ARCH and GARCH 模型分析：每週貨幣供給量之宣告對利率水準之影響

ARCH and GARCH Modeling Analysis: The Effect of Weekly Money Supply Announcements on Interest Rates

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摘要

通膨期望和流動效果假設，係研究貨幣供給量宣告及利率變動之理論基礎，多數之學者皆發現：每週非預測之貨幣供給量宣佈，對利率水準具有顯著之影響。本文主要利用GARCH模型，試著找出在OLS分析下所無法發現之流動性效果假設。研究結果發現：非預期貨幣供給量之宣告，正向且顯著地影響短期利率水準，吻合通膨期望假設理論。

關鍵字：通膨期望假設、流動效果假設、貨幣供給量宣告、GARCH、OLS

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ABSTRACT

The inflation expectation hypothesis and the liquidity effect hypothesis are two a different approaches for analyzing the relationship of the weekly money supply announcement and the interest rate movement. A positive relation supports the theory of inflation expectation hypothesis and a negative one supports the theory of the liquidity effect hypothesis.

Most of the previous authors found that the relationship between the unanticipated money supply announcement and interest rates is significant and positive. This paper intends to extend such a study by constructing the ARCH model to try finding out if there is any significant liquidity effect that could not be found by using OLS.

However, this paper provides the consistent evidence of the inflation expectation hypothesis and the policy anticipation hypothesis, indicating state that the unexpected money supply announcement brings a positive and significant effect on the short-run interest rate.

Keywords: inflation expectation hypothesis, liquid effect hypothesis, money supply announcement, ARCH, OLS.

1. Introduction

The reaction to interest rates induced by the Federal Reserve weekly money supply announcement has long been a central focus of monetary research. Economists have examined indetail the impact of the Federal Reserve's (Fed) weekly supply announcement on interest rates [see,for example, Mishkin (1981), Makin (1983), Hardouvelis (1984), Grier (1986)]. Actually, there area lot of debate issues related to this area. In particular, the most consistent finding has been that anunanticipated rise in the reported money supply tends to increase in the nominal short-term and long-term interest rates.

Two major popular explanations have been advance in previous literatures. The first is the"policy anticipation hypothesis" which states that the market expects the Fed to anticipate open salein the money market and increasing interest rates tend to bring the money supply back on target.However, the policy anticipation hypothesis is that those in the financial market believe that the FedWants to offset a positive weekly money shock which will increase the real interest rate under theassumption of short-run price rigidity. Hence, the interest rate rise of today anticipates the rise in future market participants also think about the expectation of an increase in the spread of U.S.and foreign real interest rates, resulting in capital inflow and the appreciation of the U.S. dollar. The second explanation is the "inflationary expectation hypothesis", which states that an increase in interest rates due to an increase in inflationary expectation because of an unexpected increase in the money supply of Fed reveals the market's expectation of future inflation, again raising interest rates. The inflation expectation hypothesis is where those in the market do not believe that the Fed will Commit itself to a given monetary growth policy. The Fed is anticipated to accommodate a positive Money supply surprise, by increasing money supply growth, thus increasing the inflation premium in the nominal interest rate. The increase in U.S. inflation relative to other foreign countries results in the markets participants expecting the U.S. dollar to depreciate in the financial market. In general, the policy anticipation effect and the inflation expected effect both predict that nominal interest rateswill react to the weekly unanticipated money growth announcement.

The aforementioned hypotheses are the theory of Milton Friedman (1968) stated that interestrates may rise in response to money growth because of inflation expectation. However, an alternativeviews comes from the Keynesian macro model stating that an increase in the money growth leads toa decline in the interest rate, at least in the short and medium run. The Keynesian liquidity preferencemodel states that there exists a liquidity effect because of the price level which does not respond instantaneously to monetary shock. Because of this, the interest rates adjust to reduce to clear the sudden increase in the supply of money balance.

The theory of inflation expectation hypothesis and the liquid effect hypothesis suggest a different approach for analyzing the relationship of the weekly money supply announcement and the interest rate movement. Positive signs support the hypothesis

theory of inflation expectation and negative sign supports the theory of the liquidity effect hypothesis.

Also, there are a lot of empirical results that demonstrate that the effect of an unanticipated money supply announcement tends to have a more positive and significant effect on the interest rate than on the expected and significant within subperiods and across time.

Most of the previous authors found that the consistent result of the unanticipated money supply announcement to interest rates is significant and positive. However, some authors arguewhether the model selection (OLS)[1], supports a consistent result. Grier and Perry (1993) mentionthat the most recent empirical works do not support evidence for the liquidity effect mainly becauseof the failure to model the conditional heteroscedastity of interest rates.

Therefore, in my paper, the literature is extended by constructing the ARCH model and by trying to find out if there is any significant liquidity effect where the OLS cannot find it. Hence, there are many source that analyze the change of the Fed policy at different subperiods which has a large and significant effect on the interest rate variable. Therefore, an interesting analysis of this paper is the comparison of the announcement effects in the periods before and after the Fed change in operating procedure on October 6, 1979. However, historical empirical results state that the effect of the unanticipated money supply announcement had a significant and positive relationship post October 1979. Thus, the announcement effect of the Fed switch policy regime to interest rates is discussed in this paper.

ARCH and GARCH modeling methodology is applied to compare and analyze the effect of anticipated an unanticipated weekly money supply announcement s to interest rates, and dummy variable will also include being the proxy variable to test the effect of the policy switch regime to interest rates. Then the policy anticipation theory or liquidity effect hypothesis are tested under the ARCH and GARCH results. Finally, the lag of money supply announcement to interest rates is tested.

2. Model Specification and Data

2.1The Model

The efficient markets approach is applied here to assume that the response of the interest rateto the announcement weekly money supply takes the linear form as specified in the following:

$$di_t=b_0+b_1dUm_t+e_t \quad (1)$$

$$di_t=b_0+b_1dUm_t+b_2dm_t+e_t \quad (2)$$

where di_t = difference in the interest rate over a period including the money supply

[1] OLS indicates that Ordinary Least Square method.

announcement in week t; dUm_t = difference in the unanticipated component of the announced change in the money supply; dm = difference in the announcement of change in money supply;e_t = random error term; and b_0, b_1, b_2 = estimated coefficients.

In the above model, this assumed that the market is efficient, implying that only the unanticipated change in money systematically affects interest rates. Here the residuals and predicted values from the ARIMA model for m_t are the respective proxies for the unanticipated component in equation (1). Thus, the independent variables will be orthogonal, which means that the estimated coefficient b1 states that the effect of unanticipated change of money supply to interest rates will be the same as the regressing of the change of interest rates on the unanticipated change in money supply. Previous analyses used the difference between the change of money market survey money variables and the Fed's announcement variables for the unanticipated money supply variable. Here, the ARIMA residual values of money supply are used as the proxy of the unanticipated money supply due to the lack of money market service survey data.

2.2 Data

2.2.1 Money Supply

Weekly data on the money supply were obtained from the H6 release data of the Federal Reserve Bank. The data samples range form 1975 to 1997. The data which are used is the narrowly defined money supply, M1. Because of a change in policy regimes, the data are divided into two subsample periods. The first subsample period is from 1975 until 1979, and the second subsampleperiod is from 1979 until 1997.

2.2.2 Unanticipated Money Supply

However, aforementioned show that both short-run and long-run interest rates response to increase when the change in money supply exceeds the change anticipated by market participants. Nevertheless, based on those empirical test results, economists depend more on the survey data from the expected announced change in the money supply denoted by MMS (Money Market Service Inc.). Cunningham and Cunningham (1991) explain that there are two issues to decide on market Expectations of the Fed's weekly money supply announcement. The first is a survey result which is usually the median forecast of government security dealers published by the MMS. The second is a time series model generated forecast, either an OLS or an ARIMA projection, that helps choose the appropriate proxy for market expectations. Cornell (1983), Grossman (1981), and Urich and Wachtel (1981) display the median forecast of the MMS as the best method for forecasting the actual money supply announcement. Hafer (1984) asserts that the MMS survey data are better predictors of the actual money supply announcement than an ARIMA model, but, if the abnormal weeks data[2] are eliminated, then the time series ARIMA model produces a better forecast than the MMS survey data. An ARIMA

procedure is chosen in this paper to conform with the existing weekly money supply announcement literature, which, in this case uses either an ARIMA or simple OLS procedure as a proxy for market expectations if the MMS survey itself is not used. In this paper, the ARIMA model of the money supply variable is applied to get the residual variables of the proxy of the unanticipated money supply. However, the estimates of the effect of the difference of the ARIMA residuals to the proxy for an unanticipated change in the money supply on an interest rate are robust to change in the specifications of the ARIMA model (see, Urich and Wachtel 1981).

2.2.3 Interest Rates

The three-month Treasury bill yield (tb3m) data, which are the Friday weekly ending data and the six-month maturity Treasury bill rate (tb6m) data, are the average discount rates at auctions of U.S. Treasury bills, which are also the weekly ending Friday data. Then the one-year(tc1y), three-year (tc3y), and five-year (tc5y) constant maturity data, which are also weekly ending Friday data. Last, the short-term federal fund (feud) rate data, which are weekly ending Wednesday, show the cost of borrowing immediately available funds. These interest rate data are obtained from the Fed's release data H10 series.

3. ARCH and GARCH Models

In recent years, researchers focus on the attention of examining news into the volatility process of financial variables. Hence, previous studies ignoring the volatility mechanism may not offer a through understanding of the information transmission mechanism. A Fed weekly money supply announcement increases the uncertainty about the impact of forthcoming Fed actions and causes the ex ante volatility of the real rate to increase. Previous authors found that the financial market responses quickly to weekly unanticipated change in the money supply but that anticipated change has no effect on the interest rate variables. Robert Engle (1982) shows that it is possible to simultaneously model the mean and variance of a series. ARCH models provide a way to parameterize the time-varying conditional variance commonly observed in exchange rates, asset prices, and interest rates. Engle developed the ARCH model where the conditional variance is a linear function of the past square errors. The simplest representation of this model is an ARCH(1) model defined as:

$$di_t=b_0+b_1dM_t+e_1 \quad \text{Where } e_t|_{t-1} \sim N(0, \delta^2) \tag{3}$$

and

$$\delta^2_t=a_1+a_1e^2_{t-1}+\varepsilon_t \tag{4}$$

[2] The abnormal weeks data are the weeks in which there is a benchmark revision, aseasonal adjustment revision, and/or the third of the month falls on a weekend.

Equations (3) and (4) are the basic ARCH(1) models. The conditional variance δ^2_t is a linear functionof the squared of last periods error. Here, the ARCH(1)-M model developed by Engle, Lilien andRobins (1987) is introduced. The ARCH-M model allows the mean to be a function of the conditional error variance, and it is useful for measuring time-varying risk premiums in the term structure. The ARCH-M model, as discussed above, has the following form:

$$di_t=b_0+b_1dUM_t+a_2\,\delta^2_t+e_t \qquad (5)$$

Bollerslev (1986) generalized the ARCH model by allowing the conditional variance to be a function not only of the last period's squared error term but also of its conditional variance. The GARCH(1,1) model defines the conditional variance to be the following form:

$$\delta^2=a_0+a_1e_{t-1}^2+a_2£\_t\text{-}12+\delta_{t+1}^2+\varepsilon_t \qquad (6)$$

To estimate the ARCH GARCH models, the maximum-likelihood estimation is employed using the Berndt-Hall-Hausman algorithms. However, it is believed that the maximum-likelihood estimator for applying the ARCH, GARCH models will provide efficiency estimated then the OLS method.

4. Empirical Results of Money Supply Announcement to Interest Rates

4.1. Expected Money Supply Announcement

Here, we estimate the efficient market model as an ARCH(1) process. Table 1 reports the estimation result of the expected money supply announcement to interest rates. The efficient markets ARCH model did not support the positive and significant effect at different subsample areas. Table 2 shows the results of the expected money supply announcement to interest rate at ARCH-M model. The positive and significant effect is at the variable of short-run federal feud rate. Then, the GRACH(1,1) model analysis of the expected money supply announcement effect is demonstrated in Table 3, which shows that 1st and 2nd subsample periods do not have any significant and positive money supply announcement effect. However, we find that the dtc5y and dfeud interest rate variables exist with a significant response to the expected money supply announcement.

4.2. Unexpected Money Supply Announcement

Testing is done now on the unanticipated part of the weekly change in M1 affects interest rates. The estimation results of the impact effect of the unexpected money supply announcement to interest rates is displayed in Tables 4, 5, and 6 for the ARCH, ARCH-M,

and GARCH, respectively. Table 4 shows that the dtb3m and dfeud have a positive and significant impact effect at the 1st subsample and full sample periods. Table 5 exhibits the ARCH-M model estimation results of the unanticipated money supply announcement to interest rate. Table 5 indicates that the dfeud exists with a positive and significant impact effect at the 2nd subsample and full sample periods. GRACH model analysis results are listed in Table 6. Interestingly, there was no positive or significant effects displayed at the 1st subsample, 2nd subsample, and full sample periods.

4.3. The Comparison Impact Effect of the Expected and unexpected Money supply Announcement to Interest Rates

In this paper, the analysis of the comparison of the unexpected and expected money supply Announcement to the interest rate is included for different models and periods. Table 7 displays the Unanticipated money supply announcement which has a positive and significant impact effect on the 3-monthe Treasury bill rate at the 1st subsample period. Then, at the 2nd subsample period, both the anticipated and unanticipated money supply exhibit a positive and significant effect on the federal fund rate. However, at the full sample period, expected and unanticipated money supply did not have a large or significant effect on interest rate variables.

4.4. The Two Periods Lag of the Expected and Unexpected Money Supply Announcement to Interest Rates

Tables 10 and 11 present the results of applying the ARCH-M model to the effect of the lag of the expected and unexpected money supply to interest rate. Table 10 shows the two-period lag of the expected money supply announcement which has a positive and significant effect on the dtb3m, dtb6m, and the negative and significant effect dtely and dfeud. However, Table 11 shows no significant and positive impact effect of the two-period lag of unexpected money supply announcement to interest rate. The result show that only the dtely has the negative and significant effect.

4.5. Federal Reserve Policy Change Effect

On October 6, 1979, the Fed announced that it would put stress on the behavior of the money stock and reduce the importance given to fluctuations in the federal fund rate. Here, the ARCH-M model allows us to include the dummy variables D1 and D2, which are the proxies of the Fed policy change regimes, in the conditional variance. The result of the effect of the Fed change on the monetary target policy is shown Table 12. The result shows that the switch policy regime actually has a significant effect on the interest rate variables at the full sample periods. The significant t-value of the two dummy variables indicates that the change of policy regime has a significant impact on the interest rate variables.

5. Conclusion

This paper uses the ARCH and GARCH models to test whether the expected or unexpected money supply announcement has a positive and significant effect on the interest rate variables. The empirical results show that the ARCH model coincidences with the "inflation expectation hypothesis" and "policy anticipation hypothesis." Hence, the results shown here are different from the conclusions of Grier and Perry(1993). However, this paper provides the consistent results of the inflation expectation hypothesis and the policy anticipation hypothesis, which state that the unexpected money supply announcement provides a positive and significant effect on the short-run interest rate. In this expectation, the expected money supply announcement to interest rate did not have any significant effect on interest rates is the finding in this paper. The impact effect analysis of the lag periods of the expected money supply announcement has been found statistically significant here. Also, the significant impact effect of the change of the Fed policy to the interest rate is also consistent with previous empirical results.

Another important finding is that when we employed the ARCH, ARCH-M, and GARCH models to help us look at the effect of the expected money supply announcement to interest rate, we found the ARCH of ARCH-M model supports a better expectation result. But the GARCH model did not give us any significant result of the money supply announcement to interest rate variables. Hence, the ARCH model will be the better model than the GARCH model to explain the money supply announcement effect on interest rate.

However, we did not use the data in the same way as previous authors. We employed the Forecast residuals, which are derived from the forecasting ARIMA model to be the proxy of the Unexpected money supply announcement variable. Then, we applied the ARCH, GARCH model to discuss the money supply announcement effect (expected or unexpected) on interest rates variablesand also compared the expected and unexpected money supply announcement to interest rates at the different subperiods. Then, the two periods lag of money supply announcement effect and the Fed bank switch policy regimes to interest rates variables. However, the empirical results received from the ARCH and GARCH models provide evidence of the consistency with the inflation rate expectation and policy anticipation hypothesis.

6. References

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Table 1: The Impact Effect of the Expected Money Supply Announcement on Interest Rates: (ARCH Model)

$$di_t = b_0 + b_1 dUm_t + e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta_t^2 = a_0 + a_1 e_{t-1}^2 \quad \varepsilon_t$$

Variables	1st Subsample					2nd Subsample				
	b0	b1	a0	a1	F	b0	b1	a0	a1	F
dtb3m	0.0132	0.002	0.0272***	0.291***	291	-0.0176	0.0012	0.263***	0.308***	96.6
	(0.011)	(0.00)	(0.002)	(0.073)		(0.028)	(0.002)	(0.002)	(0.066)	
dtb6m	0.15*	0.0003	0.2663***	0.145***	306	0.02	0.0044	8.85***	0.9251	-2647
	(0.011)	(0.003)	(0.002)	(0.079)		(0.346)	(0.030)	(2.305)	(0.538)	
dtc1y	0.0179*	-0.0012	0.0199	0.2188	334	0.0102*	0.0002	0.025***	0.993***	932.37
	(0.011)	(0.002)	(0.002)	(0.088)		(0.004)	(0.001)	(0.001)	(0.075)	
dtc3y	0.0107	-0.0012	0.0138***	0.197***	381	-0.008*	0.0002	0.026***	0.571***	1000.1
	(0.009)	(0.002)	(0.002)	(0.101)		(0.005)	(0.001)	(0.001)	(0.044)	
dtc5y	0.0105	-0.0008	0.0102***	0.116*	427	-0.0031	-0.0002	0.027***	0.3828*	1044
	(0.007)	(0.002)	(0.001)	(0.068)		(0.006)	(0.000)	(0.00072)	(0.0422)	
dfeud	0.0158	0.0013	0.016***	0.372***	346	0.0072	0.003**	0.062***	1.007***	527.52
	(0.010)	(0.002)	(0.001)	(0.098)		(0.007)	(0.001)	(0.002)	(0.067)	

Variables	Full Sample				
	b0	b1	a0	a1	F
dtb3m	-0.00416	0.0007943	0.209778***	0.342467***	251.863
	(0.020707)	(0.00171)	(0.001325)	(0.059679)	
dtb6m	-0.0084	0.0007301	0.188551***	0.23413***	334.009
	0.0220714	0.001576	0.001108	0.493607	
dtc1y	0.107704***	0.00006102	0.02366542***	0.9469443***	1236.011
	(0.003608)	(0.0048)	(0.007821)	(0.05867)	
dtc3y	-0.004686	0.0001331	0.23107***	0.575664***	1352.21
	(0.0044903)	(0.0004889)	(0.0006213)	(0.38485)	
dtc5y	0.0005873	-0.00021319	0.02272***	0.02272***	1425.7984
	(0.0051416)	(0.0004841)	(0.0005058)	(0.00050587)	
Dfeud	0.095241***	-0.00347	0.03379***	0.50702***	356.0285
	(0.003089)	(0.0003038)	(0.0020249)	(0.2561496)	

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 2: The Impact Effect of the Expected Money Supply Announcement on Interest Rates: (ARCH-M Model)

$$di_t=b_0+b_1 dUm_t+a_2 \delta_t^2+e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta_t^2=a_0+a_1 e_{t-1}^2 \varepsilon_t$$

Variables	1st Subsample						2nd Subsample					
	b0	b1	b2	a0	a1	F	b0	b1	b2	a0	a1	F
dtb3m	0.041	0.002	0.05	0.03	0.31	291	-0.28	0.0014	0.491	0.267	0.24	96.8
	(0.06)	(0.0)	(0.4)	(0.0)	(0.1)		(0.17)	(0.002)	(0.299)	(0.002)	(0.006)	
dtb6m	0.0267	0.001	-0.06	0.03	0.16	307	0.617	0.0022	-0.065	13.532	0.8892	-2650
	(0.11)	(0.0)	(0.6)	(0.0)	(0.0)		(1.44)	(0.029)	(0.132)	(4.300)	(0.587)	
dtc1y	0.0266	0.001	-0.06	0.02	0.156	307	-0.043	-0.001	0.2819	0.0205	1.2252	946.5
	(0.11)	(0.0)	(0.6)	(0.0)	(0.1)		(0.007)	(0.000)	(0.020)	(0.0006)	(0.061)	
dtc3y	0.099	-0.01	-0.67	0.01	0.22	381	0.0845	0.001	-0.476	0.025	0.6071	1007
	(0.08)	(0.0)	(0.6)	(0.0)	(0.1)		(0.018)	(0.00)	(0.078)	(0.0009)	(0.056)	
dtc5y	0.1479	-0.01	-1.26	0.01	0.169	429	0.0507	-0.0002	-0.287	0.02742	0.3721	1044
	(0.09)	(0.0)	(0.9)	(0.0)	(0.1)		(0.028)	(0.001)	(0.148)	(0.0007)	(0.043)	
dfeud	0.104	0.001	-0.61	0.02	0.295	343	-0.003	0.002	0.038	0.0618	1.018	527.4
	(0.05)	(0.0)	(0.3)	(0.0)	(0.1)		(0.01)	(0.00)	(0.01)	(0.002)	(0.06)	

Variables	Full Sample					
	b0	b1	b2	a0	a1	F-value
dtb3m	-0.04278	0.000857	0.0792317	0.2103***	0.3282***	252.048
	(0.09376)	(0.001695)	(0.173053)	(0.001360)	(0.058423)	
dtb6m	-0.22267*	0.007579	0.47757*	0.1894***	0.2036***	334.917
	(0.14998)	(0.001616)	(0.320671)	(0.001226)	(0.54631)	
dtc1y	-0.046***	-0.000252	0.2967***	0.0208***	1.090***	1247.444
	(0.00648)	(0.000433)	(0.02163)	(0.000624)	(0.048901)	
dtc3y	0.0824***	0.0000243	-0.475	0.0218***	0.599***	1364.378
	(0.014697)	(0.000461)	(0.066507)	(0.00073)	(0.0505287)	
dtc5y	0.1366***	-0.00031	-0.820***	0.0208***	0.485***	1431.474
	(0.016954)	(0.000437)	(0.0888756)	(0.000522)	(0.045977)	
dfeud	0.00014047	0.0025***	0.0379***	0.048***	1.028***	816.464
	(0.007483)	(0.000514)	(0.009243	(0.001062)	(0.05777)	

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 3: The Impact Effect of the Expected Money Supply Announcement on Interest Rates: (GRACH Model)

$di_t=b_0+b_1dm_t+e_t$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$\delta^2=a_0+a_1e_{t-1}+a_2\delta^2_{t-1}+\varepsilon_t$ -

Variables

1st Subsample

	b0	b1	a0	a1	a2	F-value
dtb3m	0.0119551 (0.011392)	0.0002661 (0.002351)	0.0161*** (0.004018)	0.3150*** (0.071362)	0.2926*** (0.129043)	293.1039
dtb6m	0.016177* (0.010621)	0.0006219 (0.002704)	0.0146*** (0.004981)	0.1684*** (0.072198)	0.3749*** (0.181379)	307.7993
dtc1y	0.018192* (0.011471)	-0.001066 (0.002047)	0.0124*** (0.004805)	0.2241*** (0.100765)	0.296*** (0.225539)	336.02469
dtc3y	0.0126684 (0.008975)	-0.001458 (0.001712)	0.0053*** (0.001875)	0.2041** (0.085134)	0.501*** (0.150447)	382.9383
dtc5y	0.01293** (0.006772)	-0.001045 (0.001533)	0.0021*** (0.000630)	0.1205*** (0.051058)	0.698*** (0.075412)	429.0646
Dfeud	0.0145679 (0.010568)	0.0014382 (0.002355)	0.0166*** (0.001952)	0.2938*** (0.089602)	0.0529951*** (0.07084)	342.3886

Variables

2nd Subsample

	b0	b1	a0	a1	a2	F-value
dtb3m	-0.015461 (0.027517)	0.001099 (0.001952)	0.2698*** (0.00512)	0.3040*** (0.06571)	-0.010768 (0.01653)	96.922
dtb6m	0.0329807 (0.359098)	0.001737 (0.03028)	12.798*** (3.113608)	0.854896 (0.581725)	0.0398606 (0.115431)	-2650.73
dtc1y	-0.00684* (0.004284)	0.000037 (0.0003)	0.0015*** (0.000141)	0.309*** (0.023185)	0.695*** (0.015252)	1146.876
dtc3y	-0.004448 (0.005376)	-0.000292 (0.00039)	0.0035*** (0.00023)	0.3060*** (0.02959)	0.6409*** (0.028649)	1100.775
dtc5y	-0.002752 (0.005350)	-0.000563 (0.000371)	0.0028*** (0.000229)	0.2531*** (0.025772)	0.6916*** (0.019901)	1139.201
Dfeud	-0.004812 (0.00887)	0.001688 (0.00072)	0.0178966 (0.00052)	0.609008 (0.06142)	0.4475981 (0.020662)	603.545

Variables	Full Sample					
	b0	b1	a0	a1	a2	F-value
dtb3m	-0.002517 (0.020374)	0.0007209 (0.001723)	0.2123*** (0.002273)	0.3491*** (0.060902)	-0.007461 (0.007859)	252.3598
dtb6m	-0.007684 (0.022058)	0.0007076 (0.001705)	0.1902*** (0.005396)	0.2362*** (0.050017)	-0.00641 (0.025860)	334.2591
dtc1y	-0.00708* (0.004277)	0.0000104 (0.000340)	0.0015*** (0.00016)	0.2393*** (0.023165)	0.748*** (.018057)	1464.4084
dtc3y	0.0000749 (0.00419)	-0.000396 (0.000357)	0.0013*** (0.000190)	0.1705*** (0.019144)	0.8015*** (0.018361)	1498.417
dtc5y	0.0014145 (0.003726)	-0.0006** (0.00033)	0.0012*** (0.000152)	0.1689*** (0.021557)	0.799*** (0.01996)	1571.038
dfeud	-0.005428 (0.006344)	0.0014*** (0.000468)	0.0053*** (0.000297)	0.4889*** (0.029981)	0.6019*** (0.01509)	981.713

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 4: The Impact effect of the Unexpected Money Supply Announcement on Interest Rates: (ARCH Model)

$di_t=b_0+b_1 dUm_t+e_t$

Where $e_t | I_{t-1} \sim N(0, \delta^2)$

$\delta^2_t=a_0+a_1 e^2_{t-1}+\varepsilon_t$

Variables 1st Subsample

	b0	b1	A0	a1	F-value
dtb3m	-0.0506801 (0.048697)	0.03456*** (0.0161964)	0.382131*** (0.038491)	0.20874*** (0.0839689)	-22.806718
dtb6m	0.01744 (0.010403)	-0.002147 (0.00399)	0.022865 (0.001862)	0.072776 (0.07109)	301.838
dtc1y	0.02679035 (0.03434)	0.004326115 (0.008925)	0.13558**** (0.010522)	0.32717*** (0.1163256)	79.7447
dtc3y	0.0212767 (0.0254697)	0.00271241 (0.0069315)	0.089109*** (0.00703751)	0.22405*** (0.0889909)	134.7334
dtc5y	0.0203456 (0.0232381)	0.00441127 (0.0062327)	0.076651*** (0.00609276)	0.189108*** (0.08776085)	154.1318
Dfeud	-0.0118291 (0.0360760)	0.019378*** (0.00854305)	0.180342*** (0.02200467)	0.85790*** (0.15335479)	0.610671

Variables 2nd Subsample

	b0	b1	a0	a1	F-value
dtb3m	-0.0207073 (0.0296326)	0.00259889 (0.00447488)	0.26274*** (0.0021934)	0.293652*** (0.06419008)	99.7437
dtb6m	0.01560222 (0.353135)	0.01371278 (0.0635981)	8.894761*** (2.30136826)	0.926996*** (0.55348467)	-2579.225
dtc1y	0.014612*** (0.00443)	0.0004184 (0.0010349)	0.023305*** (0.000945)	0.959363*** (0.075216)	944.629
dtc3y	-0.0052437 (0.00589704)	0.00044187 (0.0012439)	0.026580*** (0.0007956)	0.430090*** (0.0478032)	1011.0144
dtc5y	-0.002529 (0.0063978)	0.0005781 (0.0012247)	0.02694*** (0.00069334)	0.317854*** (0.04427709)	1051.93048
Dfeud	0.013112*** (0.0058036)	0.009680*** (0.00049675)	0.04567*** (0.0017658)	1.249716*** (0.08768814)	573.7637

Variables	Full Sample				
	B0	b1	a0	a1	F-value
dtb3m	0.002429 (0.0211)	-0.0010797 (0.00306)	0.210013*** (0.001553)	0.395142*** (0.0659124)	238.938
dtb6m	-0.006281 (0.022003)	0.00003485 (0.005212)	0.190858*** (0.0016312)	0.247292*** (0.0521602)	319.3412
dtc1y	0.11831*** (0.0033168)	0.001548*** (0.00076375)	0.022641*** (0.00087108)	1.012024*** (0.0605445)	1216.5104
dtc3y	-0.00171472 (0.0064363)	0.0000958 (0.0011932)	0.037626*** (0.0007732)	0.014481*** (0.00147982)	1258.7419
dtc5y	0.00023614 (0.00515957)	0.00098987 (0.0009129)	0.022469*** (0.00049913)	0.425832*** (0.0374842)	1393.177
dfeud	0.022449*** (0.0041395)	0.007087*** (0.0037191)	0.040189*** (0.001363)	1.377404*** (0.0808559)	797.9126

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 5: The Impact Effect of the Unexpected Money Supply Announcement on Interest Rates: (ARCH-M Model)

$$di_t=b_0+b_1 dUm_t+b_2\,\delta^2{}_t+e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta^2{}_t=a_0+a_1 e_{t-1}^2+\varepsilon_t$$

Variables 1st Subsample

	b0	b1	b2	a0	a1	F-value
dtb3m	0.039345 (0.1103)	-0.000333 (0.003804)	-0.134532 (0.66727)	0.0249*** (0.001917)	0.1451*** (0.076093)	283.53
dtb6m	0.105396 (0.219803)	-0.001724 (0.004067)	-0.563555 (1.42688)	0.0224*** (0.0019)	0.0621412 (0.06925)	302.558
dtc1y	-1.838851 (4.77099)	0.001392 (0.00310)	13.59577 (34.9651)	0.0186 (0.001396)	0.006147 (0.016354)	329.796
dtc3y	0.265664 (0.220106)	-0.000214 (0.00252)	-2.13014 (1.91975)	0.0120*** (0.001291)	0.13668 (0.11391)	363.858
dtc5y	0.3583*** (0.20638)	-0.001985 (0.002119)	-3.547*** (2.192084)	0.0081*** (0.000802)	0.1383636 (0.093714)	407.0321
Dfeud	0.184042 (0.132767)	-0.004189 (0.00641)	-1.217750 (1.017872)	0.0156*** (0.00128)	0.1584*** (0.09244)	333.326

Variables 2nd Subsample

	b0	b1	b2	a0	a1	F-value
dtb3m	-0.457*** (0.205480)	0.0028977 (0.004179)	0.8133*** (0.366738)	0.2671*** (0.002767)	0.2064*** (0.056926)	100.8733
dtb5m	0.1546583 (1.021561)	0.016549 (0.065828)	-0.017899 (0.098810)	11.209*** (3.030246)	0.9088*** (0.592758)	-2583.102
dtc1y	-0.052*** (0.008896)	0.0003621 (0.001017)	0.3086*** (0.031271)	0.0219*** (0.00589)	1.0647*** (0.061713)	939.5156
dtc3y	-0.0598*** (0.024803)	0.0005083 (0.001283)	-0.350*** (0.112941)	0.0274*** (0.0009)	0.4184*** (0.050323)	1004.301
dtc5y	0.020895 (0.036574)	0.0005936 (0.001260)	-0.133275 (0.196043)	0.0271*** (0.000753)	0.2951*** (0.043179)	1044.187
Dfeud	0.0485*** (0.010224)	0.0096*** (0.000587)	-0.146*** (0.014881)	0.0514*** (0.001868)	1.0758*** (0.083689)	567.586

Variables	Full Sample					
	b0	b1	b2	a0	a1	F-value
dtb3m	-0.004648 (0.086336)	-0.001067 (0.00309)	0.014718 (0.153589)	0.2099*** (0.001572)	0.3921*** (0.065545)	239.64
dtb6m	-0.20425* (0.145397)	-0.000068 (0.005289)	0.4390829 (0.309033)	0.1912*** (0.00173)	0.2174*** (0.056296)	320.72
dtc1y	-0.042*** (0.006447)	0.0010052 (0.000675)	0.2770*** (0.021387)	0.0204*** (0.00061)	1.1153*** (0.049096)	1227.482
dtc3y	0.0818*** (0.013886)	0.0006474 (0.000855)	-0.474*** (0.062361)	0.0214*** (0.000697)	0.6139*** (0.05061)	1340.69
dtc5y	0.1402*** (0.016588)	0.0006123 (0.000871)	-0.849*** (0.087708)	0.0204*** (0.000506)	0.5039*** (0.047236)	1401.42
dfeud	0.0139*** (0.005382)	0.0071*** (0.0004)	0.0260*** (0.007288)	0.0397*** (0.001329)	1.3942*** (0.079485)	800.142

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 6: The Impact Effect of the Unexpected Money Supply Announcement on Interest Rates: (GARCH Model)

$$di_t = b_0 + b_1 dUm_t + e_t$$

Where $e_t | I_{t-1} \sim N(0, \delta^2)$

$$\delta^2_t = a_0 + a_1 e_{t-1}^2 + a_2 \delta^2_{t-1} + \varepsilon_t$$

Variables 1st Subsample

	b0	b1	a0	a1	a2	F-value
dtb3m	0.0161*** (0.011781)	-0.000443 (0.003713)	0.0093*** (0.004102)	0.1414*** (0.070521)	0.5459*** (0.174514)	285.793
dtb6m	0.0160745 (0.011780)	-0.000442 (0.003713)	0.0093*** (0.004101)	0.1414*** (0.070519)	0.545948 (0.174509)	285.793
dtc1y	0.0204*** (0.011306)	0.0012279 (0.00287)	0.0090*** (0.005559)	0.1088113 (0.101002)	0.457645 (0.31661)	320.625
dtc3y	0.0143*** (0.008746)	0.000269 (0.00250)	0.0033*** (0.00196)	0.0944691 (0.061313)	0.6719*** (0.168767)	362.166
dtc5y	0.0121*** (0.006995)	-0.001 (0.00228)	0.0017*** (0.00572)	0.09058** (0.043363)	0.737*** (0.07602)	402.812
dfeud	0.0219*** (0.009786)	-0.003192 (0.003251)	0.0102*** (0.002791)	0.1455*** (0.068068)	0.3149*** (0.17414)	333.135

Variables 2nd Subsample

	b0	b1	a0	a1	a2	F-value
dtb3m	-0.0215065 (0.0295761)	0.00264329 (0.0044583)	0.262898*** (0.0022041)	0.292668*** (0.063913)	0.05*** (0.000001)	99.741
dtb6m	-0.00392566 (0.3451419)	0.01590354 (0.06459165)	11.2367*** (3.0053)	0.90861943 (0.5842429)	0.05*** (0.0000001)	-2583.13
dtc1y	-0.012*** (0.005868)	0.0005737 (0.001071)	0.0076*** (0.00014)	0.4521*** (0.056133)	0.4733*** (0.026509)	1032.661
dtc3y	-0.012*** (0.005477)	0.0006498 (0.00106)	0.0069*** (0.000215)	0.3381*** (0.049312)	0.5242*** (0.03171)	1066.068
dtc5y	-0.101044 (0.005608)	0.0007195 (0.001054)	0.0006*** (0.000209)	0.2967*** (0.049639)	0.5440*** (0.032536)	1092.843
dfeud	-0.008742 (0.00759)	0.0008906 (0.000859)	0.0057*** (0.00055)	0.5848*** (0.051124)	0.5750*** (0.020256)	666.7222

Variables	Full Sample					
	b0	b1	a0	a1	a2	F-value
dtb3m	0.0040512 (0.020791)	-0.001113 (0.00306)	0.2127*** (0.002130)	0.4005*** (0.06701)	-0.006814 (0.006483)	240.07
dtb6m	-0.005373 (0.021891)	0.0000761 (0.005252)	0.1921*** (0.005102)	0.2489*** (0.05274)	-0.006411 (0.022707)	320.176
dtc1y	-0.003605 (0.004283)	0.000699 (0.000619)	0.0013*** (0.00009)	0.2190*** (0.020567)	0.7699*** (0.016492)	1452.044
dtc3y	0.0015220 (0.00424)	0.000708 (0.000668)	0.0011*** (0.000184)	0.1584*** (0.018924)	0.8171*** (0.01874)	1477.69
dtc5y	0.0007568 (0.003878)	0.0006436 (0.000651)	0.0010*** (0.000156)	0.1625*** (0.020771)	0.8128*** (0.01992)	1543.873
dfeud	-0.002224 (0.005433)	-0.000560 (0.00064)	0.0033*** (0.00032)	0.4626*** (0.033788)	0.6461*** (0.015575)	975.338

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Tables 7: The Comparison Impact Effect of the Expected and Unexpected Money Supply Announcement to Interest Rates: (ARCH Model)

$$di_t=b_0+b_1dUm_t+b2dM_t+e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta^2{}_t=a_0+a_1e_{t-1}^2+\varepsilon_t$$

Variables 1st Subsample

	b0	B1	b2	a0	a1	F-value
dtb3m	-0.055942 (0.047595)	0.029399* (0.019585)	0.0052369 (0.00784)	0.3763*** (0.040184)	0.2256*** (0.092399)	-22.4711
dtb6m	0.0104756 (0.486319)	0.0573965 (0.177447)	-0.005126 (0.07668)	2.428858 (58.5807)	0.9706*** (1.333827)	-582.8055
dtc1y	0.0268215 (0.034358)	0.0043583 (0.010236)	-0.000022 (0.004385)	0.1355*** (0.010559)	0.3272*** (0.117024)	79.7447
dtc3y	0.0215853 (0.025493)	0.0036956 (0.008123)	-0.000732 (0.003474)	0.0891*** (0.007028)	0.2231*** (0.088407)	134.7643
dtc5y	0.020275 (0.023242)	0.0041195 (0.007191)	0.000223 (0.003247)	0.0766*** (0.00609)	0.1891*** (0.087898)	154.1352
dfeud	-0.013039 (0.036831)	0.0123033 (0.011026)	0.0055638 (0.00423)	0.1855*** (0.021597)	0.8064*** (0.141151)	1.3796

Variables 2nd Subsample

	b0	B1	b2	A0	a1	F-value
dtb3m	-0.023476 (0.02976)	0.0016215 (0.005041)	0.0010827 (0.002199)	0.2630*** (0.002469)	0.2851*** (0.061717)	100.008
dtb6m	0.015266 (0.354122)	0.0120339 (0.072677)	0.001705 (0.034764)	8.8957*** (2.3396)	0.9269*** (0.56099)	-2579.22
dtc1y	0.0145** (0.004447)	0.003456 (0.001153)	0.0000604 (0.000548)	0.0233*** (0.000956)	0.9590*** (0.075294)	944.638
dtc3y	-0.005228 (0.005901)	0.0004877 (0.001405)	-0.000045 (0.00063)	0.0265*** (0.00080)	0.4293*** (0.047918)	1011.018
dtc5y	-0.002368 (0.006405)	0.00104 (0.00137)	-0.000473 (0.000610)	0.0260*** (0.00069)	0.3166*** (0.044008)	1052.42
dfeud	0.0119*** (0.006144)	0.0082*** (0.00071)	0.0013*** (0.000621)	0.0468*** (0.001802)	1.1937*** (0.085755)	576.099

Variables	Full Sample					
	b0	b1	b2	a0	a1	F-value
dtb3m	-0.000204 (0.021307)	-0.00185 (0.003431)	0.0011021 (0.001916)	0.2113211 (0.001668)	0.367984 (0.06384)	239.251
dtb6m	-0.007963 (0.022829)	-0.000767 (0.00603)	0.000864 (0.00198)	0.191063 (0.001671)	0.2425923 (0.052616)	319.566
dtc1y	0.0124009 (0.00323)	0.0022181 (0.000853)	-0.000613 (0.000525)	0.022372 (0.00089)	1.028995 (0.061398)	1217.47
dtc3y	-0.004004 (0.00445)	0.0012214 (0.001032)	-0.000213 (0.000559)	0.0227507 (0.000605)	0.5899462 (0.039581)	1326.543
dtc5y	0.0008612 (0.005183)	0.0016961 (0.001052)	-0.000694 (0.00055)	0.0224702 (0.000498)	0.423801 (0.0373)	1394.29
dfeud	0.021005 (0.00447)	0.0056032 (0.000706)	0.001334 (0.000616)	0.041761 (0.00138)	1.2957418 (0.076695)	800.059

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Tables 8: The Comparison Impact Effect of the Expected and Unexpected Money Supply Announcement to Interest Rates: (ARCH-M Model)

$$di_t=b_0+b_1 dUm_t+b_2 dm_t+b_2 \delta^2_t+e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta^2_t=a_0+a_1 e_{t-1}^2+ \varepsilon_t$$

Variables 1st Subsample

	b0	b1	B2	b3	a0	a1	F-value
dtb3m	0.015828 (0.1134)	-0.00399 (0.005)	0.00349 (0.0032)	-0.0019 (0.6887)	0.024*** (0.0019)	0.144*** (0.0757)	284.212
dtb6m	0.107793 (0.2303)	-0.00244 (0.0049)	0.0007 (0.0031)	-0.5806 (1.4954)	0.022*** (0.0019)	0.0591 (0.0681)	302.589
dtc1y	0.359883 (0.1908)	0.005037 (0.0042)	-0.00442 (0.0031)	-2.366** (1.3918)	0.017*** (0.0015)	0.11312 (0.0855)	323.515
dtc3y	0.338475 (0.2888)	0.002984 (0.0035)	-0.00339 (0.0024)	-2.75014 (2.529)	0.012*** (0.0012)	0.121084 (0.1111)	365.184
dtc5y	0.42015** (0.05836)	0.000313 (0.00276)	-0.001998 (0.00192)	-4.233*** (0.57496)	0.0083*** (0.00061)	0.0850*** (0.04452)	342.66
dfeud	0.17538 (0.1352)	-0.00593 (0.0041)	0.00175 (0.0025)	-1.1578 (1.0373)	0.015*** (0.0013)	0.16025* (0.0961)	333.598

Variables 2nd Subsample

	b0	b1	b2	b3	a0	a1	F-value
dtb3m	0.5164*** (0.04361)	0.0011289 (0.00539)	0.000263 (0.00191)	-1.0771*** (0.09121)	0.2103*** (0.00188)	0.6307*** (0.09252)	100.72
dtb6m	0.1538103 (0.03377)	0.0155315 (0.075461)	0.0010203 (0.034978)	-0.0178316 (0.009960)	11.212*** (3.045146)	0.908859 (0.59849)	-2583.10
dtc1y	-0.05*** (0.0089)	0.000594 (0.0011)	-0.00022 (0.0005)	0.313*** (0.0316)	0.021*** (0.0006)	1.065*** (0.0624)	939.65
dtc3y	0.060*** (0.0251)	0.000597 (0.0014)	-0.00008 (0.0006)	-0.35*** (0.1150)	0.027*** (0.0009)	0.417*** (0.0505)	1004.32
dtc5y	0.021905 (0.0367)	0.00107 (0.0014)	-0.00049 (0.0006)	-0.13844 (0.1973)	0.027*** (0.0007)	0.296*** (0.0429)	1044.70
dfeud	-0.0024 (0.0080)	0.0083** (0.0007)	0.001488 (0.0006)	0.045*** (0.0105)	0.045*** (0.0017)	1.225*** (0.0867)	578.671

Variables	Full Sample						
	b0	b1	b2	b3	a0	a1	F-value
dtb3m	-0.02262 (0.0908)	-0.00184 (0.0034)	0.001145 (0.0019)	0.041842 (0.1639)	0.211*** (0.0017)	0.358*** (0.0627)	239.96
dtb6m	-0.21665 (0.1501)	-0.00095 (0.0060)	0.00094 (0.0020)	0.4626 (0.3181)	0.191*** (0.0017)	0.211*** (0.0577)	32.987
dtc1y	-0.04*** (0.0063)	0.0019** (0.0007)	-0.0008* (0.0004)	0.283*** (0.0212)	0.020*** (0.0006)	1.117*** (0.0498)	1229.33
dtc3y	0.08*** (0.0146)	0.00087 (0.0009)	-0.00023 (0.0005)	-0.48*** (0.0672)	0.021*** (0.0007)	0.610*** (0.0521)	1340.83
dtc5y	0.15*** (0.0151)	0.00135* (0.001)	-0.0008* (0.0004)	-0.91*** (0.0828)	0.020*** (0.0004)	0.516*** (0.0464)	1402.85
dfeud	0.011** (0.0057)	0.005*** (0.0007)	0.0014** (0.0006)	0.030*** (0.0073)	0.041*** (0.0013)	1.315*** (0.0750)	802.69

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 9: The Comparison Impact Effect of the Expected and Unexpected Money Supply Announcement to Interest Rates: (GARCH Model)

$$di_t=b_0+b_1dUm_t+b2dm_t+e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta^2_t=a_0+a_1e_{t-1}^2+\varepsilon_t$$

Variables 1st Subsample

	b0	b1	b2	a0	a1	a2	F-value
dtb3m	0.014638 (0.0116)	-0.00484 (0.0052)	0.00425 (0.0033)	0.009*** (0.0041)	0.146*** (0.0728)	0.54*** (0.1811)	286.84
dtb6m	0.01167 (0.0075)	-0.0044 (0.0045)	0.00166 (0.0030)	0.046*** (0.0039)	0.088*** (0.0145)	-0.97*** (0.0139)	308.02
dtc1y	0.021** (0.011)	0.00564 (0.004)	-0.0041 (0.0029)	0.00885* (0.0056)	0.13349 (0.1054)	0.4413 (0.3252)	321.93
dtc3y	0.015** (0.0086)	0.003449 (0.0033)	-0.00309 (0.0022)	0.003443 (0.0019)	0.1044* (0.0653)	0.65*** (0.1762)	363.36
dtc5y	0.012*** (0.0069)	0.000175 (0.0029)	-0.00114 (0.0019)	0.0017** (0.0005)	0.0915** (0.0442)	0.73*** (0.0785)	403.046
dfeud	0.0210** (0.0101)	-0.0053 (0.0042)	0.00212 (0.0026)	0.010*** (0.0029)	0.143** (0.0681)	0.308*** (0.1825)	333.534

Variables 2nd Subsample

	b0	b1	b2	a0	a1	a2	F-value
dtb3m	-0.22319 (0.0293)	0.001946 (0.0049)	0.00095 (0.0021)	0.268*** (0.0051)	0.285*** (0.0623)	-0.01136 (0.0163)	100.61
dtb6m	-0.00703 (0.3570)	0.019758 (0.0754)	0.000057 (0.0349)	8.422*** (2.9869)	0.83001 (0.5637)	0.10293 (0.1243)	-2582.55
dtc1y	-0.01270 (0.0059)	0.00053 (0.0012)	0.00004 (0.0005)	0.007*** (0.0001)	0.451*** (0.0561)	0.473*** (0.0265)	1032.669
dtc3y	-0.012** (0.0054)	0.000983 (0.0011)	-0.00035 (0.0005)	0.006*** (0.0002)	0.335*** (0.0487)	0.527*** (0.0314)	1066.44
dtc5y	-0.010** (0.0056)	0.00136 (0.0011)	-0.00069 (0.0005)	0.006*** (0.0002)	0.294*** (0.0489)	0.548*** (0.0323)	1094.293
dfeud	-0.01107 (0.0077)	-0.00097 (0.001)	0.001*** (0.0005)	0.005*** (0.0005)	0.560*** (0.0489)	0.585*** (0.018)	673.26

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 10: The Impact Effect of the Lag of the Expected Money Supply Announcement on Interest
Rates: (ARCH-M Model)

$$di_t=b_0+b_1 dUm_t+a_2 \delta^2_t+e_t$$

Where $e_t | I_{t-1} \sim N(0, \delta^2)$

$$\delta^2_t=a_0+a_1 e_{t-1}^2+ \varepsilon_t$$

Variables	Full Subsample					
	b0	b1	b2	a0	a1	F-value
dtb3m	0.102*** (0.00508)	0.0034*** (0.00021)	-0.016*** (0.00472)	0.044*** (0.00227)	5.69*** (0.31732)	342.95
dtb6m	-0.132942 (0.12448)	0.0016*** (0.0009)	0.291418 (0.26175)	0.186*** (0.001227)	0.261*** (0.06423)	333.84
dtc1y	-0.044*** (0.00658)	-0.001*** (0.00032)	0.2871*** (0.021932)	0.0208*** (0.000635)	1.088*** (0.04976)	1246.199
dtc3y	0.0827*** (0.014466)	-0.000307 (0.000423)	-0.475*** (0.065499)	0.0218*** (0.000732)	0.5998*** (0.04996)	1360.942
dtc5y	0.1323*** (0.017065)	0.0000795 (0.000425)	-0.797*** (0.089004)	0.020*** (0.00053)	0.4809*** (0.045848)	1427.69
dfeud	0.003495 (0.007644)	-0.003*** (0.000717)	0.0231*** (0.00978)	0.048*** (0.000591)	1.0218*** (0.055545)	820.48

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 11: The Impact Effect of the Lag of the Unexpected Money Supply Announcement on Interest
Rates: (ARCH-M Model)

$$di_t=b_0+b_1 dUm_t+a_2 \delta^2_t+e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta^2_t=a_0+a_1 e_{t-1}^2+ \varepsilon_t$$

Variables	Full Subsample					
	b0	b1	b2	a0	a1	F-value
dtb3m	-0.013197 (0.089361)	-0.000163 (0.00265)	0.0275603 (0.16056)	0.2114*** (0.001187)	0.370*** (0.064157)	238.166
dt6m	-0.212658 (0.152387)	-0.000814 (0.00268)	0.4562311 (0.31908)	0.1916*** (0.001218)	0.2135*** (0.056188)	319.432
dtc1y	-0.043*** (0.00654)	-0.0015** (0.000701)	0.285*** (0.021793)	0.020*** (0.000645)	1.1077*** (0.049429)	1225.082
dtc3y	0.0857*** (0.014169)	-0.000618 (0.00082)	-0.496*** (0.06555)	0.0214*** (0.00073)	0.6125*** (0.051746)	1336.909
dtc5y	0.147505 (0.016333)	-0.000218 (0.00083)	-0.890027 (0.087286)	0.020375 (0.000506)	0.5091102 (0.04688)	1397.28
dfeud	0.002949 (0.00798)	-0.001123 (0.0011)	0.0245*** (0.000935)	0.049*** (0.000935)	1.041*** (0.061026)	785.656

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.

Table 12: The Impact Effect of the Switched Regime of the Unexpected Money Supply Announcement to Interest Rates: (ARCH-M Model)

$$di_t=b_0+b_1 dUm_t+b_2 \delta^2_t+e_t$$

Where $e_t|_{t-1} \sim N(0, \delta^2)$

$$\delta^2_t=a_0+a_1 e_{t-1}^2+a_2 d1+a_3 d2+ \varepsilon_t$$

Variables ----------

Full Subsample ----------

	b0	b1	B2	a0	a1	a2	a3	F-value
Dtb3m	0.0244* (0.018)	0.00027 (0.002)	-0.6440 (0.069)	0.21*** (0.002)	0.26*** (0.048)	-0.1*** (0.002)	0.05*** (0.00)	378.811
Dtb6m	0.02747 (0.018)	-0.0000 (0.003)	-0.0774 (0.080)	0.18*** (0.002)	0.19*** (0.038)	-0.1*** (0.002)	0.05*** (0.00)	463.67
Dtc1y	-0.037* (0.0071)	0.00132 (0.0072)	0.2567** (0.0234)	459.397*** (4.38691)	1.03966** (0.0543)	-459.38*** (4.38689)	-459.37*** (4.3868)	1228.857
Dtc3y	0.04*** (0.019)	0.00055 (0.001)	-0.2*** (0.107)	-163.74*** (0.001)	-0.01*** (0.002)	163.7*** (0.002)	163.7*** (0.00)	1274.76
Dtc5y	0.03*** (0.012)	0.00093 (0.001)	-0.2386 (0.082)	6.2732*** (0.001)	0.35*** (0.037)	-6.26*** (0.001)	-6.24*** (0.00)	1441.23
Dfeud	0.01*** (0.006)	0.004** (0.001)	0.024** (0.010)	660.86*** (0.002)	0.9922** (0.064)	-660.8* (0.002)	-660.8 (0.00)	846.41

Note: ***indicated at least significant at 10% level, list in the parenthesis is the standard error.