International Journal of Academic Value Studies (Javstudies)

ISSN:2149-8598 | *Vol: 4, Issue: 19, pp. 478-484*

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Disciplines: Business Administration, Economy, Econometrics, Finance, Labour Economics, Political Science, Public Administration, International Relations

THE CASE OF INFLATION IN TURKEY AND INFLATION TARGETING

Türkiye'de Enflasyon Olgusu Ve Enflasyon Hedeflemesi

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Murat, Ü. & Atakişi, A. (2018). "The Case Of Inflation In Turkey And Inflation Targeting", Vol:4, Issue:19; pp:478-484 (ISSN:2149-8598)

ARTICLE INFO

Article History

Makale Geliş Tarihi
Article Arrival Date
07/03/2018
Makale Yayın Kabul Tarihi
The Published Rel. Date
30/03/2018

Anahtar Kelimeler

Enflasyon belirsizliği, enflasyon hedeflemesi, stokastik oynaklık modelli

Keywords:

Inflation uncertainty, inflation, inflation targeting, emerging markets, stochastic volatility model,

ABSTRACT

Inflation is one of the major economic problems in developing countries. Therefore, investigating the interaction between inflation uncertainty and economic magnitudes in countries, experiencing inflation problems, supports to shape the future economic policies. Inflation rates characterized as high and chronic before the year 2002 in Turkey tends to decrease with the implicit inflation targeting applications. By means of adequate and favourable conditions in internal dynamics, inflation targeting had been started until 2006 and inflation rates have reached to the single-digit level. This study addressing the effects of inflation uncertainty on inflation in the context of inflation targeting to find out if there is a structural change in the macroeconomic structure of Turkish economy, as a country that experienced the high-low inflation throughout such periods and is still classified under the emerging economies respectively. In the scope of the study, inflation, which is seen as a major indicator of price stability, is modelled and the effects of inflation uncertainty on inflation are determined within the mean stochastic volatility models.

ÖZ

Gelişmekte olan ülkelerin yaşadıkları önemli ekonomik sorunların başında enflasyon gelmektedir. Enflasyon ile sorun yaşayan ülkelerde enflasyon belirsizliği ile ekonomik büyüklüklerin etkileşiminin araştırılması gelecekte ekonomi politikaların doğru şekillenmesine olanak sağlamaktadır. Türkiye'de 2002 yılından önce yüksek ve kronik olarak seyreden enflasyon oranları örtülü enflasyon hedeflemesi uygulamasıyla azalma eğilimine girmiştir. İç dinamiklerde yeterli ve uygun koşulların sağlanmasıyla 2006 yılı sonrasında açık enflasyon hedeflemesine geçilmiş ve enflasyon oranlarında tek haneli rakamlara ulaşılmıştır. Gelişmekte olan ekonomiler sınıfında yer alan ve yüksek-düşük enflasyon deneyimini yaşayan Türkiye ekonomisi için enflasyon belirsizliğinin enflasyon üzerindeki etkilerini, enflasyon hedeflemesi kapsamında, ele alan bir çalışma makroekonomik yapıda yapısal bir değişimin olup olmadığının ortaya çıkarılması için bilgi verici olmaktadır. Çalışma kapsamında, fiyat istikranın göstergesi olan enflasyon modellenmiş ve enflasyon belirsizliğinin enflasyon üzerindeki etkileri ortalama stokastik oynaklık modelleri kapsamında belirlenmiştir.

1. INTRODUCTION

Nowadays, the debates about inflation, inflation uncertainty and growth relation, which are important problems for economic decision-makers and economic players, remain important especially in developing economies. Since the ensuring of price stability has been unsuccessful with the monetary policies including monetary aggregates or exchange rate targets; the inflation targeting regime, which aims to make monetary policy effective, have come to the forefront. The inflation targeting regime, a monetary policy strategy to achieve and maintain price stability, began to be implemented in New Zealand in 1989 and has become widespread among developed and developing countries, believing that creating a low-sustainable level of inflation has assisted to design enhanced future decisions.

Inflation targeting is defined as the announcement of an official quantitative target or target range for the inflation rate of the state, central bank or both at a specified time (Bernanke and Mishkin, 1997). In other words, it is the monetary policy, which is officially announced as the expectation of the inflation rate for one or more periods, and the monetary policy is defined as low-stable inflation (Sherwin, 2000). The inflation targeting is divided into two categories; explicit inflation targeting, which aims to stabilize only the targeted inflation rate and not the other variables, and implicit inflation targeting, that deals with other variables related with the inflation targeting (Demirhan, 2002). Within the scope of the regime, the width of the interval becomes important when the interval determination is taken instead of the point targeting. With the inflation targeting which is based on large information set and is easy to understand, focusing on the economy of the whole country with the scope of monetary policy and responding to confirmed shocks that are encountered. Furthermore, by preventing the political pressures on the central banks to pursue an expansionary monetary policy, the possibility of falling into time inconsistency is reduced (Mishkin, 2000).

In order to imply a successful inflation targeting regime, the fiscal discipline has to be ensured and fiscal dominance must be lowered. In addition, it is desirable that the level of dollarization is not high and capital movements are stable or predictable (Mishkin, 2000). It is also necessary that the central bank be independent (at least the independence on economic tools), accountable and reliable. Although, the inflation targeting regime being too strict, creating low economic growth, not able to prevent financial pressure and the possibility of causing a financial instability due to flexible exchange rate seem to be the negative aspects of inflation targeting regime; the implementation of inflation targeting is generally flexible and central banks are taking into account the stability of the real economy as long as it does not contradict inflation targets (Bernanke et al., 1999).

After the period of low growth and the increase in oil prices in the 1970s, the main objectives of central banks have been defined as the maintenance and sustainability of price stability. By the 1970s, the policies of fight against inflation have begun in Turkey's economy. Although regimes targeting monetary aggregates or exchange rates have been used to ensure price stability, the regimes not being flexible enough have led to the question of the effectiveness and the transition to inflation targeting regime, which is a medium-term monetary policy strategy directly targeting inflation itself. Transition to inflation targeting regime, which has been implemented implicitly between the years 2002-2005 in Turkey, has been accepted in 2006. With the amendment to the Central Bank Law in 2001, the independence of the central bank and its main responsibility as price stability are assured. Within the scope of the amendment, the granting of public loans was prevented. Establishment of fiscal discipline and prevention of financial pressure has been aimed as a result of structural reforms and fiscal policies. The Banking Law was amended and attempts were made to ensure that financial markets could be met with standards that could compete with international financial markets. The Central Bank has begun to organize future Expectations Survey twice a month for the inflation forecasts and as of 2003, the basket of goods and services within the scope of the consumer price index, has been replaced by Statistics Institute of Turkey. While the transition period to inflation targeting is favorable in terms of internal dynamics, it emerges as an inappropriate period in terms of international conjuncture. In 2006, the change of global liquidity conditions in favor of developed countries and as a result of capital outflows from many developing countries, the central bank has gone through monetary tightening, increased the policy interest rates and made regulations related to foreign exchange liquidity. In 2007, the decline in yields of agricultural products has caused a demand shock and inflation figures have been affected due to the excess weight of the food in Turkey's spending. Core inflation indicators have been focused on as a result of the rise in energy, food and other commodity prices, and the outcome of the 2008 global financial crisis. To sustain the credibility of applied regime, the Central Bank updated its targets for 2009-2010 and extended the forecast period in the Inflation Report to three years.

The impact of inflation targeting regimes on macroeconomic structure has been analyzed more in depth in the developed countries than in developing countries. The studies dealing with the inflation targeting regime in Turkey generally analyze the applicability of inflation targeting regime to Turkey. By taking the years between 1982 and 2001 as the pre-inflation targeting period and the years between 2002 and 2018 as the inflation targeting period, this study aims to contribute to the literature through examining Turkey's inflation performance based on the models that assume unknown volatility varies stochastically over time. Following the literature review on inflation and its

uncertainty in the second chapter, the econometric model to be applied is discussed in the third chapter. The results of the analysis are interpreted In the fourth chapter and the findings are mentioned in the last section.

2. LITERATURE REVIEW

Friedman (1977) shows that higher inflation rates may result in higher uncertainty. Ball (1992) provides an asymmetric framework to show that the uncertainty about policy makers' preferences only affects inflation uncertainty when inflation is high. Azaridis and Smith (1996) show that higher inflation rates lead to greater uncertainty when there is information disagreement in credit markets. Pourgerami and Maskus (1987) and Ungar and Zilberfarb (1993) emphasize that the uncertainty about inflation decreases in higher inflationary periods. Demetriades (1988) defines a positive relationship between inflation and uncertainty under the presence of asymmetric information. Cukierman and Meltzer (1986), Baillie et al. (1996) and Devereux (1989) argue that there is a positive relationship between inflation and inflation uncertainty. Holland (1995) emphasizes that higher inflation uncertainty is associated with lower average inflation.

While Nas and Perry (2000) and Neyapti (2000) refer to a positive relationship between inflation and uncertainty, Telatar and Telatar (2003) suggest that there is no significant relationship between inflation and uncertainty. Elder (2004) estimates the dynamic effects of shocks on inflation in the economy. Grier et al. (2004) emphasize that inflation uncertainty reduces the inflation rate and asymmetry is the issue. Fountas et al. (2004) shows that inflation increases inflation uncertainty in European Union countries other than Germany. Özer and Türkyılmaz (2005) are highlighted that inflation [via its structure] is the reason of inflation uncertainty. Fountas et al. (2006) suggest that the increase in inflation uncertainty encourages Central Banks to surprise by increasing inflation unexpectedly. John (2007) finds a negative relationship from inflation uncertainty to inflation. Akyazi and Ekinci (2008) compare the performance of the inflation targeting regimes implemented in developing countries and Turkey. The inflation targeting regime has an effect on the macroeconomic variables as well as the inflation rate. Eroğlu (2009) and Terzioğlu (2017) analyze the effect of inflation targeting on inflation performance, interest rates, exchange rates and growth performances. Terzioğlu (2018) emphasizes that the increase in inflation uncertainty in inflation targeting before and after the regime increases inflation. Karahan (2012) argues that the increase in inflation leads to inflation uncertainty and despite the inflation targeting regime, inflation is an important determinant of inflation uncertainty.

3. METHODS

Stochastic volatility (SV) is used as an alternative to ARCH models, arise under the assumption that the volatility process is an unobservable variable. In this model structure, volatility changes randomly according to the stochastic differential equations or intermittent random processes. Chib et al. (2002), Boscher et al. (2000) and Hol and Koopman (2002) show that the stochastic volatility models have better predictive performance than the GARCH models. μ_t average, α_0 fixed term and $\alpha_1, \alpha_2, \ldots, \alpha_k$ mean equation for the stochastic volatility model, including regression parameters,

$$Y_t = \mu_t + \sigma_t \varepsilon_t$$

$$\mu_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i X_{i,t}$$

is given. (Koopman and Uspensky, 2002). Error term ε_t has a discrete normal distribution with the mean zero and variance one. Therefore, the average-adjusted series is expressed as the product of the white noise process with the unit variance and the volatility period. The variance is used logarithmically and is modeled as an autoregressive model to ensure that the variance modeled as the state-space model is taken as an obscure component and is defined positively. σ^*, positive scaling factor and volatility process σ_t^2, positive scaling factor σ * and exponential stochastic process h_tThe variance equation for the stochastic volatility model to be defined as the product of $\sigma_t^2 = \sigma^{*2}\exp(h_t)$. $h_t = In(\frac{\sigma_t^2}{\sigma^{*2}})$ to be h_t stochastic process as first order autoregressive model $h_t = \phi h_{t-1} + \sigma_\eta \eta_t$, $\eta_t \sim NID(0,1)$ It is expressed in this form. Variance of the log-volatility processσ_η^2 measures the uncertainty of future volatility. $\sigma_\eta^2 = 0$ the stochastic volatility model is undefined. ϕ parameter to measure the stability of volatility shocks ϕ as the value approaches one σ_η^2 The value is approaching

zero. In addition, the volatility process σ_t^2 and Y_t should be $|\phi| < 1$ in order to be stationary (Harvey and Streibel, 1998). ε_t and η_t unconditional variance of concurrently unrelated and log-volatility process $\frac{\sigma_\eta^2}{(1-\phi^2)}$ while the shape of the stochastic volatility model

$$In\sigma_t^2 = In\sigma^{*2} + h_t = In\sigma^{*2} + \phi(In\sigma_{t-1}^2 - In\sigma^{*2}) + \sigma_\eta\eta_t = (1-\phi)In\sigma^{*2} + \phi In\sigma_{t-1}^2 + \sigma_\eta\eta_t$$

be obtained. $\mu = \log(\sigma^{*2}) + E(\log(\varepsilon_t^2)), h_t = \log(\sigma_t^2), \xi_T = \log(\varepsilon_t^2) - E(log(\varepsilon_t^2)$ and Y_t the statistical volatility model by taking the logarithm of the squares of

$$\log(Y_t^2) = \mu + h_t + \xi_T$$

$$h_t = \phi h_{t-1} + \eta_t$$

in the form of a linear model. The properties of ξ_T are dependent of ε_t' distribution. (Abramowitz and Stegun, 1970). In order to incorporate the effect of the mean into the variance, the model is expanded to the mean stochastic volatility model (SVM). β the mean equation for the mean stochastic volatility model, which is the relationship between the return and volatility of the parameter and the risk premium coefficient that measures the feedback effect at the same time,

$$\mu_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i X_{i,t} + \beta\sigma^{*2}\exp(h_t)$$

while ε_t and η_t concurrently unrelated, $\varepsilon_t \sim NID(0,1)$ and $|\phi| < 1$ average stochastic volatility model

$$Y_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i Y_{t-i} + \beta\sigma^{*2}\exp(h_t) + \sigma^*\exp(0.5h_t)\varepsilon_t$$

$$h_t = \phi h_{t-1} + \sigma_\eta\eta_t, \quad \eta_t \sim NID(0,1)$$

is given. (Koopman and Uspensky, 2002).

4. RESULTS

In order to determine the effect of inflation uncertainty on inflation in Turkey, which is positioned in emerging economies, the monthly consumer price index (CPI) data belonging to 1982: 01-2018: 01 periods are used. Since the data sets received from the electronic data distribution system (EDDS) of Central Bank of the Republic of Turkey (CBRT) contain different base years, consumer price index data are arranged on the basis of 1982. Augmented Dickey-Fuller (ADF), Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Phillips-Perron (PP) unit root tests have been applied for the stationarity tests of the regulated variables. The Schwarz (SC) criterion was used to determine the optimal number of delays that would not cause autocorrelation of the dependent variable in the unit root test.

Table 1. Unit root test results

Consumer Price Index	ADF Test Statistics	KPSS Test Statistics	PP Test Statistics
Level	0.0280	0.6354	1.0204
First Differences	-2.8639*	0.1798 **	-15.5702 ***

*** 0.01, ** 0.05 and * 0.10 is used for test critical values.

In Table 1, when the ADF, KPSS and PP stationarity test results for all variables are evaluated in general, the consumer price index is not stable at the level. Therefore, when examining the effect of inflation uncertainty on inflation, the first differences, in other words the percentage changes, were used in modeling. The logarithmic first differences of the consumer price index are taken, multiplied by 100, and the growth measure expressed as percentage changes (inflation series) is obtained. In the inflation series, with the transition to the inflation targeting regime, a fluctuation was observed in late 2002 and early 2003, so a dummy variable was added to the model structure in order to reveal the effects of the period. Dummy variant (K_t) used in model construction is defined as 1 for the months of 2002-2018 and 0 for the other periods. Within the scope of work, $\pi_t$to show inflation and h_t inflation uncertainty, to include the dynamic relationship between inflation and inflation uncertainty in the model,

$$Y_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i Y_{t-i} + \beta\sigma^{*2}\exp(h_t) + \sigma^*\exp(0.5h_t)\varepsilon_t \qquad \varepsilon_t \sim NID(0,1)$$

$$h_t = \sum_{j=1}^{p} \phi_j h_{t-j} + \sigma_\eta\eta_t, \quad \eta_t \sim NID(0,1)$$

mean stochastic volatility model was used. The average equation for inflation is defined as the AR (2) process. Appropriate delay lengths for inflation and inflation uncertainty in the model are determined with Schwarz (SC) criterion.

Table 2. Mean Stochastic Volatility Model Results

Parameter estimates of the mean equation						
Y_t	Fixed	Y_{t-1}	Y_{t-2}	K_t	$\exp(0.5h_t)\varepsilon_t$	$K_t * \exp(0.5h_t)\varepsilon_t$
	0.0112**	0.5867 **	0.2178 *	-0.0243*	1.2756 **	** -0.8907
Parameter estimates of variance equation						
h_t	h_{t-1}		h_{t-2}		η_t	
	0.4022 **		0.5120 *		0.6491 *	

*** 0.01, ** 0.05 and * 12:10 is used for test critical values.

The suitability of the model identification was examined by the Ljung-Box Q test at 6, 12 and 24 delay lengths. It was found that autocorrelation at the 10% significance level was not found in 24 delay length. In addition, according to the statistics of the Jarque-Berra Normality test and Kolmogorov Smirnov test, it was concluded that standardized residues had normal distribution at 5% significance level. In order to reveal the effects of inflation uncertainty in Turkey's economy, which has faced both high and low inflation, dummy variables, "one" is used for the period after 2002 and "zero" used in other periods, have been accepted as statistically significant. In addition, the coefficients of the interaction term, which is the product of the inflation uncertainty, are found to be statistically significant. This result indicates that the effect of inflation uncertainty on inflation differs before and after 2002.

5. CONCLUSION

In the study, the impact of inflation uncertainty on inflation under the inflation-targeting regime, which has been implemented since 2002 in Turkey, has been examined. As the direction and the size of volatility show, the expectations of the markets and its importance on policy determinations, the modelling of volatility has emerged as an important issue. In this context, to reveal the dynamics of inflation in Turkey under inflation targeting regime, stochastic volatility model is used. In this study, inflation uncertainty as a non-observable variable was added to the model and estimated. Within the scope of the study, inflation uncertainty was found to increase inflation before the period of inflation targeting. As the period after the inflation targeting being analyzed, it is concluded that inflation uncertainty has increased inflation but the effect of this increase was not as much as the previous period. In the study, according to the basis of the findings, when the inflation uncertainty raised, the inflation also raised during the period before and after 2002.

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