The Effect of Inflation Uncertainty on Money Demand in Islamic Republic of Iran

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Abstract

In this paper, we measure and analyze the effect of inflation uncertainty on money demand and quasi money in Islamic republic of Iran based on time serious quarterly data from 1990:2-2010:3.This paper uses an EGARCH method to model inflation uncertainty in Iran. We also used VECM method to estimate a long run relationship between demand for real money and explanatory variables. Our result show that inflation uncertainty has effect on money demand and quasi money in Iran and increase in inflation uncertainty leads to decrease in money demand. In other words, by increase in inflation uncertainty, economic agents prefer to less demand for money, because in high uncertainty condition, people prefer to use those asset has less risk of maintenance.

Keywords: Uncertainty Inflation; Money demand; ARCH (GARCH) Method; Iran

1. *Introduction*

Acceleration inflation in 1970, underlie the extensive studies in relation to uncertainty inflation and its effect on various variables such as money demand. The basic idea of this argument can be found in the ideas of economists such as Thornton, Fullarton, and Marshall. Thornton, in his book, which was published in the nineteenth Century, has concentrated that people hold the balance of money to protect their financial ability to repay their debts. So demand for money depends on trust of status of trades. Similarly, Fullarton, claims that the amount of money held does not related to price situation and it affected by market interest rate. Therefore, Marshall (1962) insisted the relation between three variables related to demand for money, interest rates and confidence. He believes that the choice between money and commodities, in addition to commodity utility depends on how changes in price of commodity. In this regard, Rabertson, insisted on the role of expectations and change in trust, and how to determine the demand for money (Biabani, 2009).

Inflation uncertainty is a one important inflation cost with a deviation in decision of saving and investment of economic firms and family. Clearly, cost estimation and future income got non transparent by increase in uncertainty of inflation and this can have adversely affected on resource allocation and economic activity. The effect of uncertainty on economic decision is different in time horizons. Short run uncertainty influenced mostly quick decisions while in the long run seriously affects the periodic decisions. Incomplete information on the structure of random shocks and market conditions are factors that are causing economic uncertainty. Purchasing power of durable goods remains unchanged by increases in proportion of general levels of prices. On the other hand purchasing power of money will reduce. Therefore, this led to further increase of durable goods and thus reducing the demand for money. So the overall effect of inflation uncertainty on money demand is ambiguous. Inflation uncertainty will increase precautionary demand for money in anticipation of lower future prices and risk of holding money as an asset increase that causes economic agents to reduce the amount of money held in their portfolios (Higgins & Majin, 2009).

Experimental work in this field such as Klein(1977), Laidler(1980), Blejer(1979), Allen(1982) show that the results of effect of inflation uncertainty on money demand.

It is noted that the impact of inflation uncertainty on money demand is an empirical issue and depends on market condition and economic states of each country. However, changes in the money supply and money demand function is important in the transfer of knowledge to other variables such as interest rates (Shahrestani & Sharifi, 2008). Money demand reflects the relation between monetary policies with the rest of the economy. We can predict exact effect of changes in money supply on other economic variables that money demand function is stable (Torenton, 1983).

This study is distinct into other studies of estimate of money demand function in Iranian economy because of uncertainty of inflation in money demand function. The main objective of this study is inflation uncertainty and money demand in Iranian economy.

Hypotheses are:

1) Inflation uncertainty has a negative impact on money demand (M_1) for narrow money.
2) Inflation uncertainty has positive impact on the demand for liquidity.

In this analysis, we use time series quarterly data and duration of the study is 1990:2-2010:3. The main source of data related to the model variables is the Central Bank of Iran (CBI).

Generally, the paper is organized as follows: in section 1, the general form of the money demand function and the theoretical value is present. In section 2, specific models of inflation uncertainty are explained. In section 3, data analysis and an estimation models are described. While in section 4, conclusion and suggestion are listed.

2. *Theoretical Background and Literature Review*

2.1 Money Demand

The nature and function of money is one of the economic issues that the various economic schools are considered. Analysis of factors affecting the demand for money is the issue. In the classical monetary theorists, money is that of acting as a medium of exchange. Except this function in the economy as a cover, it is like barter economy (Biabani, 2009). In Cambridge cash balance method, the demand for money indicates that private sector demand for money by a certain proportion (k) of nominal income (py), (M^D=kpy). With the economic crisis in 19292 and the general Keynes theory in 1930, economists have offered the theoretical foundation of the demand for money in the context of several different lines of thought. In Keynes theory, interest rate is as one explanatory variable in money demand function. In this approach, motives for holding money are divided into three sections: transaction motive, precautionary motive and speculative motive. Transactions and precautionary motives is in connection with the function of money as a medium of exchange and speculative motive is related to holding money.
Friedman new quantity theory was introduced from 1960 onwards. This theory was proposed in the paper« the quantity theory of money: restatement» (1956). According to Friedman's theory, money demand for an individual is limited by his resources and determine by establish equality between marginal revenues derived from the reserve money with the proceeds of asset replacement.

2.2 Relation between Inflation Uncertainty And Money Demand

According to the basis of theory and research, dependent and independent variables and model are presented below.

In narrow definite (M_1), money is all bills and currency held by the people (public) and demand deposits of commercial banks and depository institution but in widespread meaning (M_2), is money and quasi money (consist of loan deposits, savings deposits, short term investment and long term visual deposit) in Iran, which is liquidity in private sector. In this study, we use both M_1, M2.

Concerning other research carried out on this relation such as Khan,M.S.,(1980), Johansen, S.,and K., Juselius(1990), Bahmani-Oskooee.M.Chi Wing Ng, R.,(2002), Choi, D.Oxley, L.,e(2004), Hijins and Majin (2009), Islamion and heydari(2003), Hejebrkiani(1997). They used both definition in estimation of money demand.

Inflation uncertainty influence on money demand by long run interest rate in financial market and money market. Return value of long term loans will be associated with a greater risk because of inflation uncertainty.

As a result, investors will expect higher returns and greater rates have risen and rising long-term interest rates means that producers and consumers will be less invested in the machinery and equipment and purchase of durable goods (Ebrahimi &Sori,2006).

Concerning other research carried out on the relationship of the impact of inflation uncertainty on money demand, we can point to the studies of Klein (1977), Allen(1982),Gamer(1985),Smirlock (1982), Choudhry (1999), A.C. Arize, J.Malindretos, E.C.Grivoyannis (2005), Matthew L.Higgins & Shohreh Majin (2009), studies conducted by Boonekamp(1978)&Klein(1977) provides protection from direct impact of inflation uncertainty on money demand. Kelin(1977) expresses that people may be able to accept transaction that have already do in more money to maintain the balance when uncertainty about the value of real balances rises. In this regard, Bler,M.L(1979), emphasizes that the precautionary demand for money increases if there is uncertainty about the future prices. Besides, actual balance of other assets rises due to increasing the risk of uncertainty and as a result the portfolios will change and substitution is performed rather than the actual balance. Overall, the net effect of an increase in inflation uncertainty on money demand cannot be predicted but is an empirical issue. Ariz and others (2005) concluded that on increase in inflation uncertainty has significantly negative impact on demand for money both in long run and short run in the survey of inflation uncertainty for a number of less developed countries. The result of test of the impact of inflation uncertainty on money demand shows that inflation uncertainty has a negative effect on M_1 and positive effect on M_2. They replace the various components of M_2 instead of M_1 when people are faced with rising inflation uncertainty. In this study, the conditional variance of inflation is considered as an indicator of inflation uncertainty. Tobin (1958) argues that money as asset losses its security in inflationary condition.

Dehmordeh & others(2009) has examined the impact of economic uncertainty on money demand in Iranian economy. In this study, he considered the combination of economic uncertainty and instability of the variables affecting the demand for money. These variables are interest rate, inflation, stock market and gross national product. Estimation results of Auto Regressive model indicates that increase in economic uncertainty leads to decrease in demand for money in Iranian economy.

Studies such as Hoffman & Rasche (1991), Stock & Watson (1993) , Ball(2001) have shown that there is long term relationship between income and accumulated interest rate.

Shirinbakhsh (2005) considered three variables such as GDP, Wholesale Price Index (alternative inflation) and the average interest rate on deposits in relationship with the factors affecting the demand for money. In fact, estimates show that the most important factor affecting demand for money is GDP that has direct effect. The result show that people start purchases of durable goods by increase inflation rate, in order to maintain their purchasing power, means in long term increase in inflation by 1%, the demand for money will be deducted by 0/33.

$$M_{t=}\alpha_{0+}\alpha_1 y_{t+}\alpha_2 r_{t+}\alpha_3 \sigma^2{}_t+\epsilon_t \qquad (1)$$

M_t is demand for real money balances. In this study, the money demand function is estimated base on money in one side and another side by quasi money. Y_t is GDP in base price, r_t nominal interest rate and $\sigma^2{}_t$ inflation uncertainty.

3. Model Estimation and Interpretation

Review economic literature shows that extensive studies have been discovered on the nature and factors affecting these variables due to the important role in the economy in terms of economic uncertainty and widespread impact on economic activities and decision making. The idea is expressed in 1977 that higher inflation rates are generally by higher volatility increase in inflation and leads to uncertainty of future inflation rates. Non-transparent costs of future outputs, adversely affect the efficiency of resource allocation and economic activity by increase inflation uncertainty. Inflation uncertainty will change all decisions of the periodic resource by influence of interest rates.

In this context, Friedman argues that inflation uncertainty is costly, because nominal prices are distorted and increase the risk of nominal contracts. Inflation forecast becomes more difficult and investment and economic growth will be reduced. Inflation uncertainty reduces economic growth and economic efficiency and costly long term contracts and reduces the attractiveness of long term contracts. So the most important losses of inflation are due to uncertainty about the future rate of inflation. Inflation uncertainty raises the real and tangible cost. Inflation uncertainty has large economic losses such as effect on resource allocation, inefficiency in economic activity, increase in long term interest rates, distribution in long term investment and production.

The most important thing in policy related to reduce inflation is measurement of inflation uncertainty. The main focus of the policy debate in the reduction of volatility of inflation is measurement of inflation uncertainty rate. Inflation uncertainty indexes, can be divided into two categories according to economic literature (Farzinvash & abbasi, Tashkini, 2006) and (Mehrara &Mojab, 2009). Individuals and companies and consumers are asked to do their forecast of inflation in first type of criteria through field research. Vaktol and karlson (1977) and Kokrman and Vaktel (1979, 1982) used this method.

In second criteria, substitute inflation uncertainty ranges are achieved by using statistical methods. Unconditional change was used to assess the uncertainty in primary model. First Okun(1971) and after klien and Logen (1976) ,Logen& Sweney & Jaffe(1977) and Taylor (1981) used inflation fluctuation for inflation uncertainty calculation. Fisher (1981) used removable SD in his model. Then inflation uncertainty into question by criticism of models till Engel & Bollerslev (1986) introduced the ARCH and GARCH model. Variance to be considered as substitute for inflation uncertainty, with the ability to change the forecast error variance over time. Most processes for large lag length squared residual are considered in ARCH models. Conditional variance is a function of the both internal and the conditional variance of prediction error in GARCH model. In most cases, suitable method is for modeling sustainable uncertainty in relation to ARCH model. The best predictor variance in future is weighted average of long term variance, predicted variance for this period, new data of latest information by squares are shown(Engle, Focardi & Fabozzi (2007).

In both of these models, positive and negative shocks change the conditional variance but Brounner & G.Hess (1993) and Joyce (1995) found that positive inflation shocks, will create more uncertainty in relation to monetary policy than negative shocks. As a result, the above model will create misleading results about measurement uncertainty by using conditional variance. In order to solve this problem, heteroskedasticity model was introduced that negative shock to uncertainty would increase by less than a positive shock.

Some results of a study that has been conducted using the above methods are described. Tashkini (1986) concluded that inflation and inflation uncertainty together increases and there is positive relationship between conditional inflation variance and inflation. Analysis of Ebrahimi & Sori (1986) show that inflation uncertainty in the economy have increased with higher inflation and interaction between inflation and inflation uncertainty exists. Gholi Beglo (1986) by using ARCH model concluded that uncertainty in the economy over periods of inflation will exacerbate inflationary processes in future periods. Dehmordeh and others (1989) began modeling inflation uncertainty by using GARCH model in Iran. Test results of Granger test indicate that inflation is Granger cause of inflation uncertainty in Iran and there is not inverse relationship between them. Analysis of Mehra & Mojab(1989) show that increase in inflation and decrease in oil incomes can leads to inflation uncertainty in Iran. Henry,O. Olekalns, N.Suard,S.(2006) by using GARCH model concluded that higher inflation rates leads to more inflation uncertainty in US,UK & Canada. Daal ,E.Naka, A. Sanchez,B (2005) by using GARCH and Granger test concluded that inflation is main cause of inflation uncertainty in most of countries. Kontonikas (2004) in review the effect of inflation targeting in Uk reached the conclusion that there is positive relationship between post inflation and current uncertainty. Other studies in this area such as Wilson (2006), Entezarkheir (2006),Grier.R&Grier. K. (2006) and Hwang,Y.(2007) obtained main results in their studies that there is positive relationship between inflation and its conditional variance.

In this study, we used EGARCH model for creating series of inflation uncertainty. This is due to the existence of leverage effects in time series of inflation in the period under review(appendix 1). Mean and varienace equations of the model are as follows:

$$P_t = C + P_{t-1} + P_{t-4} + P_{t-5} + P_{t-8} + PP_{t-1} + \sigma_t^2 + \varepsilon_t$$

$$\log \sigma_t^2 = w + \beta \log \sigma_{t-1}^2 + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}}$$

That P quarterly inflation
PP producer price Index
σ^2_1 conditional variance on inflation

Since the results of studies in Iran such as Tashkini & Sori (2006), GholiBeglo (2007), Mehrabara & Mojab (2009) and Dehmordeh (2009) indicated that the effect of inflation uncertainty on inflation in Iran.σ^2_1 is as explanatory variable in mean equation. We used first, fourth, fifth, eight lag and first lag of producer index is used.

Selecting the optimum lag is by Akaike, Schwarz Bayesian and Hanan-Queen. The model estimation results are shown in appendix 1.

We used J-B test in order to investigate the goodness of fit normality of residuals. We used ARCH-LM to ensure the absence of the effect of ARCH model. The rest of J-B test indicate the normality of residuals. The results of ARCH-LM results reject any residual effect of ARCH.

Results shown in appendix 2

4. Data Analysis

To estimate the equation (1), we use VECM method. According to Granger Representation Theorem, error correction mechanisms associated with long term equilibrium relationship as follows:

$$\begin{bmatrix} \Delta m_t \\ \Delta y_t \\ \Delta r_t \\ \Delta \sigma_t^2 \end{bmatrix} = \Gamma(L) \begin{bmatrix} \Delta m_{t-1} \\ \Delta y_{t-1} \\ \Delta r_{t-1} \\ \Delta \sigma_{t-1}^2 \end{bmatrix} + \Pi \begin{bmatrix} m_{t-1} \\ y_{t-1} \\ r_{t-1} \\ \sigma_{t-1}^2 \end{bmatrix} + \begin{bmatrix} \varepsilon_t^m \\ \varepsilon_t^y \\ \varepsilon_t^r \\ \varepsilon_t^{\sigma^2} \end{bmatrix} \qquad (4)$$

That m_t is logarithm of the demand for real money balances that can be M_1 or M_2(equation 4 will estimate once by M_1 and other by M_2).Y_t is logarithm of GDP to base price, r_1 nominal interest rate, σ^2_t logarithm of inflation uncertainty. M_t,y_t,σ^2_t,r_t are endogenous variables in VECM model. In this analysis, we use quarterly data –the variables comprise the consolidated M_1,M_2,GDP and nominal interest rate. The main source of data related to the model variables is the Central Bank on Iran (CBI).

In order to use VECM method, we use Agmented Dickey-Fuller test to determine the accumulation of model variables. Thus, according to the ADF test, variables m_1,m_2,y,r are I(1) and σ^2_1 is I(0). The most common method to determine the optimum number of lags is VAR model based on Akaike (AIC), Schwarz Bayesain (SBC), and Hanan-Queen(HQ). So the optimum lag is 5.

Table 1: Augmented Dickey- fuller test

Augmented Dickey- fuller test			
		With intercept	With intercept & trend
Variables	Critical value of 5%	-2/90	-3/47
m_1	Computational evidence	-0/07	-2/7
m_2	Computational evidence	0/68	-1/92
y	Computational evidence	1/26	-0/27
r	Computational evidence	-2/1	-2/03
σ_t^2	Computational evidence	-3/89	-4/29

The necessity to the distinction of intercept and time trend in co-integration vectors and short term vector error correction model is the main problem in the Johansen method .Johansen (1992) suggests that we test the need for variables entered into the model along with the number of long-run equilibrium relationships. The proposed method is that we estimate 5 patterns from first scheme up to 5 and then test the hypothesis of no co-integrations vectors by order(r=0). If the hypothesis was rejected based on the critical quantities of Tracy test statistic, in second stage will test null hypothesis r=1 and similarly will do this test for r=2. Test operations stops when the null hypothesis is accepted. At this time, the number of co-integration vectors are specified together with the pattern that is determined based on the number of co-integration vectors.

As already mentioned, we can measure the demand for real balances once by M_1 once by M_2, thus we estimate equation 4 twice. Quantum the effect of test statistic and the maximum eigenvalue of the estimated five mentioned model are presented in table 2 for cases a) the demand for real balances are measured by money M_1. And b) the demand for real balances are measured by money M_2. About M_2, all quantities of test statistic of λ_{trace} , λ_{max} are larger than critical values provided by Johansen and Juselius. So hypothesis r=0 is rejected in all five above model. Now, we test a hypothesis of a co-integration vector against two co-integration vectors and more. According to both test λ_{trace} , λ_{max} ,the first hypothesis in model 4 is not rejected, so model 4 is accepted. So there is a co-integration vector among the variables M_2, y, r, σ^2_t. The linear deterministic trends in the data are available and the co-integration equation contains intercept and trend.

Table 2: The Critical Value& Computational Evidence of λ_{trace}

H_0	H_1		Sample 1	Sample 2	Sample 3	Sample4	Sample5
Critical Value and Computational Evidence of λ_{trace}							
r=0	r≥1	M_2	59/62(40/17)	73/64(54/07)	62/91(47/85)	79/51(63/87)	69/16(5/24)
		M_1	64/09(40/17)	67/72(54/07)	56/01(47/85)	76/13(63/87)	70/04(55/24)
r≤0	r≥2	M_2	27/59(24/27)	40/78(35/19)	33/31(29/79)	42/38(42/91)	34/15(35/01)
		M_1	25/51(24/27)	29/09(35/19)	18/87(29/79)	35/99(42/91)	29/91(35/01)
Critical value and Computational Evidence of λ_{max}							
r=0	r≥1	M2	32/02(24/15)	32/85(28/58)	29/59(27/58)	37/13(32/11)	35/00(30/81)
		M_1	38/58(24/15)	38/62(28/58)	37/14(27/58)	40/13(32/11)	40/13(30/81)
r≤1	r≥2	M2	18/87(17/79)	24/69(22/29)	23/91(21/13)	25/12(25/82)	18/77(24/25)
		M1	14(17/79)	14/01(22/29)	13/01(21/13)	20/5(25/82)	20/41(24/25)

The hypothesis r=0 about M_1 is rejected based on the quantity of presumption quantities of both tests. Now, we examine a null hypothesis of a co-integration vector ($r \leq 1$) versus of more than one co-integartion vector ($r \geq 2$). According to test λ_{trace}, first time null hypothesis is not rejected in model 2 and according to test λ_{max} this happen in model 1but since model 1 and 5 are less likely (Nofersti,1999), so model 2 is selected.

The long term relationships resulting from estimating equation(4) for both a) the demand for real balances are measured by money M_1 and the demand for real balances are measured by money M_2 is as follows:

$$M_{1t} = 0/27 + 0/78y_t - 0/07r_t - 0/069\sigma_t^2$$
$$[-10/46] \quad [6/4] \quad [5/98]$$
$$M_{2t} = 23/13 + 2/92y_t - 0/11r_t - 0/051\sigma_t^2 - 0/015@TREND$$
$$[-7/54] \quad [6/60] \quad [3/23]$$

Results of estimation of the money demand function show that, according to the conventional theory, national income has positive impact on money demand. (M_1, M2). Money demand and quasi money increases 0/78 & 2/29 percent by 1 percent increase in national income. So income elasticity of money demand of Iranian economy is remarkable similar to most Asian countries (Dehmordeh & Izadi, 2009), which is due to inefficiency of financial markets, investment and large intermediation sector in these countries. Interest rate has negative affect on money demand and quasi money so that by 1 percent increase in interest rate, M_1 and M_2 0/07 and 0/11 percent will decrease.

The main subject of this study is the effect of inflation uncertainty (σ_t^2) on money demand. Economic agents act rationally in choose their portfolios. People prefer to use those assets with less risk in high inflation uncertainty in their portfolios (such as land, durable goods, Gold…). So, the expectation is that by increase in inflation uncertainty, money demand falls. On the other hand, inflation uncertainty, increases precautionary demand for money in anticipation of future lower prices. Therefore, the ultimate effect of these variables on money demand is an empirical issue and depends on economic conditions and other markets situation in each country.

The results reveal that the impact of inflation uncertainty on money demand (M_1, M2) is negative in the economy of Iran in the period under review, as the demand for money in the narrow definition of the word and quasi money reduced by 7 and 5 percent by double the level of inflation uncertainty in Iranian economy. In other words, the purchasing power of durable goods inventories remain unchanged if increase their prices in accordance with changes in the general level of prices but the purchasing power of money decreases. Hence, increase in inflation uncertainty leads to more money converting into durable goods and other financial assets. As a result, the demand for money falls. The uncertainty of inflation on money demand in the Iranian economy is negligible due to that this variable will affect the financial markets and money markets by long-term interest rates. Interest rate increased by increase in inflation uncertainty and so the part of inflation uncertainty on money demand is neutralized.

4. Conclusion

This paper has examined the impact of uncertainty of inflation on money demand and quasi money after review the general form of money demand function by using economic theory include variables such as real income, interest rate and inflation uncertainty and the impact of inflation uncertainty was discussed. Inflation uncertainty increase precautionary demand for money according to forecast of future lower prices and increases the risk of holding money as an asset which makes economic agents reduce the amount of money kept in property cart.

Therefore, the effect of these variables on the total demand for money is to unclear and returns to other economic conditions. On the other hand, understanding the impact in order to understand the factors affecting the target inflation rate is the requirement of monetary and fiscal policy in every economic sector. Because, it represents the relation between monetary policy with the rest of the economy. If money demands function is stable so we can provide appropriate and accurate perdition effect of changes in money supply on other economic variables. In other words, money demand function plays an important role in transmission of money supply changes and other variables such as interest rate in the economy.

In this study, we used EGARCH model which was introduced by Nelson (1991) to create a serious of inflation uncertainty. The existence of leverage effects in the time serious in the period under review is the main reason of this process. This variable as an explanatory variable entered into money demand function after using this method to calculate the time serious of inflation uncertainty. The VECM method is used in the following method to estimate a long-run relationship between real money demand and explanatory variables.

Results of testing indicate that in overall, inflation uncertainty has had an impact on money demand and quasi money in Iranian economy. So the increase in inflation uncertainty leads to decline in the demand for money. The results confirm the first hypothesis and the second hypothesis are rejected. With increase in inflation uncertainty in the economy, economic agents prefer less money to apply. People prefer to use those assets with less risk in high inflation uncertainty (such as gold, land) that led to withdrawal of money from the economic activity cycle in the real sector of the economy.

5. Suggestions

To monetary policy makers suggested that:

1) Inflation stabilization plan use as target in the top of their program in order to guidance liquidity towards the real sector of the economy.
2) In recognition of money market,(in particular money demand) inflation uncertainty also should considered because a proper understanding of money market provides more accurate policy, especially in supply side.

To researchers suggested that to use the effect of inflation uncertainty on saving, investment and economic growth in future study.

Footnotes

1.Microfit (4.0) is an interactive econometric software package written especially for microcomputers. It is especially designed for the econometric modeling of time series data by Professor M. Hashem Pesaran and DR. Bahram Pesaran in 1997, that all the table of the paper is the output of this software.

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Appendix 1: Time Series of Inflation Uncertainty of EGARCH

Dependent variable:P Method:ML-ARCH(Marquardt)-Normal distribution Sample: 1371Q2:1389Q3 Included Observation:74 after Adjustment				
	Coefficient	Std.Error	Z-Statistic	Prob.
LOG(GARCH)	-0.554442	0.031194	-17.77397	0.0000
C	1.386083	0.040530	34.19917	0.0000
P(-1)	1.532392	0.000208	7351.469	0.0000
P(-4)	0.464636	0.000423	1097.758	0.0000
P(-5)	-0.386779	0.018474	-20.93591	0.0000
P(-8)	0.118918	0.005787	20.55069	0.0000
PP(-1)	-0.973405	0.008462	-115.0315	0.0000
Variance Equation				
C(8)	0.524348	0.019242	27.24977	0.0000
C(9)	-0.248943	0.032639	-7.62130	0.0000
C(10)	0.771173	0.119713	6.441871	0.0000
C(11)	0.538015	0.093800	5.735794	0.0000
R=squared	0.463297	Mean dependent var		4.413607
Adjusted R-squared	0.378106	S.D dependent var		3.030709
S.E of regression	2.390024	Akaike info criterion		3.812979
Sum squared resid	359.8696	Schwarz criterion		4.155475
Log Likelihood	-130.0802	F-statistic		5.438344
Durbin-Watson stat	1.988005	Prob(F-Statistic)		0.000009

Appendix 2: ARCH-LM TEST

ARCH Test				
F-statistic	0.503551	Probability		0.606584
Obs*R-squared	0.035772	Probability		0.595779
Test Equation Sample: 1371Q4:1389Q3				
Variance	Coefficient	Std.Error	t-Statistic	Prob
C	1.471510	0.305658	4.814243	0.0000
STD-RESID*2(-1)	0.030319	0.119789	0.253101	0.8009
STD-RESID*2(-2)	-0.117197	0.976845	-0.976845	0.3321
R-squared	0.014386	Mean dependent var		1.352010
Adjusted R-squared	-0.0114183	S.D dependent var		1.707406
S.E. of regression	1.719472	Akaike info criterion		3.962685
S.E of regression	204.0042	Schwarz criterion		4.057546
Log Likelihood	-139.6567	F-statistic		0.503551
Durbin-Watson stat	1.994825	Prob(F-statistic)		0.606584

Appendix 3: J-B-Test