2006

Quarter-End Effects in Banks: Preferred Habitat or Window Dressing?

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Abstract

Allen and Saunders (1992) document abnormal behavior of bank assets and liabilities at the turn-of-the-quarter and attribute it to window dressing by banks. Using different methods we re-visit bank turn-of-the-quarter balance sheet activity. We also examine quarter-end changes in the effective fed funds rates and fed funds rate standard deviations. We confirm the presence of turn-of-the-quarter activity on bank balance sheets and in the fed funds market. However, we conclude that the turn-of-the-quarter effects are more consistent with customer preferred habitats than window dressing.

Key words: Window dressing, Preferred habitat

Acknowledgments

The authors thank an anonymous referee for helpful comments.

1. Introduction

Musto (1997) examines weekly averages of daily one-month commercial paper rates at the year-end and finds that the average rate over the last week of the year is higher than the average rate over the first week of the year. Musto attributes the year-end rate pattern to flight-from-risk window dressing by money fund managers. Griffiths and Winters (2004) re-visit the year-end rate pattern in commercial paper using different methods and show that the timing of the rate changes at the year-end is not consistent with window dressing. They suggest that the timing of the rate changes is consistent with a year-end preferred habitat for liquidity. They find the rate pattern is common across one-month money market instruments.

A year-end preferred habitat for liquidity suggests that lenders withdraw from the money markets at the end of the year when the maturity of the instrument begins to span the lenders' year-end cash obligation dates (driving up interest rates) and instead hold cash (typically in the form of demand deposits) to meet their year-end obligations. After the year-end obligations are covered, lenders return to the money markets (driving down interest rates). Because year-end obligations are not all due on the last day of the year the decline in rates from lenders returning to the market need not align with the last day of the year. In fact, Griffiths and Winters (2004) show that the decline in rates typically starts a few days before the end of the year.

Allen and Saunders (1992) examine bank balance sheets and find that bank assets are higher at quarter-ends than the average across the last month of quarter. They also find that banks increase their purchased funds at quarter-end, which they suggest supports active quarter-end balance sheet management by banks, i.e. window dressing. We re-

visit the issue of bank balance sheet window dressing using different methods and find little support for window dressing. Specifically, we examine the timing of changes in bank balance sheet accounts around quarter-ends and find that the timing of the changes relative to the end of the quarter is not consistent with window dressing. Instead, our results suggest that bank quarter-end activity is most consistent with banks responding to customer quarter-end holdings of cash in the form of demand deposits. Griffiths and Winters (2004) find increased levels of demand deposits in association with the year-end preferred habitat in the money market.

2. A Review of Allen and Saunders' (1992) Methods and Results

Allen and Saunders (1992) examine bank balance sheet data for evidence of window dressing. They state that window dressing can be active (endogenous, bank initiated) or passive (exogenous, customer initiated) and that they are looking at active window dressing. They also divide bank initiated window dressing into upward window dressing and downward window dressing with upward and downward relating to the direction of the change in bank total assets.

Allen and Saunders state that window dressing is a temporary deviation from a permanent or trend level. To test for window dressing in bank assets they use the following formula:

$$WD_t = \frac{\left(A_{end,t} - A_{avg,t}\right)}{A_{avg,t}} * 100 \qquad (1)$$

where

$A_{end,t}$ = total assets on the last day of the quarter *t* and
$A_{avg,t}$ = average total assets over the last month of the quarter *t*.

Using equation (1), Allen and Saunders find that bank total assets increase significantly at quarter-ends. For this increase to support window dressing it must be temporary, and Allen and Saunders find evidence that the increase in total assets at quarter-ends is reversed in the following month.[1] Allen and Saunders state that the increase in total assets is consistent with upward window dressing.

Next, Allen and Saunders examine the liability side of the balance sheet to determine if the increase in total assets is bank initiated or is a response to customer activities. They suggest that an increase in purchased funds would support bank initiated window dressing while an increase in retail accounts would support customer initiated activity. They find that fed funds and repo purchases increase significantly at quarter-ends. In addition, among the liabilities that increase at the quarter-end, the increase in fed funds and repo purchases is the increase that is most highly correlated with the increase in bank assets. The increase in a liability account that is least correlated with the increase in total assets is the increase in retail deposit accounts. Because fed funds and repo purchases are bank initiated transactions while the retail accounts are customer initiated, the evidence supports active window dressing by banks.

To determine if the activity in the fed funds market is significant, Allen and Saunders examine fed funds rates around quarter-ends and find the fed funds rates increase by 22 basis points in the last day of the quarter and fall by 18 basis points on the first day of the quarter. This suggests the presence of significant temporary buying pressure in the fed funds market on the last day of the quarter.

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[1] The formula used to test for a reversal is: $REV_t = \frac{\left(A_{avg,t+1} - A_{end,t}\right)}{A_{avg,t+1}} * 100$

In summary, using *deviations from averages*, Allen and Saunders find that bank total assets increase significantly at quarter-ends and the increase is temporary. Further they find that the increase in total assets appears to be funded with purchased liabilities. Accordingly, Allen and Saunders conclude that banks are actively window dressing their balance sheets.

3. Reasons to Re-visit Bank Window Dressing

The recent research on the year-end effect in the commercial paper market provides two reasons to re-visit the results from Allen and Saunders. First, Griffiths and Winters (2004) show that using averages hides the timing of changes around quarter-ends and that the specific timing of changes is important in determining if window dressing exists. Second, Griffiths and Winters find that the year-end rate increase in one-month commercial paper is common across one-month private-issue money market securities and that the pattern is consistent with a year-end preferred habitat for liquidity. In other words, money market investors withdraw from the money markets prior to the year-end and hold cash (or demand deposits) to meet their year-end cash obligations. In addition, Griffiths and Winters find that demand deposits increase significantly in December (by about $17 billion) and decline significantly in January. The increase in demand deposits is a customer initiated increase in bank liabilities which could lead to a temporary increase in bank assets. Given the recent evidence that money market investors appear to prefer holding cash in the form of demand deposits at the year-end, we feel that it is appropriate to re-visit bank balance sheet changes around quarter-ends using methods focused on identifying the timing of changes.

4. Data

Allen and Saunders (1992) conclude that banks are actively window dressing because the banks increase purchases of fed funds and repos, and the purchases are highly correlated with the increase in bank total assets. As support, they report an increase in the fed funds rate on the last day of the quarter.

Since Allen and Saunders lean heavy on the activity in the fed funds market to support their conclusion of active window dressing by banks, we begin our analysis with an examination of quarter-ends in the fed funds market to determine whether quarter-ends are unusual. To begin this analysis, we collect daily standard deviations of the fed funds rate from January 3, 1994 through December 31, 2002 from the Federal Reserve Bank of New York. This sample period covers all the daily standard deviation data that is available from the Fed. For consistency we constrain the sample period for all of our data to this sample period. This period includes 36 quarter-ends. In addition to the daily standard deviation in the fed funds rate, we also collect the effective (volume-weighted) fed funds rate series. The daily fed funds rate data are collected by the Federal Reserve Bank of New York and are available from the web site of the Federal Reserve Bank of St. Louis.

To examine bank balance sheet activity, we collect weekly data series (not seasonally adjusted) for various aggregate asset and liability categories of commercial banks in the U.S. (reported every Wednesday). The balance sheet data come from the Board of Governors' H8 report and are available from the Federal Reserve Board of Governors' website.

The Federal Reserve Board generates the H8 report in weekly and monthly formats. We use the weekly data. The weekly data are generated in the following manner. The largest banks in the country report weekly to the Federal Reserve and during our sample period this number varied between 33 and 35 banks. The remaining banks are divided into eight size-based groups and a sample of banks in each group is selected weekly. The selected banks are surveyed for the data items in the H8 report. The sample results are used along with quarterly call report ratios to estimate the total values for each H8 report item for each group. The group totals are accumulated to generate the results for all banks, which is the data we use.

The Federal Reserve does a number of checks and adjustments on the estimates to insure their validity. First, the estimates are compared to actual call report data and the estimates are consistently close to the actual data. Second, mergers between banks and thrifts cause breaks in the time series. The Fed backward adjusts the data for the effects of mergers to smooth out any breaks. Third, the Fed reviews the report format every three years to ensure the usefulness of the items reported.

The point of this discussion on the H8 report is to acknowledge that we are working with estimates generated from samples of banks, instead of actual data collected from all banks. In addition, we wanted to point out that the Federal Reserve makes every effort to ensure that the sample results accurately represent the actual balance sheet positions of the banking industry in the U.S.

5. Analysis

5.1. Daily Rate Standard Deviations and the Direction of Quarter-End Rate Pressures

We begin our analysis by examining the daily standard deviations of the fed funds rate. Hamilton (1996) and Cyree and Winters (2001) find that volatility in fed funds rates increases at the quarter-end in GARCH models, so we want to determine if the high quarter-end volatility is present in our data and if so provide a feel for the regularity of high quarter-end volatility. We begin by ranking trading days within each year by the standard deviation of the fed funds rate (highest rank represents highest standard deviation). The last trading day in a quarter tends to rank very high within a year with all but one quarter-end falling into the top volatility quartiles of their respective years, and 28 of 36 falling into the top volatility deciles.

To provide additional insight into just how volatile fed funds rates are at quarter-ends, we plot the standard deviation in Figure 1. We adjusted the daily data by deleting some low volatility observations in the middle of a quarter in order to align quarter-ends over the entire sample period. After the adjustment, the last trading days of each quarter always fall on days 61, 125, 188, and 250 in the year, respectively. Once we have aligned the quarter-ends, we average the daily standard deviations for each trading day over the nine years.[2] Thus, Figure 1 plots the average daily volatility in the fed funds rate relative to quarter-ends across our sample period. Although some events other than quarter-ends such as biweekly settlements with the Fed (see Griffiths and Winters (1995)) clearly influence the behavior of the series, regular volatility spikes around the last day of the quarter are quite apparent.

[2] Utilizing standard deviations normalized within each year yields similar results.

We have verified that fed funds rates are highly volatile at the quarter-end, which tells us that something is happening at that time. However, this does not provide any insight into whether the volatility comes from bank initiated window dressing or bank customer initiated behavior. To begin to address that issue, we examine the direction of the change in the effective fed funds rate on the last trading day of the quarter. If banks are purchasing fed funds at quarter-ends to window dress, then the fed funds rate should increase at the quarter-ends. In addition, if the rate increase is from window dressing, then this increase should be temporary (we discuss the daily behavior of fed funds rates and supply and demand of reserves in the next section to provide context for our conclusions in this section).

We begin by examining changes in the effective fed funds rate on the last trading day of the quarter relative to the previous trading day. There are 27 quarter-ends in our sample period that are not year-ends, and on these 27 days the effective rate increases 23 times and decreases four times. There are nine year-ends in our sample and the effective fed funds rate decreased on eight of the nine year-ends. This suggests that about 85% of the time rates go up on the last trading day of the first three calendar quarters and about 89% of the time rates go down on the last trading day of the year. Clearly, something is going on at the end of the quarter. However, it appears that it could be something different from the first three quarter-ends of the calendar year to the year-end.

To further examine the timing of fed funds rate changes, we estimate the following equation as an AR model estimated using the unconditional least squares (ULS) method. The equation for rate change model is:

$$\begin{aligned}\Delta FF_t = {} & \alpha_0 + \beta_1 bqtr + \beta_2 qtr + \beta_3 aqtr + \beta_4 aqtr2 \\ & + \gamma_1 byend + \gamma_2 yend + \gamma_3 ayend + \gamma_4 ayend2 + \varepsilon_t\end{aligned} \qquad (2)$$

where

ΔFF_t =	first difference in the daily effective fed funds rate ($FF_t - FF_{t-1}$),
bqtr =	0/1 dummy variable that equals 1 on the day before the last trading day of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise,
qtr =	0/1 dummy variable that equals 1 on the last trading day of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise,
aqtr =	0/1 dummy variable that equals 1 on the first trading day following the end of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise,
aqtr2 =	0/1 dummy variable that equals 1 on the second trading day following the end of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise,
byend =	0/1 dummy variable that equals 1 on the day before the last trading day of the year and 0 otherwise,
yend =	0/1 dummy variable that equals 1 on the last trading day of the year and 0 otherwise,
ayend =	0/1 dummy variable that equals 1 on the first trading day the new year and 0 otherwise, and
ayend2 =	0/1 dummy variable that equals 1 on the second trading day of the new year and 0 otherwise.

The results from estimating the AR model (equations (2)) are reported in Table 1. When equation (2) is estimated using OLS, the Durbin-Watson statistic is 2.523 which suggests the presence of negative autocorrelation in the error term at better than the 1% level of significance. To address the negative autocorrelation, we switch from OLS to the AR model using the unconditional least squares (ULS) method. AR(1) and AR(2) models do not eliminate the significant negative autocorrelation, but an AR(3) model does, so the results reported in Table 1 are from an AR(3) model.[3]

The results from the equation (2) suggest that at quarter-ends the effective fed funds rate: increases significantly on the last day of the quarter (34 bp) and declines significantly across the first two days of the quarter (8 bp and 29 bp). This pattern is consistent with an increase in purchasing of fed funds on the last day of a quarter

[3] Another method for estimating equation (2) is a GARCH model with autoregressive errors. We estimated the GARCH model as a robustness check and the results from the GARCH model are consistent with the results reported in Table 1. These results are not report for brevity but are available upon request.

followed by two days of declining rates to return to normal level. The purchase of fed funds on the last day of the quarter can be consistent with window dressing, but taking two days to return to normal is not consistent with window dressing. That is, window dressing is the dressing up of the balance sheet for quarter-end and year-end reporting purposes, so once the quarter-end reporting date is past, there is no further need to continue dressing up the balance sheet and the fed funds rate should return to normal. Taking two days to return to normal in an overnight loan market suggests that the rate pressure continued one day longer than is necessary for window dressing.[4]

On the last day of the year the daily rate change is negative and significant. The decline in the effective fed funds rate on this day averages about 45 basis points. The first day of the new-year is positive and significant with the increase averaging about 76 basis points. There is clearly something is going on that the year-end. However, the pattern is opposite of the pattern at the quarter-ends, and the decline in rates on the last day of the year cannot support fed funds purchases by banks to window dress.[5] Griffiths and Winters (1997 and 2004) show that one-month interest rates decline on the last trading day of the year in repos, commercial paper, CDs, bankers' acceptances, euro-dollar deposits, and U.S. dollar-based LIBOR. Further, they show that the decline begins before the last trading day of the year and spans the year-end, which leads them to conclude that the year-end rate decline across these one-month money market securities

[4] Some may be concerned that taking two days for rates to decline is related to the settlement process in the securities markets. However, banks acquiring securities to window dress would most likely acquire money market securities because these are the typical securities in banks' investment portfolios. All money market securities trade in immediately available funds and thus have same day settlement. Accordingly, taking two days for fed funds rates to decline is not related to the settlement process in money market securities.

[5] Recall that fed funds rates decline on the last day of the year eight out of nine times during our sample period, which suggests that our results are not driven by outliers. However, we did check for outliers and none of our year-end observations were an outlier.

is caused by a preferred habitat for liquidity by money market investors. Thus, the year-end rate decrease in the effective Fed funds rate may not be from bank driven activity, but instead may results from general liquidity pressures at the year-end. Additionally, this year-end decline in the fed funds rate could be the result of large reserve supply increases by the Federal Reserve at the year-end (Demiralp, Preslopsky, and Whitesell (2004) note that the Fed has provided a generous supply of reserves at year-end in recent years). We address the source of the quarter-end and year-end pressures in section 5.3 by examining bank aggregate balance sheet activity around quarter-ends and year-ends. However, before moving on to bank balance sheet activity we discuss daily fed funds rate changes and the supply and demand of reserves.

5.2. Daily Fed Funds Rate Changes and the Supply and Demand of Reserves

In the previous section we discussed changes in fed funds rates based on bank trading behavior in the fed funds market. In this section we provide context for our discussion.

The ability of Federal Reserve to change reserve balances and therefore change the fed funds rates is known as the liquidity effect and is often taken for granted. However, the liquidity effect has been difficult to verify empirically and the lack of empirical support has become known as the "liquidity puzzle". Historically, the empirical work on the liquidity effect has used low frequency data. Recent work on the liquidity effect has moved to using daily data.

Hamilton (1997) examines the effect of reserve supply shocks on daily fed funds rates. Hamilton finds a significant liquidity effect only on settlement Wednesdays. Thornton (2001) raises questions about the robustness of Hamilton's results and in

alternative tests finds no evidence of a liquidity effect. Carpenter and Demiralp (2004) extend the line of research using a new measure for reserve supply shocks and find strong evidence of a daily liquidity effect. Clearly, the liquidity puzzle is an ongoing debate, but recent evidence provides some support for a liquidity effect in daily fed funds rate changes.

With some support of a liquidity effect in daily fed funds rates, it appears that the Federal Reserve can manage interest rates if they so chose. Then the next question becomes whether the Federal Reserve is attempting to manage interest rates. Thornton (2004) provides a detailed discussion of the Federal Reserve's operating procedures since 1982. Thornton states that there is agreement among researchers that by the early 1990s the Fed had switched its operating procedures from borrowed reserves to targeting the funds rate directly. This suggests that our primary sample period (January 3, 1994 through December 31, 2002) falls under a period when the Fed is targeting the funds rate and is therefore attempting to manage the fed funds rate. Using the verbatim transcripts of FOMC meetings, Thornton suggests that the Fed has been targeting the funds rate since it abandoned managing monetary aggregates in October of 1982. This suggests that the Allen and Saunders sample period (1978 – 1986), which we use later in this paper, crosses different Fed operating procedures.

Now, the remaining issue is the daily behavior of the fed funds rate in the presence of liquidity effects and under operating procedures where the Fed targets the funds rate. Griffiths and Winters (1995) use the regulations for bank settlement with the Federal Reserve to model daily rate pressures in the fed funds markets. Their model suggests that rates should decline on Fridays, rebound on Mondays, decline on the day

before settlement, and increase on settlement Wednesdays. Clouse and Dow (2002) model the demand for reserves and the daily demand for reserves follows the same basic pattern as the rate pressures in Griffiths and Winters. Empirical research suggests that the daily fed funds rate changes follow the predicted pattern (see, for example, Griffiths and Winters (1995), Hamilton (1996), Cyree and Winters (2001), and Bartolini, Bertola, and Prati (2002)).

The point of this discussion is that banks' predictable demand for reserves creates a persistent pattern in daily fed funds rates in an environment where the liquidity effect likely exists and the Fed is targeting interest rates. So, how is this possible? Bartolini, Bertola, and Prati (2002) state that

> *"the Fed may accommodate liquidity shocks incompletely either because institutional features of the market limit its ability to intervene on any given day, or because it prefers to allow interest rate changes to absorb part of the realized liquidity shocks."*

Further, Bartolini, Bertola, and Prati (2001) state that

> *"(T)his realistically captures the Fed's reluctance to provide liquidity elastically at a fixed target rate, and its preference for enforcing a small corridor of rates, the width of which reflects its tolerance for day-to-day expected interest rate fluctuations."*

Bartolini, Bertola, and Prati (2001) find evidence that the Fed is willing to tolerate a spread in rates within a maintenance period of 15 basis points. They note that their spread is within the 20 basis point deviation of the fed funds rate from the target rate found by Feinman (1993) for almost certain Fed intervention to manage the fed funds rate. Further, Feinman finds that at a 10 basis point deviation between the fed funds rate and the target rate there is a greater than 30% chance that the Fed will abstain from short-term open market operations. Griffiths and Winters (1995) find that the average daily

spread between the high and low fed funds rate is: between 11 and 15 basis points over the first eight trading days of the maintenance period, is 25 basis on the day before settlement, and is 59 basis points on settlement Wednesdays. Further, Feinman (1993) notes that the Fed is unlikely to make a strong move against deviations in the fed funds rate from the target rate on Fridays and settlement Wednesdays. Empirical research suggests that Fridays and settlement Wednesdays have significant daily rate changes, but these changes are temporary.

This discussion suggests that the Fed has the ability to manage interest rates, but that it does not trade against all deviations from the target rate and, in particular, often does not trade against temporary deviations. Accordingly, we feel it is reasonable to discuss daily changes in fed funds rates around quarter-ends and year-ends in terms of bank demands affecting the fed funds rates. In particular, we think this is reasonable because we test for temporary changes related to window dressing. We do acknowledge that a possible alternative explanation for the daily rate changes is Federal Reserve changes in reserve supplies and make this point where appropriate throughout the paper.

5.3. Aggregate Bank Balance Sheet Activity

Allen and Saunders (1992) find that: (1) bank total assets increase at quarter-ends, (2) fed funds purchases increase at quarter-ends, and (3) fed funds purchases are highly correlated with the increase in total assets. From this they conclude that banks are upward window dressing. Next, we analyze weekly changes in various aggregate bank assets and liabilities to determine if quarter-end effects are present using our methods and if they are present whether these effects are consistent with bank window dressing. Since

we find different effects between the first three quarter-ends and the year-end in fed funds, we analyze year-ends separately from the other three calendar quarter-ends.

The data are collected on a weekly basis and reported as of Wednesday. [6] It is seldom the case that the last business day of the quarter falls on Wednesday, but our model allows us to capture activity around quarter-ends. We run the following AR(1) model estimated using the unconditional least squares (ULS) method. The equation for changes in balance sheet items is:[7]

$$Ch_{i,t} = \alpha + \beta_1 Bq + \beta_2 Aq + \beta_3 By + \beta_4 Ay + \varepsilon_t \qquad (3)$$

where:

$Ch_{i,t}$ =	Percentage change in asset/liability *i* in week *t*,
Bq =	1 on the last Wednesday of each of the first three quarters and 0 otherwise,
Aq =	1 on the first Wednesday following the end of each of the first three quarters and 0 otherwise,
By =	1 on the last Wednesday of each year and 0 otherwise,
Ay =	1 on the first Wednesday of each year and 0 otherwise,
ε_t	is the error term, which is assumed to be normally distributed.

Estimates of equation (3) allow us to determine which bank assets and liabilities exhibit significant changes around quarter-ends and year-ends. We separate quarter-ends and year-ends to see if the activity around the 1st, 2nd, and 3rd quarter-ends is different from year-ends in terms of magnitude and/or direction of changes. The results are reported in Table 2.

[6] The data period consists of 469 weeks. The three weeks following the September 11, 2001 terrorist attacks had the largest changes in transaction deposits levels (a 50% increase in the first week followed by the return to the pre-September 11 level in the following two weeks) but were retained for the analysis. Exclusion of these three weeks does not affect the results for any of the series.

[7] The balance sheet items exhibit significant negative autocorrelation when examined with OLS. For each balance sheet item the significant negative autocorrelation is removed with an AR(1) model, so all the results in Table 2 are from an AR(1) model estimated using the unconditional least squares (ULS) method. For robustness, we also estimate equation (3) as an AR(1) model using a GARCH method. The results are generally consistent between the two methods. When differences occur, the differences come from the GARCH method not fitting the data well.

Allen and Saunders (1992) use Call report data. We use H8 report data. The data items available from the two data sets are different with the Call reports providing more detail. Accordingly, we analyze some different balance sheet items from Allen and Saunders.

Panel A of Table 2 reports results on changes in total assets and total liabilities. The parameter estimates for the quarter-ends are not significant for both total assets and total liabilities, while the parameter estimates for the beginning of each quarter shows significant (at better than the 1% level) increases for both total assets and total liabilities. Given that our data points are on Wednesdays and therefore not exactly on the last trading day of the quarter, we cannot rule out that these increases are occurring before the quarter-end (which could be supportive of window dressing). However, window dressing is by definition a temporary position, so finding increases through the first Wednesday of a quarter does not support window dressing (especially if these increases are funded with fed funds, since the typical maturity of fed funds transactions is one day). In further analysis (that is not reported here in table form, but is available upon request) we find that 50% of the increase in total assets and total liabilities is still present in the second week of the quarter. While total assets and total liabilities are moving back toward normal levels during the second week of the quarter, a two-week deviation is longer than one would expect for window dressing given the high level of liquidity in bank short-term assets and short-term liabilities where window dressing is likely to occur.

At the turn-of-the-year, the end-of-the-year parameter estimates show significant increases in total assets and total liabilities while the beginning-of-the-year parameter estimates are not different from zero. These results suggest that total assets and total

liabilities increase in advance of the year-end and remain high through the first Wednesday of the new-year. Additional analysis suggests that both total assets and total liabilities return to normal levels across the second week of the new-year.

The results for quarter-end and year-end changes in total assets and total liabilities do not provide strong support for bank window dressing. The pattern for changes in total assets and total liabilities does not match the pattern for window dressing either around quarter-ends or around year-ends, as the increase in total assets and/or total liabilities remains longer than expected for a "temporary" change.

While the evidence from total assets and total liabilities does not provide support for window dressing, we continue the search for window dressing by examining the short-term asset accounts. If a bank is upward window dressing, as suggested by Allen and Saunders, then the bank would window dress in the most liquid assets because the window dressing could quickly be reversed after the reporting date passes. Accordingly, we examine quarter-end and year-end changes in the most liquid bank assets: cash and government securities. The results for estimating equation (3) on changes in cash and government securities are reported in Panel B of Table 2.

If banks are upward window dressing, as suggested by Allen and Saunders (1992), then cash and/or government securities should increase before quarter-ends and decline following quarter-ends with the increase and decrease being of similar magnitude. We find no significant change in either cash or government securities before quarter-ends while both increased significantly (at better than the 5% level) at the beginning of quarters. Again, with the timing of our data we cannot rule out window dressing from an increase immediately before the quarter-end. However, the fact that this increase is

sustained throughout the first Wednesday of the quarter is inconsistent with window dressing. Moreover, further analysis suggests that cash and government securities return to normal levels over the second week of the quarter, which, given the liquidity of these assets, is not consistent with a temporary effect from window dressing. This is especially true if a bank is window dressing using purchased funds because purchased funds carry explicit costs while cash is a non-earning asset. At the turn of the year, we find that cash increases significantly at the end-of-the-year while government securities do not change. We also find no change in cash or government securities at the beginning of the year. These results suggest that cash increases at the end-of-the-year and remains high through the first Wednesday of the new-year. This timing does not match with the temporary nature of window dressing.

Panel C of Table 2 reports changes in transaction and non-transaction deposits. If bank customers have quarter-end and year-end preferred habitats for liquidity based on cash obligations, then we expect that they move funds into transaction accounts before the quarter-end so they can pay their obligations and out of transaction accounts after the quarter-ends. In addition, these customers will reduce non-transaction deposits before quarter-ends as they move their funds into transaction accounts, and increase non-transaction deposits after the quarter-ends as they return to storing their funds in interest-earning accounts. We find a significant increase in transaction deposits and a significant decrease in non-transaction deposits at the end of the quarter, which is consistent with bank customers preparing for quarter-end cash obligations. At the beginning of the quarter non-transaction deposits increase significantly suggesting a return to storing liquidity in earning accounts after meeting quarter-end obligations. At the turn-of-the-

year we find a significant increase in transaction deposits and a significant decrease in non-transaction deposits (at better than the 5% level) at the end of the year followed by a reversal of the pattern at the beginning of the year. The combination of results at the year-end is consistent with customers managing their deposit accounts to make payments for year-end cash obligations. Also, the turn-of-the-year increase in bank cash holdings discussed earlier parallels the changes in deposits: when customers move funds into transaction accounts, banks are likely to hold more cash to serve customers' needs and to meet the increased reserve requirements related to this customer behavior (transaction deposits have a higher reserve requirement than non-transaction deposits). These patterns are not suggestive of bank window dressing.

Panel D of Table 2 reports changes in bank borrowing. If customers are moving cash, then banks must adjust their balance sheets to accommodate this movement. Given the temporary nature of these calendar-based changes, banks are likely to adjust their cash and short-term investments, their borrowings, or both. We find that bank total borrowing did not change significantly at quarter-ends. However, total borrowing and borrowing from other than U.S. banks declined significantly (at better than the 1% level) at the beginning of the quarter. Around the year-end, the end-of-the-year parameter estimates are not different from zero while total borrowing and borrowing from others declined at the beginning of the year. Additional analysis shows that a large and significant increase in total borrowing and borrowing from others occurs two weeks before the end of the quarter or year. Now the beginning-of-quarter (year) decrease appears to be just a reversal of that earlier increase. Overall, this analysis suggests that banks prepare for quarter-ends and year-ends in advance by borrowing more funds to

accommodate the needs of their customers. By the second Wednesday of the new quarter or year bank assets and liabilities return to normal levels. Again, this is consistent with banks managing their balance sheets in response to customer activities, not window dressing.

In summary, our analysis of bank balance sheet activity strongly suggests that quarter-end and year-end effects in bank assets are not driven by window dressing. The results are generally consistent with our expectations of how bank balance sheets would adjust in response to bank customers' movement of cash for quarter-end and year-end cash obligations.

5.4. Allen and Saunders Sample Period

To this point in the paper we have re-examined the issue of bank window dressing using different methods than Allen and Saunders and found no evidence of bank window dressing. Instead, the weight of the evidence suggests that bank quarter-end and year-end balance sheet activity is in response to customer quarter-end and year-end liquidity management. However, our choice to start the analysis with the fed funds standard deviation data from the Federal Reserve caused our analysis to cover a different time period than the analysis by Allen and Saunders. Accordingly, at this point we are unable to determine whether our methods provide a clearer picture of bank quarter-end and year-end activity or that banks have changed their quarter-end and year-end behavior. To address this issue, we collect data from the Allen and Saunders sample period and re-estimate our AR models (equations (2) and (3)). The results from the AR model (equation (2)) estimated on effective fed funds rates are reported in Table 3 and the

results from the AR model (equation (3)) estimated on the H8 report balance sheet data are in Table 4.

Before discussing the parameter estimates reported in Table 3 we note that the AR model reported in Table 3 is an AR(1) model. That is, one lag in the error is sufficient to address the negative autocorrelation in the data. The sample of fed funds rates used earlier required an AR(3) model to handle the negative autocorrelation. This is our first piece of evidence that fed funds rates behave differently across the two sample periods.

The results on the daily changes in the effective fed funds rate during the Allen and Saunders sample period around quarter-ends suggest that rates increase significantly across the last two days of the quarter and decrease significantly across the first two days of the quarter.[8] This pattern is consistent with banks purchasing fed funds at the end of the quarter. However, two days of rate increases followed by two days of rate declines is not consistent with using fed funds to window dress because the typical maturity of a fed funds transaction is one day. In addition, rates increase about 82 basis points at the end of the quarter while declining only about 36 basis points at the beginning of the quarter, which suggests that the quarter-end rate pressure has not fully abated after two days.

At the year-end we find that rates increase significantly on the last two days of the year followed by rates declining significantly across the first two days of the new-year. This pattern is consistent with the pattern around the quarter-ends and is consistent with purchasing funds at the year-end. However, again, the timing of the pattern is not consistent with window dressing because the rate increase begins too early and it persists for too long. Additionally, we note that the year-end pattern during the Allen and

[8] The effective fed funds rate on the last two days of 1985 and 1986 are extreme outliers, so in our estimation of equation (2) during the Allen and Saunders (1992) sample period the quarter-end and year-end dummy variables for these days are set to 0.

Saunders sample period is in the opposite direction to the pattern reported in Table 1. This difference could be the result of changes in bank behavior. However, this difference is likely the results of Fed year-end behavior during our primary sample period as Demiralp, Preslopsky and Whitesell (2004) note that the Fed has provided a generous supply of reserve at year-end in recent years.

The results from the changes in bank total assets and total liabilities during the Allen and Saunders sample period are reported in Panel A of Table 4. The change in total assets and the change in total liabilities are not significant at quarter-ends but do increase significantly at the beginning of the quarter. In addition, we find that both total assets and total liabilities increase significantly before the year-end, but do not change significantly after the year-end. These results are consistent with our previous results (Panel A, Table 2). These results are not suggestive of bank window dressing.

Panel B of Table 4 reports the changes in cash and government securities from the Allen and Saunders sample period. We find no change in cash at the end of the quarter followed by a significant increase at the beginning of the quarter. As to the turn of the year, we find that cash increased significantly at the year-end, while it did not change at the beginning of the year. The pattern in cash is similar to the pattern reported for cash in Table 2. It is not consistent with window dressing. In addition, we find that government securities decline significantly at the end of the quarter and increase significantly at the beginning of the quarter. This pattern does not support window dressing, either.

Panel C of Table 4 reports activity in transaction and non-transaction deposits during the Allen and Saunders sample period. Transaction deposits (demand deposits) are unchanged at the end of the quarter while increasing significantly at the beginning of

the quarter, the end-of-the-year, and the beginning of the year. These results suggest that bank customers move cash into transaction accounts around the quarter-end and the year-end. This pattern cannot be bank window dressing because it is customer initiated activity. We note that the pattern in transaction deposits reported in Table 4 is different from the patterns reported in Table 2 suggesting differences between the two sample periods. Non-transaction deposits increase significantly (at better than 10% level) at the beginning of the quarter and decrease significantly (at better than the 1% level) at the beginning of the year. This pattern is different from the pattern reported to Table 2 which again suggests changes in customer behavior between the two sample periods.

Panel D of Table 4 reports results on bank borrowing during the Allen and Saunders sample period. We find no evidence of significant changes (at the 10% level or better) in any borrowing category around either the quarter-end or the year-end. However, when we extend the analysis to cover the time span from the second to last Wednesday of a quarter/year through the second Wednesday of the new quarter/year, it becomes clear that bank borrowing increases two weeks before the end of the year (it is still insignificant around quarter-ends). The increase is sustained through the first week of the new-year, and is reversed in the second week. Moreover, the increase in bank borrowing is driven by borrowing from U.S. banks. This is different from our primary sample results and is suggestive of U.S. banks being able to develop relations with other U.S. and foreign institutions and/or to access other funding sources in recent years. Again, the length of time covered by the changes is longer than is necessary for the temporary nature of window dressing.

In summary, we draw two conclusions from re-visiting data from the Allen and Saunders sample period. First, the rate pressures in the fed funds market and the bank balance sheet changes vary between the two sample periods suggesting the bank quarter-end and year-end behavior has changed from the Allen and Saunders sample period to our more recent sample period. Second, using different methods that focus on the timing of changes we find little evidence to support bank upward window dressing during the Allen and Saunders sample period. The differences between the two sample periods are mostly in the timing of turn-of-the-quarter and turn-of-the-year changes in bank assets and liabilities. Our main conclusion remains unchanged in that the weight of the evidence from our results during the Allen and Saunders sample period suggests that banks respond to turn-of-the-quarter and turn-of-the-year customer cash management activity.

5.5. Differences in Bank Balance Sheets Between the Two Sample Periods

From the analysis in sections 5.3 and 5.4, it appears that behavior of banks and bank customers at quarter-ends and the year-end changed from the Allen and Saunders sample period to the sample period covered in our primary analysis. In this section we briefly examine some differences between the two sample periods that provide insights into the differences in behavior between the two sample periods.

We begin by examining the line items on aggregate bank balance sheets used in our above analysis across the sample periods. We present these items as a percent of total assets in Table 5.[9] We provide balance sheet data from the beginning and end of

[9] We also examine some balance sheet items as a percent of total liabilities. The interpretation of the results does not change when using the percent of total assets versus the percent of total liabilities. Accordingly, we chose to report all numbers in Table 5 as a percent of total assets for consistency.

each sample period.[10] However, because each sample period begins in January and ends in December, we chose not to use the first and last available observation to avoid the year-end effects discussed previously. Instead, we use the last observation for October from the first and last year of each sample period. While this choice is arbitrary, it provides a snapshot of the changes through time that provides insights into the differences across the sample periods. [11]

Our primary analysis suggests that bank balance sheet changes at quarter-ends and year-ends occur because of customer-related activities, so we begin our discussion of the balance sheet items reported in Table 5 with transaction deposits. Transaction deposits declined, as a percent of total assets, by 8.40% (29.96% - 21.56%) during the Allen and Saunders sample period and further declined by another 10.83% (20.41% - 9.58%) during our primary sample period. This suggests that bank customers have dramatically reduced their funding of the banks' asset base with transaction deposits. However, how banks must respond to this change depends on where the deposits went. A look at non-transaction deposits suggests that, during the Allen and Saunders sample period, a very small portion of the transaction deposits appears to have moved into time deposits (which increased by 0.64%, from 50.44% to 51.08%), but the majority of the decline in transaction deposits as a percent of assets appears to be from deposits leaving the bank. Deposits apparently continued to leave banks between the end of the Allen and Saunders period and the beginning of our primary sample period. However, during this period the bulk of the decline came from non-transaction deposits, which fell by 5.90%,

[10] We chose to limit the data in Table 5 for brevity. We also examine balance sheet data annually across each sample and the results are similar to those reported in Table 5 (changes are more gradual, of course, but there are no trend reversals during either sample period).
[11] Using data from the first and last week of each sample does not change our conclusions. Using data from a different week within a year does not change our interpretations.

from 51.08% to 45.18%, while transaction deposits declined by only 1.15% from 21.56% to 20.41%. During our primary sample period, however, the 10.83% decline in transaction deposits mentioned above was offset by a 10.39% increase (from 45.18% to 55.57%) in non-transaction deposits suggesting that banks stopped further erosion of their deposit base.

Less transaction deposits means that banks can hold less cash to cover potential demand withdrawals, but also that banks will need to find other funding sources for their asset base. We observe that bank cash holdings, as a percent of total assets, fell by 2.97% (11.06% - 8.09%) across the Allen and Saunders sample period, while government securities remained relatively unchanged. This is consistent with the reduced need to hold cash. However, between 10/78 and 10/86 bank aggregate total assets increased by $1,334 billion, or 110%. This means that banks, even after the reduction in cash, will need additional funding to support their asset base, and we see that total borrowing increased by 4.12% (15.03% – 10.91%). Between the two sample periods cash holdings, as a percent of total assets, fell by 2.86% (8.09% - 5.23%). This decline in cash coincides with a 7.22% (19.13% - 11.91%) increase in government securities as a percent of total assets, which suggests that banks moved toward storing liquidity in the money markets. Finally, during the primary sample period cash continued to decline, but only by 0.46% (5.23% - 4.77%). This very small decline in cash is accompanied by a 4.63% (19.13% - 14.50%) decline in government securities. Since total assets increased by $3,055 billion, or 80%, from 10/94 to 10/02, the decline in government securities is likely the result of moving toward less liquid assets. This decline in government securities is accompanied by a 3.98% (19.76% - 15.78%) increase in total borrowing.

Total borrowing increased steadily across both sample periods. During the Allen and Saunders sample period, both borrowing from U.S. banks and other sources increased. During our primary sample period, however, the increase in total borrowing was driven by borrowing from sources other than U.S. banks. Borrowing from U.S. banks even declined, as a percent of total assets, between the two sample periods and, to a lesser extent, during the later sample period. The increase in borrowing from sources other than U.S. banks could also explain the change in the year-end behavior of the fed funds rate across the two samples. That is, the availability of other funding sources may reduce the demand for fed funds at the year-end. Unfortunately, the balance sheet data we use do not contain sufficient detail for us to explore this supposition.

The decline in transaction deposits as a percent of total assets along with the way that banks responded to this decline suggests the development of alternatives to transaction deposits for bank customers and the development of alternatives for banks to fund their asset base. Specifically, the changes in bank balance sheets across the two sample periods suggest bank and bank-customer changes that parallel the expansion of the money markets. The expansion of the money markets can be shown in many different ways. We chose to plot the dollar value of investment in money market mutual funds to demonstrate our point.[12] Figure 2 plots the dollar value of investment in

[12] We examined other alternatives to demonstrate the expansion of the money markets and all of them provided the same basic insights as provided by the plot of the money market mutual fund data.

institutional money funds and retail money funds from January 1978 through December 2002 on a monthly basis.[13]

Figure 2 shows that the beginning of the Allen and Saunders sample period coincides with the start-up phase of the money market mutual fund industry. At the beginning of the Allen and Saunders sample period banks held $360 billion in transaction deposits. During the Allen and Saunders sample period the money market mutual fund industry shows slow but steady growth. By the end of this sample period there is about $300 billion invested in money market mutual funds (institutional funds plus retail funds in Figure 2) while transaction deposits increased by $190 billion to about $550 billion. By the beginning of the primary sample investment in money market mutual funds had grown by $280 billion to approximately $580 billion with transaction deposits increasing by $230 billion to about $780 billion. Finally, by the end of the primary sample period the investment in money market mutual funds had grown by $1,616 billion to $2,196 billion while transaction deposits had declined by $120 billion to approximately $660 billion.

The point of the analysis in this section is that bank-customer behavior changed across the two samples and banks responded to this change. It is clear from the changes in the bank balance sheets that customers moved their money out of transaction deposits, either out of banks as the money markets developed to provide a viable alternative for the bank customers, or into time deposits. The development of the money markets also provides an alternative funding source for bank to offset the decline in funding by transaction deposits.

[13] The data in figure 2 on institutional and retail money funds are from Table 7 of the H6 (Money Stock Measures) report by the Board of Governors of the Federal Reserve System and are available on the Board's web site. Institutional money market funds are funds that require large dollar initial investments.

6. Conclusion

We verify that quarter-ends and year-ends are highly volatile in the fed funds market and attempt to determine if the volatility in fed funds rates is associated with bank window dressing or is a response to bank customer preferred habitat. Changes in banks' balance sheet items around quarter-ends and year-ends are consistent with banks responding to the maneuvers of their customers who prepare to meet their quarter-end and year-end obligations. While the reported evidence does not completely refute window dressing, it suggests that the quarter-end and year-end effects in banks are not due to window dressing. Instead, the evidence is consistent with banks and markets responding to quarter-end and year-end preferred habitats for liquidity driven by the timing of cash obligations.

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Table 1. **The daily change in the effective fed funds rate around quarter-ends and the year-end**

This table presents the results from estimating the AR model estimated using the unconditional least squares (ULS) method. The equation for rate change model is:

$$\Delta FF_t = \alpha_0 + \beta_1 bqtr + \beta_2 qtr + \beta_3 aqtr + \beta_4 aqtr2 + \gamma_1 byend + \gamma_2 yend + \gamma_3 ayend + \gamma_4 ayend2 + \varepsilon_t$$

where ΔFF_t = first difference in the daily effective fed funds rate ($FF_t - FF_{t-1}$), *bqtr* = 0/1 dummy variable that equals 1 on the day before the last trading day of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *qtr* = 0/1 dummy variable that equals 1 on the last trading day of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *aqtr* = 0/1 dummy variable that equals 1 on the first trading day following the end of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *aqtr2* = 0/1 dummy variable that equals 1 on the second trading day following the end of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *byend* = 0/1 dummy variable that equals 1 on the day before the last trading day of the year and 0 otherwise, *yend* =0/1 dummy variable that equals 1 on the last trading day of the year and 0 otherwise, *ayend* =0/1 dummy variable that equals 1 on the first trading day the new year and 0 otherwise, and *ayend2* = 0/1 dummy variable that equals 1 on the second trading day of the new year and 0 otherwise.

Variable	Parameter Estimate	p-value
Intercept	-0.0011	0.5625
bqtr	0.0063	0.8504
qtr	0.3363***	<0.0001
aqtr	-0.0819**	0.0159
aqtr2	-0.2854***	<0.0001

byend	0.1542***	0.0074
yend	-0.4457***	<0.0001
ayend	0.7557***	<0.0001
ayend2	-0.1932***	0.0008

Significance levels are shown as *, **, and ***, representing 10%, 5%, and 1%, respectively.

Table 2. **Turn-of-the-quarter behavior of bank assets and liabilities**

for the period January 5, 1994 through December 25, 2002 (reported weekly)

This table presents the results from running the following AR(1) model estimated using the unconditional least squares (ULS) method. The equation for changes in balance sheet items is: $Ch_{i,t} = \alpha + \beta_1 Bq + \beta_2 Aq + \beta_3 By + \beta_4 Ay + \varepsilon_t$

where $Ch_{i,t}$ = percentage change in asset/liability *i* in week *t*, *Bq* =1 on the last Wednesday of each of the first three quarters and 0 otherwise, *Aq* =1 on the first Wednesday each of the first three quarters and 0 otherwise, *By* =1 on the last Wednesday of each year and 0 otherwise, *Ay* =1 on the first Wednesday of each year and 0 otherwise, ε_t is the error term, which is assumed to be normally distributed. The coefficients have been multiplied by 100 to represent percentage changes. The numbers in parentheses are p-values

Dependent variable	Intercept	End of quarter	Beginning of quarter	End of year	Beginning of year
Panel A. Total assets and liabilities					
Total assets	0.1011***	-0.2138	0.7255***	0.6368***[c]	-0.1702[c]
	(<0.0001)	(0.1270)	(<0.0001)	(0.0074)	(0.4935)
Total liabilities	0.0926***	-0.1689	0.8161***	0.7854***[c]	-0.1817[c]
	(0.0009)	(0.2675)	(<0.0001)	(0.0024)	(0.5019)
Panel B. Cash and government securities					
Cash	0.0661	-1.2300	5.0700***	8.2000***[c]	-1.7600[c]
	(0.7594)	(0.3263)	(<0.0001)	(0.0001)	(0.4301)
Gov't securities	0.0339	0.1593	0.5378***	0.0000	0.0557
	(0.4235)	(0.3611)	(0.0020)	(0.9986)	(0.8580)

Panel C. Deposits

Transaction	-0.1235	1.3400*	1.0400	6.8700***[c]	-5.0600***[c]
deposits	(0.3649)	(0.0830)	(0.1787)	(<0.0001)	(0.0003)
Nontransaction	0.0833**	-0.4247**	1.7900***	-0.6186**	1.6400***
deposits	(0.0456)	(0.0223)	(<0.0001)	(0.0445)	(<0.0001)

Panel D. Borrowings

Total borrowings	0.3393***	-0.0090	-1.4000***	-0.1841	-1.5400**
	(<0.0001)	(0.9812)	(0.0002)	(0.7726)	(0.0213)
From U.S. banks	0.1726*	0.1191	0.2098	0.3642	-1.3300
	(0.0830)	(0.8220)	(0.6919)	(0.6863)	(0.1598)
From others	0.4156***	-0.4720	-2.0500***	-0.7264	-1.5600**
	(<0.0001)	(0.2966)	(<0.0001)	(0.3220)	(0.0420)

Significance levels are shown as *, **, and ***, representing 10%, 5%, and 1%, respectively.

[a] – the turn-of-the-year coefficient is different from the corresponding turn-of-the-quarter coefficient at the 10% level

[b] – the turn-of-the-year coefficient is different from the corresponding turn-of-the-quarter coefficient at the 5% level

[c] – the turn-of-the-year coefficient is different from the corresponding turn-of-the-quarter coefficient at the 1% level

Table 3. **The daily change in the effective fed funds rate around quarter-ends and the year-end for the Allen and Saunders (1992) sample period of 1978 through 1986.**

This table presents the results from estimating the AR model estimated using the unconditional least squares (ULS) method. The equation for rate change model is:

$$\Delta FF_t = \alpha_0 + \beta_1 bqtr + \beta_2 qtr + \beta_3 aqtr + \beta_4 aqtr2 + \gamma_1 byend + \gamma_2 yend + \gamma_3 ayend + \gamma_4 ayend2 + \varepsilon_t$$

where ΔFF_t = first difference in the daily effective fed funds rate ($FF_t - FF_{t-1}$), *bqtr* = 0/1 dummy variable that equals 1 on the day before the last trading day of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *qtr* = 0/1 dummy variable that equals 1 on the last trading day of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *aqtr* = 0/1 dummy variable that equals 1 on the first trading day following the end of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *aqtr2* = 0/1 dummy variable that equals 1 on the second trading day following the end of the 1st, 2nd, and 3rd calendar quarters and 0 otherwise, *byend* = 0/1 dummy variable that equals 1 on the day before the last trading day of the year and 0 otherwise, *yend* =0/1 dummy variable that equals 1 on the last trading day of the year and 0 otherwise, *ayend* =0/1 dummy variable that equals 1 on the first trading day the new year and 0 otherwise, and *ayend2* = 0/1 dummy variable that equals 1 on the second trading day of the new year and 0 otherwise.

Variable	Parameter Estimate	p-value
Intercept	-0.0013	0.8638
bqtr	0.2850***	0.0018
qtr	0.5391***	<0.0001
aqtr	-0.2001**	0.0258

aqtr2	-0.1636*	0.0729
byend	0.7477***	<0.0001
yend	0.3845**	0.0311
ayend	-0.3153*	0.0593
ayend2	-0.6051***	0.0003

Significance levels are shown as *, **, and ***, representing 10%, 5%, and 1%, respectively.

Table 4. **Turn-of-the-quarter behavior of bank assets and liabilities for the Allen and Saunders (1992) sample period from January 4, 1978 through December 31, 1986 (reported weekly)**

This table presents the results from running the following AR(1) model estimated using the unconditional least squares (ULS) method. The equation for changes in balance sheet items is: $Ch_{i,t} = \alpha + \beta_1 Bq + \beta_2 Aq + \beta_3 By + \beta_4 Ay + \varepsilon_t$

where $Ch_{i,t}$ = percentage change in asset/liability *i* in week *t*, Bq = 1 on the last Wednesday of each of the first three quarters and 0 otherwise, Aq = 1 on the first Wednesday each of the first three quarters and 0 otherwise, By = 1 on the last Wednesday of each year and 0 otherwise, Ay = 1 on the first Wednesday of each year and 0 otherwise, ε_t is the error term, which is assumed to be normally distributed. The coefficients have been multiplied by 100 to represent percentage changes. The numbers in parentheses are p-values.

Dependent variable	Intercept	End of quarter	Beginning of quarter	End of year	Beginning of year
Panel A. Total assets and liabilities					
Total assets	0.0916***	-0.1298	1.2900***	1.3800 ***c	0.3601 b
	(0.0066)	(0.4963)	(<0.0001)	(<0.0001)	(0.1901)
Total liabilities	0.0658*	-0.1413	1.5600***	1.6000 ***c	0.3108 c
	(0.0819)	(0.5099)	(<0.0001)	(<0.0001)	(0.4170)
Panel B. Cash and government securities					
Cash	0.0532	0.1123	3.8700***	6.9100*** c	1.0600
	(0.7723)	(0.9178)	(0.0004)	(0.0002)	(0.5853)

Gov't securities	0.1871***	-0.4850***	0.3513*	-0.2084	0.1424
	(<0.0001)	(0.0090)	(0.0556)	(0.5022)	(0.6649)

Panel C. Deposits

Transaction	-0.2342	-0.7150	6.2500***	4.9200 ***[c]	4.7000 ***
deposits	(0.1117)	(0.3877)	(<0.0001)	(0.0005)	(0.0015)
Nontransaction	0.1811***	0.0576	0.1727*	0.2094	-0.6777*** [c]
deposits	(<0.0001)	(0.5510)	(0.0740)	(0.2017)	(0.0001)

Panel D. Borrowings

Total borrowings	0.2429***	-0.1511	0.7285	1.1600	0.8162
	(0.0080)	(0.7571)	(0.1357)	(0.1632)	(0.3502)
-From U.S. banks	0.2175**	-0.1757	0.7872	1.3500	0.9440
	(0.0160)	(0.7138)	(0.1004)	(0.1006)	(0.2710)
-From others	0.2774***	-0.1670	0.6580	0.8721	0.7365
	(0.0041)	(0.7451)	(0.1995)	(0.3185)	(0.4220)

Significance levels are shown as *, **, and ***, representing 10%, 5%, and 1%, respectively.

[a] – the turn-of-the-year coefficient is different from the corresponding turn-of-the-quarter coefficient at the 10% level

[b] – the turn-of-the-year coefficient is different from the corresponding turn-of-the-quarter coefficient at the 5% level

[c] – the turn-of-the-year coefficient is different from the corresponding turn-of-the-quarter coefficient at the 1% level

***Table 5*. Aggregate Bank Balance Sheet Data**

This table provides a snapshot of aggregate bank balance sheet data from the first and last year of the Allen and Saunders sample period and the sample period for our primary analysis for the balance accounts used in our analysis. All items are reported as *percentage of total assets*.

Date	Total Liabilities	Cash	Gov't Sec.	Transaction Deposits	Non-transaction Deposits	Borrowing		
						Total	From U.S. banks	From other
Allen and Saunders Sample								
10/78	95.77	11.06	11.52	29.96	50.44	10.91	5.60	5.31
10/86	92.40	8.09	11.91	21.56	51.08	15.03	7.83	7.20
Primary Sample								
10/94	91.94	5.23	19.13	20.41	45.18	15.78	6.59	9.20
10/02	92.96	4.77	14.50	9.58	55.57	19.76	6.04	13.72

***Figure 1*. Average Daily Volatility of the Fed Funds Rate, 1994-2002**

This figure plots the standard deviation of the fed funds rate for each trading day of the year, averaged across the nine years. The trading days have been aligned such that the last trading days of each quarter always fall on days 61, 125, 188, and 250 in the year, respectively.

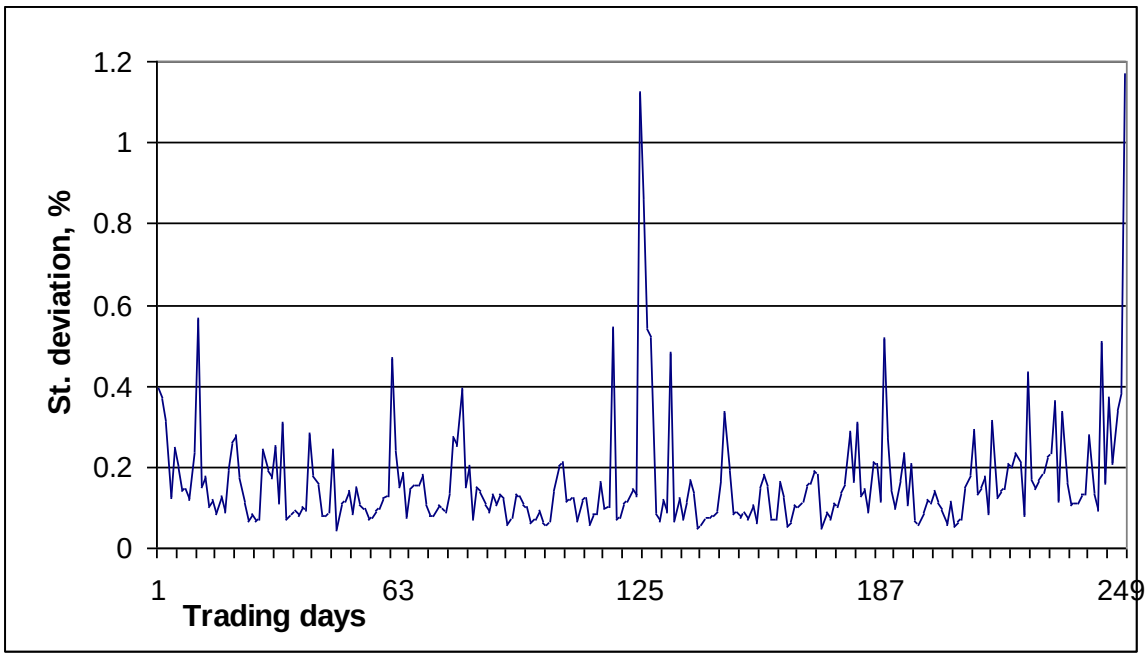

Figure 2. **Investment in Money Market Mutual Funds**

This figure provides the dollar value (in billion $) invested in money market mutual funds across the Allen and Saunders sample period and the primary sample period.