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Interest-rate and Calendar-time Effects in Money Market Fund and Bank Deposit Cash Flows

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Abstract

We examine the sensitivities of aggregate balances of retail and institutional money market funds (MMFs) and their potential substitutes, bank deposits, to changes in short-term interest rates while controlling for calendar-time effects. We find that institutional MMF and time deposit cash flows are sensitive to recent changes in short-term interest rates. Institutional MMF investors appear to take advantage of arbitrage opportunities created by MMFs using the amortized cost technique. Retail MMF investors are much less responsive to changes in interest rates.

Keywords: *Money market funds, Amortized cost, Preferred habitat for liquidity*

1. Introduction

Money markets are markets for trading liquidity (see Blackwell, Griffiths and Winters (2007)) where investors with temporary cash surpluses provide short-term loans to borrowers with temporary cash shortages. The temporary nature of the cash surplus means the investor has an identified cash obligation for the funds and therefore is unwilling to put these funds at risk because the funds are needed. Money market funds (MMFs) and bank deposits are the most liquid investment vehicles with extremely low risk. Blackwell, Griffiths and Winters (2007, p. 304) suggest that earnings are not the primary goal of a MMF. Instead, for a MMF, earnings are secondary to the preservation of capital and the ability to provide liquidity when needed. Since earnings are a likely secondary objective, we examine whether money market investors move their funds in and out of these accounts to take advantage of higher interest rates.

Currently, there are two separate streams of research on money market investor behavior. One provides evidence of calendar-based effects, while the other provides evidence of preferences for higher interest rates.

The calendar-based money market literature reaches back to at least Park and Reinganum (1986), who find that the last T-bill to mature in a month trades at a yield discount to adjacent bills, with the last bill to mature in a calendar year having the largest discount. Ogden (1987) describes the Park and Reinganum calendar-based regularity as a preferred habitat for investors (the preferred habitat hypothesis stems from Modigliani and Sutch (1966)) with calendar-based cash obligations. Griffiths and Winters (1997) further describe the calendar-based regularity in money markets as a preferred habitat for liquidity: Money market investors schedule their investments to mature in time to return their stored liquidity to pay their cash obligations. Griffiths and Winters (1997) find a year-end preferred habitat for liquidity in short-term repos. Griffiths and Winters (2005) find that the year-end preferred habitat for liquidity extends across US money markets, while Kotomin, Smith and Winters (2008) find it in LIBOR for Euros, Yen, Swiss Francs, and German Marks. Kotomin, Smith and Winters also finds some evidence of quarter-end preferred habitats. Farinella and Koch (2000) examine MMF cash flow patterns and find calendar-time effects due to liquidity preferences around quarter-ends and tax dates. Bank deposits are a substitute for money market investments. Kotomin and Winters (2006) suggest that bank quarter-end balance sheet changes are related to bank customers' preferred habitats. This body of literature suggests that calendar-based preferred habitats for liquidity permeate money market instruments and their substitutes.

The preferred habitat literature focuses on calendar time effects and shows that money market investors are willing to forego some return to strategically time their cash flows to meet calendar-based cash obligations.[1] Accordingly, literature on investors seeking higher returns in the money markets is limited. Lyon (1984) reports that some institutional MMF investors are willing to arbitrage away the under- and overvaluation created by the use of a particular valuation technique, amortized cost valuation. Koppenhaver and Sapp (2005) find that some investors move their money between U.S. Treasury money funds and direct investment in Treasury bills in response to changes in fund's performance and fees. We contribute to this literature by providing an examination

[1] In addition to the calendar-based preferred habitat literature, Simon (1994) shows that T-bill investors will not trade into adjacent bills to pickup additional yield.

of the effect of interest rate changes on MMF and bank deposit flows while controlling for calendar-time effects.

Lyon (1984) examines whether institutional MMF investors engage in arbitrage made possible by the use of the amortized cost valuation technique by MMFs. We believe the question deserves to be revisited for several reasons. First, Lyon (1984) used only two years of weekly data in the early 1980s, when MMFs were in their infancy. Second, we also study retail MMF and bank deposit balance changes in addition to those of institutional MMFs. Third, MMDAs (money market deposit accounts), which may be viewed as the closest substitute for retail MMFs, were introduced after the Lyon's study period ended. Accordingly, we study the effect of changes in short-term interest rates on aggregate balances of money market funds (MMFs) and their potential substitutes – different types of bank deposits – while controlling for the money market calendar-time effects identified in prior studies.

We find calendar-time effects consistent with investors' preferences for liquidity around year-ends, quarter-ends, and tax payment dates. Consistent with Lyon (1984), we find that institutional MMF investors take advantage of arbitrage opportunities between returns on MMFs and alternative investments. Retail MMF flows are substantially less sensitive to interest rate changes than institutional MMF flows. In addition, we find that time deposits, both large and small, vary directly with short-term interest rates. [2]

[2] Deposits are the main source of funds for banks and the key to their profitability. Based on FDIC data as of December 31, 2005, domestic deposits represented 57 percent of the $9.04 trillion of total assets in the banking industry and 97% percent of the net loans and leases made by commercial banks. The domestic deposits can be categorized as transaction accounts (14.5% of total deposits), money market deposit accounts (MMDAs) (39.1%), savings deposits excluding MMDAs (14.4%), small time deposits (14.6%), and large time deposits (17.4%). The double digit percentages in each category indicate how important each source is to the banking industry.

Section 2 describes the data and methods used. Section 3 reports and discusses empirical results. Section 4 concludes the paper.

2. Data and Methods

2.1 Data

The primary data are weekly aggregate balances of retail and institutional money market funds and liquid bank accounts such as transaction deposits, savings deposits, small time deposits, and large time deposits from June 1983 to the middle of October 2006. Savings deposits include (and are dominated by) money market deposit accounts (MMDAs) which can be viewed as a potential substitute for retail MMFs. The introduction of MMDAs in the end of 1982 with higher interest rates than MMFs appeared to have had a significant impact on the balances of savings accounts, time deposits, and retail MMFs in the last three weeks of 1982 and the first five months of 1983. This is the reason we chose June 1983 as a starting point for our analysis. For all but one data series, there are 1,220 weekly observations. The availability of large time deposits ends in the middle of March 2006. All aggregate weekly data series are not seasonally adjusted series from the H6 Report of the Federal Reserve System. To measure the direction and magnitude of changes in short-term interest rates, we use three-month constant maturity T-bill yields from the Fed's H15 Report. Table 1 contains descriptive statistics for the data series utilized in this study.[3]

[Insert Table 1 about here]

[3] Aggregate balances are reported each Wednesday, while T-bill yields are collected on Mondays. We note that the end of the sample pre-dates the financial crisis.

2.2 Methods

We estimate a GARCH (1,1) model with the following mean equation:

$$\Delta Balance_t = \alpha_0 + \alpha_1(\Delta Balance_{t-1}) + \alpha_2 Spread_t + \alpha_3 BY2 + \alpha_4 BY + \alpha_5 AY + \alpha_6 AY2 + \alpha_7 BQ2 + \alpha_8 BQ + \alpha_9 AQ + \alpha_{10} AQ2 + \alpha_{11} BTax + \alpha_{12} ATax + \varepsilon_t \qquad (1)$$

where:

$\Delta Balance_t$ = the change in the aggregate balance, in %, for a given type of account (retail and institutional MMFs, bank transaction deposits, savings deposits, small time deposits, and large time deposits) in week *t*,

$\Delta Balance_{t-1}$ = the first lag of the dependent variable[4],

$Spread_t$ = the difference between the 13-week T-bill yield in week *t* and the average 13-week T-bill yield over the last 13 weeks, ending with week *t*, in percent.

BY2 = a dummy variable that equals 1 for the second-to-last (weekly) observation of the year and 0 otherwise,

BY = a dummy variable that equals 1 for the last observation of the year and 0 otherwise,

AY= a dummy variable that equals 1 for the first observation of the year and 0 otherwise,

AY2 = a dummy variable that equals 1 for the second observation of the year and 0 otherwise,

BQ2 = a dummy variable that equals 1 for the second-to-last observation of each of the first three quarters and 0 otherwise,

BQ = a dummy variable that equals 1 for the last observation of each of the first three quarters and 0 otherwise,

AQ = a dummy variable that equals 1 for the first observation of each of the last three quarters and 0 otherwise,

AQ2 = a dummy variable that equals 1 for the second observation of each of the last three quarters and 0 otherwise,

BTax = a dummy variable that equals 1 for the last observation before April 15,

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[4] While all of the weekly balance series are nonstationary (which would be expected), the null of non-stationarity is rejected for all of the dependent variables (weekly percentage changes in the balance) at the 1% level of significance or better.

ATax = a dummy variable that equals1 for the first observation on or after April 15,

The variance equation of the GARCH model contains the intercept, the ARCH term, and the GARCH term, but no independent variables from the mean equation.

Spread is our key test variable. It is defined as the difference between the 13-week T-bill yield in a given week and the average 13-week T-bill yield over the last 13 weeks. *Spread* is designed to measure the direction and magnitude of changes in short-term interest rates and thus capture potential arbitrage opportunities in the money markets arising due to recent changes in interest rates. Most MMFs use the *amortized cost* method of valuation. Cook and Duffield (1993), who provide a detailed discussion on share valuation, risk, and regulation of MMFs, state:

In order to maintain a constant share value, most money market funds use the "amortized cost" method of valuation. Under this method securities are valued at acquisition cost rather than market value, and interest earned on each security (plus any discount received or less any premium paid upon purchase) is accrued uniformly over the remaining maturity of the purchase. By declaring these accruals as a daily dividend to its shareholders, the fund is able to maintain a stable price of $1 per share.

In effect, the MMF returns are based on the return on the investments they have purchased in the recent past. If current money market rates, as proxied by the current 13-week T-bill yield, are higher than in the recent past, then there may be an arbitrage opportunity for investors to earn a higher return in current money market securities than in MMFs.[5] Knowledgeable investors with direct access to the money markets may take

[5] According to the *2006 Investment Company Fact Book*, the average maturity for MMFs was 45.4 days from 1983 to 2005 and varied from an annual average of 28 to 58 days with 11 of the years below and 13 of the years above the average of 45.4 days. Using the 45.4 day average maturity and a naïve assumption that an equal amount of securities is purchased each day, the average returns for the past 91 days (13 weeks) should be a good proxy for the amortized-cost returns on those MMFs for the next week. We have run different specifications of the model (e.g., with the dependent variable specified as the level or natural

their money out of MMFs or not invest money in MMFs when interest rates are increasing and instead invest in money market securities directly, and bring the money back to MMFs when interest rates are declining to take advantage of the higher yields provided by money market funds. We expect a higher portion of knowledgeable investors and relatively lower transaction costs in institutional money funds than in retail funds; therefore, we anticipate a stronger reaction to changes in interest rates in institutional MMFs. We expect a negative relationship between MMF balance changes and our measure of the short-term interest rate changes, *Spread*. Savings deposits include (and are dominated by) MMDAs; therefore, they may also be affected negatively. If there is any interest rate effect on transaction deposits, we expect those balances to go down as interest rates increase due to the higher opportunity cost of holding cash. We expect a positive relationship between time deposits and *Spread*, with higher effects for large time deposits.

The next eight variables in Equation (1) are dummy variables controlling for the year-end and quarter-end effects related to *preferred habitat for liquidity* as suggested by Griffiths and Winters (1997, 2005) and Kotomin and Winters (2006). There is no overlap between turn-of-the-year and turn-of-the quarter variables (i.e., turn-of-the-quarter variables are turned on for turns of quarters one, two, and three only).

Checks written on demand deposits are the primary method for paying cash obligations, so we expect flows into demand deposits prior to calendar break points and out of demand deposits following these break points. While investors have some check

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logarithm of the aggregate balance, and the key independent variable specified as a *relative* spread between current 13-week T-bill yield and the average of 13-week T-bill yields over the past 13 weeks or six weeks). The results are qualitatively similar.

writing ability in MMFs, we expect that the MMF investors transfer funds to their checking accounts for payment of cash obligations.[6] Accordingly, we expect funds to flow out of MMFs before the calendar break points and into MMFs after the break points. Therefore, we expect the regression parameter estimates at the calendar break points to have opposite signs for MMF flows and demand deposit changes. Because savings and time deposits are potential substitutes for MMFs, we expect that the parameter estimates for MMF flows and savings and time deposits changes to have the same signs.

Garbade (1996) discusses tax-time specialness for T-bills. Farinella and Koch (2000) report that MMF cash flows change significantly around tax dates. We therefore include two tax-time dummy variables, BTax and ATax, in our analysis.[7]

3. Empirical Results

Our primary method of analysis is the estimation of the GARCH model with Equation (1) as the mean equation. However, our prior is that returns are a secondary factor in money market investment behind preservation of capital to meet calendar-based cash obligation. Therefore, we first estimate the model without the last ten (dummy) variables in the mean equation, focusing on the effect of our key variable, *Spread*. Table 2 contains the results. Then, we estimate the model with Equation (1) as the mean

[6] Corporate cash disbursements usually flow through a central checking account for audit purposes. Individuals tend to function in a similar manner. Even when checks are written directly on MMF balances, payees will initially deposit them into their checking accounts, and the pattern of falling MMF balances and increasing demand deposit balances before year- and quarter-ends would be preserved.
[7] Farinella and Koch (2000) also test for tax dates other than April 15 in their study of MMF cash flow patterns. We do not find significant balance changes around those dates (the results are not reported).

equation and report the results in Table 3.[8] To make the discussion more tractable, we first discuss the interest rate effects and then follow with the calendar-time effects.

3.1. Interest Rate Effects

Here we examine whether MMF investors move their money into and out of MMFs to take advantage of changing short-term interest rates. Our key variable, *Spread*, is defined as the difference between the 13-week T-bill yield in week *t* and the average 13-week T-bill yield over the 13 weeks ending with week *t*, in percent. Due to the use of the amortized cost technique by MMFs, investors would earn a higher rate of return in the alternative investment when *Spread* is positive and a higher return in MMFs when *Spread* is negative. Consequently, a negative relation between *Spread* and MMF flows would be consistent with investors taking advantage of arbitrage opportunities. Finally, we point out that *Spread* is designed to capture only arbitrage opportunities within the money markets.[9]

The results reported in Table 2 show a statistically significant negative relation between fund flows and the variable *Spread* for institutional MMFs. The parameter estimate suggests that the aggregate balance tends to fall by 1.58% for a 1% increase in the *Spread* variable (i.e., in the difference between this week's interest rate and the average of the interest rates over the last 13 weeks), ceteris paribus. It suggests that

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[8] We find no evidence of structural breaks. Accordingly, we estimate all regressions across the entire sample period. Additionally, we note that the ARCH and GARCH parameter estimates in the variance equation are statistically significant in all estimation of equation (1). We do not report the variance equation estimates in the interest of brevity. They are available upon request.

[9] One can argue that investors may store funds in MMFs to later invest in the stock market. If this is true, MMF balance changes may be negatively correlated with stock index returns. However, weekly money

investors in institutional MMFs move cash into and out of MMFs to take advantage of changing short-term interest rates.[10] This result is consistent with the Lyon's (1984) findings for a short period before MMDAs were introduced and shows that institutional MMFs are still interest-rate sensitive. The parameter estimate on *Spread* for retail MMFs is negative and statistically significant suggesting that retail investors also respond to changing interest rates. However, the parameter estimate for retail MMFs is one-tenth the size of the parameter estimate for institutional MMFs. The parameter estimate for the retail MMFs suggest a 0.19% decrease in fund balance for a 1% increase in *Spread*.[11]

We find no relationship between *Spread* and changes in transaction accounts. This result is reasonable because balances are held in transaction deposit accounts primarily to pay cash obligations, not earn interest. We find a negative relation between *Spread* and Savings Deposits, and the parameter estimate is similar in size to its retail MMF's counterpart. Our prior is that these are close substitutes. We find a positive relation between *Spread* and time deposit balances. It means that when current rates are above the 13-week average, investors move funds into time deposits. This is reasonable because time deposits must track current interest rates to attract investors. It appears that when funds are flowing out of MMFs to take advantage of new higher short-term rates, time deposits are attracting some of the flow.

Table 3 reports the results from estimating Equation (1). The point of these results is to determine the consistency of the parameter estimate on *Spread* from the results in Table 2 to the results from the full model in Table 3. Comparing the results on

market fund flows are not significantly correlated with contemporaneous and lagged stock market returns (these results are not reported).

[10] Table 1 shows a mean balance in institutional funds of $456.7 billion, so a 1.58% change is $7.2 billion.

Spread across the two tables we find that: (1) the signs are consistent, (2) the parameter estimates are similar and (3) the significance levels are similar. These results suggest that any investor response to changes in short-term interest rates is separate from calendar-based flows.

3.2. Calendar-time Effects

Table 3 reports results from the full model (Equation (1)), which introduces calendar-time and tax-time controls. The inclusion of these controls leads to noticeable improvements in the fit of all six regressions: The AIC (not reported) is always lower for the unrestricted models, indicating a better fit for the models with calendar effects. In general, the reported results are consistent with calendar-time preferences for liquidity (Ogden 1987, Griffiths and Winters 1997 & 2005, Farinella and Koch 2000, Kotomin and Winters 2006).

Since MMFs are storage devices for temporary cash surpluses, we expect cash to move out of MMFs before calendar break points associated with cash obligations and move back into MMFs following the break points. In Table 3 we find that cash moves out of both retail and institutional MMFs before year-end and quarter-ends and moves into these funds in the second week following the year-end and quarter-ends.[12] Somewhat surprisingly, we find that cash continues to flow out of both types of funds in the first week after both the year-end and the quarter-ends. This is not consistent with our specific expectations for preferred habitats, but is reasonable given that MMFs are

[11] Table 1 shows a mean balance of \$496.3 billion, so the change of 0.19% is \$943 million.

storage devices and not typically the transaction accounts used to cover cash obligations.[13] Cash flows of institutional MMFs tend to be more sensitive to the turn of the year than cash flows of retail MMFs.[14] We also find cash flows out of institutional and retail MMFs on the week following tax time, which is consistent with MMFs being storage devices for investors' tax payments.

The vast majority of transaction accounts are bank demand deposits. We expect cash to flow into transaction accounts before the calendar break points and out afterwards. We find that cash flows into transaction deposits before year-ends, quarter-ends, and tax time. The year-end and quarter-end flows for transaction accounts are consistent with a similar analysis in Kotomin and Winters (2006). These results are generally consistent with preferred habitats and with our results from MMF flows.

We examine three types of interest-bearing bank deposits: (1) savings accounts including MMDAs, (2) small time deposits, and (3) large time deposits. Interest-bearing bank deposits are potential substitutes for MMFs and therefore provide alternative storage devices for investors. Accordingly, we expect that cash will flow out of these deposits before the calendar break points and return following the break points.

Savings accounts show cash outflows before and cash inflows after year-ends and quarter-ends. This is similar to but not the same as the MMF cash flow patterns at calendar break points. These patterns are consistent with a preferred habitat for year-end

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[12] During our sample period, the average portfolio maturity of an MMF is 45 days. This means a significant portion of an MMF portfolio matures and converts to cash each day. This allows MMF managers to cover net cash outflows through security maturities instead of securities sales.
[13] Because we use weekly data, the first weekly change in a year (quarter) may be dominated by the cash flows that occurred between the last available observation in the year (quarter) and the end of the year (quarter). The weekly data points are Wednesdays.

and quarter-end liquidity (Ogden 1987, Griffiths and Winters 1997, 2005). Quarter-end effects are smaller in magnitude than the year-end effect, as could be expected. We also find cash outflows following tax time, which is consistent with savings accounts being liquidity storage accounts. Small and large time deposits, which are more focused on returns than liquidity needs, do not suggest any consistent pattern at year-end and quarter-ends. We do see cash outflows from large time deposits around tax time.[15]

[Insert Table 2 about here]

[Insert Table 3 about here]

3.3. Macroeconomic Controls

One may argue that the flow of funds is also affected by macroeconomics factors. Since most macroeconomic data series, including GDP or the index of industrial production, are quarterly or monthly, we are not be able to use them effectively given that we study weekly balance changes. We consider the following *weekly* macroeconomic data series that can reasonably represent macroeconomic developments:

(i) The AAA long-term seasoned corporate bond yield: Indicative of the levels and changes in long-term yields, which are tied to the expected level of inflation;

(ii) The BAA-AAA long-term seasoned corporate spread: Credit spread or premium – tends to vary inversely with expected economic growth as defaults increase during recessions and fall during expansions;

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[14] Hagerman (2007) notes that institution money funds hold 27% of corporate liquidity and are the number one investment choice of corporate Treasurers. Ogden (1987) suggests that calendar year-end effect in money markets is strong, in part, because of the concentration of corporate cash obligations at the year-end.

[15] To get a feel for the magnitude of cash flows, we also ran Equation (1) with changes in billions of dollar as a dependent variable. The year-end effect results in about $24 billion flowing out of MMFs with about $16.5 billion of these flows from institutional MMFs. Additionally, we observe about $6 billion leaving MMFs at tax time. The results are not reported but available upon request.

(iii) The Chicago Fed Adjusted National Financial Conditions Index (ANFCI): Measures risk, liquidity and leverage in money markets and debt and equity markets as well as in the traditional and shadow banking systems. Positive values indicate financial conditions that are tighter than average while negative values indicate financial conditions looser than average;

(iv) The St. Louis Fed Financial Stress Index (FSI) – constructed using principal components analysis; higher values imply more financial stress;[16]

(v) Initial unemployment claims, seasonally adjusted.

We test levels and changes, as well as various combinations of the above variables in the regressions. None of these variables is consistently significant across regressions, and regression fit as measured by AIC often worsens even when the coefficients of the macroeconomic variables are statistically significant. The main results – the direction and magnitude of the spread and calendar effects – remain unchanged in the presence of the macroeconomic controls. Accordingly, we do not include any of these variables in the model for the sake of parsimony.[17]

4. Conclusion

Focusing on the sensitivities of the safest and most liquid investment vehicles – money market funds and bank deposits – to interest rate changes, we find that institutional money fund investors appear to take advantage of arbitrage opportunities

[16] This series is only available starting on December 31, 1993, thus not fully matching our sample period. The details can be found at http://research.stlouisfed.org/publications/net/NETJan2010Appendix.pdf.

[17] While the flow of funds depends to some extent on the perceived riskiness of the investments, both bank deposits and MMFs were perceived to have extremely low levels of risk during our sample period. MMF and deposit balances are not sensitive to changes in the credit spread (BAA – AAA).

created by the MMFs using the amortized cost valuation technique. The negative correlation between balances of institutional MMFs and changes in interest rates suggests that some institutional investors move their money out of MMFs to invest in money market securities directly to take advantage of higher yields when interest rates increase. These investors appear to move their money back to MMFs when interest rates decrease and MMFs provide higher returns than money market securities. Retail MMF investors follow the same pattern as institutional investors but move less funds in response to interest rate changes. Likely reasons why retail investors respond less to changes in interest rates include lack of sophistication, relatively high transaction costs, and lack of opportunities to access the money markets directly, without the help of an intermediary. Balances of time deposits, both large and small, vary directly with interest rate changes.

Calendar times are a force driving the fund flows. In particular, money tends to flow out of institutional and retail funds and savings deposits before the end of the year or quarter and back into these accounts after the end of the calendar period. Tax payments around April 15 also cause funds to flow out of both institutional and retail MMFs. It appears that money leaving funds prior to year- or quarter-ends tend to flow into bank demand deposits. These patterns of cash movements are consistent with preferred habitat for liquidity around year-ends and quarter-ends with some support for tax time effects.

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Table 1. Descriptive statistics of the weekly data series used in the study for the period from June 6, 1983 through October 16, 2006 (1220 observations).

Series	Mean	St. Dev.	Maximum	Minimum
Retail MMF assets	496.3	260.7	986.4	134.8
Dollar change in retail MMF assets	0.5	3.9	19.1	-25.1
Percentage change in retail MMF assets	0.14%	0.73%	3.37%	-2.62%
Institutional MMF assets	456.7	424.9	1315.6	40.1
Percentage change in institutional MMF assets	1.0	9.1	82.4	-39.2
Percentage change in institutional MMF assets	0.28%	1.91%	15.76%	-11.90%
Transaction deposits	639.8	99.2	886.0	329.4
Dollar change in transaction deposits	0.2	33.4	174.0	-134.3
Percentage change in transaction deposits	0.05%	5.19%	37.32%	-17.04%
Savings deposits (including MMDAs)	1588.1	910.5	3747.3	679.9
Dollar change in savings deposits	2.5	33.7	154.8	-125.8
Percentage change in savings deposits	0.14%	1.28%	4.85%	-3.47%
Small time deposits	936.9	107.7	1176.7	720.9
Dollar change in small time deposits	0.3	2.2	6.6	-6.6
Percentage change in small time deposits	0.04%	0.23%	0.77%	-0.63%
Large time deposits (through 3/16/06)	593.2	246.8	1441.3	285.0
Dollar change in large time deposits	1.0	5.0	31.6	-21.4
Percentage change in large time deposits	0.14%	0.66%	2.93%	-2.51%
13-week T-Bill yield, %	5.17	2.32	11.10	0.86

***Note**: Balances and dollar changes are in $ billions. Mean percentage changes are geometric averages of weekly percentage changes in each series.*

Table 2. Regressions of weekly percentage changes in balance for various aggregate data series (institutional and retail MMFs, transaction deposits, savings deposits, small time deposits, and large time deposits) on the spread variable.

Dependent Variables/ Independ. Variables	Inst. MMF	Retail MMF	Transact. Deposits	Savings Deposits	Small Time Dep.	Large Time Dep.
Intercept	0.384***	0.151***	0.279**	0.079***	0.004	0.087***
Lagged DV	-0.237***	0.104***	-0.446***	0.185	0.918***	0.269***
Spread	-1.582***	-0.187***	0.323	-0.186***	0.048***	0.231***

****, **, * denote significance at the 1%, 5%, and 10% level, respectively.*

The table reports the output from estimating the mean equation of the GARCH (1,1) model we employ without calendar-time and tax-time dummy variables:

$$\Delta Balance_t = \alpha_0 + \alpha_1(\Delta Balance_{t-1}) + \alpha_2 Spread_t + \varepsilon_t$$

Table 3. Regressions of weekly percentage changes in balance for various aggregate data series (institutional and retail MMFs, transaction deposits, savings deposits, small time deposits, and large time deposits) on the preferred habitat for liquidity variables and the spread variable.

Variables	Inst. MMF	Retail MMF	Transact. Deposits	Savings Deposits	Small Time Deps.	Large Time Deps.
Intercept	0.488***	0.156***	0.000	0.066***	-0.000	0.120***
Lagged DV	-0.204***	0.191***	-0.494***	0.233***	0.932***	0.279***
By2	-0.642**	-0.365***	3.523***	-0.479***	-0.016	-0.299***
By	-0.453	-0.477***	5.414***	-0.145	0.057***	0.092
Ay	-1.450***	-0.867***	-0.315	0.717***	0.167***	-0.246
Ay2	1.617***	1.475***	-4.402***	0.236**	-0.072***	0.113
Bq2	-0.605***	-0.157**	-1.970***	-0.371***	-0.033***	-0.254***
Bq	-0.350**	-0.243***	2.726***	-0.236***	0.047***	0.023
Aq	-1.181***	-0.444***	1.670**	0.631***	0.117***	-0.291***
Aq2	0.597***	0.607***	0.895	0.271***	-0.087***	0.164**
Btax	-0.175	0.088	1.654**	0.002	0.006	-0.331***
Atax	-0.783***	-0.490***	-0.313	-0.735***	-0.049	-0.338***
Spread	-1.589***	-0.143**	0.479	-0.162***	0.043***	0.226***

****, **, * denote significance at the 1%, 5%, and 10% level, respectively.*

The table reports the output from estimating Equation (1) – the mean equation of the GARCH (1,1) model we employ:

$$\Delta Balance_t = \alpha_0 + \alpha_1(\Delta Balance_{t-1}) + \alpha_2 Spread_t + \alpha_3 BY2 + \alpha_4 BY + \alpha_5 AY + \alpha_6 AY2 + \alpha_7 BQ2 + \alpha_8 BQ + \alpha_9 AQ + \alpha_{10} AQ2 + \alpha_{11} BTax + \alpha_{12} ATax + \varepsilon_t$$