The market response to monetary policy during recent U.S. recessions

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ABSTRACT

This paper explores the market response to the discount rate changes during the recent U.S. recessions and finds that the response of market rates to discount rate changes varied during the recent two recessions. The different responses of market rates to discount rate changes are due to the various economic and policy circumstances that the market was facing. This conclusion is consistent with Thornton's finding (1998). Thornton (1998) found that the different market responses to the discount rate changes mainly depend on the information content that people believed contained in the announcements of the discount rate changes. It's interesting to point out that during the "Great Recession", market rates were not sensitive to discount rate changes. The underlying reason was the discount rates were above the federal funds rates during the "Great Recession". In other words, the discount window borrowing has lost its function to provide adequate funds to the economy during the recession.

3.1 Background

3.1.1 Discount rate as an important monetary policy instrument

The public is already getting used to consider the federal funds rate as a major monetary policy instrument. Many people were shocked when the Federal Reserve announced to raise the discount rate by 0.25 percent on February, 19, 2010, What is the implication of the Federal Reserve's action? Is it simply a technical change to keep discount rate certain level with the federal funds rate or is it a tightening monetary policy? This study was motivated by these questions and tried to further explore the related area of the discount rate.

The discount rate became monetary instrument in the United States as early as 1907. When the Federal Reserve was first established to fight the Panic of 1907, discount window and discount rate were the only monetary policy instruments.

3.1.2 A new method of establishing the discount rate from 2003

Before 2003, the discount rate was set below the target federal funds rate. From January 2003 up to the crisis in 2007, the discount rate was one percentage point above the target federal funds rate. A bank could borrow at the discount window if it was financially sound and willing to pay a relatively high interest rate.

3.1.3 More frequent changes in discount rates during recessions

As an important monetary policy instrument, discount rate was used much more frequently in recessions. The history of discount rate data shows that usually the discount rate is lowered as soon as the recession starts. As the recession gets deeper and deeper, the discount rate is lowered again and again. Once the recession is close to an end, the discount rate is raised accordingly.

3.1.4 A unique problem in the discount window borrowing and the creation of TAF

If the discount rate is higher than the federal funds rate, then borrowing from the Federal Reserve is more expensive than borrowing at the federal funds market, which is fine during normal times. However, during the recent financial crisis, although the discount rate was cut 12 times, it was never below the federal funds rate, which means the discount window could no longer ease the liquidity problem during the time of crisis. This is a unique problem that occurred in the recent crisis, because never in the U.S. history was the discount rate higher than the federal funds rate during any recessions.

Usually before 2003, the discount rate was much lower than the federal funds rate during recessions, compared to normal times.

It is quite obvious that the Fed was facing a unique problem in the discount window borrowing during the "Great Recession". Partly in response to this problem, the Federal Reserve created TAF borrowing and other borrowing facilities to allow banks borrow money from other channels rather than the discount window. As it was well known, banks were not willing to borrow from the discount window

anyway, because it may signal the bank's poor condition and the possibility of insolvency. Just as Cecchetti (2008) said in his paper, "Realizing that their traditional instruments were inadequate for responding to the crisis that began on August 2007, Federal Reserve Officials improvised." The Fed started to implement a variety of changes to make sure that the banking institutions which needed the most funds can get the liquidity. For instance, the Federal Reserve initiated TAF borrowing.

3.1.5   The relationship between a recession and a financial crisis

In the United States, it is the National Bureau of Economic Research (NBER) that defines the beginning and ending dates of the U.S. recessions. The NBER defines a recession if there is a significant decline in GDP, real income, employment, industrial production, and wholesale-retail sales.[1] The recent sub-prime mortgage crisis is usually called a "financial crisis", which is also a recession. One might ask what the difference between financial crisis and recession is. A financial crisis must be a recession, but a recession is not necessarily a financial crisis. We consider a recession a "financial crisis", if some financial institutions or assets suddenly lose a large part of their value. The recent sub-prime mortgage crisis is considered as a "financial crisis", since it associated with stock market crash, bankruptcies of large investment banks, and banking panics. Many recessions are financial crises, since usually those phenomena occur at the same time.

3.1.6   Another breaking point: 1960s

Before the early 1960s, the Federal Reserve normally did not explain why they changed the discount rate. They just simply changed it with no any further interpretation of policy indication. After the early 1960s, the Federal Reserve announced the reasons for the change of the discount rate so that the public is able to better understand the movements of the Fed and make a better decision. This is an indication that the Federal Reserve indeed improved its transparency.

3.1.7   Classification of discount rate changes

Discount rate changes can be considered either technical or nontechnical according to Thornton (1982): if the discount rate is simply adjusted to keep certain level of difference with market rates such as the federal funds rate, then it is a technical change. Otherwise, it is a non-technical change. Later, some other researchers such as Cook and Hahn (1988) did a more complicated classification. They classified discount rate changes into three types. "Type 1" is technical changes; "Type 3" is non-technical changes, meaning that the Federal Reserve changed the discount rate to deal with the inflation, economic growth, growth rate of money, and some other macroeconomic variables; "Type2" is the mixture of "Type 1" and " Type 3".

This paper follows Thornton's (1982) straightforward way of classification: discount rate changes are divided into technical, ΔDR_T, or non-technical, ΔDR_{NT}, depending on whether the discount rate changes were made purely to keep the discount rate a certain level of difference with market rates or otherwise.

3.2   Motivation

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[1] See Wikipedia for more details about the definition of "recession".

Discount rate changes were much more frequent in the recession times compared to normal times. Thus it is worth exploring the discount rate changes and their effects on market rates during the recessions. From 1996 to 2011[2], the discount rate has been resettled 52 times, among which, only two times were technical changes, and the rest were non-technical changes. Generally speaking, when the economy was in a good shape, the Fed will increase the discount rate to fight inflation. However, If the economy was facing a downturn, the Fed will reduce the discount rate to accommodate the unfavorable situation. During the years 1996 through 2011, there have been two U.S. recessions, early 2000s recession and the "Great Recession" respectively. The early 2000s recession covered the period from March, 2001 to November, 2001, totalling eight months. At that time, Green Span was in charge of the Federal Reserve, the discount rate was reduced 7 times in those short 8 months, and this frequency is very high. The "Great recession", also known as sub-prime mortgage crisis, started in December, 2007 and ended in June 2009, totalling one year and six months, which occurred when the Federal Reserve was under the charge of Bernanke. The discount rate was cut 12 times during this period. In conclusion, among 52 changes during the years 1996 through 2011, 19 occurred during the recession time. There were 16 years or 192 months in total, during which 26 months were in recession. That is, 13.5 percent of the time was in recession and 36.5 percent of the discount rate changes occurred during the recessions. Therefore, the discount rate changes were more frequent during the recessions compared to normal times. Many existing literatures have studied the discount rate, but no literature has tried to explore the discount rate changes during different U.S. recessions. In fact, it is important to understand the market's response patterns to discount rate changes in recessions, because it will help the Fed to make a more efficient monetary policy during that period of time. This paper will explore the discount rate changes and their impacts on market rates for recent U.S. recessions.

3. 3 Literature Review

Many researchers found that the market rates often respond to the non-technical discount rate changes rather than technical discount rate changes. Batten and Thornton (1983) found that announcements of non-technical discount rate changes have significant impact on the dollar's exchange rate. Thornton (1994) investigated why the market rates responded to non-technical discount rate changes. His finding contradicts Cook and Hahn's (1988) hypothesis that Treasury bill rates respond to discount rate changes simply because it signals the changes in the federal funds rate. Cook and Hahn (1988) found evidence that announcements of the discount rate changes signal the changes in the federal funds rate and hence had a significant effect on Treasury bill rates. Thornton (1998) found that the discount rate changes do not signal the changes in monetary policy. The announcement effect is different mainly depending on the information that people believed contained in those announcements. He also pointed out that the direct effect on the markets rates is near to zero. Smirlock and Yawiz (1985) found that markets do not respond to the technical discount rate changes and only react to the discount rate changes when people believed that there is a shift in the monetary policy. This finding is consistent with Thornton's findings (1998). The "markets" that Smirlock and Yawiz checked are stock returns and bond rates with different maturities. Goodfriend's (1991) evidence showed the Federal Reserve control the short-term interest rates by using the discount rate often. Chen, Mohan and Steiner (1999) found that stock market returns respond to the non-technical announcements in discount rate changes significantly.

Thornton (1996) explores the discount rate policies of five Federal Reserve chairmen: Martin, Burns, Miller, Volcker and Greenspan. He checked the market responses to discount rate changes under those five chairmen respectively and found Burns and Volcker's discount rate policies were the most effective and Miller's the least effective. The reason for this different response is that Burns and Volcker

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[2] The "Press Release" of the Federal Reserve can be found back to 1996, which explained why the the Fed changed discount rate. According to the announcement, this paper further classified the discount rate changes into technical changes or non-technical changes.

provided the market with more complete information when they changed the discount rate than other chairmen. This conclusion is consistent with another Thornton's paper (1998), which suggested that market response varied to the change of the discount rate over time, mainly depending on the information content contained in the announcements of the discount rate changes.

This paper will study the sub-prime mortgage crisis and the early 2000s U.S. recession. Because the discount rate policy is not the same under different Federal Reserve chairmen suggested by Thornton (1996), this paper divided recessions based on the terms of different chairmen. When Greenspan became chairman, he dealt with the early 2000s recession. The "Great Recession" occurred as Bernanke took charge of the Federal Reserve one year later.

3.4　The Data and Model

The data on interest rates are daily (business day only) from 1996 to 2010. The change in the discount rate is the percentage change in the discount rate on the day that a discount rate change was announced. The market interest rates are 3-month Treasury bill rates, 3-month mortgage repo rates, 3-month agency repo rates and 3-month government repo rates.

This paper follows Thornton's (1982) straightforward way of classification: discount rate changes are divided into technical, ΔDR_T, or non-technical, ΔDR_{NT}, depending on whether the discount rate changes were made purely to keep the discount rate a certain level of difference with market rates or otherwise.

To test the hypothesis of whether the market responses to the discount rate changes were significantly different during the period of different recessions, this paper will apply Thorton's model (1998):

(1)　$\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \delta(L)\Delta FR_t + \mu_{NT}\Delta DR_{NT} + \mu_T\Delta DR_T + \varepsilon_t$

Δi is the percentage change in 3-month Treasury bill rates or 3-month repo rates. Equation (1) represents that the change in market rates may depend on the change in previous market rates, the change in both current and lagged federal funds rates, the technical change in the discount rate and the nontechnical change in the discount rate. All of the changes here are percentage changes.

$\beta(L)$ and $\delta(L)$ are in the lag forms.

We can compare the sign and the magnitude of the estimated coefficients for different U.S. recessions in general, and then further check these coefficients under different chairmen.

3.5　The Responses Results of 3-month Treasury bill rates

3.5.1　Result 1 (1996-2010)

Firstly, this paper ran the regression on the following equation over the period from 1996 to 2010. Since among 52 changes in the discount rate, only two of which are technical changes, occurred in 2003 and 2010 respectively, I combined all the discount rate changes together as non-technical changes for simplicity. Equation (1) becomes equation (2):

(2) $\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \delta(L)\Delta FR_t + \mu_{NT}\Delta DR + \varepsilon_t$

The dependent variable is the percentage change in the 3-month Treasury bill rate. The independent variables are the percentage change in the lagged 3-month Treasury bill rate, both current and lagged federal funds rates, and the discount rate. This paper found that there are 5 lags in the 3-month Treasury bill rate, which indicates that the change of the 3 month Treasury bill rate correlates to the the change of the 3-month Treasury bill rate, up to 5 business days before. Moreover, this paper found coefficients on both discount rate changes and changes in the federal funds rate are not significantly different from zero.

3.5.2 Result 2 (Early 2000s recession: March, 2001 to November, 2001)

Because from the first result, this paper found evidence that the coefficient on the change in the federal funds rate is not significantly different from zero, so the term of the percentage change in federal funds rate can be ignored. Furthermore, there is no technical change in the discount rate during this period of time. Equation (1) now becomes equation (3):

(3) $\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \mu_{NT}\Delta DR_{NT} + \varepsilon_t$

This paper found that the 3-month Treasury bill rate moves the same direction with the discount rate. The coefficient on the discount rate is significantly different from zero.

3.5.3 Result 3 (Great Recession: December, 2007 - June, 2009)

Coefficients on both discount rate and federal funds rate change are not significantly different from zero. It might have something to do with the TAF borrowing, or the new method of establishing the discount rate. Since 2003, there is a new method of establishing the discount rate, which set the discount rate 100 basis above the federal funds rate, which made the discount rate higher than the federal funds rate. In other words, the discount window borrowing lost its functions during the recent financial crisis. Hence, the Federal Reserve created TAF borrowing and other borrowing facilities to accommodate the recent financial crisis. This helps explain the fact that market rates were not sensitive to the discount rate changes during the "Great Recession".

That the coefficient on the discount rate is not significantly different from zero indicates that the change in the discount rate has no significant impact on the change in the 3-month Treasury bill rate.

Since there are no technical changes in this recession either, the equation (1) becomes equation (4) :

(4) $\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \delta(L)\Delta FR_t + \mu_{NT}\Delta DR_{NT} + \varepsilon_t$

This paper also tried to run regression on equation (5):

(5) $\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \mu_{NT}\Delta DR_{NT} + \varepsilon_t$

Removing the term of the federal funds rate in equation (5), the coefficient on the change in the discount rate is not significantly different from zero either.

3.6 The Response Results of 3-month repo rates

From Chapter 2, we know that the 3-month repo rate is one of the important market rates for forecasting monetary policy. Therefore, this paper tests the 3-month repo rates response pattern to discount rate changes. Besides 3-month Treasury bill rates, this chapter will test how three types of 3-month repo rates responded to discount rate changes during the two recent U.S. recessions.

3.6.1 The responses of 3-month government repo rates

Using different estimation equations (See tables 3.11 through 3.14), this paper shows that during the early 2000s recession, 3-month government repo rates did not respond to either federal funds rates or discount rate changes significantly at both 1% and 5% significance levels.

During the "Great Recession," 3-month government repo rates did not respond to either discount rate changes or changes in federal funds rates significantly at both 1% and 5% significance levels (See tables 3.15 through 3.18). However, the significance levels of the coefficients of both federal funds rates and discount rate changes were higher during the early 2000s recession than during the "Great Recession." This may suggest that the 3-month government repo rates are less responsive to both discount rate changes and federal funds rates during the "Great Recession" than during the early 2000s recession.

3.6.2 The responses of 3-month agency repo rates

During both early 2000 recession and the "Great Recession," 3-month agency repo rates did not respond to either discount rate changes or federal funds rates at both 1% and 5% significance levels.

3.6.3 The responses of 3-month mortgage repo rates

During early 2000 recession, 3-month mortgage repo rates responded only to discount rate changes at a 5% significance level. At 1% significance level, 3-month mortgage repo rates did not respond to either discount rate changes or federal funds rates.

During the "Great Recession," 3-month mortgage repo rates did not respond to either discount rate changes or federal funds rates significantly at both 1% and 5% significance levels.

3.6.4 The summarization of the responses results of 3-month repo rates

At a 1% significance level, 3-month government, agency and government repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and the "Great Recession." This provided evidence that the response patterns of 3-month repo rates to discount rate changes were quite similar. From the second chapter, we know that the forecasting ability of three types of 3-month repo rates for monetary policy are also similar. This provided evidence for future researchers that the three types of 3-month repo rates have similar characteristics.

At a 5% significance level, both 3-month government and agency repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and the "Great Recession." However, 3-month mortgage repo rates responded to discount rate changes during early 2000s recession and did not respond to discount rate changes during the "Great Recession." To be more specific, 3-month mortgage repo rates moved the same direction with discount rate changes during the early 2000s recession and were not responsive to discount rate changes during the "Great Recession."

This is consistent with the response patterns of 3-month Treasury bill rates. This result further provids evidence that the market rates tended to be less responsive to discount rate changes during the "Great Recession." It is due to the fact that the discount window borrowing has lost its function during the "Great Recession."

3.7 Conclusions

3.7.1 The responses of market rates to the discount rate changes during U.S. recessions

Firstly, this paper shows that the responses of 3-month Treasury bill rates to the discount rate changes varied during the recent two recessions. During the early 2000s recession, the 3-month Treasury bill rate responded significantly to the discount rate changes. More specifically, the 3-month Treasury bill rate moved the same direction as the discount rate. However, the reaction of the 3-month Treasury bill rate to the discount rate changes was not significant during the "Great Recession." Why are the responses of the 3-month Treasury bill rate to the discount rate changes different between the two recessions? One of the reasons could be that the discount window borrowing has lost its function during the "Great Recession," since the discount rates were above the federal funds rates during the recent recession. Banking sectors borrowed funds from other channels instead, for instance, TAF facilities. In this case, market rates were no longer sensitive to the discount rate changes. To sum up, the different responses of market rates to the discount rate changes are due to the various economic and policy circumstances that the market was facing. This conclusion is consistent with Thornton's finding (1998). He found evidence that the announcement effect of the discount rate changes varied because of the information that people believed contained in the announcement.

Secondly, this paper showed that at a 1% significance level, 3-month government, agency and government repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and "Great Recession." At a 5% significance level, both 3-month government and agency repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and "Great Recession." However, 3-month mortgage repo rates responded to discount rate changes during early 2000s recession and did not respond to discount rate changes during "Great Recession." To be more specific, 3-month mortgage repo rates moved the same direction with discount rate changes during early 2000s recession and were not responsive to discount rate changes during the "Great Recession." This is consistent with the response patterns of 3-month Treasury bill rates. This result further provided evidence that the market rates tended to be less responsive to discount rate changes during the "Great Recession." It is due to the fact that the discount window borrowing has lost its function during the "Great Recession."

Last but not least, this paper supports Thornton's (1994) finding, which contradicts Cook and Hahn's (1988) Hypothesis that the Treasury bill rates respond to discount rate changes simply because it signals the changes in the federal funds rate. The estimation results of this paper show that both the 3-month Treasury bill rate and 3-month repo rates did not significantly respond to the changes in federal funds rates at both 1% and 5% significance levels during both recent recessions.

3.7.2 Some findings on the Characteristics of three types of 3-month repo rates

First of all, three types of 3-month repo rates have similar trends over the recent two decades. In other words, they move together at the same time.
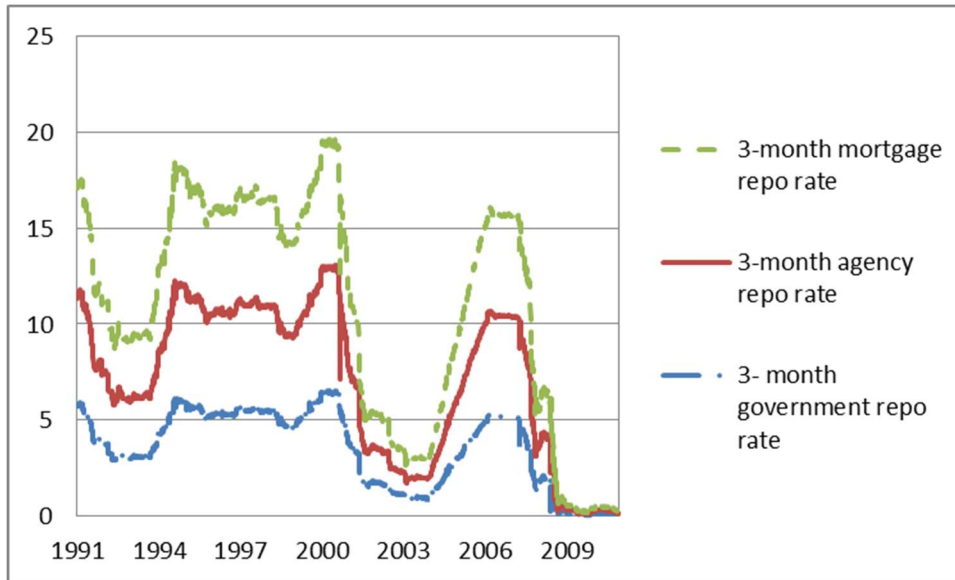
Notes: The above figure used a stacked line chart to show the trend of the three types of repo rates. It is very obvious that they tend to move together. The 3-month mortgage repo rate has the highest value of all the three types of repo rates, because a mortgage repurchase agreement is more risky than the other two repurchase agreements. Both government and agency repurchase agreements enjoy protections from U.S. Government.

Secondly, when using three types of 3-month repo rates as long term rates respectively, expectation theory is found to perform extremely well in all the three cases.

Thirdly, three types of 3-month repo rates have very similar forecasting ability for federal funds rates.

Last but not least, three types of 3-month repo rates were not responsive to discount rate changes during the recent U.S. recessions at a 1% significance level.

To sum up, three types of 3-month repo rates have similar characteristics. They have similar moving trends over time, similar performances in expectation theory, similar forecasting abilities for future federal funds rates, and similar response patterns to discount rate changes.

Table 3.1: Recent U.S. recessions and corresponding chairmen

Chairman	Term	U.S. Recession
Alan Greenspan	August 11, 1987 - Jannuary 31, 2006	Early 1990s recession Early 2000s recession
Ben Bernanke	February 1, 2006 - present	Great Recession

Table 3.2: Classification of discount rate changes (1996-2011)

(Information was collected from the website of Board of Governors of the Federal Reserve System, and was edited and consolidated by myself. According to the reasons for the changes of the discount rates that the Federal Reserve released, I classified the discount rate changes into either technical changes or non-technical changes.) From 1996 to 2011, the discount rate has been resettled 52 times, among which, only two times were technical changes. The rest were non-technical changes. Generally speaking, when the economy was in a good shape, the Federal Reserve would increase the discount rate to fight inflation. However, if the economy was facing a downturn, the Federal Reserve would reduce the discount rate to accommodate the poor situation. During the years 1996 through 2011, there has been two U.S. recessions, early 2000s recession and the "Great Recession" respectively. The early 2000s recession covered the

period from March, 2001 to November, 2001, totalling eight months. At that time, when Greenspan was in charge of the Federal Reserve, the discount rate was reduced 7 times in those short 8 months, and the frequency was very high. The "Great Recession", also known as sub-prime mortgage crisis, started in December, 2007 and ended in June 2009, totalling one year and six months, which happened when the Federal Reserve was under the charge of Bernanke. The discount rate was cut 12 times during this period. Among 52 changes, 19 occurred during the recession time. From 1996 to 2011, totalling 16 years or 192 months, 26

months were in recession. 13.5 percent of the time was in recession. 36.5 percent of the

discount rate changes occurred during the recessions. In conclusion, discount rate changes

were much more frequent in the recession times compared to normal times.

Date of Press Release	Decision	Main Reasons	Define the change
April 13, 2010	Increase the discount rate from 0.5 percent to 0.75 percent discussed on February 17, 2010.	This is the first step for the Fed to widen the spread between the discount rate and the federal funds rate.	Technical change
January 13, 2009	Decrease the discount rate from 1.25 percent to 0.5 percent on December 16, 2008.	Financial crisis became severe.	Non-technical change
November 25, 2008	Decrease the discount rate from 1.75 percent to 1.25 percent on October 29, 2008. Decrease the discount rate from 2.25 percent to 1.75 percent approved on October 7, 2008.	Tight credit conditions in financial market and weakness in the labor market were significant.	Non-technical change
May 27, 2008	Decrease the discount rate from 2.5 percent to 2.25 percent approved on April 30, 2008.	Fed wanted to help the economy out of the financial crisis.	Non-technical change
April 15, 2008	Decrease the discount rate from 3.25 percent to 2.5 percent approved on March 18, 2008. Decrease the discount rate from 3.5 percent to 3.25 percent approved on March 16, 2008.	There is a further deterioration in financial conditions and the economy.	Non-technical Change (both)
February 26, 2008	Decrease the discount rate from 4.75 percent to 4 percent approved on January 21, 2008. Decrease the discount rate from 4 percent to 3.5 percent approved on January 30, 2008.	The economic activity is weak and downside risks increase.	Non-technical Change (both)

January 8, 2008	Decrease the discount rate from 5 percent to 4.75 percent approved on December 11, 2007.	The downside risks to economic growth increased and financial market conditions became worse.	Non-technical change
November 27, 2007	Decrease the discount rate from 5.25 percent to 5 percent approved on October 31, 2007.	Housing sector had gone worse.	Non-technical change
October 16, 2007	Decrease the discount rate from 6.25 percent to 5.75 percent approved on August 16, 2007. Decrease the discount rate from 5.75 percent to 5.25 percent approved on September 18, 2007.	Credit became tight and housing sector had been intensified.	Non-technical Change (both)
July 25, 2006	Increase the discount rate from 6 percent to 6.25 percent approved on June 29, 2006.	Inflation pressures occurred.	Non-technical change
June 6, 2006	Increase the discount rate from 5.75 percent to 6 percent approved on May 10, 2006.	Economy was in good shape except for inflation pressure.	Non-technical change
April 25, 2006	Increase the discount rate from 5.5 percent to 5.75 percent approved on March 28, 2006.	Contained inflation.	Non-technical change
February 28, 2006	Increase the discount rate from 5.25 percent to 5.5 percent approved on January 31, 2006.	Inflation pressure.	Non-technical change
January 10, 2006	Increase the discount rate from 5 percent to 5.25 percent approved on December 13, 2005.	Inflation risk and high level of energy price.	Non-technical change
November 29, 2005	Increase the discount rate from 4.75 percent to 5 percent approved on November 1, 2005.	High energy price was added to inflation pressure.	Non-technical change

October 18, 2005	Increase the discount rate from 4.5 percent to 4.75 percent approved on September 20, 2005.	Good economic outlook called for removal of the monetary policy accommodation.	Non-technical change
September 6, 2005	Increase the discount rate from 4.25 percent to 4.5 percent approved on August 9, 2005.	Business conditions were improving nationwide.	Non-technical change
July 28, 2005	Increase the discount rate from 4 percent to 4.25 percent approved on June 30, 2005.	The economy was as good as expected, with modest inflation pressure.	Non-technical change
May 31, 2005	Increase the discount rate from 3.75 percent to 4 percent approved on May 3, 2005.	The gradual removal of accommodative monetary policy was appropriate	Non-technical change
April 19, 2005	Increase the discount rate from 3.5 percent to 3.75 percent approved on March 22, 2005.	Labor market and investment improved with signs of inflation.	Non-technical change
March 2, 2005	Increase the discount rate from 3.25 percent to 3.5 percent approved on February 2, 2005.	Positive near-term outlook for the economy with contained inflation.	Non-technical change
January 11, 2005	Increase in the discount rate from 3 percent to 3.25 percent approved on December 14, 2004.	Economic growth was solid.	Non-technical change
December 21, 2004	Increase in the discount rate from 2.75 percent to 3 percent approved on November 10, 2004.	The economy continued to expand and it was time to withdraw monetary stimulus gradually.	Non-technical change

November 18, 2004	Increase the discount rate from 2.5 percent to 2.75 percent approved on September 21, 2004.	The economic outlook was favorable.	Non-technical change
September 30, 2004	Increase the discount rate from 2.25 percent to 2.5 percent approved on August 10, 2004.	CPI showed an increase in inflation.	Non-technical change
August 19, 2004	Increase the discount rate from 2 percent to 2.25 percent approved on June 30, 2004.	The economy was growing at a solid pace and no longer needed monetary accommodation.	Non-technical change
August 21, 2003	Decrease the discount rate from 2.25 percent to 2 percent approved on June 25, 2003.	Expectations for growth were improving, but it was too early to be optimistic.	Non-technical change
March 28, 2003	Twelve Reserve Banks approved new formula for calculating discount rate on January 6, 2003.	100 basis points above the federal funds rate	Technical change
December 23, 2002	Decrease the discount rate from 1.25 percent to 0.75 percent approved on November 6, 2002.	Consumer confidence weakened related to terrorism.	Non-technical change
February 8, 2002	Decrease the discount rate from 1.5 percent to 1.25 percent approved on December 11, 2001.	The economic outlook remained uncertain.	Non-technical change
December 28, 2001	Decrease the discount rate from 2 percent to 1.5 percent approved on November 6, 2001.	Both business and consumer confidence weakened.	Non-technical change
November 16, 2001	Decrease the discount rate from 2.5 percent to 2 percent approved on October 2, 2001.	September 11 event effect.	Non-technical change
October 26, 2001	Decrease the discount rate from 3 percent to 2.5 percent approved on September 17, 2001.	Employment, production, and business spending were weak. After September 11, consumer confidence dropped further.	Non-technical change

October 26, 2001	Decrease the discount rate from 3.25 percent to 3 percent approved on August 21, 2001.	No significant signs of economic recovery.	Non-technical change
October 26, 2001	Decrease the discount rate from 3.5 percent to 3.25 percent approved on June 27, 2001.	There had been an continued decline in the manufacturing.	Non-technical change
May 15, 2001	Decrease from 4 percent to 3.25 percent on May 15, 2001.	The economy was still weak in the near future.	Non-technical change
April 19, 2001	Decrease the discount rate from 4.5 percent to 4 percent on April 19, 2001.	The economy was still weak in the near future.	Non-technical change
March 20, 2001	Decrease the discount rate from 5 percent to 4.5 percent on March 20, 2001.	Investment spending was weak.	Non-technical change
January 31, 2001	Decrease the discount rate from 5.5 percent to 5 percent on January 31, 2001.	Consumer and business confidence had been weakened further due to the high energy cost, which lower the purchasing power and business profit.	Non-technical change
January 4, 2001	Decrease the discount rate from 6 percent to 5.5 percent on January 4, 2001.	Consumer and business confidence had been weakened further due to the high energy cost, which lower the purchasing power and business profit	Non-technical change

May 17, 2000	Increasing discount rate at those banks from 5.5 percent to 6 percent on May 18, 2000.	Inflation pressure.	Non-technical change
March 21, 2000	Increase the discount rate from 5.25 to 5.5 percent on March 21, 2000.	Increased demand exceeded potential supply. Inflation pressure occurred.	Non-technical change
February 2, 2000	Increase the discount rate from 5 percent to 5.25 percent on February 2, 2000.	Increased demand exceeded potential supply. Inflation pressure occurred.	Non-technical change
November 16, 1999	Increase in the discount rate from 4.75 percent to 5 percent on November 16, 1999.	Inflation pressure.	Non-technical change
August 24, 1999	Increase the discount rate from 4.5 percent to 4.75 percent on August 24, 1999.	The overall economic conditions were good, so it was time to remove monetary accommodation.	Non-technical change
November 17, 1998	Decrease the discount rate from 4.75 percent to 4.5 percent on November 17, 1998.	Although conditions in financial markets have gone well since October, unusual strains remain.	Non-technical change
October 15, 1998	Decrease the discount rate from 5 percent to 4.75 percent on October 15, 1998.	The conditions in financial markets were bad.	Non-technical change

January 31, 1996	Decrease the discount rate from 5.25 percent to 5 percent on January 31, 1996.	Moderating economic expansion in recent months has reduced potential inflationary pressures.	Non-technical change

Table 3.3: Three month Treasury bill rate with one lag (equation 2)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
cfr	-.0008239	.0004507	0.068	-.0017075	.0000598
ctb3l1	.8261811	.009318	0.000	.8079122	.84445
cdisr	.0001602	.000849	0.850	-.0015044	.0018248
_cons	-.087911	.0057384	0.000	-.0991616	-.0766603

Table 3.4: Three month Treasury bill rate with two lags (equation 2)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
ctb3l1	.5119664*	.0153012	0.000	.4819669	.5419658
ctb3l2	.3806851*	.0153033	0.000	.3506815	.4106887
cfr	-.0002791	.0004183	0.505	-.0010992	.000541
cdisr	.0001119	.0007869	0.887	-.0014309	.0016546
_cons	-.0539694*	.0054905	0.000	-.064734	-.0432047

Table 3.5: Three month Treasury bill rate with four lags (equation 2)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
ctb3l1	.310697*	.0154823	0.000	.2803425	.3410515
ctb3l2	.1539418*	.0161932	0.000	.1221935	.1856901
ctb3l3	.1278207*	.0161796	0.000	.0960991	.1595422
ctb3l4	.3579709*	.0154738	0.000	.3276331	.3883088
cdisr	.0000706	.000709	0.921	-.0013193	.0014606
cfr	-.000201	.000377	0.594	-.0009402	.0005382
_cons	-.0242162*	.0050547	0.000	-.0341263	-.0143061

Table 3.6: Three month Treasury bill rate with five lags (equation 2)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
ctb3l1	.2806045*	.0165544	0.000	.248148	.313061
ctb3l2	.1437165*	.0162691	0.000	.1118194	.1756136
ctb3l3	.1149804*	.0163289	0.000	.082966	.1469949
ctb3l4	.3321171*	.0162601	0.000	.3002377	.3639966
ctb3l5	.0831356*	.016549	0.000	.0506897	.1155814
cdisr	.0000723	.0007067	0.918	-.0013132	.0014578
cfr	-.0002139	.0003758	0.569	-.0009507	.000523
_cons	-.022061*	.0050567	0.000	-.0319751	-.0121469

Table 3.7: Three month Treasury bill rate with six lags (equation 2)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
ctb3l1	.2579442*	.0162627	0.000	.2260596	.2898288
ctb3l2	.10663*	.0168428	0.000	.0736081	.1396519
ctb3l3	.0381887*	.0169298	0.024	.0049961	.0713812

ctb3l4	.2991155*	.0161399	0.000	.2674718	.3307593
ctb3l5	.0354097*	.0169365	0.037	.002204	.0686153
ctb3l6	.0253706	.0169021	0.133	-.0077675	.0585088
cfr	-.0001272	.0003671	0.729	-.000847	.0005927
cdisr	.0000705	.0006902	0.919	-.0012827	.0014238
_cons	-.0153363*	.0049692	0.002	-.0250789	-.0055938

Table 3.8: Result 2 (equation 3)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
ctb3l1	(omitted)				
ctb3l2	1*	4.87e-08	0.000	.9999999	1
ctb3l3	(omitted)				
ctb3l4	(omitted)				
ctb3l5	(omitted)				
cdisr	7.24e-10*	2.65e-10	0.007	2.00e-10	1.25e-09
_cons	.0005728*	1.88e-08	0.000	.0005727	.0005728

note: ctb3l1 omitted because of collinearity
note: ctb3l3 omitted because of collinearity
note: ctb3l4 omitted because of collinearity
note: ctb3l5 omitted because of collinearity

Table 3.9: Result 3 (equation 4)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
ctb3l1	(omitted)				
ctb3l2	1*	3.12e-08	0.000	.9999999	1
ctb3l3	(omitted)				
ctb3l4	(omitted)				
ctb3l5	(omitted)				
cdisr	-1.86e-10	3.79e-10	0.624	-9.31e-10	5.59e-10
cfr	-1.03e-10	1.04e-10	0.320	-3.07e-10	1.00e-10
_cons	.0005728*	2.84e-08	0.000	.0005727	.0005728

note: ctb3l1 omitted because of collinearity
note: ctb3l3 omitted because of collinearity
note: ctb3l4 omitted because of collinearity

note: ctb3l5 omitted because of collinearity

Table 3.10: Result 3 (equation 5)

ctb3	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
ctb3l1	(omitted)				
ctb3l2	1*	3.12e-08	0.000	.9999999	1
ctb3l3	(omitted)				
ctb3l4	(omitted)				
ctb3l5	(omitted)				
cdisr	-1.83e-10	3.79e-10	0.629	-9.28e-10	5.62e-10
_cons	.0005728*	2.84e-08	0.000	.0005727	.0005728

note: ctb3l1 omitted because of collinearity
note: ctb3l3 omitted because of collinearity
note: ctb3l4 omitted because of collinearity
note: ctb3l5 omitted because of collinearity

Table 3.11 Test 1: The response of 3-month government repo rates to discount rate changes (early 2000s recession)

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.2015769	.0714822	0.005	-.3425728	-.060581
grpl2	-.1355546	.0711293	0.058	-.2758545	.0047452
cdisr	.0400796	.0683406	0.558	-.0947196	.1748788
cfr	-.0234814	.0225956	0.300	-.0680504	.0210877
_cons	-.6709759	.2139097	0.002	-1.092905	-.2490471

Table 3.12 Test 2: The response of 3-month government repo rates to discount rate changes (early 2000s recession)

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.1768604	.0707759	0.013	-.3164586	-.0372622
cfr	-.0259484	.0227126	0.255	-.0707467	.0188499
cdisr	.0452273	.0687536	0.511	-.0903822	.1808367
_cons	-.588219	.2108863	0.006	-1.00417	-.1722677

Table 3.13 Test 3: The response of 3-month government repo rates to discount rate changes (early 2000s recession)

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.2039575	.0714603	0.005	-.3449056	-.0630093
grpl2	-.1397893	.0710273	0.050	-.2798833	.0003046
cdisr	.0360635	.0682454	0.598	-.0985436	.1706706
_cons	-.6736794	.2139384	0.002	-1.095651	-.2517081

Table 3.14 Test 4: The response of 3-month government repo rates to discount rate changes (early 2000s recession)

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.1768604	.0707759	0.013	-.3164586	-.0372622
cfr	-.0259484	.0227126	0.255	-.0707467	.0188499
cdisr	.0452273	.0687536	0.511	-.0903822	.1808367
_cons	-.588219	.2108863	0.006	-1.00417	-.1722677

Table 3.15 Test 1: The response of 3-month government repo rates to discount rate changes ("Great Recession")

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.1476465	.0497475	0.003	-.2454427	-.0498502
grpl2	-.0107008	.050221	0.831	-.109428	.0880264
grpl3	-.06108	.0501838	0.224	-.1597339	.0375739
grpl4	-.0389005	.0502771	0.440	-.1377379	.0599369
grpl5	.013069	.0497225	0.793	-.084678	.1108161
cfr	-.0612532	.1046648	0.559	-.2670089	.1445025
cdisr	.1883457	.3893065	0.629	-.5769738	.9536651
_cons	1.546673	1.437916	0.283	-1.280058	4.373404

Table 3.16 Test 2: The response of 3-month government repo rates to discount rate changes ("Great Recession")

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.1453917	.0489904	0.003	-.2416968	-.0490866
cfr	-.0579825	.10434	0.579	-.2630935	.1471286
cdisr	.1833275	.3873337	0.636	-.5780913	.9447463

_cons	1.426264	1.427485	0.318	-1.37988	4.232408

Table 3.17 Test 3: The response of 3-month government repo rates to discount rate changes ("Great Recession")

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.1458307	.0495752	0.003	-.243286	-.0483753
grpl2	-.0030231	.0495471	0.951	-.1004233	.0943771
cfr	-.0578666	.1044849	0.580	-.263264	.1475308
cdisr	.1836013	.3878334	0.636	-.5788055	.9460081
_cons	1.430413	1.430848	0.318	-1.382362	4.243188

Table 3.18 Test 4: The response of 3-month government repo rates to discount rate changes ("Great Recession")

grp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
grpl1	-.1455727	.0489479	0.003	-.2417935	-.0493518
cdisr	.1872495	.386942	0.629	-.5733938	.9478928
_cons	1.414239	1.426115	0.322	-1.38919	4.217669

Table 3.19 Test 1: The response of 3-month agency repo rates to discount rate changes (early 2000s recession)

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.1025694	.0725118	0.159	-.2455961	.0404573
arpl2	-.0024373	.0729517	0.973	-.1463319	.1414572
cfr	-.007265	.0221868	0.744	-.0510276	.0364977
cdisr	-.0216051	.0678359	0.750	-.1554089	.1121987
_cons	-.5689471	.2097771	0.007	-.9827245	-.1551697

Table 3.20 Test 2: The response of 3-month agency repo rates to discount rate changes (early 2000s recession)

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.1023424	.0720046	0.157	-.2443641	.0396793
cfr	-.0072905	.0221159	0.742	-.0509119	.0363309
cdisr	-.0213135	.0670968	0.751	-.1536551	.1110281
_cons	-.5674774	.2045785	0.006	-.9709873	-.1639674

Table 3.21 Test 3: The response of 3-month agency repo rates to discount rate changes (early 2000s recession)

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.1025267	.0723429	0.158	-.2452156	.0401621
arpl2	-.0032593	.0727388	0.964	-.1467291	.1402105
cdisr	-.0228837	.0675658	0.735	-.1561503	.1103829
_cons	-.569155	.2092879	0.007	-.9819536	-.1563563

Table 3.22 Test 4: The response of 3-month agency repo rates to discount rate changes (early 2000s recession)

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.1023424	.0720046	0.157	-.2443641	.0396793
cfr	-.0072905	.0221159	0.742	-.0509119	.0363309
cdisr	-.0213135	.0670968	0.751	-.1536551	.1110281
_cons	-.5674774	.2045785	0.006	-.9709873	-.1639674

Table 3.23 Test 5: The response of 3-month agency repo rates to discount rate changes (early 2000s recession)

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
cfr	-.0071318	.022174	0.748	-.0508663	.0366027
cdisr	-.0290446	.0670525	0.665	-.1612944	.1032052
_cons	-.5211485	.2024982	0.011	-.9205421	-.1217549

Table 3.24 Test 6: The response of 3-month agency repo rates to discount rate changes (early 2000s recession)

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.1001265	.0729881	0.172	-.2441075	.0438545
arpl2	-.0019255	.0736781	0.979	-.1472676	.1434165
arpl3	.0175497	.0736834	0.812	-.1278027	.1629022
arpl4	-.0226244	.0732424	0.758	-.167107	.1218583
arpl5	.054783	.0729981	0.454	-.0892175	.1987836
cfr	-.0066622	.0223299	0.766	-.0507116	.0373871
cdisr	-.0277991	.0688965	0.687	-.1637087	.1081104
_cons	-.5456446	.2211427	0.015	-.9818845	-.1094047

Table 3.25 Test 1: The response of 3-month agency repo rates to discount rate changes ("Great Recession")

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.5028742	.0496793	0.000	-.6005365	-.4052119
arpl2	-.2959229	.0551175	0.000	-.4042759	-.1875699
arpl3	-.1624143	.0563531	0.004	-.2731962	-.0516324
arpl4	-.0813604	.0549528	0.140	-.1893895	.0266687
arpl5	-.0321365	.0491841	0.514	-.1288252	.0645522
cfr	-.0398113	.0410281	0.332	-.1204666	.040844
cdisr	-.1221029	.1522449	0.423	-.421394	.1771883
_cons	-.1068515	.5596822	0.849	-1.207105	.9934017

Table 3.26 Test 2: The response of 3-month agency repo rates to discount rate changes ("Great Recession")

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.3836339	.0457761	0.000	-.4736204	-.2936474
cfr	-.0341007	.0422349	0.420	-.1171259	.0489246
cdisr	-.0870958	.156524	0.578	-.3947899	.2205983
_cons	-.0862602	.5764683	0.881	-1.219479	1.046958

Table 3.27 Test 3: The response of 3-month agency repo rates to discount rate changes ("Great Recession")

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.4662309	.0483391	0.000	-.5612564	-.3712054
arpl2	-.2158416	.0478941	0.000	-.3099922	-.121691
cfr	-.0381661	.0412795	0.356	-.1193137	.0429815
cdisr	-.1073132	.1530123	0.483	-.4081062	.1934798
_cons	-.0923585	.5632942	0.870	-1.199688	1.014971

Table 3.28 Test 4: The response of 3-month agency repo rates to discount rate changes ("Great Recession")

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.3816794	.0456926	0.000	-.4715012	-.2918577
cdisr	-.0850245	.1564363	0.587	-.3925441	.222495
_cons	-.0934549	.5761541	0.871	-1.226048	1.039138

Table 3.29 Test 5: The response of 3-month agency repo rates to discount rate changes ("Great Recession")

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
arpl1	-.4902726	.0491112	0.000	-.5868151	-.39373
arpl2	-.2696619	.0527909	0.000	-.3734379	-.1658859
arpl3	-.1181446	.0486538	0.016	-.213788	-.0225012
_cons	-.0670295	.5566543	0.904	-1.161298	1.027239

Table 3.30 Test 6: The response of 3-month agency repo rates to discount rate changes ("Great Recession")

arp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	

arpl1	-.492894	.0492305	0.000	-.5896724	-.3961155
arpl2	-.2729168	.0528867	0.000	-.3768828	-.1689508
arpl3	-.1205972	.0487219	0.014	-.2163759	-.0248186
cdisr	-.1204637	.1521504	0.429	-.4195646	.1786371
cfr	-.0405921	.0410336	0.323	-.121257	.0400728
_cons	-.1017703	.5597926	0.856	-1.202224	.9986835

Table 3.31 Test 1: The response of 3-month mortgage repo rates to discount rate changes (early 2000s recession)

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
mrpl1	-.0917864	.0713402	0.200	-.2325023	.0489295
mrpl2	.0159791	.0712856	0.823	-.1246291	.1565873
cfr	-.0054524	.0211391	0.797	-.0471484	.0362436
cdisr	.1565391	.0640209	0.015	.0302604	.2828178
_cons	-.4592702	.2005899	0.023	-.8549262	-.0636142

Table 3.32 Test 2: The response of 3-month mortgage repo rates to discount rate changes (early 2000s recession)

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
mrpl1	-.0934349	.0707844	0.188	-.2330499	.0461801
cfr	-.0053515	.0210819	0.800	-.0469335	.0362304
cdisr	.1569177	.0638401	0.015	.0309997	.2828356
_cons	-.468113	.1961855	0.018	-.8550686	-.0811574

Table 3.33 Test 3: The response of 3-month mortgage repo rates to discount rate changes (early 2000s recession)

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
mrpl1	-.0921355	.0711538	0.197	-.232479	.048208
mrpl2	.0155879	.071096	0.827	-.1246416	.1558175
cdisr	.1556534	.0637731	0.016	.0298676	.2814393
_cons	-.4594763	.2001001	0.023	-.8541531	-.0647995

Table 3.34 Test 4: The response of 3-month mortgage repo rates to discount rate changes (early 2000s recession)

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	

mrpl1	-.0934349	.0707844	0.188	-.2330499	.0461801
cfr	-.0053515	.0210819	0.800	-.0469335	.0362304
cdisr	.1569177	.0638401	0.015	.0309997	.2828356
_cons	-.468113	.1961855	0.018	-.8550686	-.0811574

Table 3.35 Test 5: The response of 3-month mortgage repo rates to discount rate changes (early 2000s recession)

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
cdisr	.1616092	.0638635	0.012	.0356491	.2875693
cfr	-.0058211	.0211194	0.783	-.0474757	.0358334
_cons	-.4181375	.1928675	0.031	-.7985363	-.0377388

Table 3.36 Test 6: The response of 3-month mortgage repo rates to discount rate changes (early 2000s recession)

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
cdisr	.1606696	.0636204	0.012	.0351931	.2861462
_cons	-.41795	.1924065	0.031	-.797427	-.038473

Table 3.37 Test 1: The response of 3-month mortgage repo rates to discount rate changes ("Great Recession")

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
mrpl1	-.1828347	.0495796	0.000	-.2803009	-.0853686
mrpl2	-.0872755	.0502723	0.083	-.1861035	.0115525
mrpl3	-.0311055	.0504466	0.538	-.1302761	.068065
mrpl4	-.0585983	.0502152	0.244	-.1573139	.0401174
mrpl5	-.0940599	.0671058	0.162	-.2259801	.0378604
cfr	-.0267551	.0975689	0.784	-.2185612	.165051
cdisr	-.3766381	.495089	0.447	-1.34991	.5966342
_cons	1.216738	1.339524	0.364	-1.41657	3.850046

Table 3.38 Test 2: The response of 3-month mortgage repo rates to discount rate changes ("Great Recession")

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
mrpl1	-.1636372	.0487712	0.001	-.2595115	-.067763
cfr	-.0263583	.0977414	0.788	-.2184979	.1657813
cdisr	.0330872	.3624525	0.927	-.6794203	.7455947
_cons	1.087429	1.336371	0.416	-1.539603	3.71446

Table 3.39 Test 3: The response of 3-month mortgage repo rates to discount rate changes ("Great Recession")

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
mrpl1	-.1765637	.0493379	0.000	-.2735526	-.0795748
mrpl2	-.0792302	.0493283	0.109	-.1762002	.0177398
cfr	-.0246813	.0975583	0.800	-.2164624	.1670997
cdisr	.0409496	.3617859	0.910	-.6702527	.7521519
_cons	1.181205	1.335068	0.377	-1.443286	3.805695

Table 3.40 Test 4: The response of 3-month mortgage repo rates to discount rate changes ("Great Recession")

mrp	Coef.	Std. Err.	P>|t|	[95% Conf. Interval]	
mrpl1	-.1632786	.0486978	0.001	-.2590078	-.0675494
cdisr	.0348303	.3619838	0.923	-.6767507	.7464112
_cons	1.081497	1.334674	0.418	-1.542181	3.705175

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