Effects of the Federal Reserve’s Primary Credit Program

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Abstract We test whether the Federal Reserve achieved several announced goals with its new overnight lending facility, finding a significant reduction in the average absolute spread between the federal funds rate and its target rate, though without any measurable increase in the aggregate volume of lending. We also find no evidence that Federal Home Loan Banks (FHLBs) adjusted the pricing of their overnight lending in response to the new discount rate pricing, suggesting that the FHLBs do not view the discount window as a primary competitor.

Keywords: Discount window, lender of last resort, central banking

JEL Classification: E5, G28

1. Introduction

On January 9, 2003, the Federal Reserve introduced a new discount window program, altering the manner in which discount window borrowings can be used by depository institutions in the U.S. Under the new program, the discount rate—the interest rate charged to depository institutions on overnight loans from the discount window—is set above the federal funds target rate, in contrast to the previous program where it was kept below the federal funds target rate. This paper is a preliminary exploration of changes in several dimensions of market behavior that occurred under the new program. Because the new policy is similar to that already in place in many other countries (Madigan and Nelson, 2002), the results are not only useful for evaluating the initial success of the U.S. policy, but also of interest to central bankers elsewhere.

The Federal Reserve has publicized three goals of the new program (ibid.; Stevenson, 2002). First, the central bankers intended to decrease the amount of the administration, or non-price rationing, of discount window loans; to accommodate this change, they eliminated an ongoing opportunity for arbitrage by setting the discount rate above the federal funds target rate. Second, they hoped to eliminate the stigma formerly associated with borrowing from the discount window by making the new primary credit available only to financially sound banks. Both of these changes were anticipated to reduce banks’ reluctance to borrow from the discount window, thus strengthening the ability of the discount window to offset shocks in the money markets. As a consequence, the new program was expected to reduce the volatility of the federal funds rate, relative to its target rate, by effectively capping it at the new discount rate. This change should have improved the efficacy of monetary policy, which in the U.S. is conducted primarily through targeting the federal funds rate (the interest rate charged by banks in the interbank loan market).
Attainment of these goals should be manifested in two hypotheses tested below. Under the new program, the volume of aggregate overnight borrowing should be higher due to lower administrative costs, elimination of rationing, and reduced stigma of borrowing. In addition, there should be a decrease in the average absolute deviation between the federal funds target rate and the observed federal funds rate. A third tested hypothesis, an increase in the average deviation between the federal funds rate and Federal Home Loan Banks’ (FHLB) core mission asset rate (CMA rate), is not directly related to the Federal Reserve’s stated goals but is predicted by economic theory to the extent that FHLBs perceive themselves as lending in direct competition with the discount window.

It should be noted that economic theory also predicts that the higher discount rate would reduce the demand for borrowing, ceteris paribus. This effect would tend to offset any increased borrowing prompted by removing the stigma and reducing administrative costs, rendering the net direction of any change in borrowing volume an empirical question.

We find that the new program did not significantly change the average level of aggregate overnight discount window borrowing, controlling for other variables potentially associated with borrowing. This finding is consistent with a roughly equal offset between the higher direct cost of borrowing and lower indirect costs under the new policy. The average spread between the federal funds target rate and the federal funds rate fell significantly after the policy change, consistent with an expressed goal of the Federal Reserve. Finally, several simple tests indicated that the pricing of overnight FHLB loans did not respond to the systematic change in the discount rate, suggesting that the FHLBs do not view the discount window as a primary competitor for their overnight lending.

The remainder of this paper is organized as follows. Section 2 reviews prior research on the discount window. Section 3 describes the old and new discount window programs. Section 4 presents the empirical model and results for aggregate borrowing levels. Section 5 explores the pattern of federal funds rates, section 6 explores the pattern of Federal Home Loan Banks’ CMA rates, and section 7 concludes.

2. Previous Studies

Relatively few previous studies have examined the discount window, nearly all addressing different issues than those explored here. In a classic article, Goodfriend (1983) showed that the Federal Reserve’s policy of non-price rationing makes the theoretical demand for borrowing a function of recent borrowing and of the spread between the discount rate and the federal funds rate, a pattern supported empirically by Dutkowsky (2002) and Peristiani (1994). Shaffer (1998) presents a theoretical framework that identifies an expanded set of variables as influencing rational borrowing decisions made by banks.

However, since the mid-1980s the spread between the discount rate and the federal funds rate has exhibited less explanatory power in predicting aggregate borrowing from the discount window (Mitchell and Pearce, 1992; Cosimano and Sheehan, 1994; Peristiani, 1998; Dutkowsky and McCoskey, 2001; Darrat et al., 2004). Apparently related to this change, a reluctance to borrow
from the discount window became evident in the 1980s, manifested by a reduced volume of aggregate borrowing unexplained by any change in Federal Reserve policy or other factors (Peristiani, 1998; Madigan and Nelson, 2002), though more sophisticated dynamic modeling questions that conclusion (Dutkowsky and McCoskey, 2001).

Flannery (1996) evaluates the efficiency of the discount window under situations in which private borrowing arrangements would likely falter. His model establishes that, unless private banks and investors routinely make poor credit evaluations, there is little need for the discount window in normal times, though the ability to provide funds quickly is a strong advantage of the discount window during times of financial crisis. Shaffer (1999), on the other hand, demonstrates that ordinary short-term fluctuations in deposit supply may induce banks to choose a larger lending capacity if the discount window is available than if it is not, thus establishing an aggregate benefit of the discount window during ordinary times.

Exploring an unrelated question, Thornton (2000) shows that the Federal Reserve’s change in the discount rate policy in the early 1960’s yields evidence that the market responds more closely with the Fed’s intentions when they are known. Other recent literature has examined spreads between bond yields and the Federal Reserve's target rate, both as a way of improving the prediction of yield curves and to analyze the response of monetary policy to market rates (Cochrane and Piazzesi, 2002; Piazzesi, 2005). Our study differs from this more recent literature in two main ways. First, we focus on overnight interbank loan rates instead of Treasury yields. Second, we focus on a possible one-time shift in the relationship between actual interbank loan rates and the Fed's target rate, driven by the Fed’s publicly announced policy change, rather than on the ability of the target rate to explain or predict bond yields.

Two prior studies have addressed the behavioral consequences of the 2003 discount window policy. Furfine (2003) represents a very preliminary investigation using daily data ending in March 2003, less than three months after the new program was implemented. He finds that borrowing volume was lower than anticipated during the first few weeks of the new program and interprets this finding as evidence of continued stigma attached borrowing from the central bank. Hilton (2005), in an internal Federal Reserve study, reported that the federal funds rate has exceeded the primary discount rate only four times since the policy change and has halted exactly at the primary discount rate several times (Hilton, 2005). However, due to exceptionally low interest rates and the general absence of market conditions that might lead to discount window borrowing during this period, Hilton concludes that we cannot yet be certain of the policy’s effect on the federal funds rate overall. This paper contributes to the question by utilizing a longer period of data and addressing multiple dimensions of market behavior.

3. Background Information

3.1 Original Lending Programs

Prior to January 9, 2003 the Federal Reserve operated three lending programs: adjustment credit, extended credit, and seasonal credit. All programs required proper documentation and collateral before any funds were loaned. Adjustment credit was intended to help banks meet a temporary
unexpected need for funds. The adjustment credit interest rate (“discount rate”) was kept below the Federal Open Market Committee’s target federal funds rate for the past several decades (Madigan and Nelson, 2002). This negative spread created an arbitrage incentive for depository institutions, which the Federal Reserve opposed by requiring institutions to exhaust all other sources of funds before borrowing from the discount window and by monitoring banks’ use of the borrowed funds (http://www.ny.frb.org/aboutthefed/fedpoint/fed18.html). Further, each institution was limited in its frequency of borrowing from the discount window. These restrictions imposed considerable nonpecuniary costs on borrowing institutions, deterring not only inappropriate borrowing but also likely some appropriate borrowing.

Besides facing substantial administrative costs of borrowing adjustment credit, many institutions felt that such borrowing could be interpreted by regulators and others as a sign of financial weakness. However, the FDIC Improvement Act of 1991 made the Federal Reserve financially liable to pay any excess costs of bank failure attributable to lending by the discount window to failing banks, thus reducing or eliminating any objective basis for the stigma even if the public may have overlooked this change. Some institutions would not borrow from the discount window in times when it would have been appropriate because of the perceived stigma (http://www.ny.frb.org/aboutthefed/fedpoint/fed18.html), undermining the discount window’s ability to reduce shocks to the money markets.

Extended credit was designed to lend to banks experiencing more permanent deposit outflows, typically associated with a run on the bank (Koch and McDonald, 2003, p. 456). This program was used only when absolutely necessary.

Under the seasonal credit program smaller institutions could borrow to meet the needs of their communities if their loans and deposits fluctuate systematically due to seasonal factors. Institutions eligible for this credit program must be in satisfactory condition, have total deposits less than $500 million, and demonstrate a reoccurring seasonal need for funds that persists for at least four weeks (http://www.ny.frb.org/banking/seasonalcredit.html). The interest rate charged on seasonal credit is a floating market rate based on the federal funds rate and the secondary market rate on 90-day CDs.

3.2 The New Primary Credit Program

The lending policy adopted in January 2003 left the seasonal credit program unchanged but replaced adjustment credit with primary credit and extended credit with secondary credit. Documentation and collateral requirements remained unchanged.

Primary credit, the focus of this paper, differs from adjustment credit in two main ways. First, the primary interest rate is set above the federal funds target rate (currently 100 basis points above), whereas the interest rate on adjustment credit had typically been set 25-50 basis points below the federal funds target rate (Madigan and Nelson, 2002). Second, restrictions on the frequency of borrowing and use of funds have been replaced by the requirement that borrowing institutions must be at least adequately capitalized with an examination (CAMELS) rating no worse than 3. While primary credit may be made available on an exception basis to other
institutions, institutions that meet these eligibility requirements may borrow at any time for any reason (ibid.; http://www.frbdiscountwindow.org/programs.cfm?hdrID=14&dtlID=45).

The reduced administrative burden should enable the new primary credit program to function as a better instrument when money markets tighten significantly and improve the ability of the discount window to serve as a source of backup or short-term funds (Madigan and Nelson, 2002). In addition, the requirement of sound financial condition as a prerequisite to borrowing primary credit should further reduce any remaining stigma attached to such borrowing. This argument is mitigated, though, by recognizing that banks should prefer to borrow in the cheaper federal funds market when possible, so that observers might still worry about the reasons why a bank would turn to the discount window for overnight funds.

4. Testing for Shifts in Aggregate Borrowing

To test for possible shifts in the pattern of overnight discount window borrowing after the policy change, we use data from the Federal Reserve on monthly borrowings from January 2001 to January 2005; descriptive statistics are shown in Table 1. September 2001 was removed from the sample as an outlier (McAndrews and Potter, 2002). Our sample period is symmetric in length around the implementation date of the new program and begins after banks may have adjusted their borrowing behavior to new collateral rules adopted by the Federal Reserve in 1999 (see http://www.ny.frb.org/aboutthefed/fedpoint/fed18.html).

The following regression equation was used to test for a shift in primary borrowing after the new program was implemented:

\[ P = \alpha + \beta D_t + \gamma X + \varepsilon \] (1)

where:

- \( P \) = Primary Borrowing after the policy change, or Adjustment Borrowing before the change (three versions of this variable were tested, as described below);
- \( D_t \) = dummy variable equal to 0 under the old program and 1 under the new program;
- \( X \) = vector of control variables:
  - \( X_1 \) = trend term;
  - \( X_2 \) = yield on three-month U.S. Treasury bill;
  - \( X_3 \) = monetary base;
  - \( X_4 \) = aggregate borrowing from the Federal Reserve’s seasonal lending program;
- \( \varepsilon \) = stochastic error term.

A nonzero estimated coefficient on the event dummy would indicate a shift in the pattern of borrowing following implementation of the new policy. Several variations of the model were
estimated to explore robustness of the shift term estimates. Alternate dependent variables included the natural logarithm of total primary or adjustment borrowing, in millions of dollars; the log of the ratio of primary or adjustment borrowing to total discount window borrowing; and the log of the ratio of primary or adjustment borrowing to the monetary base. Control variables included a trend term, the three-month U.S. Treasury bill yield (secondary market data), the monetary base and, in some specifications, seasonal borrowing.

The trend term controls for possible effects of industry growth, technological change, growth of the interbank loan market, growth of Federal Home Loan Bank lending, and other intertemporal developments unrelated to the Federal Reserve’s change of program. The T-bill yield is a proxy for market interest rates generally. At lower rates, the demand for loans should be higher and the supply of deposits may be lower, suggesting that banks on average may experience greater needs for temporary liquidity when market rates are low. This logic would imply a negative coefficient on the three-month T-bill rate, which is further reinforced if the cost of borrowing is positively correlated with the T-bill yield. In addition, the T-bill yield is positively correlated over time with the cost of equity capital (Friedman and Kuttner, 1992; Hardouvelis and Wizman, 1992), which was predicted by Shaffer (1998, 1999) to have a negative influence on the demand for discount window loans if risk-based capital requirements are binding.

The monetary base (currency in circulation plus deposits with the Federal Reserve) reflects both the scale of the economy and the amount of systemic liquidity, with offsetting predictions for the sign of the coefficient, rendering that sign an empirical question. The coefficient on seasonal borrowing likewise has an a priori ambiguous sign. On the one hand, such borrowing may substitute for overnight borrowing among qualifying institutions, implying a negative coefficient. On the other hand, seasonal borrowing may reflect external factors stimulating demand for all forms of discount window borrowing, implying a positive coefficient. Complicating this linkage is the fact that the pricing of seasonal credit did not change under the new program, reversing the sign of the spread between that rate and the discount rate for overnight loans (Madigan and Nelson, 2002). For these reasons we estimated the models both with and without seasonal borrowing. For the third dependent variable, the log of the ratio of primary borrowing to the monetary base, we also estimated a version without the monetary base because of its inclusion in the denominator of the dependent variable.

We did not include the spread between the federal funds rate and the discount rate, as introduced by Goodfriend (1983), because the only significant change in that spread during our sample period occurred with the implementation of the new discount program, which was also associated with other major changes likely to affect borrowing and is therefore more appropriately represented in the model by our event dummy Dt. Nor did we include the regulatory capital requirement as in Shaffer (1998, 1999) because it did not vary during the sample period.

Table 2 reports the regression results. The adjusted R-squared demonstrated only slight explanatory power of the models overall, while the event dummy was never significant at conventional levels and did not exhibit the same sign of point estimate in all regressions. Additional regressions, not reported in the table, tested additional specifications with the same result. Yet other regressions, also not summarized in the table tested for alternate shift points not
exactly coinciding with the adoption of the new discount window policy, but did not find any consistently significant shift point. The evidence thus indicates that aggregate overnight borrowing behavior did not measurably change under the Federal Reserve’s new program.

The use of time-series data raises the potential issue of unit roots. A survey of this issue by McCallum (1993, p. 30) concludes that "neither overdifferencing nor underdifferencing leads to serious estimation or testing mistakes in regression models with exogenous regressors, provided that the investigator takes intelligent account of serial correlation present in the regression residuals." Since the regressions reported in Table 2 do not exhibit significant serial correlation, as indicated by the Durbin-Watson statistics, we do not need to take first differences or to perform further tests on the residuals. Nevertheless, we also performed weighted symmetric (tau) tests for unit roots in each dependent variable: this test, not reported in the table, rejected unit roots in all cases at significance levels ranging from 0.003 to 0.007.

5. Behavior of the Federal Funds Rate

Under the new program, the discount rate should function as an effective cap on the federal funds rate (the interbank loan rate) because a bank in need of short-term funds has a financial incentive to borrow from the discount window whenever the federal funds rate exceeds the discount rate. This cap should result in lower volatility of the federal funds rate relative to the target rate established by the central bank. Since one of the major goals of the new program was to decrease the deviation between the federal funds rate and its target rate set by the Federal Reserve to achieve monetary policy objectives, we test the average absolute deviation between the two rates.

Table 3 presents descriptive statistics for daily data from the Federal Reserve on both the daily federal funds rate and the federal funds target rate from January 1, 2001 to January 1, 2005. Because seven individual days exhibited much larger spreads between the two rates than other days, we created an alternative trimmed sample by removing these few outliers. The outliers were defined as any day where the absolute value of the deviation was greater than 0.40 percent, and included September 17 – 20, 2001; January 1 - 2, 2001; and June 30, 2003. The September 2001 outliers can be attributed to the terrorist attacks of September 11, 2001 (McAndrews and Potter, 2002). The January 2001 outliers appear to be associated with a federal funds target rate decrease that was announced on January 3, 2001 in response to requests by seven Reserve Banks (http://www.federalreserve.gov/boarddocs/press/general/2001/20010103/default.htm). The June 2003 outlier may also be attributed to a decrease in the federal funds target rate. Because all but one of these outliers occurred before the policy change, and because one stated goal of the new policy was to reduce such outliers, we tested for a shift using both the trimmed sample and the full sample.

Table 4 shows that the average absolute deviation between the federal funds rate and its target rate was much smaller under the new discount window program—roughly half its former value—consistent with one of the Federal Reserve’s stated goals. A t-test indicates that this shift was significant at the 0.001 level for both the full sample and the trimmed sample.
6. Federal Home Loan Banks’ CMA Rate

The Federal Home Loan Banks (FHLBs) offer an overnight loan program to qualified member banks, as well as extended term lending. Funds can be borrowed on an overnight basis from an institution’s regional Federal Home Loan Bank as long as the proper collateral and documentation are in place. To the extent that depository institutions and the FHLBs view overnight loans from the discount window as significantly substitutable for FHLB loans, an increase in the discount rate should prompt a competitive response in the form of an increase in the FHLBs’ CMA rate, or the rate charged on overnight funds. At the same time, FHLB loans compete against the interbank loan market, so the CMA rate should also continue to respond to the federal funds rate.

Perhaps the simplest and most stringent test of price competition between the FHLBs and the discount window is to measure the direct response of the CMA rate to the discount rate. If the two types of institutions are strong competitors, we might expect to find no significant difference in the spread between the two rates after the policy change. On the contrary, that spread changed signs with the change of policy, with Seattle’s CMA rate averaging 72.75 basis points above the discount rate before the change but 85.77 basis points below the discount rate after the change, and Cincinnati’s CMA rate averaging 68.29 basis points above the discount rate before the change but 82.88 basis points below the discount rate after the change. These changes were significant at the 0.0001 level (t = 117.71 for Seattle and 152.94 for Cincinnati).

An alternative simple test is to measure the spread between the CMA rate and the federal funds rate. As it happens, the CMA rate has consistently exceeded the federal funds rate both before and after the new policy. To the extent that the CMA rate responded to the increase in the discount rate relative to the federal funds rate, the difference (CMA rate minus federal funds rate) should be higher on average under the new policy than under the old policy. Absence of such a change would suggest that the FHLBs do not perceive their overnight lending to face strong competition from the discount window.

Table 5 present descriptive statistics for monthly CMA rates from two of the twelve regional FHLBs (Seattle and Cincinnati), which—unlike the other FHLBs—report historical rate data on their web sites. Table 6 shows that the average deviation, calculated from the monthly CMA rates minus the monthly federal funds rate, was actually lower after the discount window policy change; t-tests indicate that this shift was significant at the 0.01 level for both the FHLB of Seattle and the FHLB of Cincinnati. This surprising result suggests that these two FHLBs, at least, did not set their overnight pricing as though the discount window was a significant competitor, but have reduced their CMA rates over time to track the federal funds rate more closely than before.

One possible explanation for this pattern might be that the average level of the federal funds rate was much lower in the later period (1.28 percent) than in the earlier period (2.78 percent). In this situation, it is possible that the standard arithmetic spread might be less relevant than a ratio comparison. Additional t-tests, not reported in the tables, gave similar results for the average ratios of CMA rates to federal funds rate: the Cincinnati FHLB exhibited a significantly lower
average ratio under the new policy than before \( (t = -4.41, \text{ significant at the 0.001 level}) \); while the Seattle FHLB likewise exhibited a slightly lower average ratio under the new policy, though that difference was not significant \( (t = -0.63) \). These results demonstrate that the conclusions indicated in Table 6 are robust to alternative forms of calculation.

One might therefore conjecture that perhaps the FHLBs have not consistently attempted to maximize their overnight lending, nor pursued any closely related objective; this notion is consistent with their failure to follow the discount rate upward, but not necessarily consistent with the observed decline in the gap between the CMA rates and the federal funds rate. Or it might be that the FHLBs perceive the federal funds market as strongly dominating the discount window in competition for FHLB overnight lending; this notion would be consistent both with the failure to follow the relative increase in the discount rate and with the declining gap between the CMA rates and the federal funds rate. Whatever the true explanation, this question warrants further study, and suggests that the growth of FHLB lending in recent years is not a likely cause of the apparent reluctance of depository institutions to borrow from the discount window.

7. Conclusion

While the long-run impact of the discount window policy change of 2003 is still to be determined, tests presented here explore the initial impact that the change had on the level of overnight borrowing, the behavior of the federal funds rate, and the Federal Home Loan Banks’ CMA rates. Economic theory would predict that higher discount rates would lead to lower borrowing, ceteris paribus. However, the data indicate that the policy change was not associated with any significant change in the average level of aggregate discount window borrowing, controlling for trend growth and other variables believed to be associated with borrowing. These results suggest that the relaxed borrowing requirements and decreased administrative costs roughly offset the higher direct cost of overnight borrowing under the new program.

In addition, one would predict that the average gap between the federal funds target rate and the federal funds rate would decrease due to the fact that the discount rate should now act as an effective ceiling on the federal funds rate. The results are strongly consistent with this hypothesis, showing a significant decrease in the gap despite an unchanged average volume of borrowing. This finding is also consistent with Hilton’s (2005) evidence that the new primary credit rate appears to be functioning as a cap on the federal funds rate. Thus, it appears that the new program has succeeded in achieving one of its most important objectives, and that average loan volume alone is inadequate as an indicator of the discount window’s effectiveness in stabilizing financial markets. In that respect, the continued stigma identified by Furfine (2003) may not be a material impediment to effective monetary policy.

Finally, several simple tests found no evidence that Federal Home Loan Banks have adjusted their overnight CMA rate in response to the new discount rate pricing, even though data from Seattle and Cincinnati indicated that the CMA rates have been set closer to the federal funds rate since the program change. This somewhat surprising finding suggests that the FHLBs do not view the discount window as a primary competitor for overnight lending, perhaps because overnight lending is dominated by the interbank loan market. This issue warrants further study,
especially as it suggests that the increased FHLB lending in recent years may not be a measurable factor contributing to the apparent reluctance of depository institutions to borrow overnight from the discount window.

Endnotes

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References


Table 1. Summary of Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>N</th>
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<tr>
<td>Primary Borrowing</td>
<td>46.7</td>
<td>47.3</td>
<td>3</td>
<td>211</td>
<td>47</td>
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<td>Seasonal Borrowing</td>
<td>84.2</td>
<td>66.4</td>
<td>5</td>
<td>238</td>
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<td>Total Borrowing</td>
<td>131.1</td>
<td>90.0</td>
<td>22</td>
<td>335</td>
<td>47</td>
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<td>Monetary Base</td>
<td>680448</td>
<td>51146</td>
<td>589340</td>
<td>758273</td>
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<td>Three-month T-Bill Yield</td>
<td>1.83</td>
<td>1.11</td>
<td>0.88</td>
<td>5.15</td>
<td>47</td>
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</tbody>
</table>

Source: www.federalreserve.gov/releases. Dollar totals are in millions of dollars; the T-bill yield is from secondary market data on a discount basis.

Table 2. Regression Estimates of Overnight Borrowing Levels

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Adj. R-Sqr.</th>
<th>Durbin-Watson</th>
<th>Intercept</th>
<th>Event Dummy</th>
<th>Trend</th>
<th>T-Bill Yield</th>
<th>Monetary Base</th>
<th>Seasonal Borrowing</th>
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<tr>
<td>Log (Primary)</td>
<td>0.026</td>
<td>2.19</td>
<td>38.08</td>
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<td>-0.128</td>
<td>-5.8x10^{-5}</td>
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<tr>
<td></td>
<td>0.034</td>
<td>2.29</td>
<td>41.84</td>
<td>-0.644</td>
<td>0.230</td>
<td>-0.205</td>
<td>-6.4x10^{-5}</td>
<td>0.0028</td>
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<td>Log (Primary / Total)</td>
<td>0.060</td>
<td>1.68</td>
<td>18.10</td>
<td>0.510</td>
<td>0.113</td>
<td>-0.250</td>
<td>-4.3x10^{-3}</td>
<td>--</td>
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<tr>
<td></td>
<td>0.278</td>
<td>2.05</td>
<td>16.77</td>
<td>0.0626</td>
<td>0.0957</td>
<td>-0.0657</td>
<td>-2.9x10^{-3}</td>
<td>-0.00661</td>
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<tr>
<td>Log (Primary / Base)</td>
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<td>2.11</td>
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<td>0.130</td>
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<td></td>
<td>0.064</td>
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<td>29.51</td>
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Heteroscedastic-consistent (White) t-statistics in parentheses: significant at the *0.01 or **0.10 level.
Table 3. Descriptive Statistics of Selected Daily Interest Rates

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<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>N</th>
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<tr>
<td>Federal Funds Rate %</td>
<td>1.97</td>
<td>1.25</td>
<td>0.86</td>
<td>6.2</td>
<td>1444</td>
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<tr>
<td>Federal Funds Target Rate %</td>
<td>1.97</td>
<td>1.25</td>
<td>1</td>
<td>6</td>
<td>1444</td>
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<tr>
<td>Discount Rate %</td>
<td>2.22</td>
<td>1.01</td>
<td>0.75</td>
<td>5.5</td>
<td>1444</td>
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Table 4. Average Absolute Deviation (AAD) Between the Federal Funds Rate and its Target Rate

<table>
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<tr>
<th>Date Range</th>
<th>Trimmed Sample</th>
<th>Full Sample</th>
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</thead>
<tbody>
<tr>
<td>From Jan 1, 2001 through Jan 8, 2003</td>
<td>0.057664</td>
<td>0.065962</td>
</tr>
<tr>
<td>From Jan 10, 2003 through Jan 1, 2005</td>
<td>0.030319</td>
<td>0.030899</td>
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<tr>
<td>t-Statistic on the Hypothesis of Equal AAD</td>
<td>10.72</td>
<td>7.25</td>
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</table>

Table 5. Descriptive Statistics of Selected Monthly Rates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHLB Seattle CMA %</td>
<td>2.20</td>
<td>1.34</td>
<td>1.12</td>
<td>6.26</td>
<td>48</td>
</tr>
<tr>
<td>FHLB Cincinnati CMA %</td>
<td>2.19</td>
<td>1.31</td>
<td>1.15</td>
<td>6.23</td>
<td>48</td>
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<tr>
<td>Federal Funds Rate %</td>
<td>2.01</td>
<td>1.30</td>
<td>0.98</td>
<td>5.98</td>
<td>48</td>
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</tbody>
</table>


Table 6. Average Deviation (AD) Between FHLB CMA Rates and Federal Funds Rate

<table>
<thead>
<tr>
<th></th>
<th>Seattle</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>AD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From January 2001 through December 2002</td>
<td>0.2420</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From February 2003 through January 2005</td>
<td>0.1337</td>
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<tr>
<td>t-Statistic on the Hypothesis of Equal AD</td>
<td>12.48</td>
<td></td>
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<tr>
<td></td>
<td>Cincinnati</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>AD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From January 2001 through December 2002</td>
<td>0.1892</td>
<td></td>
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<tr>
<td>From February 2003 through January 2005</td>
<td>0.1625</td>
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<td>t-Statistic on the Hypothesis of Equal AD</td>
<td>6.16</td>
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