STICKY DEPOSIT RATES: DATA AND IMPLICATIONS FOR MODELS OF PRICE ADJUSTMENT

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ABSTRACT

We use a panel dataset of over 2,500 branches of about 900 depository institutions (DIs) observed weekly over ten years to examine the dynamics of changes in interest rates on interest checking accounts, money market deposit accounts (MMDAs), and six different maturities of CDs, replicating and extending previous work on the topic. We have six key findings. First, CD rates are quite flexible, with the median institution changing such rates every 5 weeks on average, while rates on MMDAs and interest checking accounts show much more inertia, changing every 12 weeks and 18 weeks on average, respectively. By comparison, the target federal funds rate – an important determinant of DIs' cost of funds, and thus a good proxy for DI marginal cost – changed about every 12½ weeks over the sample. Second, the frequency of rate changes exhibits considerable dispersion for some types of deposits, with about a quarter of branches changing interest checking rates twice a year or less frequently. Third, deposit rate changes are asymmetric: rates adjust about twice as frequently during periods of falling target federal funds rate than rising ones. Fourth, rates are uniformly quite sticky during periods when the federal funds rate is flat, with median durations between price changes ranging from 8 weeks to 39 weeks. Fifth, the median size of rate changes is 20 basis points, comparable to the typical 25 basis point change in the target federal funds rate; the distribution of average decreases and increases is about the same, and is relatively dispersed, with many small changes of a few basis points. Sixth, there is a greater degree of upward stickiness in rates on interest checking and money market accounts for branches of large DIs than for branches of smaller ones. Although these results are broadly consistent with panel data studies of goods and services prices, deposit rates display more asymmetry in adjustment, and there are other deposit rate facts for which there is not yet comparable evidence on prices. We compare our facts to the predictions of eight models of price adjustment, and find that although such models can match about half the facts about deposit rates, none predicts the asymmetric response, and none attempts to model the cross-firm dispersion in rate-setting behavior.

I. Introduction

In many models of business cycles, the effects on macroeconomic variables of monetary policy and other shocks depend on the details of how prices are set. Several papers in recent years have used large panel datasets that follow the prices of many goods and services through time to document the dynamic behavior of prices and to evaluate how well different models of price setting fit the facts.[2]

Data on another kind of price—interest rates on bank and thrift deposits—may serve as an additional source of evidence on how prices are set. Unlike many other financial prices, which may change almost continually, deposit rates adjust sluggishly, and thus act more like prices on goods and services. But unlike many goods and services, deposits are usually not subject to sales, making analysis of the frequency of rate changes relatively cleaner. Moreover, deposits are arguably a relatively homogeneous product, making comparisons across institutions easier.

In addition, deposit rates are important for their own sake. Over $6 trillion in assets are held in the form of bank and thrift deposits.[3] According to the 2007 Survey of Consumer Finances (SCF), about ¾ of households in the bottom income quintile had bank deposits as assets, while only single-digit percentages of such households had any holdings in other financial assets.[4] Taken together, these facts suggest that changes in deposit rates may have not inconsequential effects on consumers.

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[2] See, for example, Levy and Young (2004) , Nakamura and Steinsson (2006a, 2006b), Bils and Klenow (2004), Klenow and Kryvstov (2008), and Eichenbaum, Jaimovich and Rebelo (2008).

[3] For deposit data, see Federal Reserve Statistical Release H.6, "Money Stock Measures."

[4] Holdings of non-bank financial assets only reach double digit rates for the third quintile of income and above. See Bucks et al. (2009) for further details.

Researchers have long recognized the potential utility of deposit rates in studying price-setting behavior. Hannan and Berger (1991), Neumark and Sharpe (1992), and Diebold and Sharpe (1990) have shown that rates may take months to change and respond asymmetrically to changes in banks' costs of funds (as proxied by the federal funds rate or other interest rates): deposit rates are upwards-sticky but downwards-flexible. This earlier work was done shortly after deposit rates were deregulated in the 1980s and was thus based on relatively short samples, making it difficult to precisely estimate the frequency of deposit rate adjustment. Moreover, during these earlier sample periods, changes in the target federal funds rate were not publicly announced, making it more difficult to evaluate the response of deposit rates to changes in this variable.

In this paper, we update and extend this work by using a high-frequency (weekly) panel dataset observed over a ten-year period for over 2,500 branches of about 900 depository institutions (DIs). Given this sample, which is both longer and broader than those previously used, we are able to more precisely estimate the duration between interest rate changes and document the asymmetry of price adjustment over the course of two full FOMC easing and tightening cycles. The large number of DI branches allows us to study differences in rate-changing behavior across institutions; this sort of evidence complements the typical approach in the literature on price-setting, which looks at changes in the prices of many goods at a single firm or of single goods averaged over many firms. We also document the sluggishness of deposit rates at the aggregate level.

We have six key findings. First, some deposit rates are more flexible than others. Rates on certificates of deposits (CDs) – are quite flexible, with the median institution changing such rates every 5 weeks on average. Rates on money market deposit accounts (MMDAs) and interest

checking accounts show much more inertia, changing every 12 weeks and 18 weeks on average, respectively. By comparison, the target federal funds rate – an important determinant of DIs' cost of funds, and thus a good proxy for DI marginal cost – changed about every 12 weeks across the period. Second, the frequency of rate changes exhibits considerable dispersion for some types of deposits, with about a quarter of institutions changing interest checking rates twice a year or less frequently. Third, deposit rate changes are asymmetric: rates adjust about twice as frequently during periods of falling target federal funds rate than rising ones. Fourth, rates are uniformly quite sticky during periods when the federal funds rate is flat, with median durations between price changes ranging from 8 weeks to 39 weeks. Fifth, the median size of rate changes is 20 basis points, comparable to the typical 25 basis point change in the target federal funds rate; the distribution of average decreases and increases is about the same, and is relatively dispersed, with many small changes of a few basis points. Sixth, there is a greater degree of upward stickiness in rates on interest checking and money market accounts for branches of large DIs than for branches of smaller ones.

We compare these facts with those found in the empirical literature on goods and service price changes. Qualitatively, deposit price changes and goods and service price changes share many common features, including having relatively frequent changes, relative large average absolute changes, having many small changes, and having time-varying durations between price changes. However, deposit rates also exhibit some behavior not observed in prices of other goods and services, including having different frequencies of adjustment for increases and decreases.

Following Klenow and Kryvstov (2008) and Nakamura and Steinsson (2006a), we compare these facts with the predictions made by eight price-setting models. Existing models

appear to fit well existing facts in the price-setting literature. However, the models do not appear to match the asymmetries in deposit rate changes. Moreover, the models do not attempt to capture the large differences in the frequency of rate changes across deposit types offered by the same DI branch.

The rest of the paper proceeds as follows. We provide details on our dataset in section II. In section III, we document the sluggishness and asymmetry of deposit rate adjustment at the aggregate level over the past two decades, which includes two episodes of monetary policy tightening and easing. In section IV, we discuss deposit rate behavior at the microeconomic level. Section V relates our work to previous work on deposit rates. Section VI compares our finding to those papers using microeconomic data on prices, and discusses the implications of our deposit-rate data findings for models of price adjustment. Section VII concludes.

II. Data

The core dataset of this paper is a proprietary weekly micro dataset of bank and thrift deposit rate data that is collected by Bankrate, Inc.[5] This dataset covers several thousand branches of nearly 900 DIs over a time span of about ten years, from the week of September 19, 1997 through the week of March 2, 2007. Data for each branch has the parent institution's NIC identification code as well as indicators of the banking market. The dataset has rates on interest-bearing checking accounts, money market deposit accounts (MMDAs), and nine different maturities of certificates of deposit (CDs): 3, 6, 12, 24, 30, 36, 48, 60, and 84 months. The set of branches that provide data is not fully consistent from week to week due to mergers, exit and entry, and observations of zero, which we believe to be missing observations. The dataset begins

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[5] http://www.bankrate.com. This dataset is available to users within the Federal Reserve System but, in accordance with the Federal Reserve Board's contract with Bankrate, cannot be shared with users outside the Federal Reserve

with 443,189 observations, or an average of 897 cross-sectional observations for each of the 494 weeks in the sample. A relatively small number of observations suffered from certain irregularities, which we treated as follows.

Some observations appeared to be partial or full duplicates of others, as if one observation sometimes contained a partially-completed survey and a separate observation contained the full set of information. We identified and dropped about 800 such duplicates, bringing the sample size to 442,407. Some observations also were incomplete but were followed by one or more additional observations with the same bank identification number and market rank and complementary data. Combining these observations eliminated about 22,000 observations and brought the sample size to 419,881 observations. Finally, we deleted the 55 observations that contained data for only one week, leaving us with 419,826 observations. The remaining dataset contained information on rates of 2,770 branches for 897 DIs.

Comparison with other data sources

One other sources of interest rate data at the bank level has been used in previous work. Hannan and Berger (1991) and Neumark and Sharpe (1992) used the Federal Reserve's Monthly Survey of Selected Deposits and Other Accounts (hereafter the Monthly Survey). The survey collected the most commonly offered rate by account type; starting in 1989, the surveys allowed for the possibility that higher rates were offered for larger balances, a policy known as tiering. The Federal Reserve survey stopped collecting information on offered interest rates in 1994 and was discontinued in 1997.

An additional potential source of deposit rate data is the quarterly Consolidated Reports on Condition and Income, known more generally as the Call Reports. These quarterly financial statements, available since 1934, do not provide direct measures of deposit rates for commercial

banks.[6] However, one can divide the interest expenses paid by the bank by the quantity of

deposits in the account to obtain a weighted average of interest rates paid. A disadvantage is

that, in the case of time deposits, the rate may not reflect current offered rates. Another

disadvantage is that some categories of deposits are combined.[7]

An advantage of using the Bankrate data over the Monthly Survey is that the longer time

series allows us to more accurately estimate longer durations of price stickiness. Moreover, the

weekly frequency of the data allows us to see changes at a higher frequency than either the

Monthly Survey or the Call Reports. A further advantage is that this data is collected for a wider

variety of deposit types than other sources: we observe data on interest checking accounts,

MMDAs, and CDs with nine different maturities. Finally, the Bankrate data is collected for a

much larger group of DIs than the monthly survey, and at the branch level, allowing for better

cross-sectional comparisons.

A significant disadvantage of the Bankrate data is that it appears to only reflect the

lowest rate offered by deposit type. Rice and Ors (2006) document that the Bankrate data, on

average, has significantly lower rates than the quarterly call report-based measures, suggesting

that a substantial fraction of deposits are paid at higher rates.

The discrepancy in the average level of rates among datasets may not be completely

problematic for our purposes. First, it is not clear that the stickiness properties of the rates on the

bottom tier are different from those on upper tiers. As we show below, rates are sticky both at

the aggregate level and the microeconomic level, suggesting that the Bankrate data is capturing

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[6] The comparable reports for savings and loans (thrifts) do provide direct measures of offered deposit
rates.

[7] In part to avoid having deposit liabilities that are subject to reserve requirements, some banks "sweep"
balances from reservable liabilities to non-reservable ones overnight, restoring them the following
morning. This sweeping makes measurements of particular account types difficult. The Call Reports
deal with this problem by aggregating reservable and non-reservable types of accounts.

the degree of price inflexibility appropriately. Second, although most deposits are likely paid at higher tiers, it is not clear that most depositors are receiving such rates, since the distribution of holdings across consumers is not uniform. To establish the importance of tiering, we surveyed 10 large banks and thrifts and 10 small banks and thrifts listed at the bankrate.com website, which has more information on deposit rates by tier, to find average tiering levels. We found that the median levels at which tiering starts was $5,000 for MMDAs and interest checking accounts and $10,000 for CDs. Next, we used data from the 2004 Survey of Consumer Finances (SCF) to determine what fractions of households who hold those types of deposits have holdings below the tiering level. We find that about 76 percent of households with interest checking accounts have balances below the first tier cutoff of $5,000; for savings accounts and CDs, the analogous figures are 60 percent and 36 percent respectively. We conclude that the bankrate.com interest rates are economically meaningful to a large number of households.

III.   Behavior of Aggregate Deposit Rate Data

A. Overview

We begin by showing that stickiness of deposit rate data is apparent even at the aggregate level. Figures 1 through 4 illustrate the slow asymmetric adjustment of aggregate deposit rates to market rates. Figure 1 plots the time series of the overall return to M2, the heavy gray line, and returns to small time deposits and liquid deposits, the gray dashed and thin lines, along with the federal funds target rate and the three-month Treasury bill rate, the heavy and light black lines, respectively.[8] Notably, in late 2000, the federal funds target declined precipitously, while

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[8] The overall M2 rate, or "own rate," is calculated as the deposit-weighted average of rates paid on the major components of M2, which are liquid deposits, small time deposits, currency (zero), and retail money market mutual funds. The small time deposit rate is proxied by the six-month CD rate provided by Bankrate. "Liquid deposits" is the sum of checking and savings deposits, including MMDAs; this

deposit rates initially declined more slowly than the target rate but then began to keep pace with the declines in the target rate. As the target rate rose beginning in late 2004, deposit rates rose much more slowly.

To better highlight the asymmetry of deposit rate adjustment, Figures 2 through 4 break up figure 1 into periods during which the federal funds rate is falling or flat (top panels) or rising or flat (bottom panels). The top panels show that deposit rates fall by closer to the same amount than the target federal funds rate falls, and the declines begin sooner after the initial decline in the federal funds rate. The bottom panels show that the M2 own rate, liquid deposit rate, and small-time deposit rate increases by much less than the corresponding increases in the federal funds rate; moreover, the M2 own rate continues to be flat or decline even after increases in the federal funds rate have begun. In the next subsection, we document this asymmetric sluggishness more formally by estimating some simple models.

B. Evidence of Sticky and Asymmetric Adjustment in Aggregate Data

We model the time-series behavior of aggregate deposit rates as depending on their own lagged values and on market interest rates. We estimate the regressions below over a sample that begins in July, 2000, the beginning of the most recent full easing cycle, and ends in July 2007, just before the recent financial turmoil began.

The two panels of Table 1 present results of a regressions of the change in the M2 own rate as well as its major components on changes in two market rates, the effective federal funds rate and the 3-month T-bill rate. The 3-month Treasury bill rate is commonly used in the computation of the opportunity cost of holding money, as it represents the rate on an asset that

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summation is done in order to control for the effects of sweeping, described above. The liquid deposit rate is constructed based on Call Report and Bankrate data. Rates on money market mutual funds are provided by ICI.

may be a close substitute to money and thus affects the demand for deposits. The effective federal funds rate, which is highly correlated with the T-bill rate, is related to the marginal cost to the DI of an extra dollar of deposits, and thus influences the supply of deposits.[9] Both of these rates move essentially continuously and can be easily observed at a daily frequency.

In the top panel, the dependent variable is the change in the deposit rate (the overall M2 rate, the liquid deposit rate, or the small time deposit rate) and the independent variables are the lagged deposit rate, the change in the effective federal funds rate, and the change in the federal funds rate interacted with a dummy variable that is one when the change is positive and zero otherwise.[10] A significant t-statistic on this last variable indicates that the response is significantly different when the rate is rising relative to the baseline of steady or falling rates. For all three deposit rate measurements, adjustment to changes in the federal funds rate is partial, ranging from 22 basis points per percentage point of change for liquid deposit rates to 54 basis points per percentage point of change in the effective federal funds rate for small time deposits during times of stable or falling rates. In addition, for the small time rate, adjustments are significantly slower when the market rate is increasing.

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[9] On deposits subject to reserve requirements, the federal funds rate is the cost to the DI of borrowing to fulfill the requirement (or the opportunity cost of holding reserves for DIs who do not need to borrow).

[10] All t-statistics are computed using standard errors that are robust to heteroskedasticity and serial correlation in the errors.

Table 1
Sample: July 2000 – July 2007

Dependent Variable	D(M2 own rate)	D(Liquid deposit rate)	D(Small time rate)
	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Constant	-0.000 (0.003)	0.000 (0.005)	0.002 (0.005)
Lagged dep. var.	0.312** (0.051)	0.189** (0.073)	0.229** (0.082)
D(fed funds)	0.304** (0.028)	0.218** (0.035)	0.542** (0.105)
D(fed funds)+	-0.052 (0.048)	0.007 (0.073)	-0.172* (0.102)
Adjusted R^2	0.90	0.64	0.88
N	85	85	85
Constant	0.007 (0.005)	0.001 (0.006)	0.019** (0.007)
Lagged dep. var.	0.577** (0.065)	0.394** (0.080)	0.508** (0.077)
D(3-mo. T-bill)	0.219** (0.029)	0.150** (0.035)	0.428** (0.087)
D(3-mo. T-bill)+	-0.144* (0.063)	-0.026 (0.093)	-0.373** (0.122)
Adjusted R^2	0.83	0.51	0.81
N	85	85	85
* Significant at a 10% level ** Significant at a 1% level			

The bottom panel presents similar regressions using the 3-month T-bill rate as the market rate rather than the effective federal funds rate. Again, the coefficients are far below unity in all cases, indicating that rates adjust only partially at a monthly frequency, ranging from 15 basis points per percentage point of change for liquid deposit rates to 43 basis points per percentage point of change in the 3-month T-bill rate for small time deposits during times of stable or falling rates. In addition, as indicated by the negative and statistically significant coefficients for all but liquid deposits, the pace of adjustment is also asymmetric, being even slower during periods of rising rates. Again, this last effect is strongest for small time deposit rates.

Table 2 presents a summary of tests of asymmetry over different time periods and for a set of regressors that includes the effective federal funds effective rate. The regression results, not shown, indicate that the two rates have independent correlations with deposit rates over the full and early samples. In the long sample and in the sample up to 2000, the null hypothesis of

symmetric adjustment is strongly rejected for all three dependent variables relative to T-bill rates

as well as the effective federal funds rate. In the recent sample, however, the rejection of the null

hypothesis of symmetric coefficients is evident most strongly for small time deposit rates and a

bit less strongly for the overall M2 rate. As indicated by the Chow test statistics, the coefficients

were not stable across cycles.[11]

Deposit rate	Sample	H0: FF and T-Bill Coefficients Equal (F-Statistic)	H0: Fed Funds Coefficients Equal (T-Statistic)	H0: Treasury Bill Coefficients Equal (T-Statistic)
	Table 2 **Tests of Asymmetry**			
M2 Own Rate	1986:1 – 2007:7	4.13**	-2.80**	-3.66**
	1986:1 – 2000:6	4.22**	-2.79**	-3.22**
	2000:7 – 2007:7	0.52	-1.09	-2.28*
	H0: Coefficients same in early and late samples (F-statistic)	3.08*	2.41*	1.09
Liquid Deposits	1986:1 – 2007:7	4.63**	-3.09**	2.77**
	1986:1 – 2000:6	4.05**	-2.61**	*-2.75**
	2000:7 – 2007:7	0.82	0.07	-0.28
	H0: Coefficients same in early and late samples (F-statistic)	6.59**	5.16**	1.83
Small Time	1986:1 – 2007:7	3.77*	-2.63**	-3.21**
	1986:1 – 2000:6	2.91*	-2.67**	-2.62**
	2000:7 – 2007:7	4.94**	-2.49*	-3.07**
	H0: Coefficients same in early and late samples (F-statistic)	4.41**	3.60**	2.11*

* Significant at a 10% level
** Significant at a 1% level

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[11] This instability is also of interest but is beyond the scope of this paper.

IV. Deposit Rate Behavior at Individual DI Branches

A. Durations between Rate Changes

1. Results

The results of the previous section show that at the aggregate level, deposit rates are sluggish and adjust symmetrically. In this section, we look at the adjustment of deposit rates at the DI branch level. Figure 5 plots histograms, by deposit type, of the average number of weeks between interest rate changes. For each DI branch, we compute the average by dividing the number of weeks the DI branch is in the sample by the number of interest rate changes observed. The first six panels of the figure display histograms for certificates of deposits (CDs) of different maturities.[12] The last two panels present histograms for money market deposit accounts (MMDAs) and interest checking accounts, respectively. Insets in each chart give the medians of the average number of weeks between rate changes.

The first six charts show that CD rates change relatively quickly: the median number of weeks on average between rate changes ranges from 4.9 to 6.6, implying that rates change at nearly a monthly frequency. The distribution across banks is fairly tight, and few banks average more than 12 weeks between changes for CD rates.

By contrast, the last two charts show considerably longer durations between interest rate changes for MMDAs and interest-bearing checking accounts. The median average duration between price changes is about 12 weeks – or three months – for MMDAs and about 19 weeks— or nearly 5 months – for interest checking accounts. Moreover, there is much greater diversity in behavior across DI branches with these accounts than for CDs: over a quarter of DI branches

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[12] Maturities charted are 3, 6, 12, 24, 36, and 60 months. Data for 30-, 48-, and 84-month maturities are available in the dataset but are relatively sparse and are omitted, though the results are qualitatively similar to other CD rates.

change MMDA rates on average about every 6 months or less frequently, while about the same percentage of DI branches change interest checking rates on average yearly or less frequently.

2. Measuring the Degree of Deposit Rate Stickiness

As we noted above in our discussion of aggregate deposit rates, we would expect rates to move in response to changes in deposit demand and supply; thus rates would be fully flexible if they changed at least as frequently as measured demand or supply shocks. Standard models of money demand suggest that deposit demand should depend on deposit opportunity cost, the difference between a short-term interest rate and the deposit rate. Since the 3-month T-bill rate, like other deposit rates, changes nearly continuously, fully flexible deposit rates should also adjust, at least to some extent, continually.[13] Arguably, then, all deposit rates across all DI branches are sticky, since no DI branch on average changes any of its deposit rates at a weekly frequency.

It is possible that deposit demand itself responds sluggishly to changes in opportunity cost. Thus, the response of deposit rates to shocks to deposit supply may be a more accurate guide to how sticky deposit rates are. As noted above, the effective federal funds rate represents the marginal cost of an additional dollar of many kinds of transactions deposits. Moreover, bank prime lending rates, which in turn determine the pricing for many loans, are typically set as a fixed margin over the target federal funds rate. Hence the federal funds rate is an important determinant of both marginal cost and marginal revenue.

Over the 494 weeks of the sample period, the FOMC changed its target federal funds rate 39 times, implying an average time between changes of 12.6 weeks. By this standard, CD

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[13] Deposit rates need not adjust by the full amount of the shock; doing so would complete undo the demand shock. However, if there is no adjustment in deposit rates—as appears to be the case here—then the adjustment is purely in quantities, suggesting a horizontal supply curve and thus completely sticky deposit rates.

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rates are quite flexible, changing almost twice as frequently as the target federal funds rate; median MMDA rates change about as often as the federal funds rate, though there is a long tail of DIs that change rates much less frequently; and interest checking rates are relatively sticky.

If we took as a criterion for having sticky deposit rates that a DI branch changed rates less frequently than the change in the target federal funds rate, then between about 8 to 16 percent of DI branches have sticky CD rates; over 45 percent have sticky MMDA rates; and nearly 2/3 have sticky interest checking rates.

Deposit rates are generally somewhat more flexible than goods prices; Klenow and Kryvstov (2008) and Nakamura and Steinsson (2006a) found that posted goods prices on average change about every four months; depending on how one accounts for sales, this figure can rise to eight months. However, deposit rates change much less frequently than the prices of many other financial assets that are alternative stores of value, such as equities or bonds (on the secondary market), which may change minute to minute.

3. Asymmetric Response of Deposit Rates to the Federal Funds Rate

From our results with the aggregate data, we suspect that there will likely be an asymmetric response of deposit rates to changes in the target federal funds rate, with faster responses to increases in the target than to decreases. We explore this hypothesis in Figures 6 and 7. For Figure 6, we break up the sample into time periods during which the federal funds rate is rising and time periods during which it is falling; for Figure 7, we use periods during which the target federal funds rate is unchanged. The Figure 6 charts are histograms of the average number of weeks between during rates changes during periods of falling (left-hand charts) and rising (right-hand charts) target federal funds rates. It is immediately apparent that rates are much more flexible during periods of falling target rates. For CD rates, the median

number of weeks between price changes ranges between 3 to 5 weeks during periods of falling target rates and 7 to 9 weeks during periods of rising rates. In addition, the distributions are much more compressed during periods of falling rates. The same general pattern holds true for MMDAs and interest checking, though the distributions during periods of rising funds rate have much wider supports, with the average number of weeks between price changes exceeding two years for some DIs.

Figure 7 shows the results during periods where the target federal funds rate is flat. All rates show much greater median intervals between rate changes; for CDs, medians range between 8 and 16 weeks; for MMDAs, the median is 24 weeks, and for interest checking, 39 weeks. Moreover, the distributions in average rate changes across DI branches are much wider, particularly in the cases of CD rates. Given the absence of a clearly important shock to deposit supply—federal funds rate changes—it is perhaps not surprising that durations between rate changes rise, although the high value of the median suggests that other shocks to deposit demand and supply may not be quantitatively important determinants of deposit rates. However, it is not clear to us why the dispersion in the distribution of average weeks between rate changes should rise.

4. Dynamic Response of Deposit Rates to Target Federal Funds Rate Changes

The results above show relatively sluggish responses of many deposit rates to changes in the target federal funds rate. In Figure 8, we further explore the dynamic path of responses to target rate increases and decreases. Each panel on the first page of figure 8 reports the cumulative fraction of DI branches to have made any change in its deposit rate following the 25

basis point increase in the target federal funds rate at the June 1999 FOMC meeting.[14] We plot

the fractions for the 7 weeks until the next FOMC meeting (at which time there was another

increase). The charts show that only a very small fraction of DI branches make any change in

their deposit rates in the week following the meeting—nearly zero in the case of interest

checking and MMDAs, to about 20 percent for longer-maturity CD rates. For CD rates with

maturities of more than 6 months, the fractions rise by nearly 10 percent per week, so that by the

time of the next FOMC meeting, between 50 and 70 percent of DIs have adjusted their deposit

rates. In contrast, MMDA and interest checking rates are extremely sluggish to change; by the

time of the next FOMC meeting, only 10 to 20 percent of DIs have adjusted their rates.

The second page of Figure 8 shows comparable results for the January 2001 intermeeting

decrease in the federal funds rate; only four weeks are plotted, since that was the length of time

until the next regularly-scheduled FOMC meeting.[15] A somewhat larger fraction of DI branches

changed their CD rates immediately than in the case of the increase in the target rate. After four

weeks, the vast majority of branches had changed their longer-maturity CD rates. Again in

contrast, only a small fraction of branches changed their MMDA or interest checking rates in the

weeks following the change.

Taken together, the results confirm that DI branches respond both sluggishly and

asymmetrically to changes in the target federal funds rate. Moreover, the average fractions of

price changes each week are quite low—even among the deposit rates for which branches are

comparably more responsive to changes in the target federal funds rate, only about 10 percent

per week of DI branches are changing rates.

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[14] We choose that meeting because it was at the beginning of a tightening cycle; thus, deposit rates were
not still responding to previous changes in the target federal funds rate.

[15] An additional feature of this change in the target rate was that it was likely more unexpected than other
changes, since it did not occur during a regularly scheduled meeting.

5. Size of Deposit Rate Changes

We next look at the average size of rate increases and decreases. As in menu cost models, if infrequent deposit rate changes are caused by costs of changing rates, we should see relatively large rate changes. Figure 9 plots histograms of the size of rate increases (left-hand charts) and rate decreases (right-hand charts) by deposit types. As with prices of other goods, we see a fairly wide range of price changes, including some small changes. Median changes are about 20 basis points, comparable to the typical 25-basis-point sized change in the federal funds rate. The distributions of size by increases and decreases do not seem to differ in economically significant ways.

6. Differences by DI size

Finally, we look at the distribution of branch-level deposit rate changes by size of the parent DI, since larger institutions may act differently towards their customers than smaller ones. Figures 10 through 13 display the same calculations as Figures 5 through 7 and 9, but for branches belonging to the top ten banks (by total deposits) in each time period.[16] A comparison of Figures 5 and 10 shows that CD rates at large banks behave similarly to all banks; median durations between rate changes differ by a week or less. MMDA and interest checking rates appear to be noticeably more sluggish at larger banks. The median duration between rate changes for MMDA rates was 15.6 weeks at large banks and at 12 weeks at all DIs; the figures for interest checking are 25.3 and 18.8 weeks, respectively. There also appears to be considerably more dispersion in the duration of interest rate changes at larger banks.

A comparison of Figures 6 and 11 shows that the difference in the number of weeks between rate changes across periods of rising and falling federal funds rates is greater for

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[16] At the end of 2007, Call Report data showed that these institutions held about 30 percent of all interest checking deposits, half of all savings deposits, and 34 percent of all small time deposits.

branches of large DIs than for branches of all DIs. The differences in median durations for

MMDA and interest checking rates across rising and falling periods are both about 29 weeks,

compared with about 12½ and 24 weeks, respectively, for all DIs. On the whole, larger banks

raise deposit rates more sluggishly during periods of rising federal funds rates.

In contrast, a comparison of Figures 7 and 12 shows relatively little qualitative difference

in average durations of rate changes between branches of larger DIs and branches of all DIs

during periods where the federal funds rate is flat. A comparison of Figures 9 and 13 similarly

shows relatively little difference in the distribution of the size of interest rate changes between

large banks and all DIs.

Taken together with the above results for the rising and falling periods, it seems that

larger DIs respond more strongly to changes in the federal funds rate than smaller DIs, but do not

react in a different way to other deposit demand and supply shocks.

One other notable feature of these figures is that they contain far more than ten

observations, since large DIs tend to have many branches. The still-considerable dispersion in

the average duration of rate changes across DI branches thus indicates that deposit rate setting

behavior varies across branches of the same institution. One might have thought *a priori* that

there would be standard policies for each DI, and that we would therefore see clustering in the

histograms around ten of fewer points.

V. Relation to Previous Work on Deposit Rates

Several earlier papers have documented stickiness and asymmetric behavior in deposit

rates. Hannan and Berger (1991) look at monthly observations on money market deposit

accounts (MMDAs) of 398 banks from September 1983 to December 1986 from the Federal

Reserve's Monthly Survey of Selected Deposits and Other Accounts. Hannan and Berger find

that, of the 12,179 observations, 2,471 involved rate increases, 5,338 decreases, and 4,370 no rate change. They estimate multinomial logit models of the decision to change deposit rates, finding that banks have a 62 percent probability of reducing deposit rates in response to a decrease in the 3-month Treasury bill rate of 29 basis points (the mean absolute change over their sample), but only a 39 percent probability of raising rates in response to an equal-sized increase. They further show that banks in more concentrated markets have more rigid prices; larger banks have more flexible prices; and banks with larger market customer bases have less rigid prices.

Neumark and Sharpe (1992) look at the same survey, using monthly data on six-month certificates of deposits (CDs) and MMDAs for 255 banks from October 1983 through November 1987. They estimate a partial adjustment model, in which in the long run deposit rates are assumed to be proportional to the six-month Treasury bill rate. The speed of adjustment is allowed to depend on concentration ratios and other market characteristics. They find that MMDA rates appear to adjust more sluggishly than CD rates. When rates are constrained to adjust symmetrically, concentration ratios appear to affect the long-run level of the markup of deposit rates over Treasury bill rates, but have little impact on the speed of adjustment. They estimate switching models to test for asymmetry in deposit rate setting. They find that rates adjust more slowly upwards than downwards, with banks in more concentrated markets being slower to adjust deposit rates upwards and faster to adjust deposit rates downwards. The long-run equilibrium markup is lower when asymmetry is allowed for.

Diebold and Sharpe (1990) examine the dynamic relationships among retail (deposit) rates and wholesale (federal funds and Treasury bill) rates. For deposit rates, they use weekly data on 6-month CDs, MMDAs, and super NOW (interest checking) accounts from Bank Rate Monitor (the predecessor of bankrate.com) from October 5, 1983 to December 25, 1985. The

rates are averaged over 25 major banks and 25 major thrift institutions. They find that wholesale

rates generally Granger-cause retail rates, but the latter do not Granger-cause the former. Retail

rates have hump-shaped and persistent responses to innovations in wholesale rates. It takes

about 2 weeks for one quarter of the response of retail rates to a shock to wholesale rates to

manifest itself; about 5 weeks for half of the response, and about 10 weeks for three quarters of

the response.

In the current paper, we also find sluggish and asymmetric adjustment of deposit rates to

changes in the federal funds rate. We newly document that there is a fairly wide dispersion in

average duration between interest rate changes across institutions and in the size of interest rate

changes.

VI.   Implications for Models of Price Adjustment

In this section, we first compare the facts about deposit rate changes discussed above

with the facts about price changes other researchers have discovered. We then discuss the

implications of the pattern of deposit rate changes for price setting models.

A. Comparison with Microeconomic Data on Price Adjustment

Our work is also related to papers that document price stickiness at the microeconomic

level. That work has found a high degree of diversity in the duration of price changes across

goods. Cecchetti (1985) found that magazine prices change every 1½ to 3¼ years. Lach and

Tsiddon (1991) showed that food prices in Israeli supermarkets change every 1.9 months to 1.6

months during periods of high inflation. Kashyap (1995) reported that the average time between

price changes on retail goods in catalogs 15 months, with longer intervals not unusual. Carlton

(1986) show that data from Stigler and Kindahl (1970) on individual transactions prices for

industrial goods indicate average durations of price stickiness of 6.5 months, with, again, many

prices changing even less frequently.. Levy and Young (2004) document that the price of a 6.5

ounce bottle of Coca Cola remained at 5 cents for more than 70 years (1886-1959).

Several more recent studies have used the data underlying the computation of the

consumer price index to show price stickiness for a broader range of goods. Bils and Klenow

(2004) calculate an average duration of price changes of 4.3 months, or 5.5 months including

sales. The duration of price stickiness again differs substantially across price categories.

Nakamura and Steinsson (2006a) find slightly different results. They document that: the median

duration of price changes to be 11 months, or 8.7 months for finished goods prices[17]; one third of

price changes are price decreases.; the frequency of price increases responds to inflation, while

frequency of price decreases and size of price increases and decreases does not; price changes

are highly seasonal (largest in the first quarter, smallest in the fourth quarter); and the hazard

function for price changes is downward sloping for first few months, and flat thereafter, except

for a large spike at 12 months in consumer services. Nakamura and Steinsson (2006b) use the

results of this paper to evaluate the ability of different kinds of price adjustment models to fit the

data. Klenow and Kryvtsov (2005) find a wide distribution of price changes, with some prices

changing monthly while others taking more than 5 years to change.

In our current paper, we find that deposit rates change relatively more frequently than

prices, with median durations of price changes across DIs of about 1 month for CD rates, 3

months for MMDAs, and nearly 5 months for interest checking accounts. The frequency of rate

increases or decreases is linked to the frequency of target federal funds rate changes; since rates

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[17] Part of the difference between their results and those of Bils and Klenow arises from the definition of a
sale or a temporary price change.

decrease more rapidly than they increase, in long-run equilibrium it is likely that interest rate increases will be more frequent than decreases.

Table 3 compares facts about changes in price setting reported in the papers discussed above with facts about deposit rate changes uncovered in this paper and previous papers on deposit rates; the table adapts and expands Table 8 in Klenow and Kryvstov (2008). The leftmost column presents facts; the second and third columns state whether those facts are present in goods and services prices or deposit rates, respectively. We see that, in many respects, prices and deposit rates behave in similar ways: both show frequent changes; the average absolute value of changes is large; there are many changes that are small in size; and the duration of price or deposit rate changes varies over time (for deposit rates, we see that in the differences across episodes of monetary policy tightening and easing).

There is at least one important feature of deposit rate behavior that does not appear to be matched by similar behavior in other prices: deposit rates are upwards-sticky but downwards-flexible, while price changes appear to be more symmetric. There are several other facts about deposit rates for which we are not aware of corresponding evidence for prices: the frequency of price changes appears to differ by bank size; there appears to be substantial variation in the frequency of changes across DIs, as well as across branches of the same DI; increases and decreases in marginal cost—in the case of deposit rates, the federal funds rate—appear to affect deposit rates differently; and there appear to be substantial differences across product type within the same bank.

There is also a set of facts about price changes that either is not matched by deposit rates, or for which we have not yet uncovered evidence on the latter. Deposit rates do not appear to have a constant hazard rate over time: changes are most likely to occur right after a federal funds

rate change. We have not measured whether the size of deposit rate changes grows with the duration since the last change; similarly, we do not know whether the intensive margin dominates the variance of inflation, or whether the frequency of changes varies with inflation (though it would be difficult to disentangle the latter from the frequency of change of the federal funds rate).

On the whole, this comparison suggests to us that deposit rates and goods and services prices behave sufficiently similarly that the new facts about deposit rates we have reported may be helpful in improving models of price setting. The reverse is also true: models of price setting may be useful in helping us understand how deposit rates are set.

Table 3: Facts about Prices and Deposit Rates		
Fact	Prices	Deposit Rates
Frequent changes	Yes	Yes
Large average absolute change	Yes	Yes
Many small changes	Yes	Yes
Variable duration over time	Yes	Yes
Flat hazard rate	Yes	No
Size of price changes does not increase with duration	Yes	Unknown
Intensive margin dominates the variance of inflation	Yes	Unknown
Frequency of price/rate increases and decreases moves with inflation	Yes	Unknown
Frequency of price/rate changes different for increases, decreases	No	Yes
Frequency of price/rate change differs by firm/bank size	Unknown	Yes
Frequency of price/rate changes differs by increases, decreases in marginal cost	Unknown	Yes
Frequency of price/rate changes across products differs by firm/bank	Unknown	Yes
Variable duration across firm/bank	Unknown	Yes

B. Evaluating Models of Price Adjustment

We can use these facts about deposit rates to evaluate how well models of price adjustment can explain changes in deposit rates, following the approach of Nakamura and Steinsson (2006a) and Klenow and Kryvstov (2008) (hereafter KK). In table 4, we again build on table 8 in the latter paper. The first column of table 4 presents the facts about deposit rates which received an answer of "yes" in the third column of table 3 above. The remaining eight columns state, respectively, whether those facts are matched by predictions in models of menu costs; Dotsey, King and Wolman (1999); Calvo (1983); Taylor (1977); Gertler and Leahy (2008); Kiley (2007); Lucas (1972); and Mankiw and Reis (2002).

The upper left 4x4 portion of the matrix is taken directly from KK. They solve and simulate the four models they discuss, which allows them to make definitive statements about the properties of those models. To try to fill in the rest of the entries of the table, we take a less ambitious approach in this paper. We simply note whether the model appears to permit the particular deposit-rate fact ("possible") or not ("no"); whether it is unclear ("unknown"); or whether that particular fact is not in the model setup ("not modeled"). We briefly and qualitatively discuss each of the eight models and the results below, and then present an overall discussion of the models.

Fact	Menu Cost	Dotsey-King-Wolman	Calvo	Taylor	Gertler-Leahy	Kiley	Lucas	Mankiw-Reis
Frequent changes	Yes	Yes	Yes	Yes	Possible	Possible	Possible	Possible
Large average absolute change	Yes	No	Yes	Yes	Unknown	Unknown	Unknown	Unknown
Many small changes	No	Yes	Yes	Yes	Possible	Possible	Possible	Possible
Variable duration over time	Yes	Yes	Yes	No	Possible	Possible	Possible	Possible
Frequency of rate changes different for increases, decreases	No	No	No	No	No	No	No	No
Variable duration across bank	Possible	Possible	Possible	No	Possible	Possible	Possible	Possible
Frequency of rate changes differs by increases, decreases in marginal cost	No	No	No	No	No	No	No	No
Frequency of rate changes differs by bank size	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled
Frequency of rate changes differs by product within bank	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled	Not modeled

Table 4: How do Price Adjustment Model Predictions Fit Deposit Rate Facts?

Menu Cost Models

In menu cost models monopolistically competitive firms face a fixed cost of changing prices (the menu cost), assumed to be the same for all firms.[18] Firms' optimization leads to a desired relative price. While shocks may cause the desired price to change, firms will not change their prices unless the benefits to doing so exceed the menu cost.

KK calibrate the Golosov and Lucas model, and find that it can produce frequent changes in prices, a large average absolute change, and variability in the duration of price changes over time. They find that it cannot produce many small price changes; intuitively, firms will only change their prices when the benefits from doing so are sufficiently large, implying that price changes should, on average, be large.

We additionally conjecture that it is possible for this model to exhibit variable durations in price changes across firms. Variations in the frequency of shocks across firms, or in parameters of the firms' profit functions (other than the menu cost) appear to be able to deliver such a result. The models appear to be symmetric, implying that the frequencies of price increases and decreases and the response to increases and decreases in marginal cost are the same. The model does not attempt to account for differences by firm size or across different products sold by the same firm.

Dotsey-King-Wolman

This is also a menu cost model; the key difference from the two models above is that the fixed cost of changing prices differs across both firms and time. KK's simulations indicate that, as in the Mankiw and Golosov-Lucas models, this model permits frequent price changes and a variable duration in price changes over time. Unlike those other models, this model does not

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[18] Different aspects of the response of firms to costs of changing prices have been developed by Barro (1972), Rotemberg (1982), Mankiw (1985), and Golosov and Lucas (2008).

display a large absolute change. It does allow for the possibility of many small price changes, arising from the fact that some firms' menu costs are very small.

The model again appears to be symmetric; it does not explicitly attempt to model differences in price change frequency by firm size (though it could likely be easily modified to do so), and does not attempt to model differences in frequency across products within the same firm.

Calvo

Calvo (1983)'s setup assumes that each monopolistically competitive firm has a constant hazard rate for being able to change prices; that is, individual prices are assumed fixed until a Poisson opportunity arises to change prices. Consequently, the timing of price changes is not related to other determinants of the firms' profit function (though the size of changes will be). KK's simulations show that the model can generate frequent changes; a large absolute average change; many small changes, and a variable duration of changes over time.

We believe that the model should also be able to generate a variable observed duration in rate changes across banks, since over short time samples, even banks that have the same Poisson parameters will have different realizations of those parameters. The model again appears to be symmetric to us across increases and decreases in either rates or marginal cost; and the model does not attempt to account for possible differences in rate changes by bank size or across different products within the same bank.

Taylor

In the Taylor framework, firms are permitted to change prices after a fixed and deterministic number of periods. As with the Calvo model, then, the timing of price changes is not related to other determinants of the firms' profit function. KK's simulations show that the

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model can generate frequent changes in prices, many small price changes, and a large average absolute price change. It cannot show a variable duration in price change over time, by construction.

We similarly conjecture that the model cannot show a variable duration in price change across banks, since banks are assumed symmetric and have fixed prices for the same number of periods. We believe that the model is symmetric, and, as in other cases discussed above, does not attempt to account for differences across bank size or product.

Gertler-Leahy

In this (S,s) model of price adjustment, firms both face idiosyncratic costs of changing prices and idiosyncratic shocks to their profit functions. As the authors note, the model shares many of the properties of that of Golosov and Lucas, but has an additional layer of flexibility due to the idiosyncratic shocks. Thus, we conjecture that, unlike the Golosov and Lucas model, this model may be able to generate many small price changes over time.

Lucas

In this model, a set of perfectly competitive firms imperfectly observe the price level and other aggregate variables. Thus, although they are able to adjust prices continuously, the amount by which prices are adjusted will not correspond to the full-information optimum, leading to apparent sluggishness in price adjustment. Since prices can adjust continuously, this leads us to believe that both frequent price changes, and frequent small price changes are possible. The duration of price changes over time could vary in response to external shocks or across firms. The model appears to us to be symmetric, and, as in all other cases discussed above, does not attempt to account for differences across bank size or product.

Kiley

This paper effectively attempts to combine the Calvo (1983) and Lucas (1972) papers. As in the Calvo model, firms are able to adjust their prices with a constant probability. As in the Lucas model, firms imperfectly observe aggregate variables, including the price level, and thus face an information extraction problem. We conjecture that this model shares the same properties as the Calvo and Leahy models, when those models have similar predictions.

Mankiw-Reis

In this model, firms are able to change prices continuously, but only update their information on the price level and other aggregate variables with some constant hazard rate. We conjecture that this model shares many of the predictions of the Calvo model (at least with respect to the facts on rate changes in table 4).

Summary and Discussion

As might be expected, no single model fits all of the facts on deposit rate changes listed in the first column of table 4. The last four rows of the table present new facts for deposit rates for which there are as yet no corresponding evidence on prices. Although most of the price-setting models allow for variable durations in price setting across banks, most do not allow for increases and decreases in marginal cost to have asymmetric effects on prices, and none attempts to models differences across product lines or firm or DI size. It may be the case that price-setting models that fit these facts will also do better in fitting facts on prices that have already been established.

There are two important facts about deposit rate changes that no model fits: the frequency of rate changes is different for rate increases and decreases; and the response to changes to the federal funds rate (an element of marginal cost) also differs. These asymmetries are large, and are evident at the aggregate level. While it may be possible to alter one of the existing price-setting models to allow for such asymmetries, these results suggest that new models will likely be needed to understand deposit-rate setting.

Although we generally subscribe to the idea that models should be evaluated based on their predictions rather than their assumptions, some of the assumptions of the models presented here may more easily fit more general models of price adjustment than they do models of deposit rate changes. In particular, models with imperfect information by the firm seem more difficult to justify in this context. Arguably the most important aggregate variable to deposit pricing is the federal funds rate. Many DIs actively trade in the federal funds market on a daily basis; moreover, when the Federal Reserve changes its target for the federal funds rate, the effective federal funds rate adjusts almost immediately (at least over this sample period, which is prior to the recent financial crisis), as do prime lending rates. Hence it seems quite implausible to assume that banks are failing to adjust prices because they are unaware of changes in the federal funds rate.

Finally, we note one other significant puzzle about deposit rates. As document in this paper and previous ones, deposit rates can remain stable for long periods of time. Rates of return on many other assets change continuously, including returns on Treasury bills and other close substitutes to deposits. It is unclear to us why deposit rates exhibit so much inflexibility when compared with other financial market prices.

VII. Conclusion

We use a panel dataset of over 2,500 branches of about 900 depository institutions (DIs) observed weekly over ten years to examine the dynamics of changes in interest rates on interest checking accounts, MMDAs, and nine different maturities of CDs. We have six key findings. First, some deposit rates are more flexible than others. CD rates are quite flexible, with the median branch changing such rates every 5 weeks on average, while MMDA and interest checking rates show much more inertia, changing every 12 weeks and 18 weeks on average, respectively. Second, the frequency of rate changes exhibits considerable dispersion for some types of deposits, with about a quarter of institutions changing interest checking rates twice a year or less frequently. Third, deposit rate changes are asymmetric: rates adjust about twice as frequently during periods of falling target federal funds rate than rising ones. Fourth, rates are uniformly quite sticky during periods when the federal funds rate is flat, with median durations between price changes ranging from 8 weeks to 39 weeks. Fifth, the median size of rate changes is 20 basis points, comparable to the typical 25 basis point change in the target federal funds rate; the distribution of average decreases and increases is about the same, and is relatively dispersed, with many small changes of a few basis points. Sixth, there is greater upward stickiness in rates on interest checking and money market accounts for branches of large DIs than for smaller ones.

These results taken together confirm and extend the earlier findings of Hannan and Berger (1990), Diebold and Sharpe (1990), and Neumark and Sharpe (1992) on smaller and shorter datasets. Except for the findings of asymmetry, the facts here are comparable to the facts that others have found for price changes on goods and services, although the durations between rate changes are generally slightly shorter than the durations between price changes found by

Bils and Klenow (2006), Nakamura and Steinsson (2006a), and others. Our data also allows us to measure the dispersion of changes in rates for a single deposit type across many firms; we find that for some rates the amount of dispersion is high, suggesting that models with identical firms may fail to capture important dynamics of price setting and that models with heterogeneity may better capture currently existing facts on prices.

We compare nine facts about deposit rates to predictions from eight different models of price adjustment. We find that while several of the models fit more than half of the facts, no model appears to predict the asymmetric behavior of deposit rates. We also think that some of the models that rely on imperfect information at the firm level are unlikely to be good fits for this area, since there is substantial evidence that banks are rapidly aware of changes in the federal funds rate. Any model of deposit rate setting should also attempt to explain why deposit rates are sticky while many other financial market prices are highly flexible. Perhaps new models in which consumers, rather than firms, are inattentive about deposit rates and other financial variables would help explain the behavior of deposit rates.

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Figure 1
Market Rates and Aggregate Rates on M2 and Its Major Components
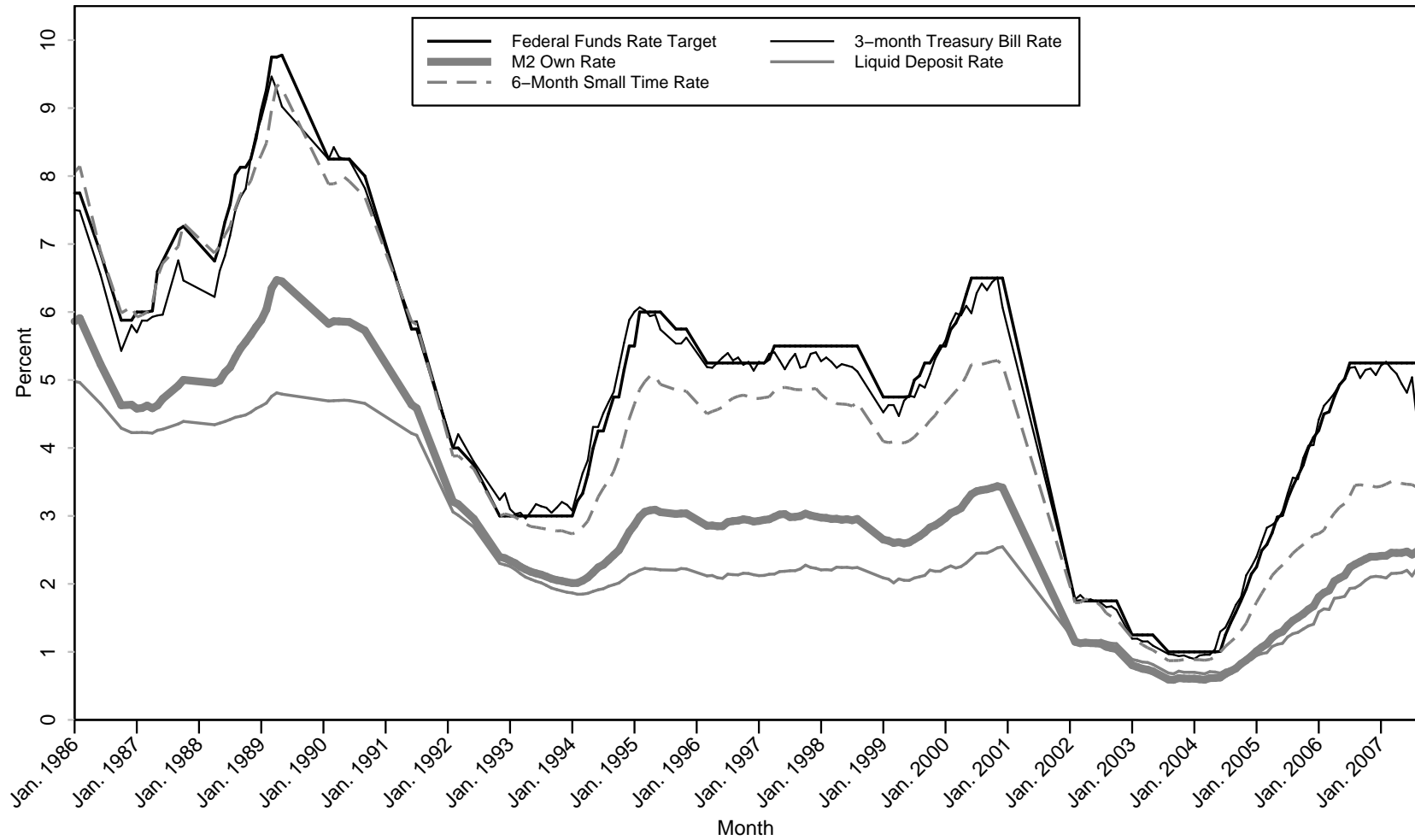
Figure 2A
M2 Own Rate and Federal Funds Rate Target When Funds Rate Target is Falling or Flat
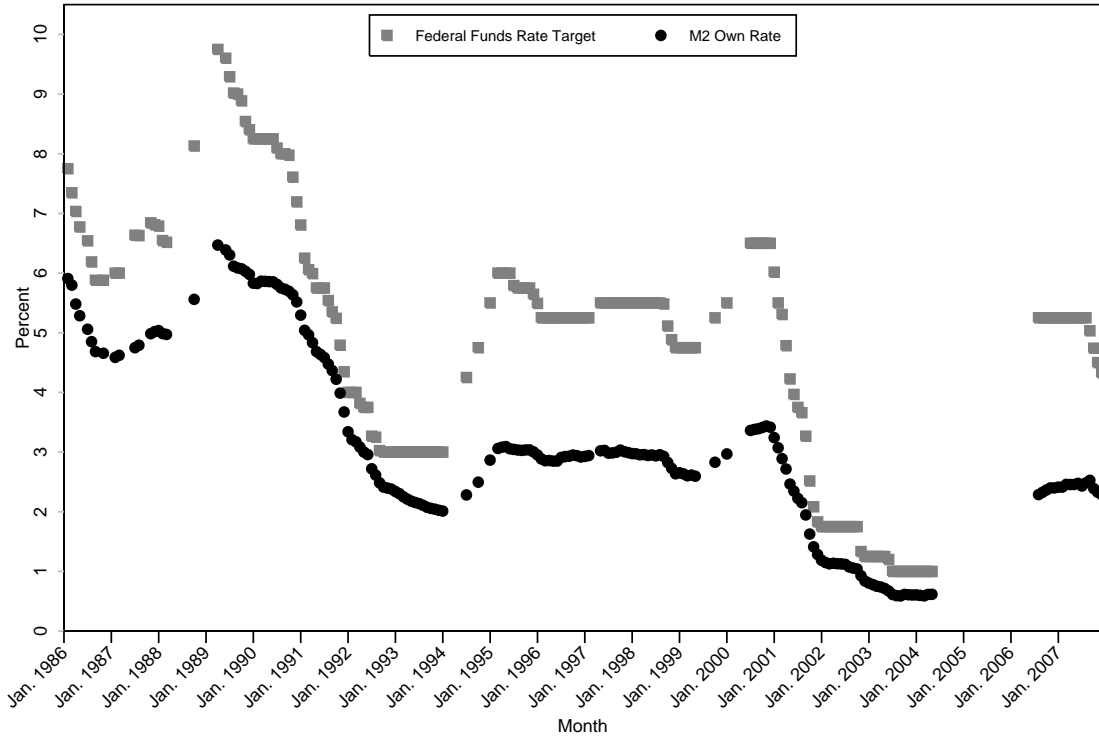
Figure 2B
M2 Own Rate and Federal Funds Rate Target When Funds Rate Target is Rising or Flat
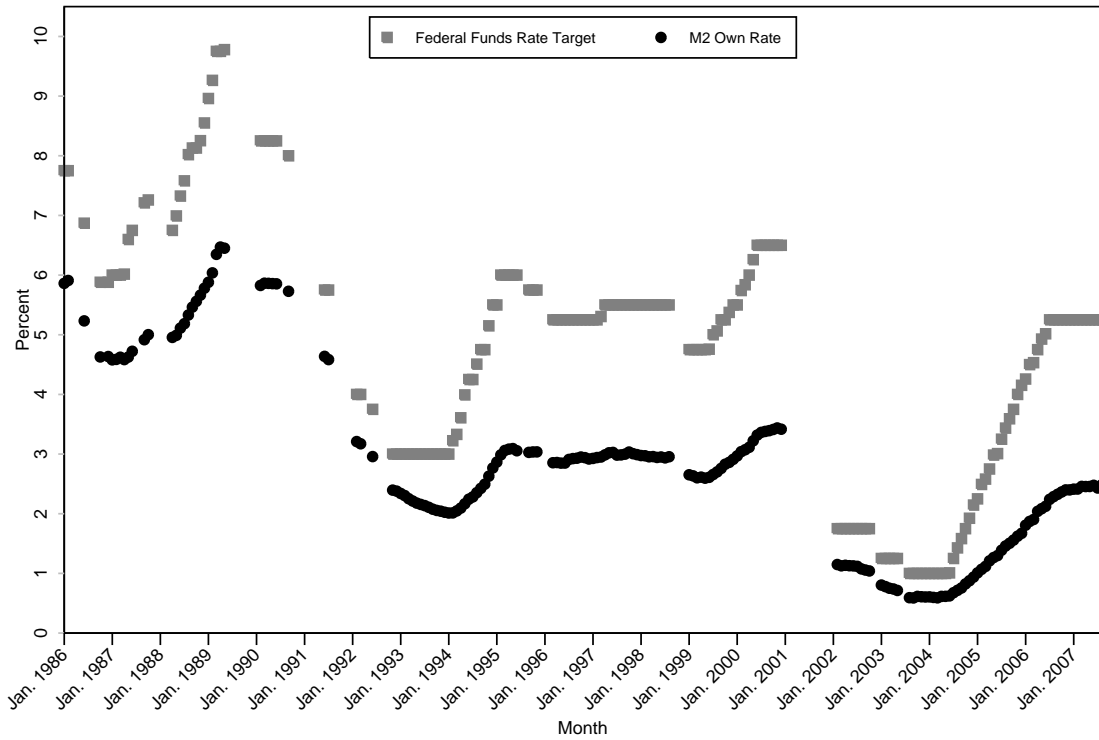
Figure 3A

Liquid Deposits Rate and Federal Funds Rate Target When Funds Rate Target is Falling or Flat
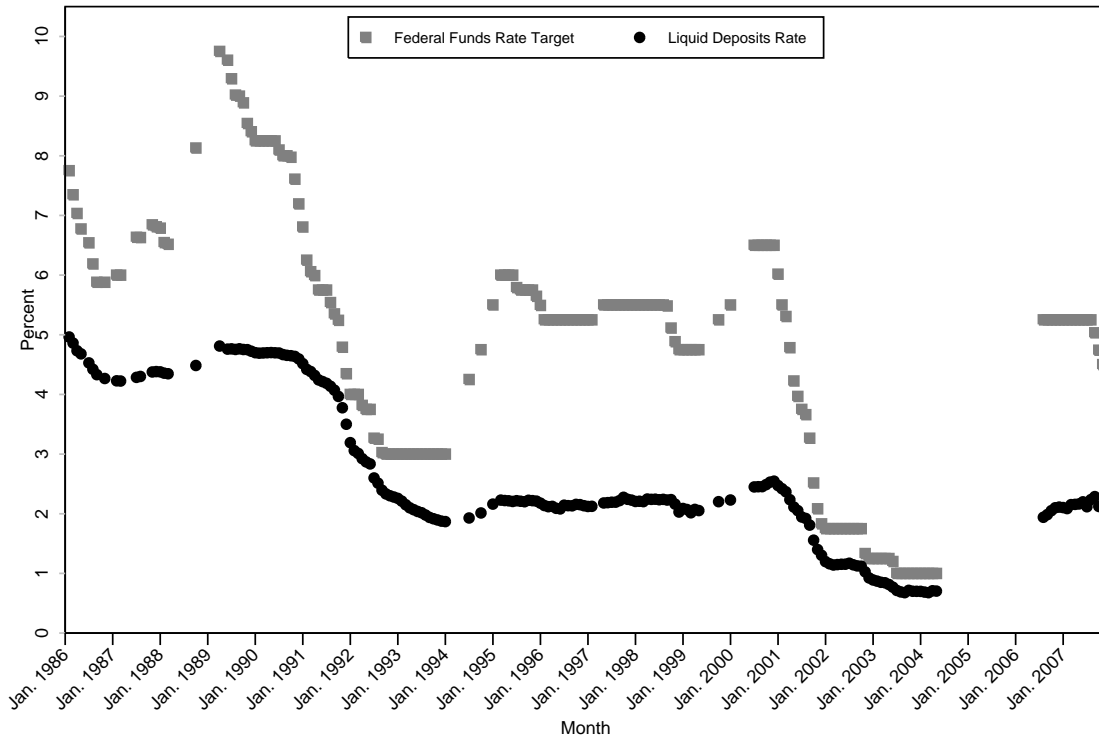
Figure 3B

Liquid Deposits Rate and Federal Funds Rate Target When Funds Rate Target is Rising or Flat
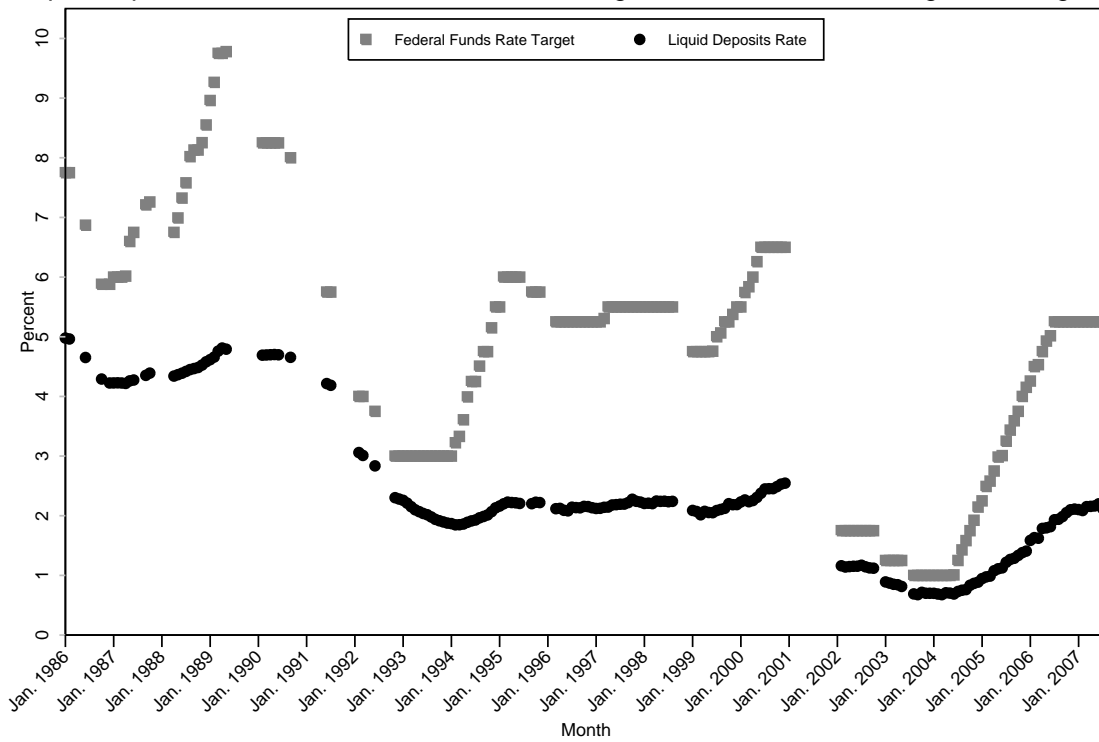
Figure 4A
6–Month Small Time Rate and Federal Funds Rate Target When Funds Rate Target is Falling or Flat
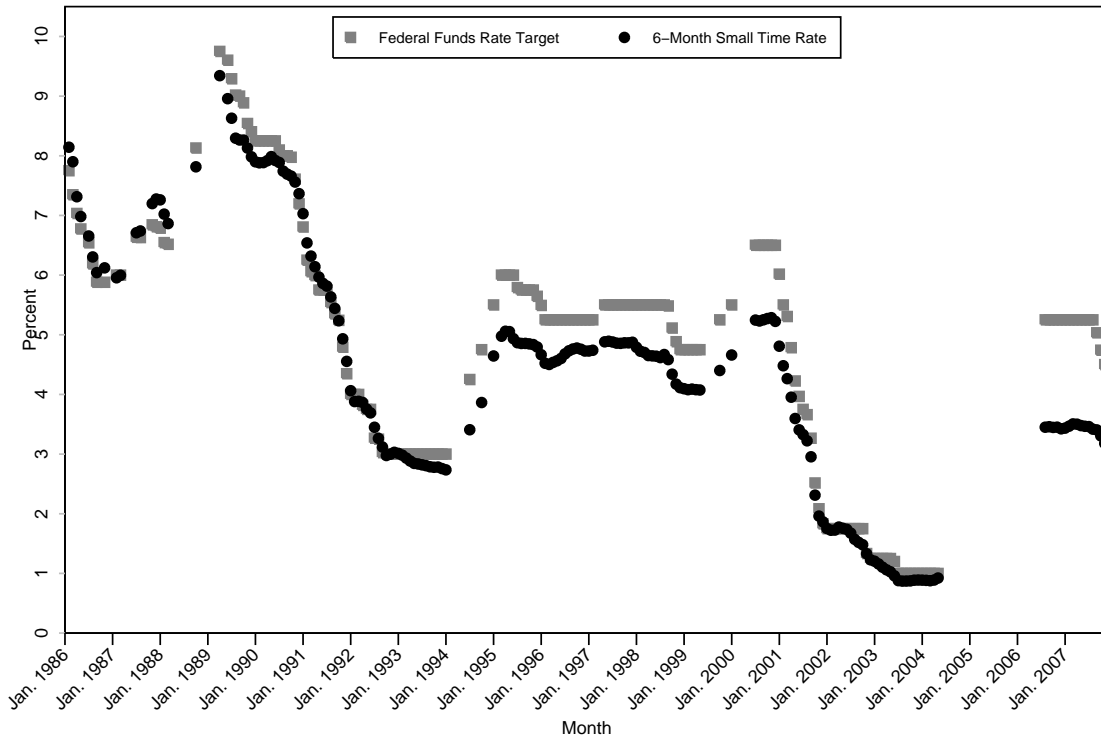
Figure 4B
6–Month Small Time Rate and Federal Funds Rate Target When Funds Rate Target is Rising or Flat
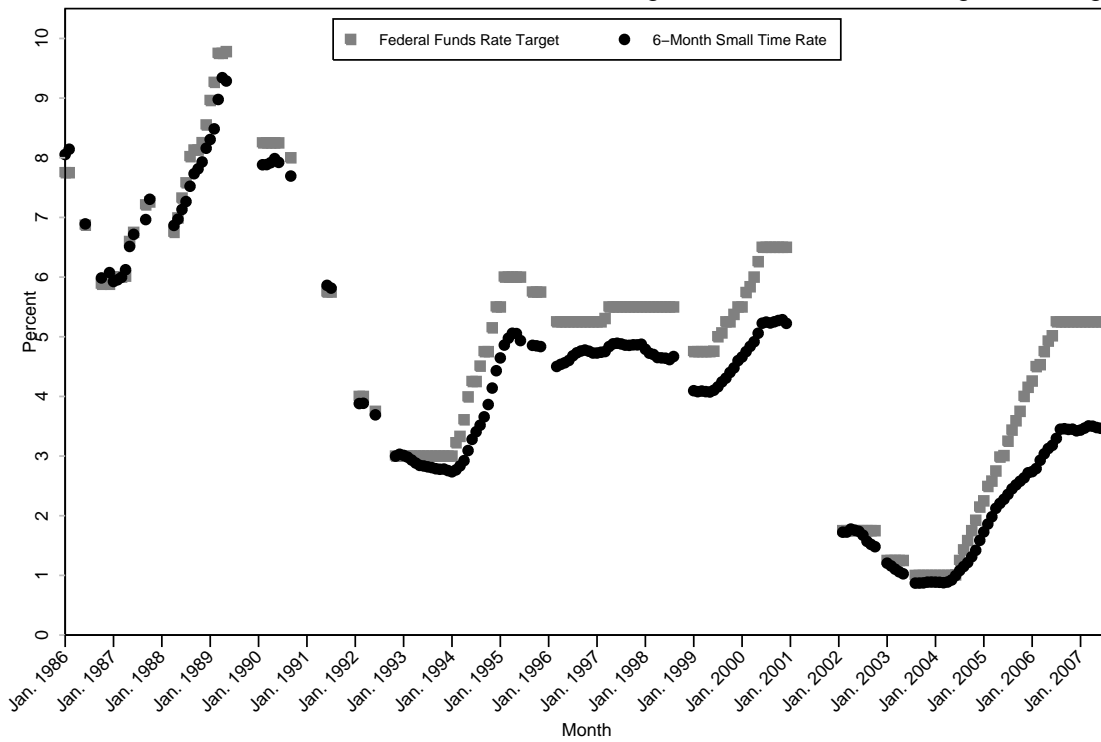
Figure 5: Distribution of average number of weeks between rate changes

Weeks Between Rate Changes: 3-month CDs

Median = 6.6 weeks

Number of DI branches / Weeks Between Rate Changes

Weeks Between Rate Changes: 6-month CDs

Median = 5.4 weeks

Number of DI branches / Weeks Between Rate Changes

Weeks Between Rate Changes: 12-month CDs

Median = 5.0 weeks

Number of DI branches / Weeks Between Rate Changes

Weeks Between Rate Changes: 24-month CDs

Median = 4.9 weeks

Number of DI branches / Weeks Between Rate Changes

Weeks Between Rate Changes: 36-month CDs

Median = 5.0 weeks

Number of DI branches / Weeks Between Rate Changes

Weeks Between Rate Changes: 60-month CDs

Median = 5.0 weeks

Number of DI branches / Weeks Between Rate Changes

Weeks Between Rate Changes: MMDA

Median = 12.0 weeks

Number of DI branches / Weeks Between Rate Changes

Weeks Between Rate Changes: Interest Checking

Median = 18.8 weeks

Number of DI branches / Weeks Between Rate Changes

Note: These charts plot the distribution of the average number of weeks between rate changes, by depository institution (DI) branch. For example, on the chart for interest checking, about 110 DI branches averaged about 5 weeks between price changes.

Figure 6: Distribution of average number of weeks between rate changes for periods where the target federal funds rate is rising or falling

Weeks Between Rate Changes: Funds Rate Falling
3-month CDs

Median = 4.9 weeks

Weeks Between Rate Changes: Funds Rate Rising
3-month CDs

Median = 9.4 weeks

Weeks Between Rate Changes: Funds Rate Falling
6-month CDs

Median = 3.5 weeks

Weeks Between Rate Changes: Funds Rate Rising
6-month CDs

Median = 7.4 weeks

Weeks Between Rate Changes: Funds Rate Falling
12-month CDs

Median = 3.4 weeks

Weeks Between Rate Changes: Funds Rate Rising
12-month CDs

Median = 6.7 weeks

Weeks Between Rate Changes: Funds Rate Falling
24-month CDs

Median = 3.3 weeks

Weeks Between Rate Changes: Funds Rate Rising
24-month CDs

Median = 7.4 weeks

Weeks Between Rate Changes: Funds Rate Falling
36-month CDs

Median = 3.5 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Weeks Between Rate Changes: Funds Rate Rising
36-month CDs

Median = 7.7 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Weeks Between Rate Changes: Funds Rate Falling
60-month CDs

Median = 3.5 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Weeks Between Rate Changes: Funds Rate Rising
60-month CDs

Median = 7.7 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Weeks Between Rate Changes: Funds Rate Falling
MMDA

Median = 11.6 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Weeks Between Rate Changes: Funds Rate Rising
MMDA

Median = 23.0 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Weeks Between Rate Changes: Funds Rate Falling
Interest Checking

Median = 21.2 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Weeks Between Rate Changes: Funds Rate Rising
Interest Checking

Median = 45.0 weeks

Number of DI branches vs *Weeks Between Rate Changes*

Note: These charts plot the distribution of the average number of weeks between rate changes, by depository institution (DI) branch.
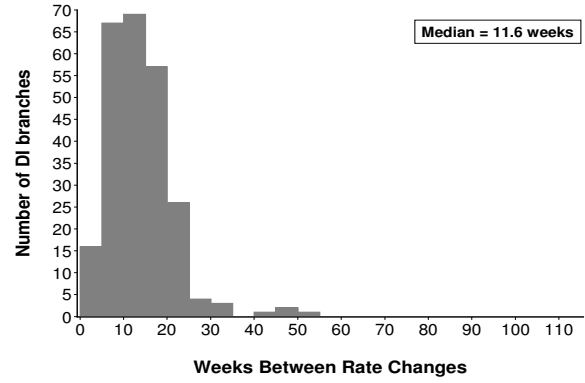For example, on the chart for interest checking when funds rate is falling, about 50 DI branches averaged about 5 weeks between price changes.
The averages are computed over periods during which the target federal funds rate is rising and periods during which it is falling.

Figure 7: Distribution of average number of weeks between rate changes for periods where the target federal funds rate is flat
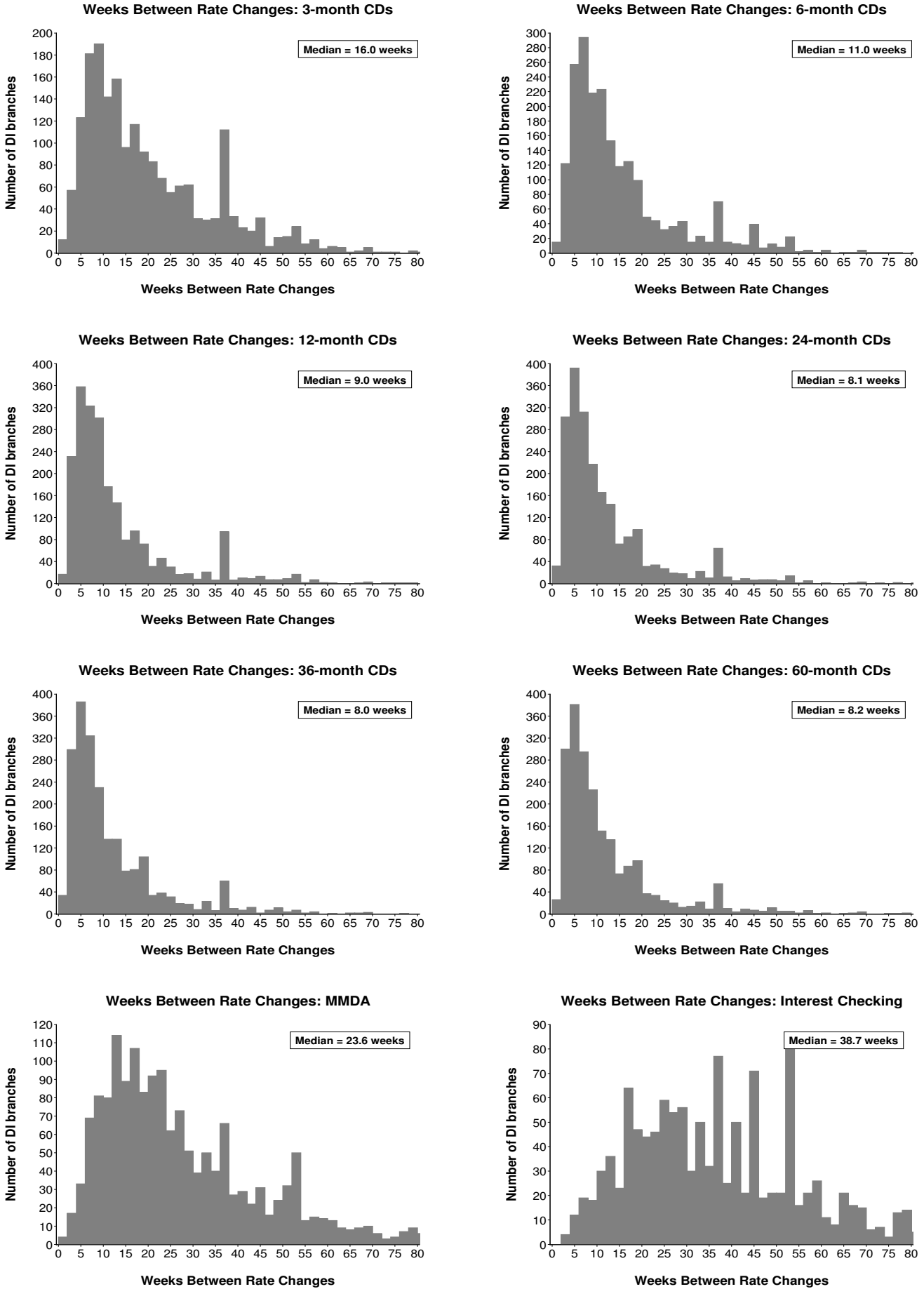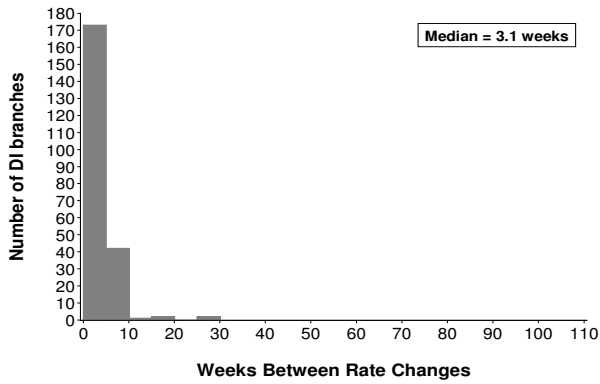
Note: These charts plot the distribution of the average number of weeks between rate changes, by depository institution (DI) branch. For example, on the chart for interest checking, about 12 DI branches averaged about 5 weeks between price changes.

Figure 8: Cumulative weekly response of DI branches to target federal funds rate changes
1999: Increase in target rate
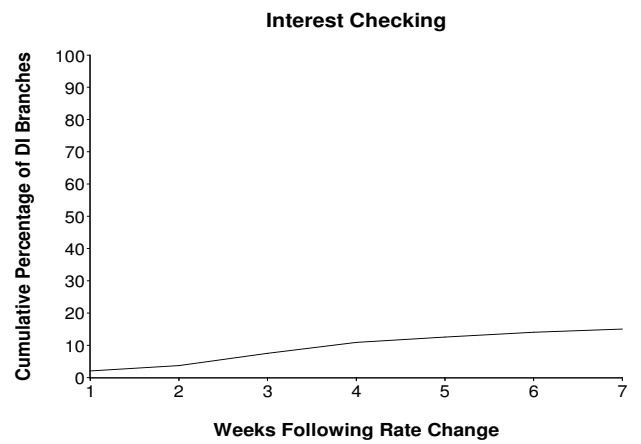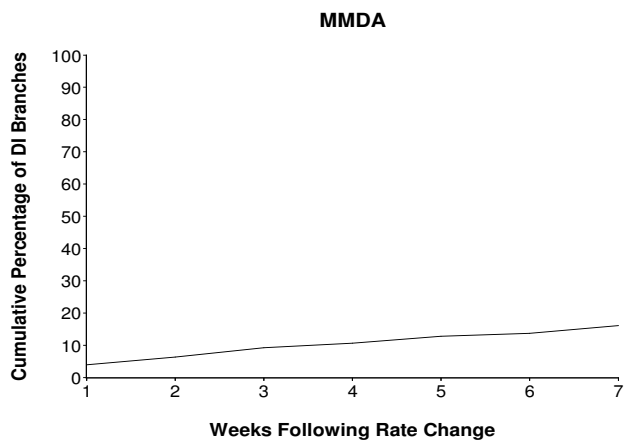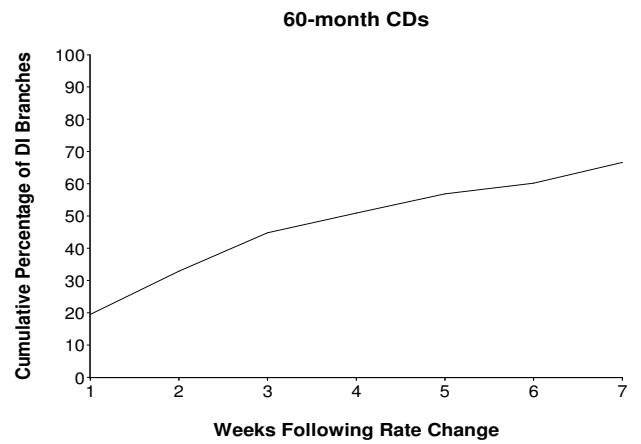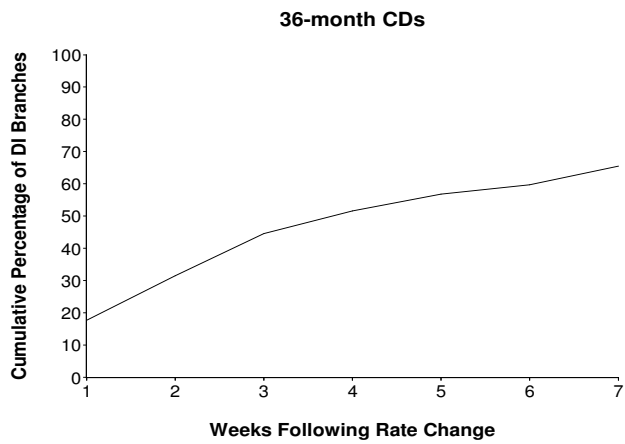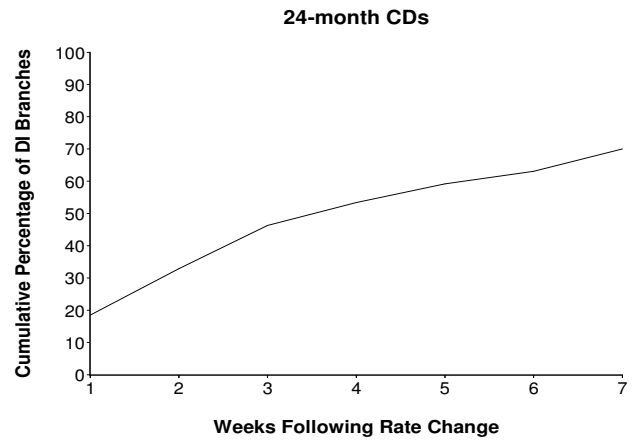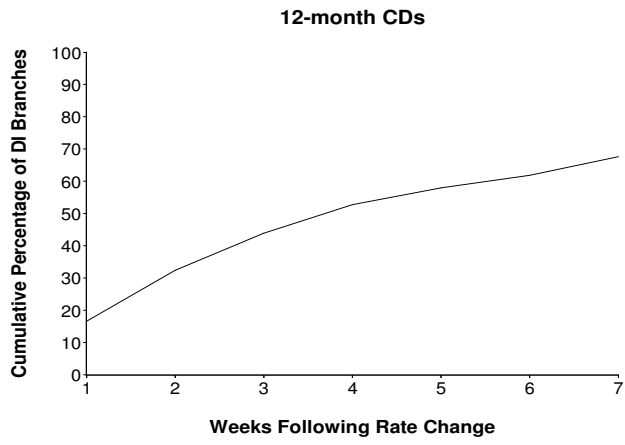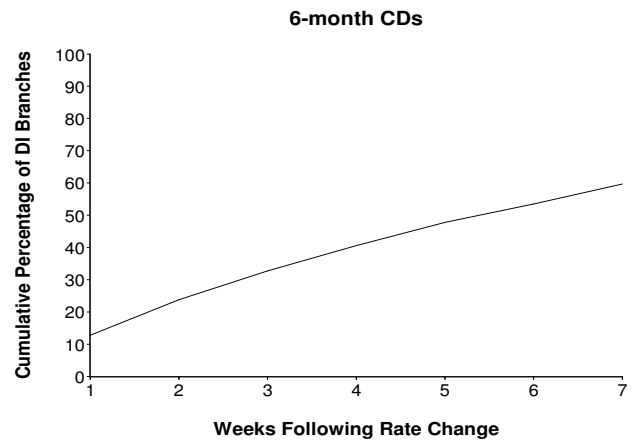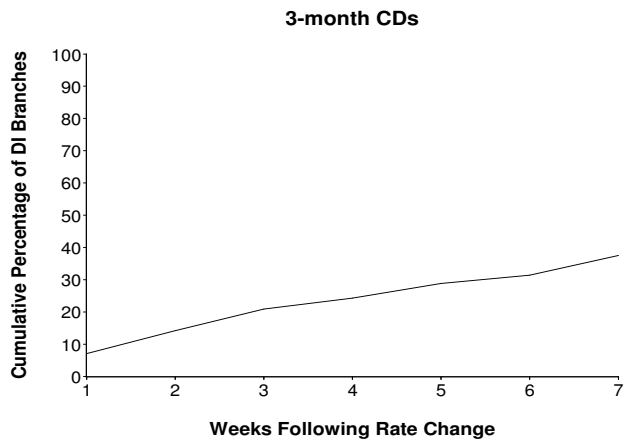
2001: Decrease in target rate

3-month CDs

6-month CDs

12-month CDs

24-month CDs

36-month CDs

60-month CDs

MMDA

Interest Checking
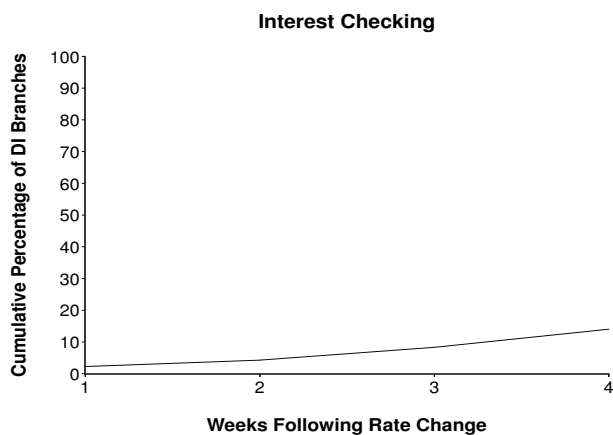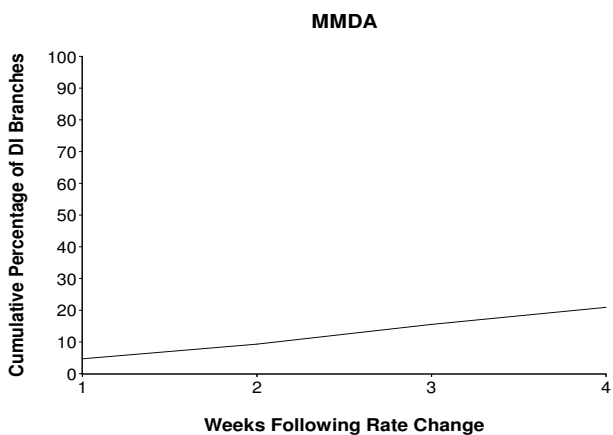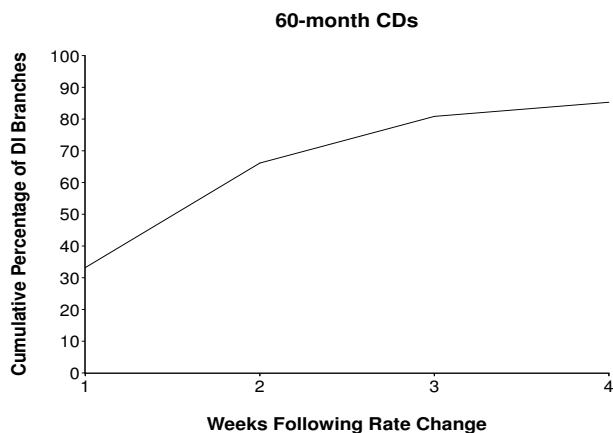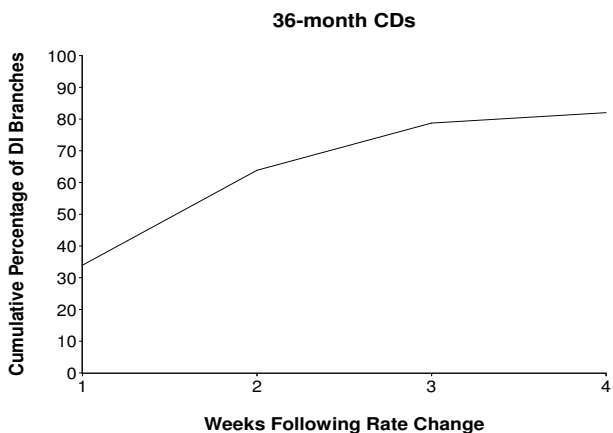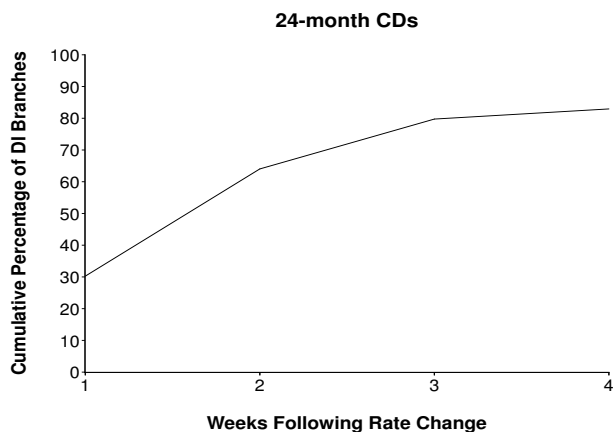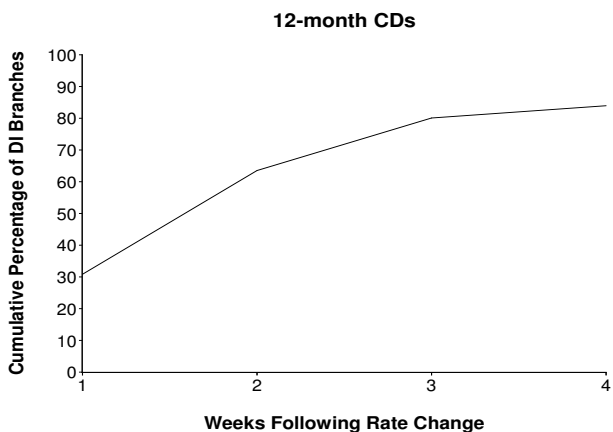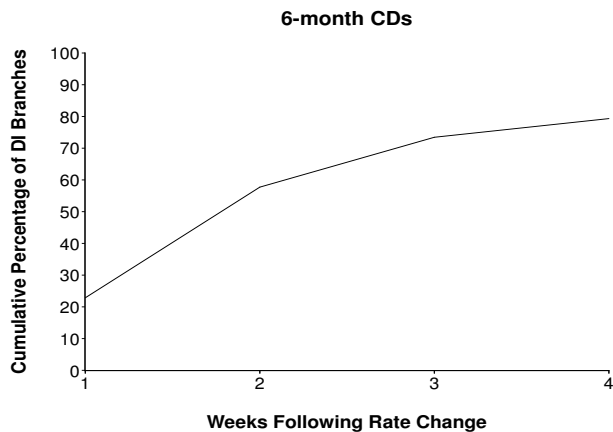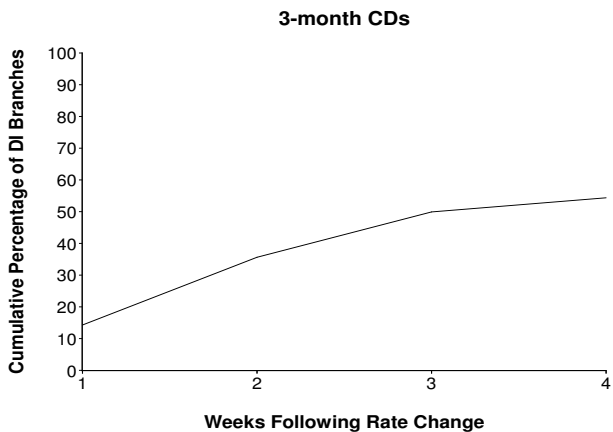
Note: Each point plots the cumulative fraction of DI branches to have changed its deposit rate after a target federal funds rate change.

Figure 9: Average size of rate increases and decreases
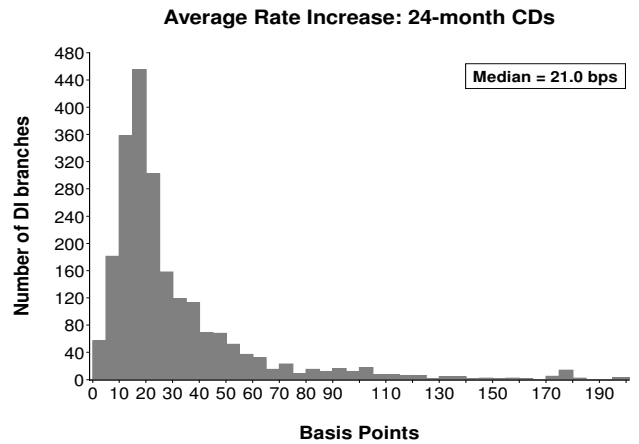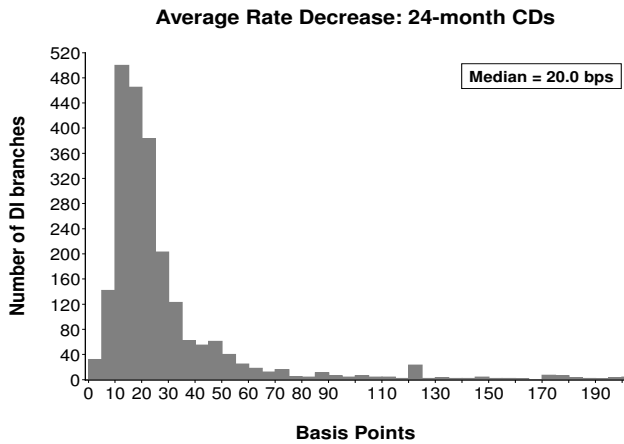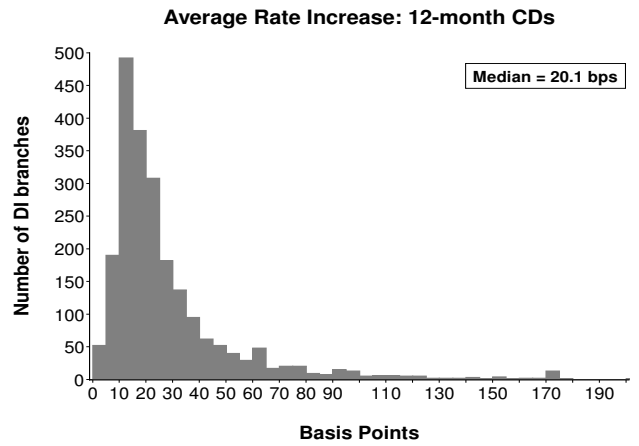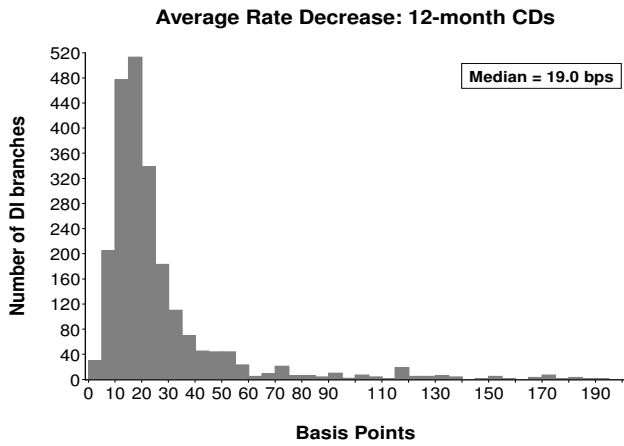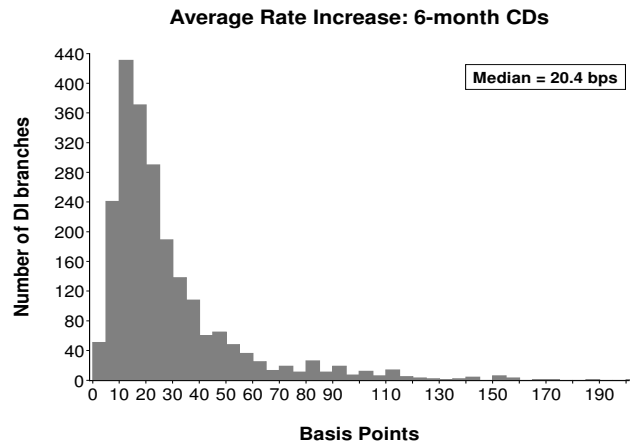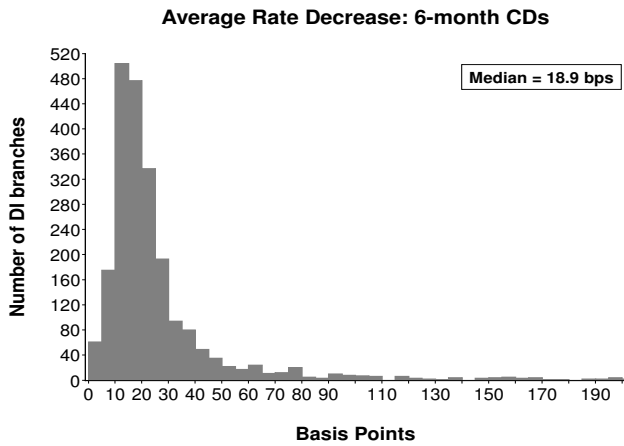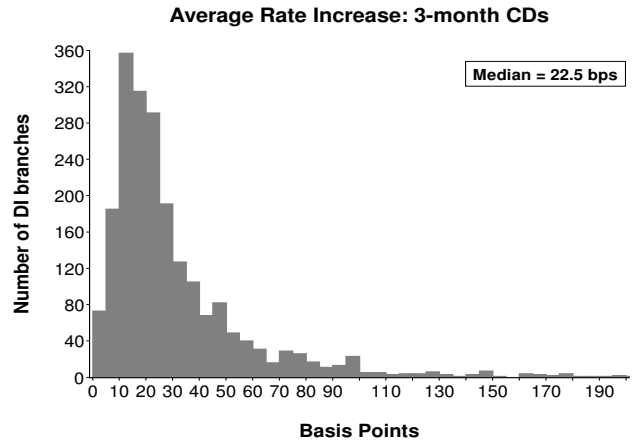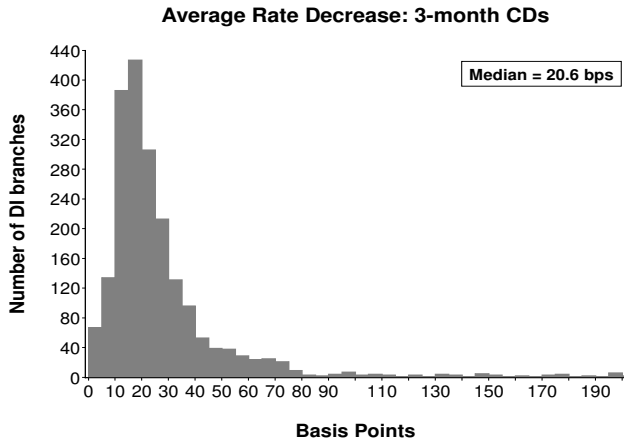
Average Rate Decrease: 3-month CDs

Median = 20.6 bps

Average Rate Increase: 3-month CDs

Median = 22.5 bps

Average Rate Decrease: 6-month CDs

Median = 18.9 bps

Average Rate Increase: 6-month CDs

Median = 20.4 bps

Average Rate Decrease: 12-month CDs

Median = 19.0 bps

Average Rate Increase: 12-month CDs

Median = 20.1 bps

Average Rate Decrease: 24-month CDs

Median = 20.0 bps

Average Rate Increase: 24-month CDs

Median = 21.0 bps

Average Rate Decrease: 36-month CDs

Median = 19.2 bps

Number of DI branches

Basis Points

Average Rate Increase: 36-month CDs

Median = 20.7 bps

Number of DI branches

Basis Points

Average Rate Decrease: 60-month CDs

Median = 20.7 bps

Number of DI branches

Basis Points

Average Rate Increase: 60-month CDs

Median = 23.5 bps

Number of DI branches

Basis Points

Average Rate Decrease: MMDA

Median = 23.3 bps

Number of DI branches

Basis Points

Average Rate Increase: MMDA

Median = 22.5 bps

Number of DI branches

Basis Points

Average Rate Decrease: Interest Checking

Median = 16.7 bps

Number of DI branches

Basis Points

Average Rate Increase: Interest Checking

Median = 14.7 bps

Number of DI branches

Basis Points

Note: These charts plot the distribution of the average size of rate increases and decreases, in basis points, across depository institution branches.

Figure 10: Distribution of average number of weeks between rate changes
Branches of top 10 DIs
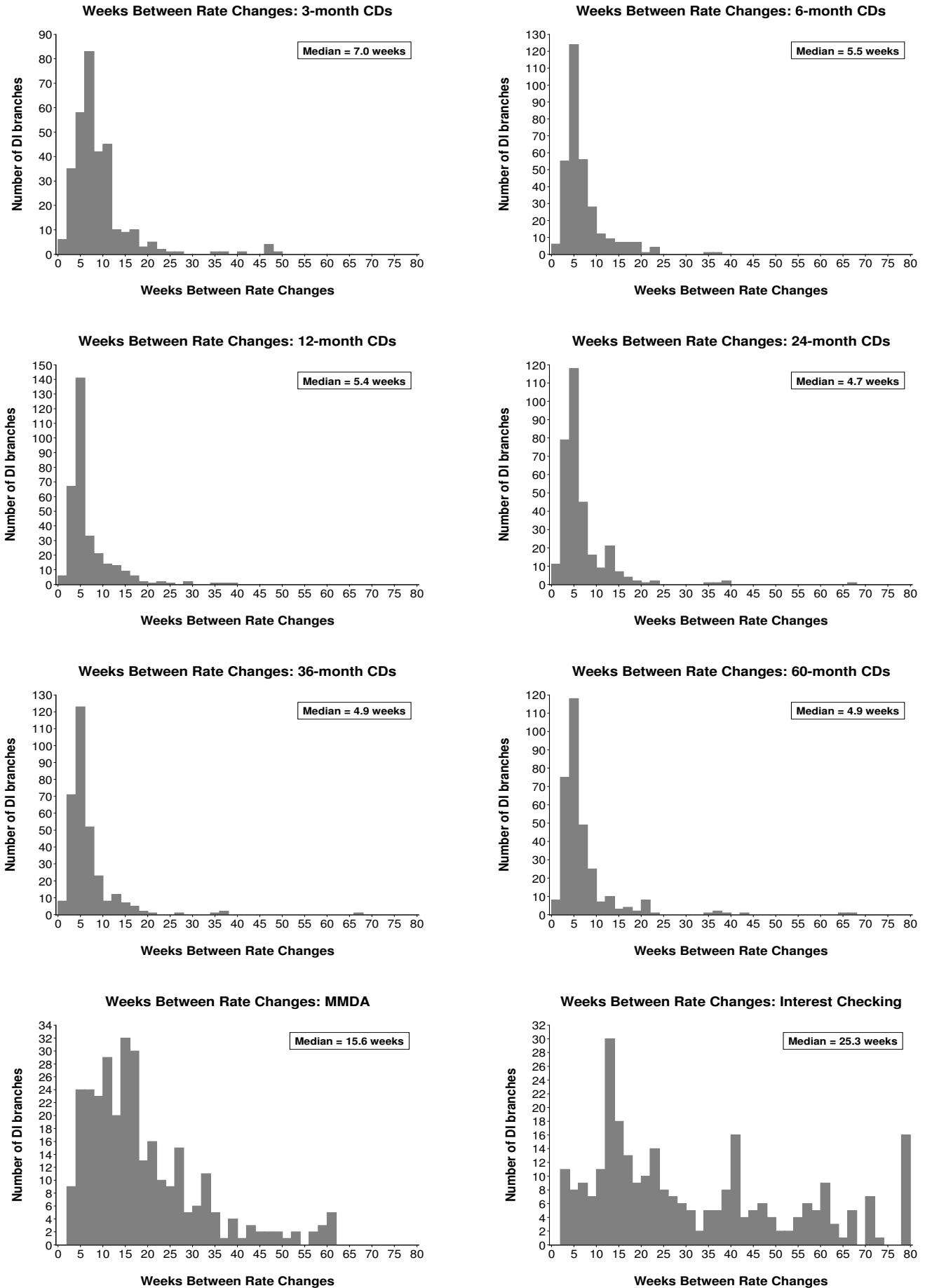
Weeks Between Rate Changes: 3-month CDs
Median = 7.0 weeks

Weeks Between Rate Changes: 6-month CDs
Median = 5.5 weeks

Weeks Between Rate Changes: 12-month CDs
Median = 5.4 weeks

Weeks Between Rate Changes: 24-month CDs
Median = 4.7 weeks

Weeks Between Rate Changes: 36-month CDs
Median = 4.9 weeks

Weeks Between Rate Changes: 60-month CDs
Median = 4.9 weeks

Weeks Between Rate Changes: MMDA
Median = 15.6 weeks

Weeks Between Rate Changes: Interest Checking
Median = 25.3 weeks

Note: These charts plot the distribution of the average number of weeks between rate changes, by depository institution (DI) branch.
For example, on the chart for interest checking, about 8 DI branches averaged about 5 weeks between price changes.

Figure 11: Distribution of average number of weeks between rate changes for periods where the target federal funds rate is rising or falling
Branches of top 10 DIs

Weeks Between Rate Changes: Funds Rate Falling
3-month CDs
Median = 4.4 weeks

Weeks Between Rate Changes: Funds Rate Rising
3-month CDs
Median = 11.6 weeks

Weeks Between Rate Changes: Funds Rate Falling
6-month CDs
Median = 3.1 weeks

Weeks Between Rate Changes: Funds Rate Rising
6-month CDs
Median = 8.7 weeks

Weeks Between Rate Changes: Funds Rate Falling
12-month CDs
Median = 2.9 weeks

Weeks Between Rate Changes: Funds Rate Rising
12-month CDs
Median = 9.9 weeks

Weeks Between Rate Changes: Funds Rate Falling
24-month CDs
Median = 3.1 weeks

Weeks Between Rate Changes: Funds Rate Rising
24-month CDs
Median = 10.7 weeks

Weeks Between Rate Changes: Funds Rate Falling
36-month CDs

Median = 3.3 weeks

Number of DI branches

Weeks Between Rate Changes

Weeks Between Rate Changes: Funds Rate Rising
36-month CDs

Median = 10.4 weeks

Number of DI branches

Weeks Between Rate Changes

Weeks Between Rate Changes: Funds Rate Falling
60-month CDs

Median = 3.4 weeks

Number of DI branches

Weeks Between Rate Changes

Weeks Between Rate Changes: Funds Rate Rising
60-month CDs

Median = 9.3 weeks

Number of DI branches

Weeks Between Rate Changes

Weeks Between Rate Changes: Funds Rate Falling
MMDA

Median = 13.1 weeks

Number of DI branches

Weeks Between Rate Changes

Weeks Between Rate Changes: Funds Rate Rising
MMDA

Median = 42.3 weeks

Number of DI branches

Weeks Between Rate Changes

Weeks Between Rate Changes: Funds Rate Falling
Interest Checking

Median = 25.4 weeks

Number of DI branches

Weeks Between Rate Changes

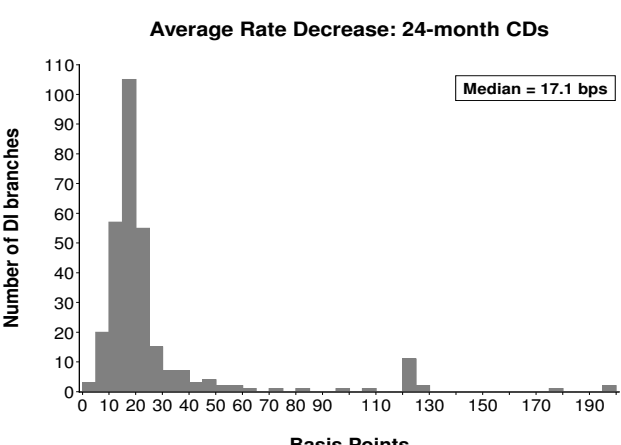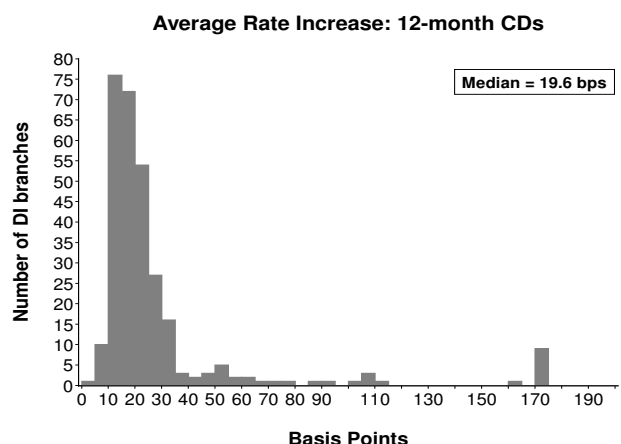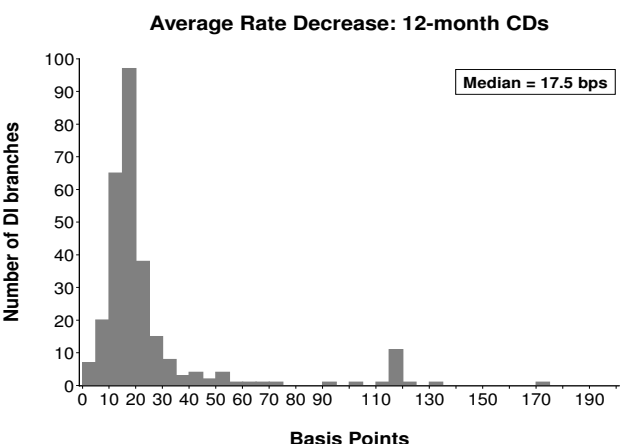**Weeks Between Rate Changes: Funds Rate Rising**
Interest Checking

Median = 53.5 weeks

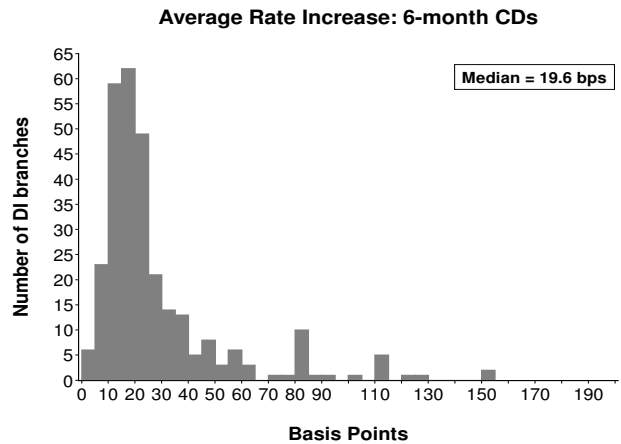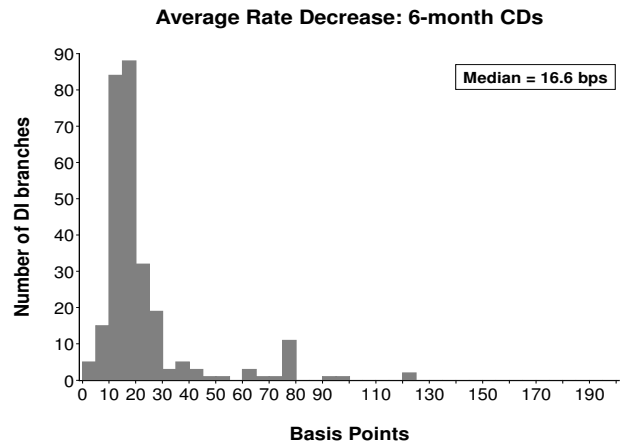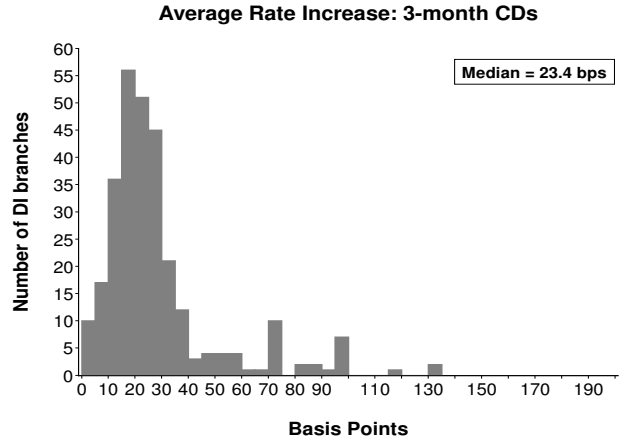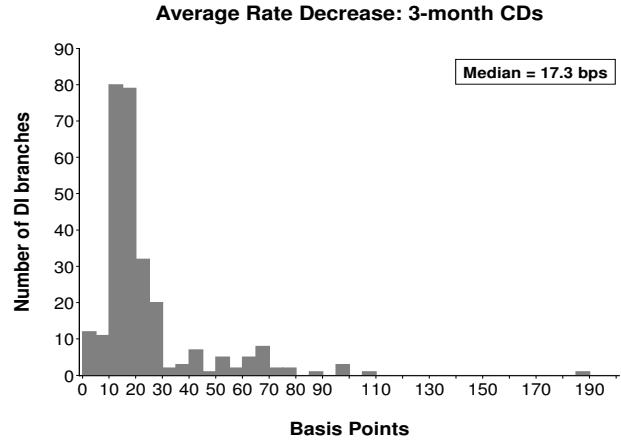Number of DI branches

Weeks Between Rate Changes

Note: These charts plot the distribution of the average number of weeks between rate changes, by depository institution (DI) branch.
For example, on the chart for interest checking when funds rate is falling, about 27 DI branches averaged about 10 weeks between price changes.
The averages are computed over periods during which the target federal funds rate is rising and periods during which it is falling.

Figure 12: Distribution of average number of weeks between rate changes for periods where the target federal funds rate is flat
Branches of the top 10 DIs
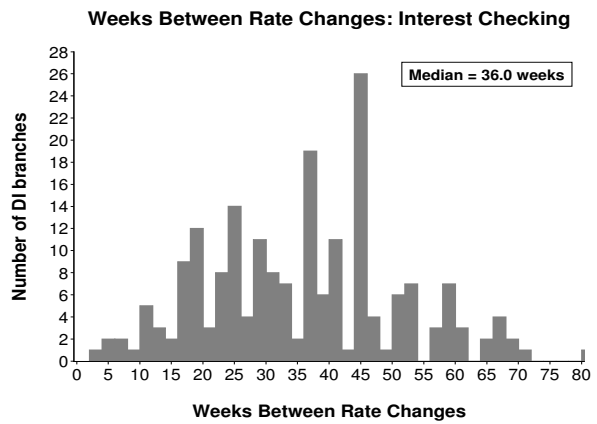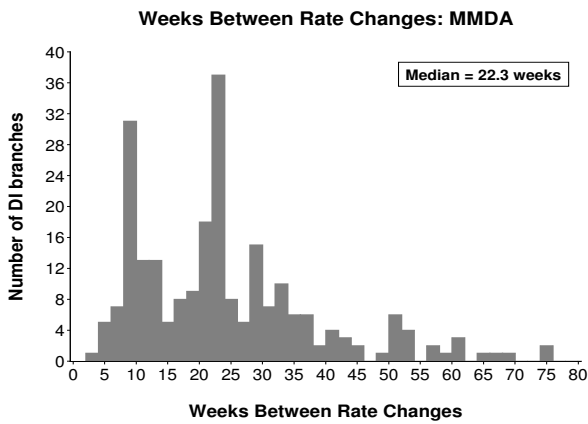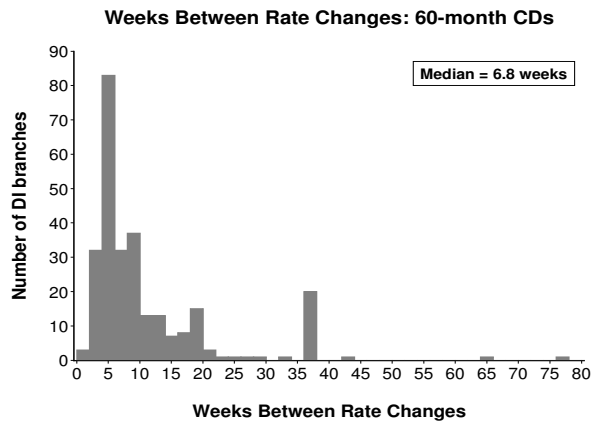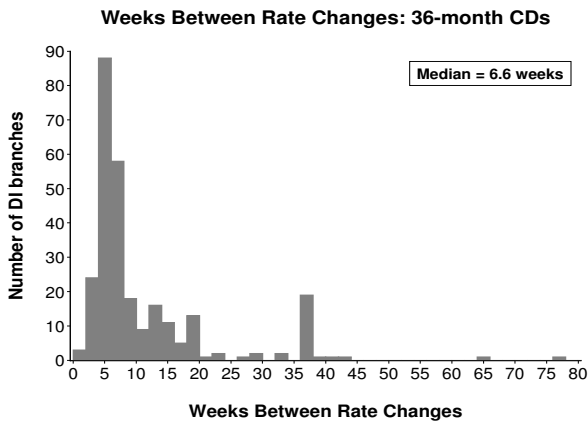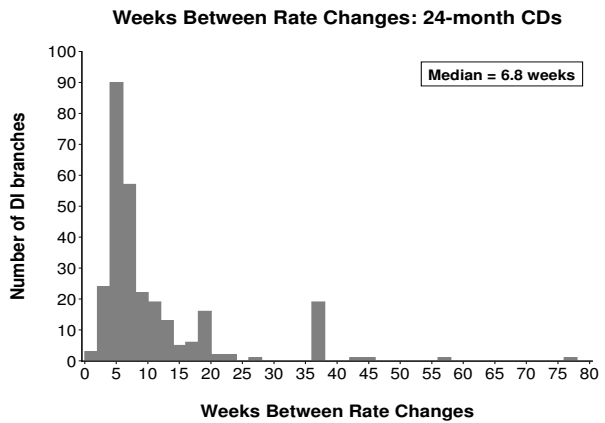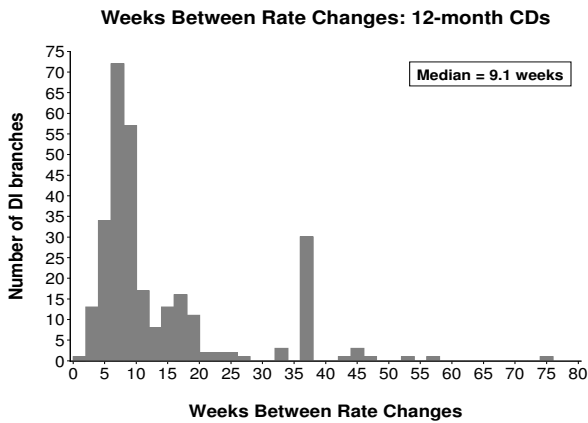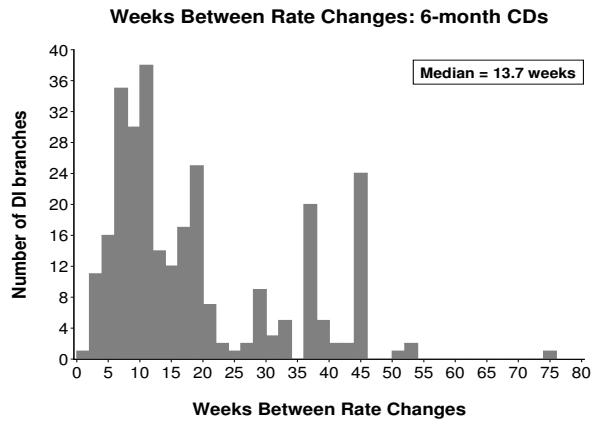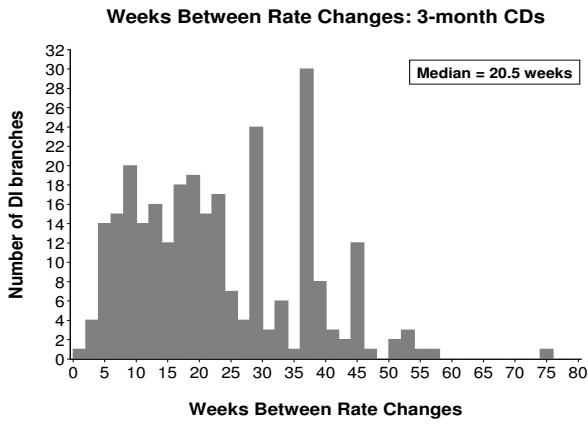
Weeks Between Rate Changes: 3-month CDs — Median = 20.5 weeks

Weeks Between Rate Changes: 6-month CDs — Median = 13.7 weeks

Weeks Between Rate Changes: 12-month CDs — Median = 9.1 weeks

Weeks Between Rate Changes: 24-month CDs — Median = 6.8 weeks

Weeks Between Rate Changes: 36-month CDs — Median = 6.6 weeks

Weeks Between Rate Changes: 60-month CDs — Median = 6.8 weeks

Weeks Between Rate Changes: MMDA — Median = 22.3 weeks

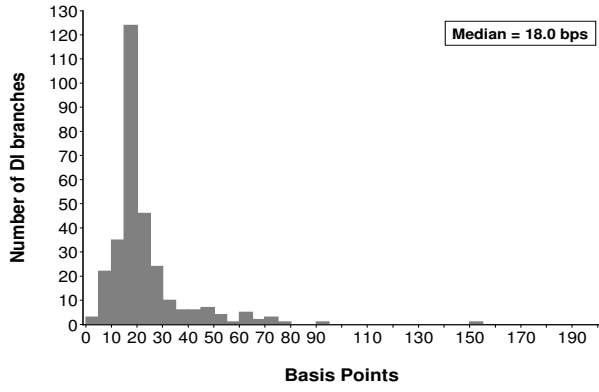**Weeks Between Rate Changes: Interest Checking** — Median = 36.0 weeks

Note: These charts plot the distribution of the average number of weeks between rate changes, by depository institution (DI) branch. For example, on the chart for interest checking, about 2 DI branches averaged about 5 weeks between price changes.
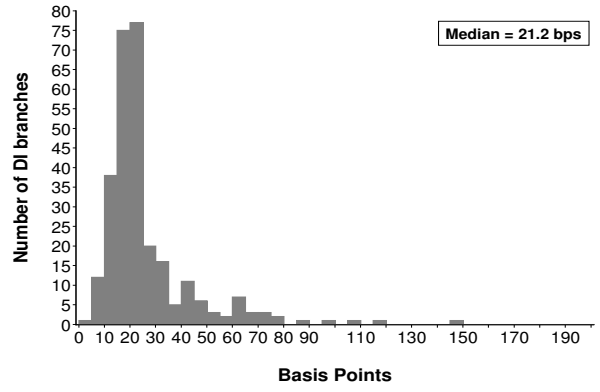
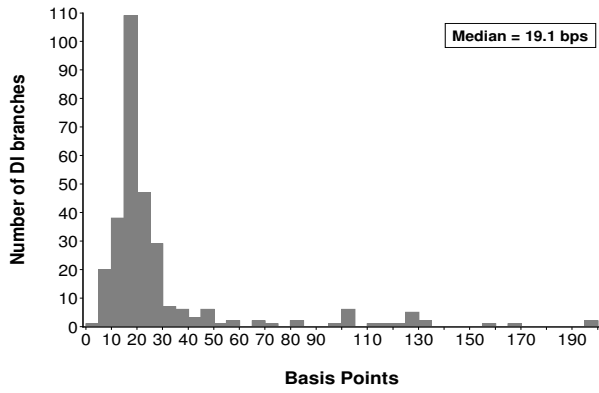Figure 13: Average size of rate increases and decreases
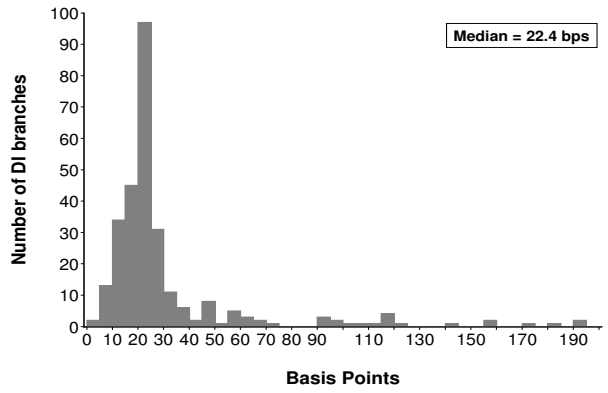Branches of top 10 DIs
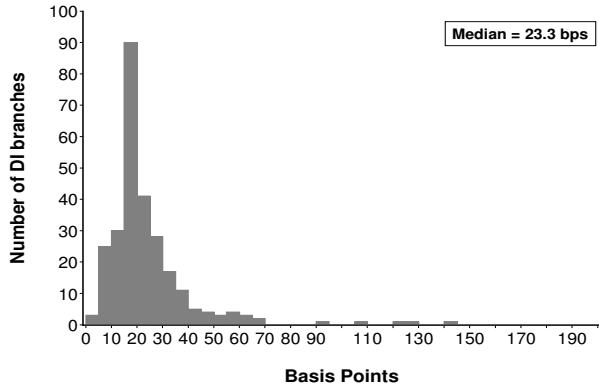
Average Rate Decrease: 36-month CDs

Median = 18.0 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Average Rate Increase: 36-month CDs

Median = 21.2 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Average Rate Decrease: 60-month CDs

Median = 19.1 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Average Rate Increase: 60-month CDs

Median = 22.4 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Average Rate Decrease: MMDA

Median = 23.3 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Average Rate Increase: MMDA

Median = 22.5 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Average Rate Decrease: Interest Checking

Median = 16.7 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Average Rate Increase: Interest Checking

Median = 14.7 bps

X-axis: Basis Points
Y-axis: Number of DI branches

Note: These charts plot the distribution of the average size of rate increases and decreases, in basis points, across depository institution branches.