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Emerging Markets Queries in Finance and Business

## Inflation Targeting for Turkey

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### Abstract

In this study, we analyze the behavior of inflation rate in Turkey by using monthly data belonging 2003:M01-2014:M08 period. We employ Markov Switching Auto regression (MSI-AR) approach in order to investigate whether the monetary authorities have asymmetric behaviors. Results imply that the Central Bank of the Republic of Turkey plays active or inactive role in the economy due to economic conditions.

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*Keywords:* Inflation Targeting, Consumer Price Index, Markow Switching VAR

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### 1. Introduction

Especially in last 60 years, there is a great tendency to focus on monetary policies that also have influence in many economic issues. Monetary policies and its relation with variables such as interest rate, inflation, exchange rate and growth are investigated by many academicians. Inflation targeting is a framework for monetary policy characterized by the public announcement of official quantitative targets or target ranges for the inflation rate over one or more time horizons, and by explicit acknowledgement that low, stable inflation is monetary policy's primary long-run goal Bernanke, 1999. The price stable when economic actors does not care about the price changes when they decide to make saving or investment or consumption Greenspan, 2001. Inflation targeting is different from some other monetary politics in such aspects; declaring inflation targets for one or more terms, when deciding something about monetary policies, not only variables such as exchange rate or money base, also inflation are considered as a variable Mishkin, 2000.

Implementation process follows the five main steps:

1. Announcement of the mid-term quantitative targeted inflation level to the public by the central bank

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(central bank is always used as monetary authority).

2. Price stability is supposed to be realized as the ultimate and primarily goal of monetary policy by an institutional commitment and other goals are subordinated.

3. Setting the policy tools based on a comprehensive information strategy which includes not solely money aggregates and the interest rate but also does all economic variables.

4. Communication with public, market institutions, other monetary authorities and monetary institutions is the key element in a successful inflation targeting process. Therefore, increasing the transparency in the way of communication with economic agents is one of the most important parts of implementation to achieve the target level. Thereby, monetary authority is supposed to declare the plans, objectives and decisions in a predetermined time horizons.

5. Accountability of the Central Bank must be increased in order to attain the targeted inflation objectives.

Philipps Curve states that output-inflation trade off exists. Due to Friedman (Friedman, 1970); inflation has a trade off with unemployment but only in the short run. It is then understood that (after the oil crises) inflation and unemployment may rise together (called stagflation). What is clear is inflation is a very important macroeconomic tool that has a relation with output so policies depend on inflation may be very difficult to manage.

Inflation rate has an effect in decision making for households, due to Walsh (Walsh, 2003):

$$c_t^{-\sigma} = \beta(1+i_t) E \left( \frac{P_t}{P_{t+1}} \right) C_{t+1}^{-\sigma} \tag{1}$$

Here in the equation above, it states that intertemporal allocation of consumption goods is determined by their prices, that is, expected inflation is an important variable for consumption decision.

For the firms, it is the same, in order to set the prices; they consider the expected inflation rate due to the model of Walsh:

$$\frac{P_t^*}{P_t} = \frac{\theta}{\theta-1} \cdot \frac{E_t \sum_{i=0}^{\infty} w^i \beta^i \varphi_{t+1} C_{t+1}^{1-\sigma} \left( \frac{P_{t+1}}{P_t} \right)^\theta}{E_t \sum_{i=0}^{\infty} w^i \beta^i C_{t+1}^{1-\sigma} \left( \frac{P_{t+1}}{P_t} \right)^{\theta-1}} \tag{2}$$

About the inflation targeting, it is very well known that first implementation was made in New Zealand, and this system is accepted for most people as a monetary tool to developed countries. The problem of inflation targeting that makes it harder to implement in developing countries is the not professionalized financial and monetary systems in the developing countries. Another point that is very important is the independence of the Central Banks when implying Monetary Policies. There are many comments for Turkey if the government makes something to force Central Bank to change its decisions or not. There is an accepted definition to show why the Central Banks cannot be perfectly independent in the developing countries; heavy reliance seignior age, shallow capital markets and fragile banking system Mason, Savastano, & Sharma, 1997. In Turkey’s case, seignior age ratio is almost five times more than developed countries.

**2. Literature review**

George J. Bratsiotis, Jakob Madsen and Christopher Martin, Bratsiotis, Madsen, & Martin, 2002 argues in their research about Inflation targeting and inflation persistence that when inflation target the persistence of inflation exist is at a lower level. This idea means that if monetary policy is concentrated on inflation it will be more receptive. Bratsiotis, Madsen and Martin focused their research in late of 1980's until the early of 1990's on seven countries (Australia, Canada, Finland, New Zealand, Spain, Sweden and the UK), they used for quarterly data the HEGY test and for annual data the simple ADF tests. They have found a way with which

they can influence or support the inflation rate, namely the way in which political regimes affect the inflation rate fluctuations. And also, they continued to observe that the persistence of inflation is lower when an inflation target exists.

Aaron Mehrotra in Mehrotra, 2008 did a research about Japanese inflation from middle of 1990's, in that period Japan was in a disinflation and deflation period. He found that if you increase the money supply it will has major changes in prices but not and on the real output. For examining policies which was applied in that period he used the Markov Switching model, Structural Vector Auto Regressions and structural IS equations, with this models he was looking if the price level and inflation targeting was correctly applied in the period of disinflation. The MSVAR model showed that the inflation rate is relatively stable, even if it is at a low level and the output gap also appears to be stable. VAR with McCallum rule shows that a change in monetary growth also causes an increase in the monetary base in a short period using these researches sustained that policies which was applied had a positive influence on price and also he sustained that the shock doesn't affect too much the level of real GDP.

The inflation persistence is based on the inflation target which is fixed by Central Banks, about this wrote Cleomar Gomes and Maria Carolina da Silva Leme, 2008. They examined the period from 1995 until 2008, and exactly the Real Plan which was applied in that period in Brazil. In their research they used Auto-Regressive Fractionally Integrated (ARFIMA) models to examine IPCA (the official inflation rate), inflation expectations, and the Selic interest rate. Research has shown that inflation was supported by high interest rates but inflation was at a stationary level with a low degree of persistence. The results also shows that the persistence of inflation decreases , that inflation expectations was unsteady and that monetary policy was based on a low level of IPCA and a high rate of Selic persistence.

Vuslat Us in Us, 2004 analyzed the Turkish economy from 1970 to 1990. Using Variance Decomposition (VDC) and Impulse Response Functions (IRF) showed that inflation was influenced by public sector prices and the rate of internal prices. VDC analysis shows that rising prices in the public sector creates changes in inflation, which can be seen later. Vuslat also says that for a stable economy are needed reforms as: lower interest rates, lower tax burdens and a stronger currency.

Marika Karanassou and Dennis J. Snower in Karanassou & Snower, 2004 said that Inflation is primarily based on inflation expectations and on some variables like labor force, unemployment, output gap and some other examples. The Karanassou and Snower deducted two processes:

- A temporary money growth shock: Inflation affected by this temporary shock they called inflation persistence.
- A permanent money growth shock: Late effects of inflation of a permanent monetary shock have called inflation under-responsiveness.

Firouz Fallahi in Fallahi, 2011 investigated energy consumption (EC) and GDP for United States, for the period 1960 to 2005. To learn more about EC and GDP he used Markov-switching vector autoregressive (MS-VAR) models and vector autoregressive (VAR) models and to compare them used the standard linear GC. The results show that at that time there was no causal link between EC and GDP and the results are the same as in MS-VAR models causality. An important problem that has been analyzed in detail was the high level of inflation and the budget deficit; these two variances do not allow the country to develop. Oreste Napolitano and Alberto Montagnoli Oreste Napolitano, 2001 analyzed the 90s when was disinflation period in Turkey. In the years 1991-1994, Turkey has suffered a decline in credibility, the Central Bank through their policies failed to regain credibility had before. Christian Conrad and Thomas A. Eife (Christian Conrad, 2012) did the research to Explain Inflation persistence by the Time varying Taylor Rule. He examined the period from 1975 to 2010 from U.S. In his work he used Taylor rule for monetary policy and simple New Keynesian model, with the simple New Keynesian model showed three variables with which the central bank sets the inflation rate, these variables are: aggregate supply, aggregate demand and monetary policy rule.

Steinar Holden and John C. Driscoll (Steinar Holden, 2001) studied the persistence of inflation in terms of Fuhrer and Moore (1995) and Blanchard and Katz (1999). Jeff Fuhrer and George Moore (1995) stated that workers compare their wages with the wages of other workers have been applied in the past, thus making a

difference of evolution and also workers are interested in real wages, not nominal wages. Blanchard and Katz (1999) argued that unemployment benefits depend on wages which you had and the real salaries what other people earn. After that two different papers, Steinar Holden and John C. Driscoll had a final conclusion that inflation persistence may be caused by coordination problems between employee and employer.

The framework of inflation persistence depends on the analysis applied, Clarck, 2003 for the period 1959:Q1-2002:Q4 and Paya et al., 2007 for the period 1947-2005 for USA, O'Reilly and Whelan, 2004 for period 1970:Q1-2002:Q4 in Eurozone both used autoregressive models for average inflation. Other studies that tried to see the inflation persistence are in the economy by using the structural unit root tests; Levin and Piger (2004) Austria, Canada, France, Germany, Italy, Japan, Holland, New Zealand, Sweden, Switzerland, England and USA for the period of 1984:Q1-2003:Q4, Bilke, 2005 for the period 1973:M1-2004:M4 for France, and D'Amato et al., 2007 for the period 1980:M1-2007:M12 in Argentina.

There are also some empirical studies that calculate inflation persistence in Turkey. In his error correction model (ECM) analysis Tutar, 2001 showed that in Turkey for the period 1984:M1-1999:M12 there is a long memory between large inertial component in wholesale price index, CPI and WPI indexes. Erlat, 2001 by using autoregressive fractionally integrated moving average (ARFIMA) showed that CPI and WPI series has important components that shows long term memory. In another study that focused on the causes of inflation Özcan et al., 2004 showed that in 1988-2000 period in Turkey, both negative lagged effect of import price inflation on the CPI inflation. Autoregressive fractionally integrated moving average (ARFIMA) was used by Balcılar, 2004 and the value for WPI was found as: 0.40, Kutlarve Turgut, 2006 found the same value as 0.45 and showed that the inflation series has long memory but stationary. Altınok et al., 2009 in their study for the period 1988:M1-2007:M10 used alternative inflation data and has a conclusion that CPI persistency is higher than WPI. They applies spectral regression method in their study. The rest of the paper is organized as follows. The econometric methodology is outlined in Section 3 and the data is described in Section 4. Then the empirical findings are discussed in Section 5. Finally, some concluding remarks are offered in Section 6.

### 3. Methodology

#### 3.1. Regime Switching Models

Regime switching models are separated into two depending on the switching type of the regime during the period. Firstly the regimes are considered to be changed depending on an observable variable. Threshold Autoregressive and Smooth Transition Autogressive, STAR models are the examples for the first group. In the second models, the regimes are unobservable and they are determined by randomly variables. Markov Switching model is an example for such cases. In Markov models; it is not known for sure which regime is effective in a given time period. But there is a probability of observation on regimes in each given time. Markov switching autoregressive MS-VAR was used by Hamilton, 1989, 1990, 1994, and 1996, Kim ve Nelson, 1998, Krolzing, 1997, 1998, 2000, and 2001 in order to analyze conjunctural waves. According to Hamilton (1989) two regime MSA AR (p) model is showed as;

$$y_t = \begin{cases} \phi_{1,0} + \phi_{1,1}y_{t-1} + \dots + \phi_{1,p}y_{t-p} + \varepsilon_t & \text{if } (s_t = 1) \\ \phi_{2,0} + \phi_{2,1}y_{t-1} + \dots + \phi_{2,p}y_{t-p} + \varepsilon_t & \text{if } (s_t = 2) \end{cases} \quad (3)$$

$$y_t = \phi_{0,st} + \phi_{1,st}y_{t-1} + \dots + \phi_{p,st}y_{t-p} + \varepsilon_t \quad (4)$$

The mentioned  $\phi_{1,j}$  and  $\phi_{2,j}$  shows the autoregressive lag-lengths belong to regimes,  $s_t$  the value for

each regime,  $p$  autoregressive rating of the model,  $\sigma_i^2 < \infty$ . Mohd, Zaidi, 2006:57, Fallahi, Rodriguez, 2007:5). The regimes are determined by the unobservable regime variables that are generated by Markov Switching Model. Regimes changes due to the past value and the switching probabilities and showed as: (Chang, Hu, 2009:1256-1257);

$$\Pr(S_t = j | S_{t-1} = i) = P_{ij} \geq 0 \tag{5}$$

Above,  $i, j = 1, 2, \dots, k$ ,  $k$  different possible regime,  $P_{i,j}$  shows the probability to change from regime  $i$  to regime  $j$  and is:

$$\sum_{j=1}^k \Pr(S_t = j | S_{t-1} = i) = 1 \tag{6}$$

The regime variable's move from one to another is controlled by Markov Model. This model is shown as below;

$$P[a < y_t \leq b | y_1, y_2, \dots, y_{t-1}] = P[a < y_t \leq b | y_{t-1}] \tag{7}$$

If the variable exists from Markov Model only thing that we should calculate is the current change ration that will be included in the future regime Hamilton, 1994:679, Owen, 2004:9:

$$P = \begin{pmatrix} P_{11} & \dots & P_{1k} \\ \vdots & \ddots & \vdots \\ P_{k1} & \dots & P_{kk} \end{pmatrix} \tag{8}$$

If the regime possibility on time  $t$  is determined by  $\pi_t = (P_1, P_2, \dots, P_k)$ , then at time  $t+1$  each regime possibility is determined by  $\pi_{t+1} = P' \pi_t$ . Stationary Markov model has a an ergodic vector that can be considered as a probability in each regime.

### 3.2 Data

In this study it is aimed to make an empirical analysis, by using the monthly data from 2003:M1 to 2014M8 that Turkey started to imply Inflation Targeting. The data for the variables are gathered through the Electronic Data Delivery System of Central Bank of Turkey. Tramo/Seats method is used in order to eliminate the seasonality effect. Unit root tests applied in order to prepare the data for the analysis, and then Markov Switching regime changes model that takes into consideration the regime changes in the economy is applied.

Table 1: Descriptive Statistics

Variable	Sample	Mean	Standard Deviation	Coefficient of Variation	Skewness	Kurtosis	Jarque-Bera [Prob]
CPI	140	5.04	0.271	0.053	-0.077	2.81	8.345 [0.015]

Due to the statistics standard deviation ratio is 0.271. On the other hand, if the skewness ration is taken into consideration, that shows the asymmetry in probability distribution of the sample, it is tended to the left. The

Kurtosis ratio is also meaningful. According to Jarque-Bera test that the null hypothesis accepts normal distribution, null hypothesis is rejected, that means the variable does not have a normal distribution.

#### 4. Empirical Analysis

Before implying MSVAR method, the variables should be cleared in terms of unit root problem. In this respect, the unit root tests developed by Dickey and Fuller (1979 and 1981) (henceforth ADF), Phillips and Perron (1988) (henceforth PP) and Elliot et al. (1996) (henceforth DF-GLS) are employed. In table 2 the results are shown according to the tests that are hold and the constant term of the variable has unit root in intercept. So the first lagged differences will be used in the analysis.

Table. 2 Results for Unit Root Test without Structural Breaks

Levels	Variable	ADF	DF-GLS	PP
Intercept	CPI	-0.499 (4)	1.06 (12)	-1.85 (39)
Intercept and Trend	CPI	-4.42 (1)*	-36.32 (1)**	-3.35 (14)***
First-differences				
Intercept	CPI	-8.783 (3)*	-0.66 (11)	-15.42 (137)*
Intercept and Trend	CPI	-8.763 (3)*	-8.38 (0)***	-22.86 (137)*

Notes: \*, \*\*, \*\*\* denotes significance value of 1%, 5%, and % 10 levels, respectively.

For the DF-GLS test: The asymptotic critical values for without trend -2.591, -1.944 at the %1 and %5 levels. The asymptotic critical values for with trend -3.602, -3.1772 at the %1 and %5 levels. The figures in parenthesis denote the number of lags in the tests that ensure white noise residuals. The Schwarz criterion was used. For the ADF test: shows the results of Dickey Fuller test in the case of zero lag length and lag length chosen due to SIC criteria. For the ADF test, the Mac Kinnon, 1996 critical values for with constant -3.485, -2.885, -2.579 at the 1 %, 5 % and 10 % levels. The critical values for with constant and trend -4.035, -3.447 and -3.148 at the 1 %, 5 % and 10 % levels, respectively. For the PP test: Values in the parenthesis show bandwidths obtained according to Newey-West, using Bartlett Kernel criteria. For the PP test Mac Kinnon, 1996 critical values for with constant -3.483, -2.884, and 2.579 at the 1 %, 5 % and 10 % levels. The critical values for with constant and trend -4.033, -3.446 and -3.148 at the 1 % 5 % and 10 % levels, respectively.

Table. 3 Regime Number and Test Statistics

Number of Regime	Log Likelihood	LR Linearity	Davies	AIC	SC
MSI(2)-AR(4)	-223.2833	-0.0002	0.00	3.4159	3.6087
MSI(3) -AR(4)	-223.2834	-0.0005	0.00	3.4895	3.7893
MSI(4) -AR(4)	-223.2836	-0.0009	0.00	3.5924	4.0422

Note: AIC: Akaike Information Criteria, SC: Schwarz Information Criteria, LR likelihood ratio

According to Likelihood Ratio, Linearity and Davies\* test statistics, all regimes has non-linear and asymmetric structure. On the other hand, it seems that in the model that has the lowest statistics and the biggest likelihood ratio there are two transitions in two regimes as expansion and contraction due to SC test. For the optimal lag-length, 1 to 12 lag lengths are tested and due to Schwarz Criteria (SCI) optimal lag length is considered to be 4. Table 4 shows the “Transition Probability Matrix” that includes the results for MSI(2)-AR(4) model:

Table 4: Transition Probability Matrix

	Expansion Regime	Contraction Regime
Expansion Regime	0.8995	0.1015
Contraction Regime	0.0949	0.9051

According to Transition Probability Matrix, the contraction regime lasts in 10.53 quarters that is 2.63 years and the expansion regime lasts 1.10 quarters that is 0.27 years. Economy spends more time in Contraction than Expansion that is not surprising. That’s why it seems that there is an asymmetry between expansion and contraction in the economy. Levin and Piger, 2004 argues that the monetary authorities that announce the inflation target very transparently because the old inflation rates to be less considered by individuals and it will result as a downward pressure on the inflation.

On the other hand, due to Transition Probability Matrix, in 1.11 quarter economy can get over the contraction period and to enter contraction the period is 1.10 quarters. The fact that the regime changes are slow in Turkey just might be the reason of the pricing of the goods and services in Turkey are rare. Altınok et al. (2009) suggests that 70% effects of the shocks occurs in CPI disappears in 1 quarter. In the following years after a contraction, the chance to live recession again is 0.9051 and for the opposite, that is an expansion after an n expansion period is 0.8995.

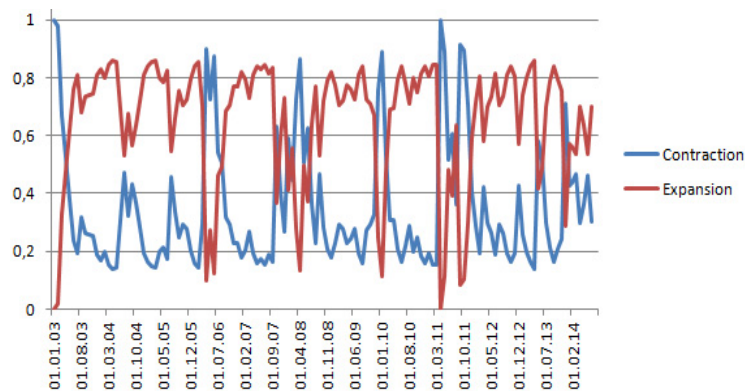


Fig. 1: Regime Possibilities

If there is high persistency in inflation, sacrifice ratio also should be high. That’s why the output cost of fights against inflation increases. It will be useful to determine the inflation persistence in order to calculate the effect of monetary policy on inflation shocks.

\*For details about Davies asymmetry test: Davies (1977, 1987) and Garcia ve Perron (1996)



## 5. Conclusion

In Turkish economy lived inflation problem since long years and after, inflation targeting is implemented starting from 2002. In this research it is aimed to examine the CPI index regime changes from the period the inflation targeting started up to today. In this respect, Dickey and Fuller (1979 and 1981), Phillips and Perron (1988), and Elliot et al. (1996) unit root tests are applied. The test results show that CPI indexes has unit root. In that parallel, Markov Regime change model is tested in order to see if there is an asymmetry in CPI in contraction and expansion periods. The results of Transition Probability Matrix show that, in 1.11 quarter economy can get over the contraction period and to enter contraction the period is 1.10 quarters. The fact that the regime changes are slow in Turkey just might be the reason of the pricing of the goods and services in Turkey are rare.

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