

# Money Fund Runs

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**A Proposal for Consideration for Q-Group Research Funding**

## I. Abstract of the Proposal

Money market funds have become a close substitute to bank deposits, in the eyes of investors. It is now commonplace for such investors to keep most of their liquid assets in money market mutual funds, and to transfer money back and forth to these funds as liquidity is needed on (if necessary) a daily basis. Investors appear to view these money funds as a risk-free alternative to bank deposit accounts that also accrue a higher rate of interest. Indeed, some commentators have referred to money market mutual funds as “shadow banks,” although without any explicit guarantee of capital safety. However, some investors appear to believe that implicit guarantees exist, either from the management company or from the U.S. Government. In addition, money funds have become a major short-term financing alternative for corporations, who may be able to obtain cheaper financing by selling their short-term debt to these funds.

In this project, I will conduct an empirical study of a run on money market mutual funds that developed in September 2008. Money market funds have certain characteristics in common with banks, but also significant differences. Owing to these similarities and differences, I believe that the episode of September 2008 presents a unique opportunity to add perspective to the literature on bank runs. My main goal in this project is to explore the characteristics that made some money funds more susceptible to runs than others during this episode. That is, I will study the institutional characteristics of different money market funds (e.g., their fund family structure), their portfolio holdings, and their investors.

During the week of September 15, 2008, the Reserve Primary Fund “broke the buck,” that is, marked the net asset value of the fund below \$1 per share following the failure of Lehman Brothers on September 14. This event was the first time a money market fund “defaulted,” in the sense that it failed to return principal of \$1.00 per share to investors on demand. My goal in this study is to shed light on what triggered the run on the Reserve Fund, as well as the ensuing run on other money funds that had no exposure to Lehman debt. For instance, I wish to determine who initiated the run (institutional vs. individual investors) as well as the timing of their withdrawals. Further, I wish to observe the reaction of the funds, to see how they met the liquidations without seriously harming other investors.

Ultimately, the U.S. Treasury stepped in to guarantee (up to a limit) the investments of shareholders in money market funds. Thus, my study has important implications both for regulators of money funds and for their investors. I also believe that my study has implications for commercial banks, since the behavior of investors is likely very similar in the absence of deposit insurance, or with inadequate deposit insurance.

The goal of this project will be to develop insights into the mechanics of the \$3.8 trillion money market mutual fund industry. This work will be of great relevance to policymakers, such as the Securities and Exchange Commission. The SEC is currently considering amending the regulations governing money funds, given the crises of September 2008. I expect that this project will provide scientific results to help guide SEC regulatory policy, as well as the policies of mutual fund families when offering money funds to their investors.

## II. Literature Review

The seminal theory on bank runs is developed by Diamond and Dybvig (DD; 1983). DD develop a model of bank runs that illustrates how a bank run can be an equilibrium outcome with bank deposits; in this equilibrium, investors think the bank is going to fail, and it becomes a self-fulfilling prophecy. Investors judge whether to deposit money, depending on the probability of a run. The DD model also finds that bank deposits can provide allocations of capital superior to those of disintermediated security markets. Postlewaite and Vives (1987) extend DD by modeling how bank runs are an equilibrium outcome even if investors cannot observe public information about the probability of a particular bank's failure beforehand.

Goldstein and Pauzner (2005) further extend DD by tying the probability of bank runs to observable fundamentals. Using this concept, they find conditions under which banks increase welfare overall, as well as constructing a demand-deposit contract that trades off the benefits of liquidity against the costs of runs. Peck and Shell (2003) extend DD to show, by examples, that under an optimal demand deposit contract, a post-deposit game can have a run equilibrium.

Jacklin and Bhattacharya (1988) contrast panics and information-based bank runs to provide a model of how bank runs are triggered. Information-based runs are driven by two-sided asymmetric information—the bank cannot observe the liquidity needs of the depositors, and the depositors cannot observe the bank asset quality. Finally, Bryant (1980) shows how demand deposits backed by fractional currency reserves and public insurance can be beneficial, depending on the costs of illiquidity and incomplete information.

There are no other academic studies of the high-frequency flows to and from individual money market funds, to our knowledge. Therefore, our study provides the first empirical evidence of the potential for runs in mutual fund money markets. We focus on the September 2008 run on

several money market funds to determine the causes and consequences of a panic in money market funds.

### III. Data and Methodology

#### III.A. Data

Our data on daily money fund flows is obtained from iMoneyNet ([www.imoney.net](http://www.imoney.net)). iMoneyNet provides daily dollar flows for over 2,000 money market mutual funds that invest primarily in U.S. short-term dollar-denominated debt obligations. These money funds are offered to retail as well as institutional investors. The iMoneyNet data consists of daily flows (the change in net assets, which neglects the very small daily return) by share class, as well as data on the fund investment objective, fund family/adviser, fund type (i.e. retail vs. institutional), portfolio average maturity, and asset breakdown. We augment these data with proprietary portfolio holdings data of the money funds from the Investment Company Institute (ICI).

Table 1 shows the total net assets, number of shareholder accounts, number of money market mutual funds, and number of shareclasses in these funds at the end of each year from 1990 to 2008. The total assets held in money market funds increases from almost \$500 billion at the end of 1990 to more than \$3.8 trillion at the end of 2008, reflecting the huge increase in popularity of these funds among individuals and institutions. Note that, until the crisis of 2008, money market funds holding predominantly non-government securities dominated the asset value of the sample. During 2008, assets held in government money market funds nearly doubled to 1.45 trillion. Further, note that the average number of shareclasses per fund has increased from one to almost three during the sample period. This trend indicates that the actions of one class of investors has a greater potential to affect other classes over time, such as institutions affecting individuals, and vice-versa.

Table 2 explores the net cash inflows as well as a breakdown into sales and redemptions for each year from 1984 to 2008. The table shows that flows into money market funds have been vastly increasing over the sample period, especially since about 1995. Note, also, the movement toward money funds during the market crisis of 2007 and 2008.

It is important to understand the portfolio holdings of money funds to explore the liquidity and other risks that they carry. Table 3 shows that funds that focus on non-governmental securities made a secular movement from commercial paper to bank CDs, repurchase agreements, and corporate notes over our sample period. Clearly, funds have become more diversified among asset classes while retaining a weighted-average asset maturity of about 50 days.

### III.B. Methodology

Our intention in this paper is to study the causes and consequences of money market mutual fund runs. In order to achieve this goal, we will first build a model of money market fund flows during normal (non-crisis) periods. We start by modeling the fund and investor characteristics that covary with money fund flows:

$$Flow_{i,t} = f(Flow_{i,t-j}, Flow_{-i,t-j}r_{i,t-j}, Ind_{i,t-1}, Liq_{i,t-1}, Mgmt_{i,t-1}) + \varepsilon_{i,t}, \quad (1)$$

where  $Flow_{i,t-j}$  equals the net flows into money fund  $i$  during each day of the window ending at day  $t-j$  ( $j=1$  to  $N$ ),  $Flow_{-i,t-j}$  equals the same variable, measured across all other same-category (e.g., high-quality corporate) money funds excluding fund  $i$ ,  $r_{i,t-j}$  equals the NAV return of money fund  $i$  during each day of the window ending at day  $t-j$  ( $j=1$  to  $N$ ),  $Ind_{i,t-1}$  equals the proportion of shareholders that are individuals (rather than institutions),  $Liq_{i,t-1}$  is the liquidity characteristics of

the most recently available portfolio holdings of fund  $i$  at the end of day  $t-1$ , and  $Mgmt_{i,t-1}$  is the day  $t-1$  characteristics of the management company that offers money fund  $i$  at day  $t$ .

Next, we use the model, fitted over several different windows (30-day, 60-day, 90-day, and 180-day) prior to the studied crisis week (the week of September 15, 2008) to estimate abnormal daily flows,

$$ABFLOW_{i,t+j} = Flow_{i,t+j} - \hat{E}[Flow_{i,t+j}], \quad (2)$$

where  $E[Flow_{i,t+j}]$  is the expected day  $t+j$  fund  $i$  flow using the fitted regression from Equation (1) at the end of day  $t$  and variables updated to day  $t+j-1$ . This model is a high-frequency model that is similar to the low-frequency model of Warther (1995), who studies the determinants of monthly equity mutual fund flows.

We will next determine the relation between abnormal daily flows,  $ABFLOW_{i,t+j}$ , and fund as well as investor characteristics:

$$ABFLOW_{i,t+j} = f(FundChar_{i,t}, InvChar_{i,t}) \quad (3)$$

$FundChar_{i,t}$  and  $InvChar_{i,t}$  are measured fund characteristics and investor characteristics, respectively. We will use the following fund characteristics:

- Management company size and liquidity
- Fund size
- Fund holdings of asset classes

Also, we will use the following investor characteristics:

- Proportion institutional vs. individual
- Lagged flow volatility
- Distribution channel breakdown (e.g., retail brokerage vs. retirement)

We will apply the above fund-by-fund regressions using daily flows from (essentially all) money funds over the period August 31 to Sept 30 to understand the causes of money fund runs. We will also, in further tests, estimate the above models at the aggregate money fund category level, such as daily flows to all non-government money market funds in individual shareclasses.

Further, we will study the reaction of money funds to actual and expected runs. Specifically, we will look at shifts in portfolio holdings as a function of lagged money fund abnormal flows and expected flows.

#### IV. Deliverables

I plan to have a complete first draft of the paper by September 2011, and, after circulation, to submit a revised draft to a top academic finance journal by January 2012. This project is a natural extension of my work on investment management, which focuses on the performance and strategies of mutual fund managers.

#### V. Preliminary Findings

We have surveyed our dataset, and find that flow volatility, clientele characteristics, management company “deep” versus “shallow pocket,” type of fund, and what the fund was holding appear to impact the potential for money fund runs. In addition, we find that certain broker-related funds (Morgan Stanley, Dreyfus) were hit harder than other complexes. Some money market fund providers were hit worse than others in that outflows from “prime money market funds” (those that invest in commercial paper, bank CDs, and other such investments) exceeded *inflows* that those same providers received in Treasury-only money market funds (those that invest

only in U.S. Treasury and agency securities). Other providers (e.g., JP Morgan) lost a lot of money from prime funds, but probably made back more than all of that in inflows to Treasury funds.

The response of money funds with runs varied, and followed three different paths: (1) some funds paid out redemptions in kind (e.g., American Beacon), (2) some funds transferred the fund to another complex (e.g., Putnam to Federated), and (3) some funds attempted to increase their liquidity through securities trades. We will build on these preliminary findings by further investigating the characteristics of fund management companies that chose these different responses.

We also find that, although the events of September 2008 were similar in many respects to a typical bank run, they were very different in other respects. First, runs were almost entirely due to institutional rather than retail customers, which indicates that “sophisticated” investors may present a risk to “passive” investors. Second, runs were more pronounced among funds that didn’t have “deep pocket backing,” indicating that investors infer that funds are guaranteed by their management company. Third, runs were more pronounced among funds advised by banks or brokers that were under the most stress and had littlest capital (again, inferring implied guarantees). And, finally, institutional investors, for the most part, moved their money into U.S. government (only) money market funds in the same fund complex, indicating that they were sophisticated enough to know when not to rely on the management company’s liquidity-provision.



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**Table 1**  
**Total Net Assets, Number of Shareholder Accounts, Number of Funds, and Number of Share Classes of Money Market Funds**  
**by Type of Fund**  
*Year-end*

Year	Total net assets				Number of shareholder accounts*			
	<i>(millions of dollars)</i>				<i>(thousands)</i>			
	Taxable		Non-		Taxable		Non-	
	Total	Government	government	Tax-exempt	Total	Government	government	Tax-exempt
1990	\$498,341	\$107,592	\$307,142	\$83,608	22,969	2,273	19,305	1,391
1991	542,442	138,009	314,550	89,882	23,556	2,547	19,316	1,693
1992	546,194	151,286	300,067	94,841	23,647	2,817	18,954	1,876
1993	565,319	148,697	313,207	103,415	23,585	2,806	18,780	1,998
1994	611,005	147,096	353,540	110,369	25,383	3,049	20,295	2,039
1995	753,018	179,176	450,810	123,032	30,144	3,824	24,035	2,285
1996	901,807	217,912	544,077	139,818	32,200	4,147	25,760	2,292
1997	1,058,886	244,978	653,105	160,803	35,624	4,548	28,413	2,663
1998	1,351,678	302,792	860,375	188,512	38,847	4,384	32,058	2,405
1999	1,613,146	325,911	1,082,820	204,415	43,616	4,793	36,385	2,438
2000	1,845,248	352,468	1,254,748	238,033	48,138	4,888	40,592	2,659
2001	2,285,310	437,235	1,575,676	272,399	47,236	5,124	39,290	2,821
2002	2,271,956	447,673	1,549,500	274,784	45,380	5,092	37,634	2,655
2003	2,052,003	403,535	1,360,095	288,373	41,214	4,111	34,301	2,802
2004	1,913,193	372,440	1,230,407	310,346	37,636	3,651	31,143	2,842
2005	2,040,537	382,493	1,324,046	333,998	36,837	3,117	30,916	2,805
2006	2,338,451	405,822	1,566,225	366,404	37,067	3,292	30,714	3,061
2007	3,085,760	726,084	1,894,602	465,075	39,130	3,481	32,181	3,467
2008	3,832,244	1,450,340	1,890,444	491,460	38,112	4,160	30,339	3,613

Year	Number of funds				Number of share classes			
	Total	Taxable		Tax-exempt	Total	Taxable		Tax-exempt
		Government	Non-government			Government	Non-government	
1990	741	174	332	235	762	180	343	239
1991	820	211	342	267	871	228	364	279
1992	864	234	351	279	914	247	369	298
1993	920	260	368	292	1,009	280	393	336
1994	963	271	375	317	1,261	360	493	408
1995	997	279	395	323	1,380	394	555	431
1996	988	271	395	322	1,453	404	596	453
1997	1,013	271	411	331	1,549	428	642	479
1998	1,026	275	410	341	1,627	459	674	494
1999	1,045	284	418	343	1,730	493	733	504
2000	1,039	277	426	336	1,855	531	793	531
2001	1,015	273	416	326	1,948	575	822	551
2002	989	265	414	310	2,006	588	876	542
2003	974	258	404	312	2,031	584	879	568
2004	943	247	392	304	2,046	589	882	575
2005	871	220	375	276	2,031	565	900	566
2006	847	212	362	273	2,012	567	888	557
2007	805	197	349	259	2,018	553	897	568
2008	784	195	341	248	1,989	568	880	541

*\*Number of shareholder accounts includes a mix of individual and omnibus accounts.*

*Note: Data for funds that invest primarily in other mutual funds were excluded from the series. Components may not add to the total because of rounding. Source: ICI Factbook, 2009*

**Table 2**  
**Net New Cash Flow<sup>1</sup> and Components of Net New Cash Flow of Money Market Funds**

Millions of dollars, annual

Year	Net new cash flow	Sales			Redemptions		
		New + exchange	New <sup>2</sup>	Exchange <sup>3</sup>	Regular + exchange	Regular <sup>4</sup>	Exchange <sup>5</sup>
1984	\$35,077	\$640,021	\$620,536	\$19,485	\$604,944	\$586,990	\$17,953
1985	-5,293	848,451	826,858	21,592	853,743	831,067	22,676
1986	33,552	1,026,745	978,041	48,704	993,193	948,656	44,537
1987	10,072	1,147,877	1,049,034	98,843	1,137,805	1,062,671	75,133
1988	106	1,130,639	1,066,003	64,636	1,130,534	1,074,346	56,188
1989	64,132	1,359,616	1,296,458	63,158	1,295,484	1,235,527	59,957
1990	23,179	1,461,537	1,389,439	72,098	1,438,358	1,372,764	65,594
1991	6,068	1,841,131	1,778,491	62,640	1,835,063	1,763,106	71,957
1992	-16,006	2,449,766	2,371,925	77,841	2,465,772	2,382,976	82,796
1993	-13,890	2,756,282	2,665,987	90,295	2,770,172	2,673,464	96,707
1994	8,525	2,725,201	2,586,478	138,722	2,716,675	2,599,400	117,275
1995	89,381	3,234,216	3,097,225	136,990	3,144,834	3,001,968	142,866
1996	89,422	4,156,985	3,959,014	197,971	4,067,563	3,868,772	198,791
1997	103,466	5,127,328	4,894,226	233,102	5,023,863	4,783,096	240,767
1998	235,457	6,407,574	6,129,140	278,434	6,172,116	5,901,590	270,526
1999	193,681	8,080,959	7,719,310	361,649	7,887,278	7,540,912	346,367
2000	159,365	9,826,677	9,406,287	420,391	9,667,312	9,256,350	410,962
2001	375,291	11,737,291	11,426,804	310,487	11,362,000	11,065,468	296,533
2002	-46,451	12,035,774	11,739,560	296,215	12,082,225	11,810,695	271,530
2003	-258,401	11,235,890	11,011,317	224,574	11,494,292	11,267,700	226,592
2004	-156,593	10,953,410	10,786,918	166,492	11,110,003	10,939,725	170,277
2005	63,147	12,596,546	12,420,401	176,145	12,533,399	12,362,620	170,779
2006	245,236	15,707,260	15,496,005	211,256	15,462,024	15,269,381	192,643
2007	654,476	21,315,157	21,040,070	275,087	20,660,681	20,409,373	251,307
2008	636,832	24,574,175	24,189,115	385,059	23,937,343	23,620,680	316,663

<sup>1</sup>Net new cash flow is the dollar value of new sales minus redemptions, combined with net exchanges.

<sup>2</sup>New sales are the dollar value of new purchases of mutual fund shares. This does not include shares purchased through reinvestment of dividends in existing accounts.

<sup>3</sup>Exchange sales are the dollar value of mutual fund shares switched into funds within the same fund group.

<sup>4</sup>Redemptions are the dollar value of shareholder liquidation of mutual fund shares.

<sup>5</sup>Exchange redemptions are the dollar value of mutual fund shares switched out of funds and into another fund in the same group.

Note: Data for funds that invest primarily in other mutual funds were excluded from the series.

Components may not add to the total because of rounding. Source: ICI Factbook, 2009

**Table 3**  
**Asset Composition of Taxable Non-Government Money Market Funds as a Percent of Total Net Assets**  
*Year-end*

<b>Year</b>	<b>Total net assets</b> <i>(millions of dollars)</i>	<b>U.S. Treasury bills</b>	<b>Other Treasury securities</b>	<b>U.S. government agency issues</b>	<b>Repurchase agreements</b>	<b>Certificates of deposit</b>	<b>Eurodollar CDs</b>	<b>Commercial paper</b>	<b>Bank notes<sup>1</sup></b>	<b>Corporate notes<sup>2</sup></b>	<b>Other assets<sup>3</sup></b>	<b>Average maturity</b> <i>(days)</i>
1990	\$307,142	4.3%	2.3%	4.7%	3.3%	6.8%	8.8%	65.0%	–	–	4.7%	48
1991	314,550	5.8	3.0	4.3	4.1	10.5	6.9	59.7	–	–	5.8	56
1992	300,067	2.8	2.6	7.5	5.1	10.3	6.7	57.4	–	–	7.4	59
1993	313,207	2.7	2.5	11.9	6.4	7.9	3.2	52.2	–	–	13.2	58
1994	353,540	2.6	1.3	11.3	6.0	6.3	4.5	53.2	2.4%	–	12.4	38
1995	450,810	1.5	1.0	9.2	6.5	8.8	4.4	52.2	3.7	–	12.6	60
1996	544,077	0.7	1.9	8.9	5.4	12.7	4.3	50.5	2.3	–	13.3	56
1997	653,105	0.5	0.8	5.5	5.6	14.6	3.7	51.5	3.2	–	14.8	57
1998	860,375	0.6	0.9	9.5	4.9	12.9	3.6	48.3	3.9	5.8%	9.6	58
1999	1,082,820	0.5	0.3	6.7	5.1	12.7	3.9	48.9	3.1	8.3	10.4	49
2000	1,254,748	0.5	0.1	6.2	4.5	10.2	7.8	50.2	3.6	10.4	6.6	53
2001	1,575,676	0.6	0.3	12.4	6.4	13.2	8.8	41.2	1.5	10.9	4.6	58
2002	1,549,500	1.5	0.3	12.1	8.4	12.4	8.2	39.7	1.3	11.8	4.3	54
2003	1,360,095	1.5	0.4	15.2	8.5	10.5	6.0	35.1	2.0	15.9	4.7	59
2004	1,230,407	0.5	0.1	12.2	9.0	12.7	6.9	33.4	2.6	17.6	5.0	41
2005	1,324,046	0.8	0.1	4.6	12.4	13.3	6.9	37.9	2.3	17.6	4.2	37
2006	1,566,225	0.2	0.2	3.0	10.9	12.5	5.5	39.0	2.2	21.3	5.3	49
2007	1,894,602	0.9	0.2	3.3	12.4	13.4	6.9	36.2	3.9	16.4	6.4	44
2008	1,890,444	2.4	0.5	13.1	9.1	18.6	7.0	33.4	3.0	9.1	3.8	47

<sup>1</sup>Prior to 1994, bank notes are included in other assets.

<sup>2</sup>Prior to 1998, corporate notes are included in other assets.

<sup>3</sup>Other assets include banker's acceptances, municipal securities, and cash reserves.

Note: Data for funds that invest primarily in other mutual funds were excluded from the series. Source: ICI Factbook, 2009