNet* reports investor returns over different time intervals. In Table 3, we demonstrate the robustness of the results pertaining to net yield to these different measures of investor returns. These measures are the 30-day net simple yield, the 7-day net compound yield, the 1-month net simple return[9], the 1-month net simple yield, and the 1-day net simple yield. We observe that in all cases, irrespective of the specific yield, the net return on investment is 10 to 13 basis points lower for the MMFs that were sponsored by BHCs after the collapse of Lehman.

**5.3 Distribution of expense ratios**

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[8] These are asset backed commercial paper, bank obligations, commercial paper, floating rate notes, repos, time deposits, and US government debt.

[9] We use *iMoneyNet*'s definitions that calculate "yield" by using the dividend factor and the "return" by using the dividend factor plus capital gains and losses.

Next, we examine the variation in expense ratios across different minimum required investments. We segregate funds into three buckets: "small" for funds with minimum balances of less than $25,000, "medium" for funds with between $25,000 and $1,000,000, and "large" for funds with minimum balances of more than $1,000,000. Figure 3 displays the average expense ratios for each of these three buckets of minimum balances. Expense ratios are inversely related to the size of minimum investment requirement for both types of funds. This observation is consistent with Schmidt, Timmerman, and Wermers (2016) who argue that minimum investments capture investor sophistication. Funds with higher minimum investments attract more sophisticated investors who pay lower expense ratios. However, we observe that on average, BHC-sponsored PI-MMFs increased the expense ratios at every minimum size bucket in the post-Lehman period. These observations cannot be consistent with investors getting less sophisticated (justifying charging a higher expense ratio) in a falling interest rate environment. In contrast, the results give support to the argument that expense ratios reflect risk, at least to some extent. We argue that BHC-sponsored funds charge higher expense ratios in an environment where the implicit insurance the sponsoring BHC provides becomes more valuable.

### 5.4 Economic significance

In Table 2, we show that the expense ratios at BHC-sponsored funds were seven basis points higher than the expense ratios at nonbank sponsored funds. Our argument is that this finding reflects a form of insurance against losses on funds placed by their sponsored MMF. While the BHC sponsor's guarantee is implicit, there are analogous guarantees that are easily observed and provide protection to investors against loss; with that protection, itself, being derived from the same ultimate source: the federal government. This relation can provide an idea of the economic magnitude of the observed difference in charged expense ratios and provide a reasonable benchmark.

In the United States, funds placed directly in a bank, for instance in a money market deposit account, are explicitly insured by the Federal Deposit Insurance Corporation (FDIC) (under the applicable statutory conditions). In 2008, matching the bulk of our sample period, the FDIC guaranteed an average of $4.6 trillion in insured deposits. That same year, it collected $3 billion in insurance assessments (i.e., insurance premiums) that equals a 7 basis points insurance premium per insured dollar. Our point estimates of around 7 basis points for a qualitatively similar "insurance" guarantee aligns remarkably well with this point of reference.

### 5.5 Placebo test

We have thus far shown a significant difference in the response to the Lehman failure of PI-MMFs sponsored by BHCs and those that are not. However, it is conceivable that there are other explanations for this observation. For instance, potentially, there could be a clientele difference between BHC- and non-BHC-sponsored PI-MMFs. Perhaps investors in BHC-sponsored PI-MMFs are less financially sophisticated, and therefore more willing to accept a larger expense ratio and lower net yields. Along the same lines, differences in expense ratios might have nothing to do with the underlying risk but instead with the unobserved differences between BHC- versus non-BHC-sponsored PI-MMFs. Alternatively, perhaps due to the structure of the tests or because of coincidental events surrounding the Lehman failure, the tests are biased in favor of finding a result.

To analyze these concerns, we construct a "placebo" test in which the PI-MMFs have both BHC and non-BHC sponsors that were also exposed to the Lehman failure but were less affected by the changes in risk: Government Institutional MMFs (GI-MMFs). The asset holdings of these funds are much more restricted than PI-MMFs and predominantly contain bonds of government and government-sponsored entities. To facilitate a falsification test, we apply the identical analysis as in Table 2 to the GI-MMFs; the results are shown in Table 4. We observe that contrary to the results

for PI-MMFs, we find no significant difference between GI-MMFs sponsored by BHCs and those that are not. If there were unobserved characteristics of BHCs or of their clientele that generated our main results, we would expect that result to carry over to other funds sponsored by the same BHCs and non-BHCs. If the differences in expense ratios were unrelated to risk, we would expect to see them both in relatively risky PI-MMFs *and* in relatively safe GI-MMFs. Moreover, if our tests were biased towards finding a result, we would be more likely to see a significant result in the second environment, as well as the first. The fact that we find none of these outcomes adds confidence to our interpretation that the observed significant differences in the change in expense ratios of PI-MMFs are associated with increased risk.

## 6. Do institutional investors' redemptions differ by sponsor type?

We next analyze the changes in the redemption decisions of investors during the post-Lehman period. Having observed that BHC-sponsored funds charged higher expense ratios, if BHC and non-BHC sponsors provided equal guarantees, we should expect to see these return-seeking, prime institutional investors move their funds away from the relatively expensive BHC-sponsored funds toward the relatively inexpensive non-BHC-sponsored funds. This behavior would be consistent with the predictions of Christoffersen (2001), Christoffersen and Musto (2002), Kacperczyk and Schnabl (2013), and Cherenkov and Sunderam (2014).

To assess the difference in redemptions between BHC-sponsored and non-BHC-sponsored funds before and after the Lehman crisis, we use the data on daily assets under management from *iMoneyNet* and estimate equation 1. In Column 1 of Table 5, we report the difference-in-differences estimates between the post-Lehman period (September 2008 – March 2009) and the pre-Lehman period (March – August 2008). This analysis parallels that of Tables 2 and 3 in which we found that institutional investors earned less during the post-Lehman period at BHC-sponsored PI-MMFs. In

contrast, Column 1 of Table 5 shows that investors at BHC-sponsored funds behave differently than what the research has predicted. After the collapse, even while the BHC-sponsored funds charged significantly higher expense ratios and, therefore, payed significantly lower net yields, these funds faced no greater associated net outflows of funds. In fact, BHC-sponsored funds experienced 40% lower outflows than the non-BHC-sponsored funds (although insignificant) during the post-Lehman period.

In all, the evidence of the flow analysis shows that institutional investors in BHC-sponsored funds behave differently. Despite being charged higher expense ratios and earning lower net yields than investors in non-BHC sponsored funds, they do not respond by redeeming more. Instead, investors in non-BHC sponsored funds redeem more, suggesting that BHC-sponsorship provides a safety net for institutional investors, which they are willing to pay for.

## 7. Conclusion

PI-MMFs are an important part of the shadow banking system. In this paper, we show that an important distinguishing feature of these funds is that PI-MMF investors perceive BHC-sponsored funds to be less risky than non-BHC-sponsored PI-MMFs and price this BHC affiliation accordingly. We provide evidence that they accepted lower net yields and redeemed less, in contrast to explanations from the previous literature. In other words, institutional investors behaved as if they were paying insurance premiums to BHC sponsored MMFs to protect their investment against losses during the 2008 MMF crisis.

These observations are important in light of the definition of shadow banks first proposed by McCulley (2009) and followed by many others (Acharya, Schnabl, and Suarez, 2013; Kane 2013; Financial Stability Board, 2015). These definitions highlight two quintessential characteristics of shadow banks. One, they operate in the shadows without access to FDIC insurance. The other is that

because shadow banks do not have explicit access to the government safety net, they do not operate under the same regulatory constraints.

However, our findings add a third characteristic. We show that shadow banks can extend shadow insurance. We show that during the 2008 crisis BHC sponsored MMFs extended shadow insurance by charging "premiums" in the form of higher expense ratios. This guarantee was more pronounced at BHC-sponsored MMFs because sponsoring BHCs had access to the government safety net. Therefore, we believe it is best to characterize some of these nontraditional intermediation activities as "banks in the shadows extending shadow insurance" rather than "shadow banks."

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**Figure 1:** This figure shows the average gross yields for prime institutional money market funds from January 2006 through December 2009. The vertical lines show the two important dates that affect the risk of the funds. August 2007 is when the French bank BNP Paribas announced that they had frozen $2.2 billion of subprime funds. September 2008 is when the Lehman crisis occurred.
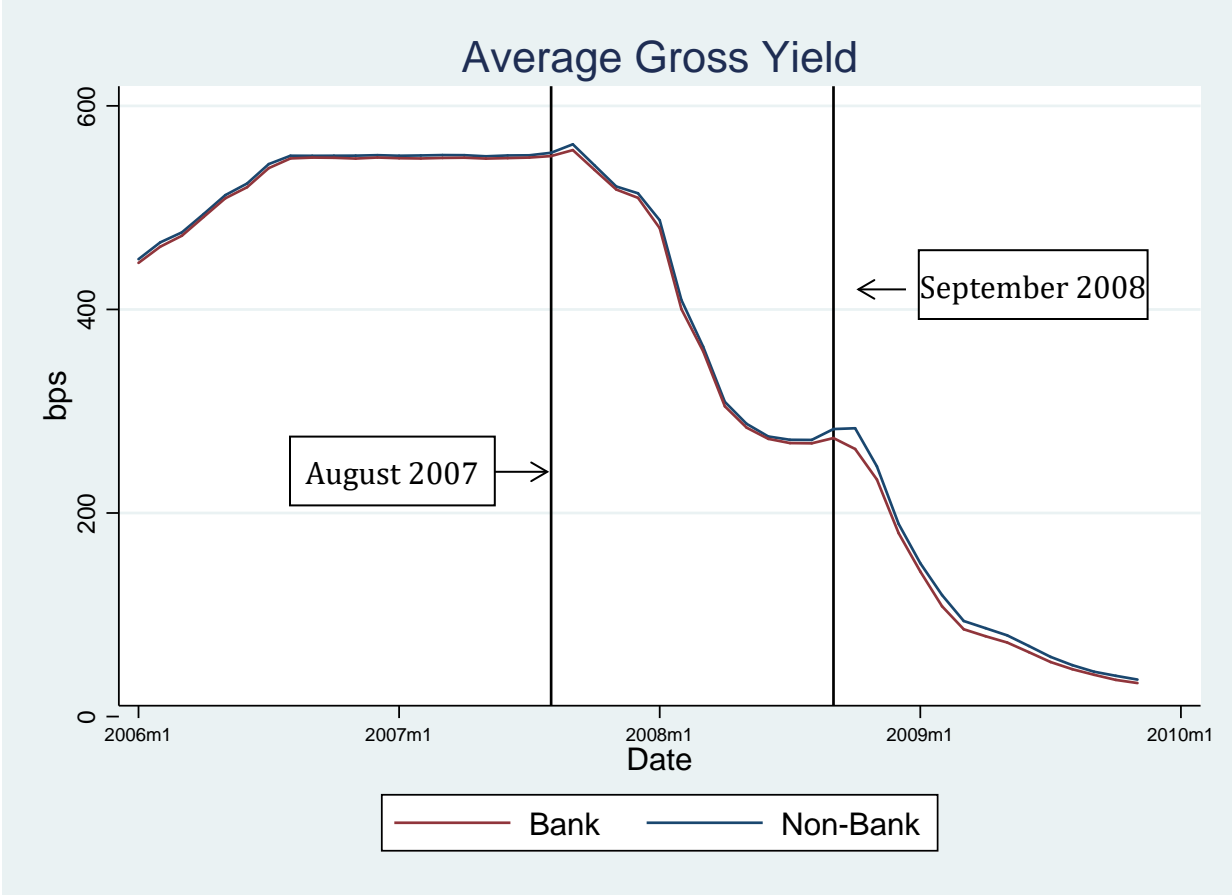
**Figure 2:** This figure shows the average expense ratios for prime institutional money market funds from January 2006 through December 2009. The vertical lines show the two important dates that affect the risk of the funds. August 2007 is when the French bank BNP Paribas announced that they had frozen $2.2 billion of subprime funds. September 2008 is when the Lehman crisis occurred.
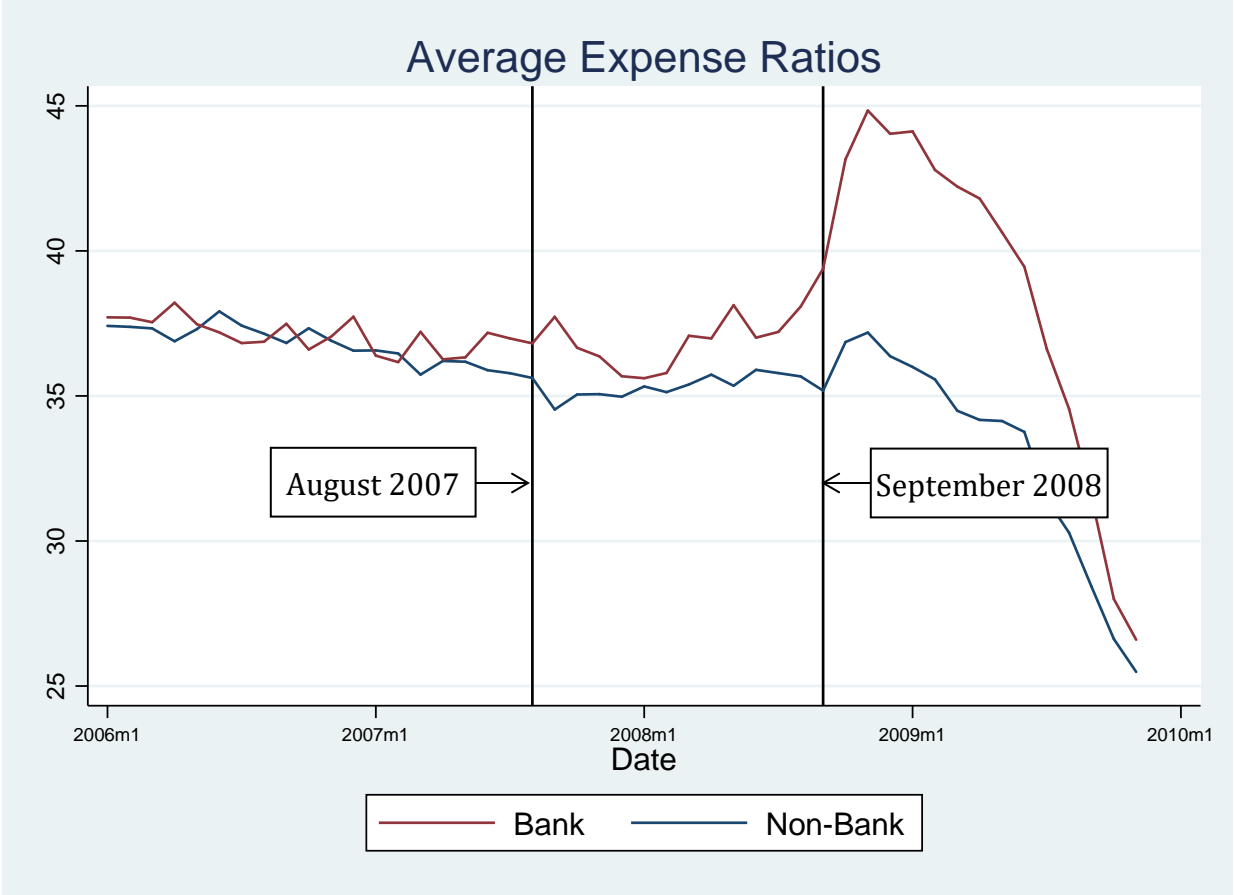
**Figure 3:** This figure shows the average expense ratios by required minimum investment before and after the Lehman failure (September 2008). Funds are separated into three size categories: "small" for funds with minimum balances of less than $25,000, "medium" for funds with between $25,000 and $1,000,000, and "large" for funds with minimum balances of more than $1,000,000.

**Table 1**: This table presents the portfolio characteristics of PI-MMFs as of June and December 2008. The means for each variable are given for the universe of PI-MMFs as well as for each group of sponsors – non-BHCs and BHCs. The standard deviations are in the parentheses below the mean. Holdings are as a fraction of total net assets. Stars on the mean represent the significance of the difference between non-BHC and BHC-sponsors, with *** for 1%, ** for 5%, and * for 10%.

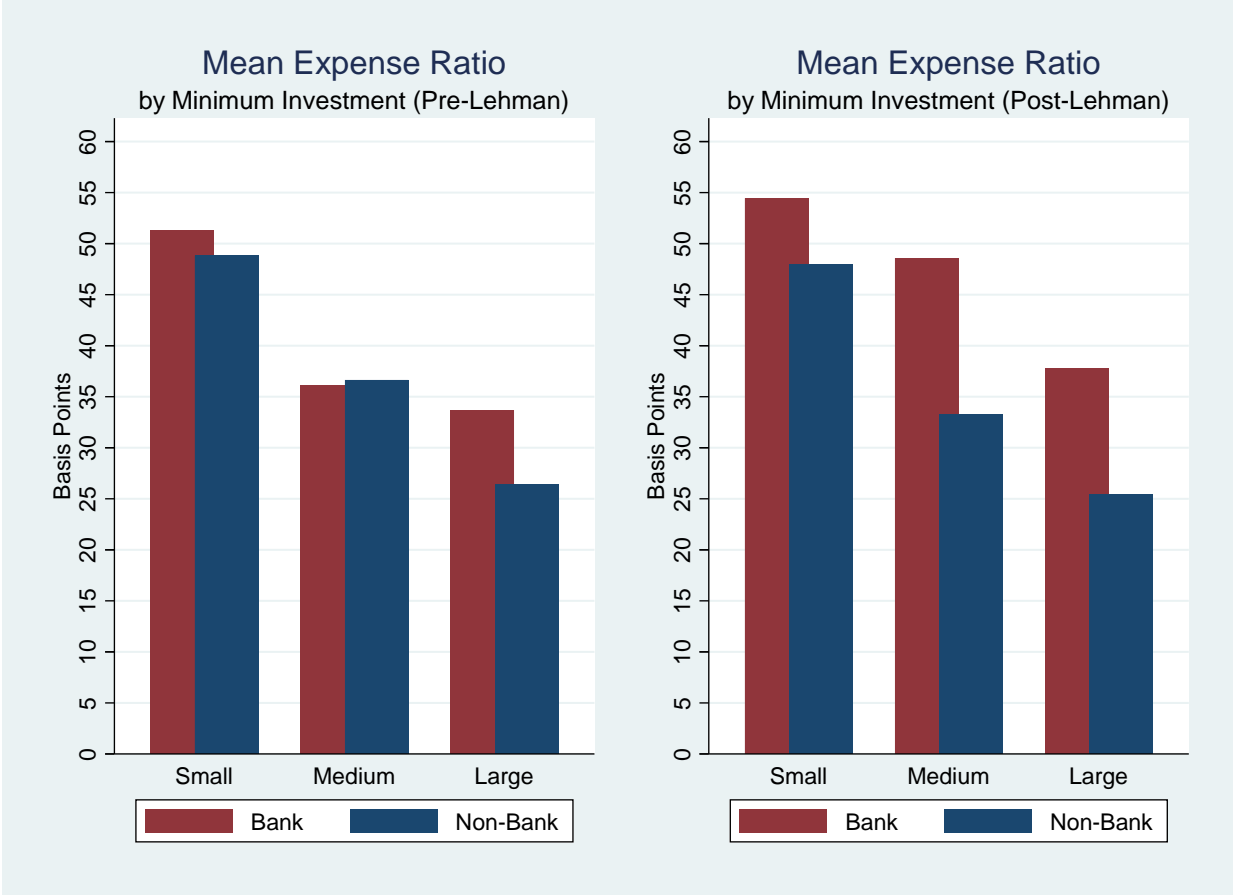| | June 2008 | | | December 2008 | | |
|---|---|---|---|---|---|---|
| | All | Non-BHC | BHC | All | Non-BHC | BHC |
| 30-Day Gross Yield (bps) | 274.3 | 275.1 | 272.9 | 185.2 | 189.6 | 180.3* |
| | (17.14) | (16.89) | (17.61) | (50.68) | (59.45) | (38.27) |
| Expense Ratio (bps) | 36.3 | 36.04 | 36.83 | 39.83 | 36.16 | 43.92*** |
| | (23.98) | (25.45) | (20.83) | (24.22) | (23.39) | (24.54) |
| 30-Day Net Yield (bps) | 238 | 239 | 236 | 145.3 | 153.4 | 136.4*** |
| | (28.55) | (30.03) | (25.34) | (52.51) | (58.88) | (42.80) |
| Share Class Assets ($B) | 3.5 | 3.3 | 3.9 | 3.2 | 3.0 | 3.4 |
| | (7.6) | (7.6) | (7.8) | (7.1) | (6.4) | (7.8) |
| WAM (days) | 42.24 | 42.31 | 42.1 | 37.85 | 39.14 | 36.42* |
| | (11.82) | (12.34) | (10.73) | (13.54) | (16.28) | (9.467) |
| Age (years) | 9.948 | 9.942 | 9.959 | 10.87 | 11.17 | 10.55 |
| | (6.999) | (7.142) | (6.734) | (7.147) | (7.638) | (6.568) |
| Complex Assets ($B) | 103.6 | 108.4 | 94.0 | 137.5 | 131.7 | 143.8 |
| | (108.9) | (119.8) | (82.4) | (138.9) | (160.6) | (109.9) |
| **Low-risk holdings** | | | | | | |
| U.S. Govt. | 0.0489 | 0.048 | 0.0507 | 0.0861 | 0.0859 | 0.0863 |
| | (0.0951) | (0.0891) | (0.107) | (0.129) | (0.121) | (0.137) |
| Repos | 0.135 | 0.136 | 0.133 | 0.148 | 0.147 | 0.150 |
| | (0.118) | (0.125) | (0.104) | (0.165) | (0.203) | (0.109) |
| **Risky Holdings** | | | | | | |
| *All Risky Holdings* | 0.816 | 0.816 | 0.816 | 0.766 | 0.767 | 0.764 |
| | (0.159) | (0.158) | (0.161) | (0.201) | (0.218) | (0.181) |
| Time Deposits | 0.0297 | 0.0208 | 0.0473*** | 0.0357 | 0.0231 | 0.0499*** |
| | (0.0412) | (0.032) | (0.0508) | (0.0613) | (0.0405) | (0.0759) |
| Bank Obligations | 0.189 | 0.18 | 0.207 | 0.176 | 0.208 | 0.140*** |
| | (0.15) | (0.143) | (0.162) | (0.151) | (0.167) | (0.122) |
| Floating Rate Notes | 0.185 | 0.194 | 0.168* | 0.149 | 0.149 | 0.148 |
| | (0.137) | (0.144) | (0.12) | (0.138) | (0.157) | (0.113) |
| Commercial Paper | 0.242 | 0.218 | 0.290*** | 0.222 | 0.226 | 0.218 |
| | (0.189) | (0.196) | (0.163) | (0.159) | (0.181) | (0.129) |
| ABCP | 0.17 | 0.203 | 0.103*** | 0.184 | 0.162 | 0.208** |
| | (0.164) | (0.173) | (0.118) | (0.183) | (0.176) | (0.188) |
| Observations | 345 | 230 | 115 | 317 | 167 | 150 |

**Table 2:** The regressions show the relation between the yields and expense ratios with fund sponsorship. The values in parentheses are the associated *t*-statistics. The data cover March 2008 through March 2009. "Post-Lehman" is an indicator that the date is after September 2008, the month of Lehman's failure. Stars represent the level of significance, with *** for 1%, ** for 5%, and * for 10%.

| | (1) 30-Day Gross Yield (bps) | (2) 30-Day Net Yield (bps) | (3) Charged Expense Ratio (bps) |
|---|---|---|---|
| Bank | -5.39** (-2.46) | -6.39* (-1.73) | 3.44 (1.22) |
| After Lehman | -24.24*** (-7.90) | -22.82*** (-6.88) | -2.90* (-1.74) |
| Bank * After Lehman | -7.55* (-1.91) | -12.44** (-2.45) | 6.80** (2.21) |
| log(Complex Assets) | -0.32 (-0.32) | -0.79 (-0.69) | 1.11 (1.20) |
| Treasury Yield (bps) | 0.50*** (27.69) | 0.52*** (30.08) | -0.02*** (-3.73) |
| WAM (logarithm of) | 16.23*** (3.76) | 10.39** (2.14) | 4.32** (2.33) |
| Risky Holdings (%) | 100.23*** (8.55) | 106.27*** (7.90) | -5.40 (-0.58) |
| log(Minimum Investment) | | | -1.40*** (-4.33) |
| Constant | 93.97*** (6.75) | 76.69*** (5.28) | 31.74*** (3.98) |
| Observations | 4,365 | 4,364 | 4,359 |
| $R^2$ | 0.505 | 0.484 | 0.117 |

**Table 3**: The regressions show the relation between the yields and expense ratios with fund sponsorship that use alternative measures for investors' yields and returns. The values in parentheses are the associated *t*-statistics. Data cover March 2008 through March 2009. "Post-Lehman" is an indicator that the date is after September 2008, the month of Lehman's failure. September itself is excluded from the analysis. All yields and returns are annualized. Stars represent the level of significance, with *** for 1%, ** for 5%, and * for 10%.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | 30-Day Net Simple Yield (bps) | 7-Day Net Compound Yield (bps) | 1-Month Net Simple Return (bps) | 1-Month Net Simple Yield (bps) | 1-Day Net Simple Yield (bps) |
| Bank | -5.63 (-1.63) | -6.39* (-1.73) | -6.25* (-1.71) | -6.22* (-1.70) | -5.35 (-1.44) |
| After Lehman | 1.45 (0.40) | -12.37*** (-3.69) | -18.99*** (-6.17) | -19.03*** (-6.24) | -2.05 (-0.18) |
| Bank * After Lehman | -13.13*** (-2.72) | -11.38** (-2.23) | -12.75** (-2.52) | -12.19** (-2.46) | -10.27* (-1.74) |
| log(Complex Assets) | 0.10 (0.09) | -0.84 (-0.73) | -0.80 (-0.71) | -0.73 (-0.65) | 0.56 (0.43) |
| Treasury Yield (bps) | 0.58*** (29.22) | 0.60*** (38.77) | 0.54*** (31.61) | 0.54*** (31.82) | 0.72*** (13.15) |
| WAM (logarithm of) | 13.71*** (3.21) | 10.00** (2.01) | 8.99* (1.90) | 9.00* (1.90) | 9.73* (1.76) |
| Risky Holdings (%) | 89.51*** (6.54) | 109.72*** (8.12) | 104.24*** (7.92) | 103.85*** (7.91) | 98.98*** (6.83) |
| Constant | 66.92*** (5.07) | 52.79*** (3.69) | 73.11*** (5.12) | 72.61*** (5.09) | 25.85 (1.39) |
| Observations | 2,658 | 4,366 | 4,367 | 4,367 | 4,330 |
| R2 | 0.456 | 0.506 | 0.499 | 0.498 | 0.524 |

**Table 4.** This table presents the yield and expense ratio regressions for government funds. The regressions show the relation between the yields and expense ratios with fund sponsorship. The values in parentheses are the associated $t$-statistics. The data cover March 2008 through March 2009. "Post-Lehman" is an indicator that the date is after September 2008, the month of Lehman's failure. Stars represent the level of significance, with *** for 1%, ** for 5%, and * for 10%.

| | (1)<br>30-Day Gross Yield<br>(bps) | (2)<br>30-Day Net Yield<br>(bps) | (3)<br>Expense Ratio<br>(bps) |
|---|---|---|---|
| Bank | -3.98<br>(-0.81) | -5.47<br>(-0.97) | 2.83<br>(1.16) |
| After Lehman | -59.30***<br>(-12.91) | -58.94***<br>(-12.42) | -1.57<br>(-1.19) |
| Bank * After Lehman | -2.05<br>(-0.33) | -2.34<br>(-0.37) | 2.36<br>(1.04) |
| log(Complex Assets) | -2.58**<br>(-2.00) | -3.20**<br>(-2.10) | 1.16*<br>(1.76) |
| Treasury Yield (bps) | 0.43***<br>(14.54) | 0.41***<br>(14.71) | 0.02***<br>(3.94) |
| WAM (logarithm of) | 2.44<br>(1.10) | -0.18<br>(-0.08) | 1.80<br>(1.51) |
| Risky Holdings | 1.40***<br>(8.76) | 1.44***<br>(8.55) | -0.04<br>(-0.79) |
| log(Minimum Investment) | - | - | -1.55***<br>(-4.87) |
| Constant | 164.66***<br>(11.02) | 144.96***<br>(8.58) | 36.20***<br>(5.24) |
| Observations | 4268 | 4264 | 4258 |
| $R^2$ | 0.653 | 0.620 | 0.131 |

$t$ statistics in parentheses

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

**Table 5**: The regressions show investor redemptions in response to the Lehman crisis. Column 1 is the difference-in-differences between March 2008 and August 2008 period and October 2008 and March 2009 for BHC and BHC-sponsored MMFs. Stars represent the level of significance, with *** for 1%, ** for 5%, and * for 10%.

|  | (1)<br>Redemptions<br>March 2008 – March 2009<br>(%) |
| --- | --- |
| Bank | 31.20<br>(1.01) |
| After Lehman | -17.21<br>(-0.98) |
| Bank * After Lehman | -40.91<br>(-1.03) |
| Treasury Yield (bps) | -0.12<br>(-0.99) |
| log(Complex Assets) | 2.57<br>(0.96) |
| 30−Day Gross Yield (bps) | -0.35<br>(-0.99) |
| WAM (logarithm of) | 17.31<br>(0.89) |
| Expense Ratio (bps) | -0.07<br>(-0.85) |
| Risky Holdings | -4.21<br>(-0.38) |
| Constant | 12.98<br>(0.91) |
| Observations | 2,986 |
| R2 | 0.003 |

**Appendix A: Sample prime institutional funds as of September 2008 and corrections to fund sponsors reported by *iMoneyNet*.**

| Complex | Number of Funds | Number of Share Classes | *iMoneyNet* BHC Indicator | New Indicator |
|---|---|---|---|---|
| *BHC status change within sample period (2 complexes / 8 funds / 32 share classes)* | | | | |
| Goldman Sachs | 5 | 21 | BHC/Non-BHC | Non-BHC then BHC |
| Morgan Stanley | 3 | 11 | BHC | Non-BHC then BHC |
| *No domestically domiciled regulatory high-holder (7 complexes / 10 funds / 20 share classes)* | | | | |
| Barclays | 2 | 8 | BHC/Non-BHC | Non-BHC |
| BMO (Bank of Montreal) | 1 | 1 | BHC | Non-BHC |
| Credit Suisse | 1 | 3 | BHC | Non-BHC |
| HSBC | 1 | 2 | BHC | Non-BHC |
| ING | 3 | 3 | BHC | Non-BHC |
| RBC | 1 | 1 | Non-BHC | BHC |
| UBS | 1 | 2 | BHC | Non-BHC |
| *Data error (8 complexes / 21 funds / 40 share classes)* | | | | |
| American Century | 2 | 2 | Non-BHC | BHC |
| BlackRock | 8 | 16 | BHC/Non-BHC | Non-BHC |
| CitizensSelect | 1 | 4 | BHC | Non-BHC |
| Legg Mason | 4 | 9 | BHC/Non-BHC | Non-BHC |
| Monarch | 1 | 4 | Non-BHC | BHC |
| Munder | 2 | 3 | BHC/Non-BHC | Non-BHC |
| RidgeWorth | 1 | 1 | BHC | Non-BHC |
| Virtus | 1 | 1 | BHC | Non-BHC |
| BBH (Brown Brothers Harriman) | 1 | 1 | BHC | Non-BHC |
| *No change from iMoneyNet data (57 complexes / 100 funds / 237 share classes)* | | | | |
| Advisors Inner Circle | 1 | 1 | Non-BHC | Non-BHC |
| Allegiant | 2 | 3 | BHC | BHC |
| Ambassador | 1 | 1 | Non-BHC | Non-BHC |
| American Beacon | 1 | 4 | Non-BHC | Non-BHC |
| AMF | 1 | 1 | Non-BHC | Non-BHC |
| Bishop St | 1 | 1 | BHC | BHC |
| BNY Mellon | 1 | 1 | BHC | BHC |
| BofA Global Capital | 2 | 10 | BHC | BHC |
| Cadre | 1 | 2 | Non-BHC | Non-BHC |
| Calvert | 1 | 1 | Non-BHC | Non-BHC |
| Cavanal Hill | 1 | 2 | BHC | BHC |
| Deutsche | 3 | 7 | BHC | BHC |
| Dreyfus | 7 | 24 | BHC | BHC |
| Evergreen | 2 | 9 | BHC | BHC |

| | | | | |
|---|---|---|---|---|
| Federated | 6 | 15 | Non-BHC | Non-BHC |
| Fidelity | 5 | 18 | Non-BHC | Non-BHC |
| Fifth Third | 1 | 4 | BHC | BHC |
| First American | 1 | 4 | BHC | BHC |
| Fortis | 2 | 3 | Non-BHC | Non-BHC |
| Franklin | 1 | 2 | Non-BHC | Non-BHC |
| GE | 2 | 2 | Non-BHC | Non-BHC |
| Hancock Horizon | 1 | 1 | BHC | BHC |
| Invesco | 3 | 16 | Non-BHC | Non-BHC |
| Janus | 2 | 3 | Non-BHC | Non-BHC |
| JPMorgan | 2 | 11 | BHC | BHC |
| Lehman Brothers | 4 | 11 | Non-BHC | Non-BHC |
| Meeder | 1 | 1 | Non-BHC | Non-BHC |
| Nationwide | 1 | 1 | Non-BHC | Non-BHC |
| North Track | 1 | 1 | Non-BHC | Non-BHC |
| Northern | 2 | 6 | BHC | BHC |
| OppenheimerFunds | 1 | 3 | Non-BHC | Non-BHC |
| Pax World | 1 | 1 | Non-BHC | Non-BHC |
| Performance | 1 | 1 | BHC | BHC |
| PFM | 1 | 1 | Non-BHC | Non-BHC |
| Pioneer | 2 | 4 | Non-BHC | Non-BHC |
| PNC | 1 | 1 | BHC | BHC |
| Principal | 1 | 1 | Non-BHC | Non-BHC |
| Prudential | 2 | 3 | Non-BHC | Non-BHC |
| Reich & Tang | 1 | 2 | Non-BHC | Non-BHC |
| Reserve | 2 | 10 | Non-BHC | Non-BHC |
| RMK | 1 | 1 | BHC | BHC |
| Schwab | 2 | 4 | Non-BHC | Non-BHC |
| SEI | 2 | 9 | Non-BHC | Non-BHC |
| SSgA (State Street) | 2 | 3 | BHC | BHC |
| Sterling Capital | 1 | 1 | BHC | BHC |
| TD Asset Mgmt USA | 1 | 2 | BHC | BHC |
| Thrivent | 1 | 1 | Non-BHC | Non-BHC |
| TIAA-CREF | 2 | 3 | Non-BHC | Non-BHC |
| Touchstone | 2 | 3 | Non-BHC | Non-BHC |
| Utendahl | 1 | 1 | Non-BHC | Non-BHC |
| Vanguard | 1 | 1 | Non-BHC | Non-BHC |
| Victory | 1 | 2 | BHC | BHC |
| Wells Fargo | 4 | 7 | BHC | BHC |
| Wilmington | 2 | 4 | BHC | BHC |
| Wilmington Trust | 1 | 1 | BHC | BHC |
| **Total** | **139** | **329** | | |