# INFLATION AND INFLATION UNCERTAINTY IN TURKEY: EVIDENCE FROM EGARCH MODELING

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**Abstract**

Inflation leads to significant welfare losses to society, even if it is predictable. Inflation uncertainty also has welfare costs via distorted relative prices and resource allocation. Turkish economy experienced high and highly volatile inflation since 1970s. This study investigates the relationship between inflation and inflation uncertainty employing the AR-EGARCH-M model using monthly Turkish inflation data between January 1968 to December 2017. The empirical results suggest that higher inflation rates increased inflation uncertainty in Turkey, providing strong support for the Friedman-Ball hypothesis. However, the response of inflation uncertainty to inflation is negative but not statistically significant. Lastly, the asymmetric effect has been found to be statistically significant, which implies that a positive shock increases inflation uncertainty less than a negative shock.

***Anahtar Kelimeler:*** *Inflation Uncertainty, inflation, EGARCH-M*
***JEL Sınıflandırması:*** *C22, E31, E64*

# TÜRKİYE'DE ENFLASYON VE ENFLASYON BELİRSİZLİĞİ: EGARCH MODELLEMESİNDEN KANIT

**Öz**

Enflasyon öngörülebilir olduğunda dahi önemli refah kayıplarına yol açmaktadır. Enflasyon belirsizliği de bozulan nisbi fiyatlar ve kaynak dağılımı nedeniyle refah maliyetlerine sahiptir. Türkiye ekonomisi 1970'lerden itibaren yüksek ve oldukça değişken bir enflasyon tecrübesine sahiptir. Çalışma, enflasyon ve enflasyon belirsizliği arasındaki ilişkiyi Ocak 1968 – Aralık 2017 döneminde aylık Türkiye enflasyon verisi için AR-EGARCH-M modelini kullanarak incelemektedir. Ampirik sonuçlar, daha yüksek enflasyon oranının enflasyon belirsizliğini artırdığını göstererek, Friedman-Ball hipotezini desteklemektedir. Bununla birlikte enflasyon belirsizliğinin enflasyona etkisi negatif fakat istatistiksel olarak anlamsız bulunmuştur. Son olarak, asimetrik etkinin istatistiksel olarak anlamlı bulunması, pozitif şokların enflasyon belirsizliğini negatif şoklara göre daha fazla artırdığını göstermektedir.

***Keywords:*** *Enflasyon Belirsizliği, Enflasyon, EGARCH-M*
***JEL Classification:*** *C22, E31, E64*

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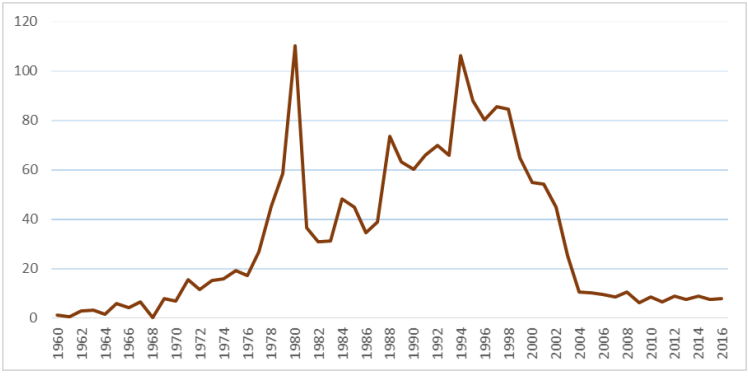
## 1. Introduction

Inflation leads to significant welfare losses to society, even if it is predictable. Inflation uncertainty also has welfare costs via distorted relative prices and resource allocation. On the other hand, there is no consensus on theoretical approaches nor on empiricial results about the relationship between inflation and inflation uncertainty. The hypotheses which are an increase of inflation rate effects inflation uncertainty positively (hypothesis of Friedman and Ball), an increase of inflation rate effects inflation uncertainty negatively (hypothesis of Pourgerami and Maskus), an increase of inflation uncertainty effects inflation rate positively (hypothesis of Cukierman and Meltzer), and an increase of inflation uncertainty effects inflation rate negatively (hypothesis of Holland) have been tested in the literature by many researchers applying a wide range of econometric methods such as time series, panel data and cross section analyses. These hypotheses also tested for Turkey and most of the studies have found that the hypothesis of Friedman and Ball has been valid for Turkey (see Literature section).

Turkish economy has a long, volatile and painful inflation history over the period from 1975 to 2004. As Kibritcioglu (2004:3) stated that it is commonly argued that sustainability of high and persistent inflation since the early 1970s has been "fed" by (1) high public sector budget deficits (2) monetization of public sector budget deficits (3) massive infrastructure investments of the various governments (4) high military expenditures (5) political instability (6) persistent inflationary expectations of economic agents (7) inflationary effects of changes in exchange rates via increases in prices of imported inputs (8) occasional increases in world prices of major imported inputs (particularly, crude-oil) (9) increases in regulated prices of public sector products which are mainly used as input by the domestic private sector and/or (10) rising interest rates resulting from the crowding-out effect of public sector borrowing in a shallow domestic capital market.

Turkish monetary policy has undergone structural changes throughout the period under investigation, i.e. from 1975 to 2017. Graph 1 plots the percentage change in CPI over the same month of the previous year for the period of 1960-2016. The main cause of inflation in the 1970s was the oil price shocks. The average annual inflation rate between 1960-1970 was 3.8% but it was 33.6% between 1971-1980. Turkey had a balance-of-payments crisis in 1979, followed by a stabilization and liberalization program in January 1980. This program was based on a stand-by agreement with the IMF and countered the crisis with an extensive liberalization in finance and trade. Measures continued throughout the 1980s and culminated in a capital account liberalization in August 1989 (see Uygur, 2010). By the end of 1980, inflation reached 110%, but the average inflation rate was 37.9% for the years 1981 to 1987 thanks to the stabilization program and economic growth.

Graph 1: **Annual inflation rate based on CPI (%)**




Source: The World Bank Data, 2018

After the capital account liberalization in 1989, Turkey faced an economic crisis in 1994, 1999 and 2001 and increasing inflation rates. The average inflation rate in the 1990s was 77.2%. In the

'90s, Turkey started stabilization programs that were supported with IMF stand-by agreements to get rid of high inflation with volatile growth. However, the economic stabilization programs were not successful in terms of controlling inflation at low levels and providing sustainable growth.

The stabilization policy based on a crawling exchange rate peg adopted in 2000 ended with the deepest crisis of Turkish history in February 2001. Inflation targeting became the monetary policy regime in Turkey following the failure of disinflationary policies based on monetary targeting or exchange rate anchoring in 1980's and 1990's. After the 2001 crisis, a stand by program with the IMF was implemented, transition to the strong economy program was started with the framework of tight fiscal policies and strong banking sector reforms, the central bank of Turkey gained its independence and passed the float exchange rate regime. The annual consumer inflation rate declined to under 10% in 2004. As Akyazı and Ekinci (2009) stated, the year 2004 is an important break year in terms of inflation persistency, expectations and credibility in Turkey (for more information on inflation policies in Turkey see, Kara, 2008; Özatay, 2005; Dibooglu and Kibritcioglu, 2004).

Inflation is one of the most important macroeconomic variables in Turkey. This paper focuses on a long period of Turkish inflation from 1968 to 2017 to test the relationship between inflation and inflation uncertainty employing an AR-EGARCH-M model. The rest of the article is organized as follows: Section 2 presents the literature overview, Section 3 describes the model used in obtaining empirical results, Section 4 presents the empirical results and Section 5 concludes.

**2. Literature Review**

In the 1970s, there was an increased interest in the effects of government monetary policies on inflation rates in the literature. This research area has been focused on determining the optimum inflation rate at full employment. At the same time, discussing the effects of uncertainty on the monetary policies of governments has also improved the Philips curve analyses. Analyses of the relationship between uncertainty and inflation were added to the discussions of the monetary policies area in the 1970s.

Studies on the relationship between inflation and inflation uncertainty were started by Okun (1971). Okun argued that inflation increases inflation uncertainty since monetary policy becomes more unpredictable during the period of high inflation using annual cross-section data on 17 OECD countries for the period 1951 to 1968. Logue and Willet (1976) investigated the relationship between average annual inflation rate and standard deviation of inflation rate in forty-one countries for the period of 1948-1970 by using regressions analyses. The results indicate that there is a strong positive relationship between the variability of inflation and the average rate of price change.

Friedman (1977:466) stated that inflation arising from uncertainty provides for the rise of unemployment because delay in adjusting the length of commitments may lead to less satisfactory adjustment and so high unemployment. The contribution of Friedman (1977) on the impacts of inflation uncertainty on labor market, monetary policy and efficiency has been developed by Ball (1992), who created a game model between the monetary authority and the public. Ball has claimed that the hypothesis is high inflation leads to uncertainty about future monetary policy via the game model combining elements of Barro and Gordon (1983a,b), Canzoneri (1985), and Alesina (1987). Hence, the hypothesis high inflation creates high uncertainty is named the *Friedman-Ball hypotheses* in the literature. Though the opposite form of this hypothesis which is high inflation causes low uncertainty has been added to literature by Pourgerami and Maskus (1987). However, this hypothesis has not been cited much by researchers.

On the contrary of the Friedman-Ball hypotheses, Cukierman and Meltzer (1986) have stated that there is a positive effect of inflation uncertainty on the inflation rate. Cukierman and Meltzer, using Barro and Gordon's (1983a) model, inferred that economic stimulation achieved through surprise inflation creation can be provided with increases from policy makers' decisions in

uncertainty money growth. In other words, unexpected monetary growth accelerates employment and output growth. This analysis, arguing that higher inflation uncertainty leads to more inflation rate, is called the *Cukierman and Meltzer Hypothesis*. Conversely, Holland (1995) claims a negative causal effect of inflation uncertainty on inflation.

The hypotheses which are an increase of inflation rate effects inflation uncertainty positively (hypothesis of Friedman and Ball), an increase of inflation rate effects inflation uncertainty negatively (hypothesis of Pourgerami and Maskus), an increase of inflation uncertainty effects inflation rate positively (hypothesis of Cukierman and Meltzer), and an increase of inflation uncertainty effects inflation rate negatively (hypothesis of Holland) have been tested in the literature by many researchers applying a wide range of econometric methods such as time series, panel data and cross section analyses. The findings from empirical studies testing for these hypotheses in Turkey have been reviewed in this paper, and because of that the paper has focused on the relationship between inflation and inflation uncertainty in Turkey.

The relationship between inflation and inflation uncertainty in the case of Turkey was tested for the first time by Yamak (1996) for the period of 1949-1992 using regression analyses. According to the results from the regression estimations, there was a positive impact of inflation rate on inflation uncertainty. Hence Yamak found that the hypothesis of Friedman and Ball is valid for Turkey. The empirical results of these hypotheses tested by other researchers for Turkey have been presented in Table 1:

Table 1: **Summary of the Empirical Studies Examining Relations between Inflation and Inflation Uncertainty in the Literature for Turkey**

| *Authors* | *Method* | *Period* | *Results* |
|---|---|---|---|
| Yamak (1996) | Regressions Analyses | 1949-1992 | The hypothesis of Friedman and Ball has been valid. |
| Nas and Perry (2000) | GARCH and Granger Causality Analysis | 1960M1-1998M3 And Sub Periods of 1960M1-1998M3 which are 1980M1-1998M3, 1986M1-1998M3 and 1990M1-1998M3. | The results of Granger Causality analyses have indicated that hypotheses of Friedman and Ball, and Holland are valid for the full sample and the period of 1960M1-1998M3 respectively. On the other hand the findings on hypotheses of Cukierman and Meltzer, and Holland have mixed according to sub periods of the sample. Hypotheses of Holland, and Cukierman and Meltzer have been valid for the periods of 1980M1-1998M3, 1986M1-1998M3, and 1990M1-1998M3 and 1986M1-1998M3, and 1990M1-1998M3, respectively. |
| Neyapti (2000) | ARCH | 1982M10-1999M12 | The hypothesis of Friedman and Ball has been valid. |
| Berument et al. (2001) | EGARCH | 1986M1-2000M12 | The hypothesis of Friedman and Ball has been valid. |
| Telatar (2003) | GARCH and Granger Causality Analysis | 1987M1-2001M12 | The results of Granger Causality analyses have indicated hypothesis of Friedman and Ball has been valid. |

| | | | |
|---|---|---|---|
| Telatar and Telatar (2003) | OLS, MLE, Kalman Filter, and Granger Causality | 1995M3-2000M12 | The results of Granger Causality analyses which are used series of inflation uncertainty obtained from time-varying regression estimations show that hypothesis of Friedman and Ball has been valid. |
| Çetin (2004) | GARCH and Granger Causality Analysis | 1985M1-2003M11 | The results of Granger Causality analyses have indicated that the hypothesis of Friedman and Ball has been valid. |
| Akyazı and Artan (2004) | GARCH, Granger Causality, impulse response and Variance decomposition analyses | 1987M1-2003M10 | The results of Granger Causality analyses have indicated that the hypothesis of Friedman and Ball has been valid. |
| Erdoğan and Bozkurt (2004) | ARCH, GARCH and TARCH | 1983M1-2003M09 | The authors found that the inflation raised its uncertainty significantly over the sample period. |
| Daal et al. (2005) | PGARCH and Granger Causality Analysis | 1957M2-2004M5 | The results of Granger Causality analyses have indicated that the hypothesis of Friedman and Ball has been valid. |
| Özer and Türkyılmaz (2005) | EGARCH, Granger Causality, impulse response and Variance decomposition analyses | 1990M4-2004M4 | The hypothesis of Friedman and Ball has been valid |
| Oltulular ve Terzi (2006) | EGARCH, Granger, Hsiao and VAR Causality, impulse response and Variance decomposition analyses | 1987M1-2005M6 | The results of Granger, Hsiao and VAR Causality analyses have indicated that the hypothesis of Friedman and Ball has been valid. |
| Thornton (2007) | GARCH and Granger Causality Analysis | 1970M1-2005M12 | The results of Granger Causality analyses have indicated that the hypotheses of Friedman and Ball and Holland have been valid. |

| | | | |
|---|---|---|---|
| Erkam (2008) | ARCH, GARCH and PARCH | 1982M1-2008M1 | Hypothesis of Friedman and Ball has been valid and Hypothesis of Holland has been valid for the short run. |
| Özdemir and Fisunoğlu (2008) | ARFIMA, GARCH, and Granger Causality Analysis | 1987M2-2003M11 | The hypothesis of Friedman and Ball has valid. The hypothesis of Cukierman and Meltzer has been supported by Toda and Yamamoto Causality test as weakly. |
| Artan (2008) | GARCH, Johansen Cointegration test and Error Corection Model | 1987Q1-2003Q | The results of error correction models estimations have indicated that hypotheses of Friedman and Ball and Cukierman and Meltzer have been valid. |
| Omay (2008) | GARCH and Granger Causality Analysis | 1986M6-2007M1 And Sub Periods of 1986M6-2007M1 which are 1988M6-1994M3, 1994M5-2005M1 and 2001M3-2007M1 | The results of Granger Causality analyses have indicated that hypothesis of Friedman and Ball is valid for the full sample and the sub periods of 1986M6-2007M1 and hypothesis of Cukierman and Meltzer is valid for the full sample and the sub periods of 1986M6-2007M1 except for the period of 1994M5-2005M1. |
| Sever and Demir (2008) | EGARCH, Granger Causality, impulse response and Variance decomposition analyses | 1987M1-2007M12 And Sub Periods of 1987M1-2007M12 which are 1987M1-2001M12 and 2002M1-2007M12. | The results of Granger Causality analyses have indicated that hypothesis of Friedman and Ball has been valid for the full sample and the sub periods of 1986M6-2007M1 and hypothesis of Cukierman and Meltzer has been valid for the period of 1987M1-2007M12. |
| Saatçioğlu ve Korap (2009) | EGARCH and Granger Causality Analysis | 1987M1-2008M7 | The results of Granger Causality analyses have indicated that the hypotheses of Friedman and Ball and Holland have been valid. |
| Türkyılmaz and Özer (2010) | GARCH, VAR Granger Causality and impulse response Analyses | 1997M1-2008M5 | The results of VAR Granger Causality analyses have indicated that the hypotheses of Friedman and Ball and Cukierman and Meltzer have been valid. |

| | | | |
|---|---|---|---|
| Keskek and Orhan (2010) | GARCH, TGARCH and EGARCH | 1984M1-2005M10 | The hypotheses of Friedman and Ball and Holland have been valid |
| Berument et al. (2011) | SVM model | 1984M1-2009M2 | The hypothesis of Cukierman and Meltzer has been valid. |
| Erdem and Yamak (2013) | Kalman Filter and Granger Causality Analysis | 1980M1-2012M12 | The results of Granger Causality analyses have indicated that hypotheses of Friedman and Ball, Cukierman and Meltzer have been valid. |
| Erdem and Yamak (2014) | Kalman Filter and Granger Causality Analysis | 1988M1-2004M12<br>2004M1-2010M12 | The results of Granger Causality analyses have indicated that hypothesis of Friedman and Ball has been valid for the period of 1988M1-2004M12 and hypothesis of Cukierman and Meltzer has been valid for the period of 1988M1-2004M12 and 2004M1-2010M12. |
| Yılmaz et al. (2017) | EGARCH and Granger Causality Analysis | 1995M1-2016M12 | The results of Granger Causality analyses have indicated that a hypothesis of Friedman and Ball has been valid. |

**3. Model**

The studies on the relationship between inflation and inflation uncertainty have mostly used two-step procedure, especially in the '90s. At the two-step procedure, conditional variance of inflation is firstly estimated from the GARCH model of inflation as inflation uncertainty and then inflation uncertainty and inflation are used for testing Granger causality (see Grier and Perry, 1998; Nas and Perry, 2000). However, Pagan (1984) argues that the two-step procedure has a simultaneous estimation problem. A simultaneous estimation problem occurs due to using the inflation uncertainty as an independent variable in the second step when it is generated from inflation in the first stage. The GARCH-M model has an advantage of estimating jointly the inflation and inflation uncertainty (see Balcombe, 1999; Grier and Grier, 2006). An Autoregressive (AR) model is firstly estimated for the mean equation of inflation as follows:

$$\pi_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \pi_{t-i} + \varepsilon_t \quad (1)$$

The Hannan-Quinn information criterion is used for determining the lag order of the AR process for the mean model of the inflation given in equation (1).

The GARCH-in-Mean (GARCH-M) model (see Engle, Lilien and Robins, 1987) gives the opportunity to add inflation uncertainty into the mean equation as standard deviation:

$$\pi_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \pi_{t-i} + \delta\sqrt{h_t} + \varepsilon_t \quad (2)$$

where $\delta$ shows the effect of inflation uncertainty on average inflation. The conditional standard deviation, $\sqrt{h_t}$, represents the inflation uncertainty into the mean equation.

The Exponential GARCH (EGARCH) model is employed (see Nelson, 1991). The specification for the conditional variance is:

$$\log(h_t^2) = \theta + \gamma \left|\frac{\varepsilon_{t-1}}{h_{t-1}}\right| + \delta \frac{\varepsilon_{t-1}}{h_{t-1}} + \alpha log h_{t-1}^2 + \tau' \pi_{t-1} \quad (3)$$

The EGARCH model has several advantages over the GARCH specification. The conditional variance is guaranteed to be nonnegative even if the parameters are negative since the volatility is modelled as the log of the conditional variance. Second, asymmetric effect is allowed and exponential under the EGARCH formulation. If $\delta = 0$, there is no asymmetric effect. If $\delta > 0$, it implies that positive shocks generate higher volatility more than negative shocks. If $-1 < \delta < 0$, a positive shock increases volatility less than a negative shock. If $\delta < -1$, then a positive surprise actually reduces volatility (see Berument, Dincer and Mustafaoglu, 2011:2). The parameter α capture the persistence in conditional volatility of inflation. Following Kontonikas (2004), it is allowed for feedback effects between the conditional mean and the conditional variance by adding the lag of inflation into the variance equation. Where $\tau'$ shows the coefficient of the lag of the inflation. Following Nelson (1991), we use the Generalized Error Distribution (GED) for the errors.

**4. Data**

Inflation, $\pi$, is measured as the first difference of the seasonally adjusted log of the Istanbul Chamber of Wholesale General Price Index for the period of 1968:01-2017:12 and obtained from the Central Bank of the Republic of Turkey (CBRT) Electronic Data Delivery System (EDDS). Table 2 presents the statistical properties of the inflation data.

Table 2: **Data Properties**

| *Mean* | *Median* | *Max.* | *Min.* | *Std. Dev.* | *Skewness* | *Kurtosis* | *Jarque-Bera* | *Prob.* |
|---|---|---|---|---|---|---|---|---|
| 0.023 | 0.018 | 0.237 | -0.049 | 0.022 | 2.544 | 19.415 | 7371.6 | 0.000 |

**5. Results**

Augmented Dickey–Fuller (ADF) and Phillips-Perron (PP) tests have been carried out for the inflation to detect the existence of the unit root. It can be seen from Table 3 that all ADF and PP test statistics are statistically significant at the 1 or 5 percent level, thereby indicating that inflation is stationary.

Table 3: **Unit Root Test Results**

| | *ADF (constant)* | *ADF (constant+trend)* | *PP (constant)* | *PP (constant+trend)* |
|---|---|---|---|---|
| $\pi$ | -3.488*** | -3.670** | -14.729*** | -14.943*** |

Notes: Specifications for ADF tests: The optimal lag length based on SIC, maxlag=12. Specifications for PP tests: Spectral estimation method: Barlett-kernell, the optimal lag length based on Newey-West bandwidth. *** Significance at 1 percent level. ** Significance at 5 percent level.

Modelling inflation is a difficult task. The AR(8) model for the mean model of inflation is chosen by the Hannan-Quinn information criterion. Dummy variables are included in the AR model, which have clear outliers for the 1980:02, 1989:10, 1994:04 and 2001:04. Table 4 presents the model results and residual diagnostics for the AR(8) model. The AR(8) model with dummies has 0.648 adjusted $R^2$ and Ljung-Box Q test statistics for autocorrelation up to twelve, which do not reject the null hypothesis of no serial correlation. However, the Ljung-Box statistics of the squared residuals ($Q^2$) confirm the presence of heteroscedasticity.

Model results and residual diagnostics for the AR(8)-EGARCH(1,1)-M model are reported in Table 4. The coefficient of inflation volatility, $\delta$, in the mean equation is negative but statistically insignificant. Then there is no evidence that inflation volatility has an effect on inflation. On the other hand, the variance equation offers more findings. The second part of Table 4 reports the results of the variance equation. The coefficient of the lag of the inflation, $\tau$, is positive and statistically significant at the five percent level. It indicates that inflation increases the inflation volatility as argued by the Friedman–Ball hypothesis. The $\delta$ coefficient, which indicates asymmetric

effect, is -1< δ < 0 and statistically significant at the five percent level. It implies that a positive shock increases inflation volatility less than a negative shock.

Volatility effect is also checked for two other different specifications of the volatility in mean equation, i.e. the conditional variance and the natural log of the conditional variance. The results are the same in regards to the negative but insignificant volatility coefficient in the mean equation, negative and significant at five percent level asymmetry coefficient and positive and significant at five percent level the lag of inflation coefficient in the variance equation.

Table 4: **Model Results and Residual Diagnostics**

| *Coefficient* | *AR(8)* | *AR(8)-EGARCH(1,1)-M* |
|---|---|---|
| $\delta$ | | -0.0410 |
| $\alpha_0$ | 0.0034*** | 0.0017 |
| $\alpha_1$ | 0.2983*** | 0.4373*** |
| $\alpha_2$ | 0.0719** | 0.1208*** |
| $\alpha_3$ | 0.0391 | 0.0264 |
| $\alpha_4$ | 0.0683** | 0.0614* |
| $\alpha_5$ | 0.0454 | 0.0362 |
| $\alpha_6$ | 0.0690** | 0.0315 |
| $\alpha_7$ | 0.1304*** | 0.0801*** |
| $\alpha_8$ | 0.0969*** | 0.0937*** |
| D80M02 | 0.1177*** | 0.1159* |
| D89M10 | 0.0227** | -0.0139 |
| D94M04 | 0.1875*** | 0.1818 |
| D01M04 | 0.0673*** | 0.0636* |
| Variance equation | | |
| $\theta$ | | -4.7518*** |
| $\gamma$ | | 0.4821*** |
| $\delta$ | | -0.2566** |
| $\alpha$ | | 0.5498*** |
| $\tau$ | | 14.543** |
| Diagnostic statistics | | |
| Adj. $R^2$ | 0.6483 | 0.6259 |
| $Q_1$ | 0.0066 | 0.1538 |
| $Q_6$ | 7.9550 | 2.8692 |
| $Q_{12}$ | 16.282 | 14.155 |
| $Q_1^2$ | 145.14*** | 3.9815 |
| $Q_6^2$ | 147.12*** | 5.8673 |
| $Q_{12}^2$ | 149.56*** | 12.959 |

Notes: $Q_i$ is the ith order Ljung-Box test of the null of residual serial independence with degrees of freedom adjusted for AR parameter estimation; $Q_i^2$is the ith order Ljung-Box test of serial independence in the squared residuals. * Significance at 10 percent level. ** Significance at 5 percent level. *** Significance at 1 percent level.

**6. Conclusion**

In this study, the relationship between inflation and inflation uncertainty in the case of Turkey has been tested employing the *AR(8)-EGARCH(1,1)-M model.* Inflation is measured as the first difference of the seasonally adjusted log of the Istanbul Chamber of Wholesale General Price Index for the period of 1968:01-2017:12. The effect of inflation uncertainty on inflation can be tested by employing the EGARCH-M model by adding the conditional volatility into the mean equation in the forms of the conditional standard deviation, the conditional variance and the natural log of the conditional variance. The coefficient of inflation volatility in the mean equation is negative but statistically insignificant. Then there is no evidence on inflation volatility has an effect on inflation.

Following Kontonikas (2004), it allowed for feedback effects between the conditional mean and the conditional variance by adding the lag of inflation into the variance equation. The coefficient

of the lag of the inflation into the EGARCH-M model is positive and statistically significant at the five percent level. It indicates that inflation increases the inflation volatility as argued by Friedman–Ball hypothesis.

The last finding is about the asymmetric effect of the inflation. The asymmetric effect has been found as $-1< \delta < 0$ and statistically significant, which implies that a positive shock increases inflation uncertainty less than a negative shock.

The paper has a long time period from 1968 to 2017. However, the characteristics of the Turkish economy have changed dramatically after the economic crisis in 1980, 1989, 1994 and 2001. Hence future studies will focus on sub-periods when investigating the relationship between inflation and inflation uncertainty.

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