International Journal of Economics, Commerce and Management
United Kingdom ISSN 2348 0386 Vol. IX, Issue 5, May 2021

http://ijecm.co.uk/

ON INFLATION AND INFLATION REGIMES, ALBANIA IN 25 YEARS OF TRANSITION: A MARKOV REGIME-SWITCHING APPROACH

Anisa Plepi
University of Tirana, Faculty of Economics, Albania
anisaplepi@feut.edu.al

Abstract

Following the structural transformation of the Albanian economy, in 25 years of transition, inflation has undergone various phases. Phase one, the hyperinflation levels that emerged with the process of transition from a centrally planned to a market-oriented economy, phase two the disinflation that followed the aftermath of the collapse of the financial pyramid schemes and phase three characterized by moderate values with the introduction of new monetary policy instruments and regime shifts. In addition, the following questions arise: How should the history of inflation in Albania be characterized? Should historical inflationary or deflationary periods be treated as varying outcomes from a single regime, that of price stability or a multi-state representation of inflation data is more appropriate? In order to explore these questions, a Markov regime-switching model is adopted in which the Albanian economy is allowed to switch between regimes, each characterized by its own inflation dynamic properties. The empirical results sustain a two-state representation of inflation history, according to which the Albanian economy has been in the low/stable inflation regime for the last 19 years, with the probability of departing from price stability only 0.02.

Keywords: Inflation dynamics, Markov switching model, Transition probabilities, Price stability

INTRODUCTION

In 25 years of transition, following the significant changes in the institutional structures and the policy-making environment, inflation in Albania has undergone several phases. The fall of the communist regime, with the resignation of the last communist government in June 1991, marked the beginning of a new chapter for inflation; after nearly three decades of control, prices were allowed to fluctuate. The transition from a centrally planned to a market-oriented economy was characterized by near hyperinflation levels that appeared to slow down by 1995 through a prudent monetary management, with the inflation rate from 226% in 1992 to only 7.8% in 1995.

Nevertheless, the demand pressures that resulted from the lax fiscal stance ahead of May 1996 parliamentary elections, combined with a sharp depreciation of the exchange rates after the collapse of several major financial pyramid schemes in Mars 1997 -which at their peak amounted to almost half of Albania's GDP- posed the risk that the economy might return to the periods of very high inflation or even hyperinflation Kalra (1998a).

The post-1997 crisis period on the other hand, with the formation of the new government and the return to careful financial policies, was characterized by substantial disinflation with inflation rates at 0.4% in 1999 and 0.1% in 2000. However, after 2000, with the introduction of indirect instruments of monetary policy (the reserve requirement, refinancing window and liquidity requirement), inflation rates were stabilized around the 3% target set by the Bank of Albania Kota (2011a).

The global financial crisis of 2008, which coincided with the adoption of the inflation targeting regime, marked the beginning of the era of low inflation rates. This reflected the overall fall in global inflation and the accommodative monetary policy with the benchmark interest rates cut to historical lows – from the pre-crisis level of 6.25% to only 1.25%.

Hence, it appears that throughout the 25 years of transition, Albania has been through periods of high inflation as well as periods of moderate or low inflation. In this context several questions arise: How should the history of inflation in Albania be characterized? Should historical inflationary or deflationary periods be treated as varying outcomes from a single regime, that of price stability or a multi-state representation of inflation data is more appropriate? What are the dynamic properties of inflation when in different regimes?

The existing literature on inflation in Albania is limited to mainly determining the driving forces behind inflation and relies on models in which a one-state representation of inflation data approach is followed.

More specifically, Kalra (1998b), Domac & Elbirt (1998) are among the first attempts to identify the determinants of inflation in Albania during the period 1993-1997 through a linear Error Correction Model (ECM). A similar methodology was later employed by Rother (2000) to

investigate the short and long run dynamics of inflation and the relative price adjustments during the transition period 1993-2000. Kunst & Luniku (1998) on the other hand, attempt to identify the potential causes of inflation over a time frame from 1993-1997 through a simple linear regression model that allows for a single structural break. Kota (2011b) focuses on estimating persistence for headline and core inflation in Albania while checking for the presence of structural breaks for a time period from 1993-2008 through a univariate approach where inflation is modeled as a simple autoregressive (AR) process.

This approach, the reliance on a single model for the conditional mean to represent the patterns inflation exhibits over time, fails to take into consideration the potential switches between regimes and hence the alteration in inflation behavior that is due to the regime switch.

This paper provides the first attempt in literature to fill the existing gap concerning inflation behavior in Albania by introducing a Markov Switching framework in modeling inflation, as proposed by Hamilton (2010). The methodology differs from the standard linear approach widely employed in literature; instead of treating inflation as a unit root process, inflation behavior is characterized by a Markov regime-switching model in which the economy can potentially shift between regimes of low and high inflation and vice versa. In this regard, through this approach, it is possible to capture the distinct dynamic behavior inflation exhibits when in different regimes.

In addition, the purpose of this paper is two-fold: First, to specify a model that seizes inflation dynamics throughout the different stages of transformation that the Albanian economy has undergone from 1996-2017. Second, to describe the characteristics of inflation behavior that are specific to each regime.

The paper is structured as follows. Section 2 gives a brief review of the literature concerning previous empirical applications of the Markov-Switching framework to characterize inflation behavior in other countries. Section 3 presents the features of the econometric model employed, the dataset and the estimation methodology while Section 4 provides the empirical results. Section 5 finally concludes.

REVIEW OF THE EMPIRICAL LITERATURE

This paper builds on a vast amount of literature in which inflation is modeled as a multistate Markov- Switching process and as such can provide further insight regarding the estimation procedure and the characterization of inflation data. The empirical literature is mainly divided in two fronts. On one side there are those who find support for a two-state representation of inflation data and on the other a three-state characterization of inflation

dynamics is found to be a better fit. Overall, to the best of my knowledge, the two-state characterization of inflation dynamics finds better support in the empirical literature.

More specifically, Ricketts & Rose (1995a) report that for G-7 countries, two-state Markov-Switching models with one state imposed to be a random walk are favored over one-state representation of inflation data whereas three-state models prove useful in explaining specific episodes in history for some countries.

Simon (1996) provides further evidence in favor of a two-state characterization of inflation. In an empirical analysis of inflation dynamics in Australia, he finds that since the early 1960-s, a two state Markov Switching autoregressive model with a single output gap term that provides additional information regarding inflation behavior, is a good characterization of inflation data.

Pagliacci & Barraez (2010) further sustain a two-state representation of inflation dynamics, through a Markov-Switching estimation of the Venezuelan New Keynesian Philips curve. The estimates determine two regimes, a "normal or backward looking" regime and "a rational expectations" regime that relates to episodes of high uncertainty in terms of economic performance.

In addition, Amissano & Fagan (2010a) model the inflation process of Euro Area, US, UK and Canada since 1960, through a time-varying transition probabilities Markov Switching model in which the inflation dynamics are characterized by two regimes, one of high inflation and a low inflation one.

In the other front, Ayuso et al. (2003) find evidence that in Spain, the stochastic process followed by inflation over a time frame from 1962-2001 is best described by a Markov-Switching model with three states: a low and stable inflation regime, a medium and more volatile inflation regime and a high and volatile inflation regime.

RESEARCH METHODOLOGY

Model Specification and Estimation Procedure

In this paper, following Amisano and Fagan (2010b), inflation is modeled as a stationary first-order autoregressive process that is governed by two distributions. Each distribution is characterized by distinct means, conditional on an unobservable discrete state variable s_t that follows a first order Markov chain and determines the switching between distributions (regimes):

$$y_t=\alpha_{st}+\Phi y_{t-1}+\varepsilon_{st} \qquad \varepsilon_{st} \sim N(0,\sigma_{st}) \qquad (1)$$

Where, ε_{st} is a Gaussian disturbance with a state-dependent standard deviation.

More specifically, there are two regimes in which inflation can potentially be in: s_t=1 (low inflation) and s_t=2 (high inflation) with the probability of a change in regime depending only on the value of the previous state (regime):

$$P(s_t=j \mid s_{t-1}) = P(s_t=j \mid s_{t-1}=i) = p_{ij} \quad i,j=1,2 \qquad (2)$$

with the transition matrix:

$$P=\begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} \qquad (3)$$

Where, p_{12} = 1-p_{11} ; p_{21}= 1-p_{22}

Taking into consideration that only y_t (inflation) can be observed directly, whereas s_t which dictates the regime switch is a latent (unobservable) variable, in order to make an inference about the value of s_t , the information derived by y_t is used. In addition, to assess the likelihood of the discrete state variable s_t, it is necessary to estimate the conditional expectations of s_t=j , j=1,2 given different information sets.

Given the collection of observed variables up to time *t* (in our case inflation) Y^t =(y_t,$y_{t-1,...}y_1$) which represents the information set available at time *t,* the information set that covers the full sample Y^T and the vector of parameters Ÿ = (α_1, α_2, Φ, σ_1, σ_2, p_{11},p_{22}), the prediction P(s_t = j | Y^{t-1};Ÿ), filtered P(s_t=j | Y^t; Ÿ and smoothed probabilities P(s_t=j |Y^T; Ÿ) can be evaluated.

The inference is implemented iteratively for t=1,2,…,T with the prediction probability

$$\eta_{i,t-1} = P(s_{t-1}=i \mid Y^{t-1}; \ddot{Y}) \qquad (4)$$

acting as an input for i=1,2 and in exchange producing as an output:

$$\eta_{j,t} = P(s=j \mid Y^t; \ddot{Y}) \qquad (5)$$

Having said that, the density of y_t conditional on the information set available at time *t*-1, Y^{t-1} and the current state of inflation s_t=*j* , *j=1,2* is:

$$V_{jt} = f(y_t \mid s_t=j, Y^{t-1}; \ddot{Y}) = \frac{1}{\sqrt{2\pi\sigma_j}} \exp\left[-\frac{(y_t-\alpha_j-\Phi y_{t-1})^2}{2\sigma_j^2}\right] \qquad (6)$$

Furthermore, given the prediction probability $\eta_{i,t-1}$ specified in (4) as an input, the density of y_t conditional only on the information set available at time *t-1*, Y_{t-1} can be obtained from (6):

$$f(y_t \mid Y^{t-1}; \ddot{Y}) = \sum_{i=1}^{2} \sum_{j=1}^{2} p_{ij}\, \eta_{i,t-1} V_{jt} \qquad (7)$$

From here, given the Bayes theorem, the filtered probabilities of being in regime *j* in time *t* are derived:

$$\eta_{jt} = P(s_t=j \mid Y^t; \ddot{Y}) = \frac{P(s_t=j \mid Y^{t-1}; \ddot{Y}) * f(y_t \mid s_t=j, Y^{t-1}; \ddot{Y})}{f(y_t \mid Y^{t-1}; \ddot{Y})} \qquad (8)$$

$$= \frac{P(s_t=1 \mid Y^{t-1}; \ddot{Y}) * V_{1t}}{f(y_t \mid Y^{t-1}; \ddot{Y})}$$

The relationship between the filtered and prediction probabilities can be expressed as:

$$P(s_{t+1} = i \mid Y^t;\ddot{Y}) = p_{1j}\, P(s_t=1 \mid Y^t;\ddot{Y}) + p_{2j}\, P(s_t=2 \mid Y^t;\ddot{Y}) \quad (9)$$

Where $p_{1j} = P(s_{t+1} = i \mid s_t=1)$ and $p_{2j} = P(s_{t+1} = i \mid s_t=2)$ are the transition probabilities.

By iterating equations 6-9, assuming the Markov chain to be ergodic (the starting value of $\eta_{i0} = P(s_o=i) = \frac{1-p_{jj}}{2-p_{ii}p_{jj}}$), the quasi-log-likelihood function can be derived:

$$ł_T(\ddot{Y}) = \log f(y_1,y_2,\ldots,y_T \mid y_0;\ddot{Y}) = \sum_{t=1}^{T} \log\, f(y_t \mid Y^{t-1};\ddot{Y}) \quad (10)$$

The QMLE $\ddot{Y}_T$ can be evaluated through the maximization of (10) through a numerical optimization algorithm.

Furthermore, by relying on Kim (1994) smoothing algorithm, the smoothed probabilities can be derived:

$$P(s_t=i \mid Y^T;\ddot{Y}) = P(s_{t+1}=1 \mid Y^T;\ddot{Y}) * P(s_t = i \mid s_{t+1}=1, Y^T;\ddot{Y}) + \quad (11)$$

$$P(s_{t+1}=2 \mid Y^T;\ddot{Y}) * P(s_t = i \mid s_{t+1}=2, Y^T;\ddot{Y})$$

$$= \left\{ \frac{p_{i1} P(s_{t+1}=1 \mid Y^t;\ddot{Y})}{P(s_{t+1}=1 \mid Y^t;\ddot{Y})} + \frac{p_{i2} P(s_{t+1}=2 \mid Y^t;\ddot{Y})}{P(s_{t+1}=2 \mid Y^t;\ddot{Y})} \right\} * P(s_t=i \mid Y^T;\ddot{Y})$$

Statistical tests: Stationarity and inflation regimes

In this subsection, i examine whether the specified model on the behavior of inflation in Albania is consistent with the pattern conveyed by inflation data as measured by the Consumer Price Index (CPI)[1]. In addition, the focus is put on two key issues: First, can inflation in Albania be treated as a stationary process? Second, is the Markovian structure supported by data or the state variables are independent?

In order to provide an answer to the first issue, thus determine whether the presence of a unit root in inflation data can be rejected in the case of Albania, i rely on several tests as reported by Table 1 (Appendix).

According to the Augmented Dickey-Fuller (1979) ADF test, Phillips-Perron (1988) PP test, the null hypothesis of a unit root can be rejected in both cases with and without a time trend at a 5% level of significance. The Kwiatkowski, Phillips & Schmidt (1991) KPS test on the other hand, fails to reject the null hypothesis of inflation as a stationary process against the alternative of the presence of a unit root at the 5 percent level of significance without a time trend, whereas when a time trend is included in the test equation, the null cannot be rejected at the 1 percent level. This suggests that in the case of Albania, shocks do not have a permanent

[1] The quarterly data on Consumer Price Index (CPI) are taken from the database of the Bank of Albania (BoA) and cover a time period from 1996:Q1-2017:Q1, the longest period available; a total number of 84 observations. In addition, inflation is represented by dlog(CPI).

effect on inflation and the nominal anchor for monetary policy is functional which is of particular importance for countries under the inflation targeting regime.

As for the second issue, the independence of the state variables would imply that the current state/regime of inflation is not affected by the previous one. Hence, inflation would have the same probability of being in the low/high regime in spite of the previous one: $p_{11}=p_{21}$ and $p_{12}=p_{22}$ therefore a simple switching model could be employed to characterize inflation dynamics. This model would not be very compelling from a policy making/analysis perspective for, as argued by Ricketts and Rose (1995b) economic agents would form expectations in the same way regardless of the stance of monetary policy.

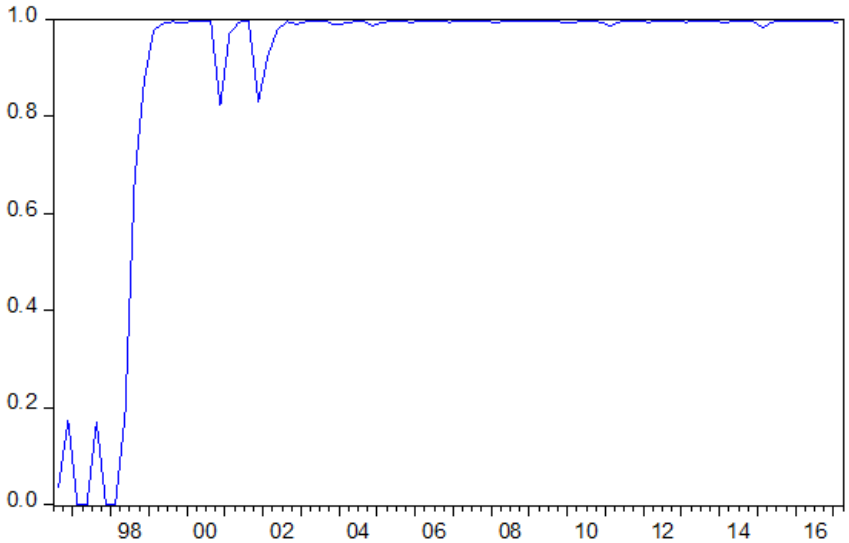
The independence of the state variables would imply that $p_{11}+p_{12}=1$ and $p_{21}+p_{22}=1$, therefore the null hypothesis of independent states can be represented as: H_0:$p_{11}+p_{22}=1$. In addition, as shown by the results of the Wald test in Table 2 (Appendix), the null hypothesis of independent states is not supported; therefore there is no evidence against the Markovian structure specified in the previous subsection to characterize inflation dynamics in Albania.

RESULTS

Inflation regimes

The Quasi-Maximum Likelihood estimates shown in Table 3 (Appendix), indicate that $s_t=1$ is the state of low inflation with a mean of 0.59% whereas $s_t=2$ the state of high inflation with a mean of 6.81%. The smoothed probabilities $P(s_t=1|\ Y^T)$, plotted in Figure 1, suggest that after 1998 the Albanian economy has been in the regime of low inflation, as shown by the close to 1 values throughout this time period.

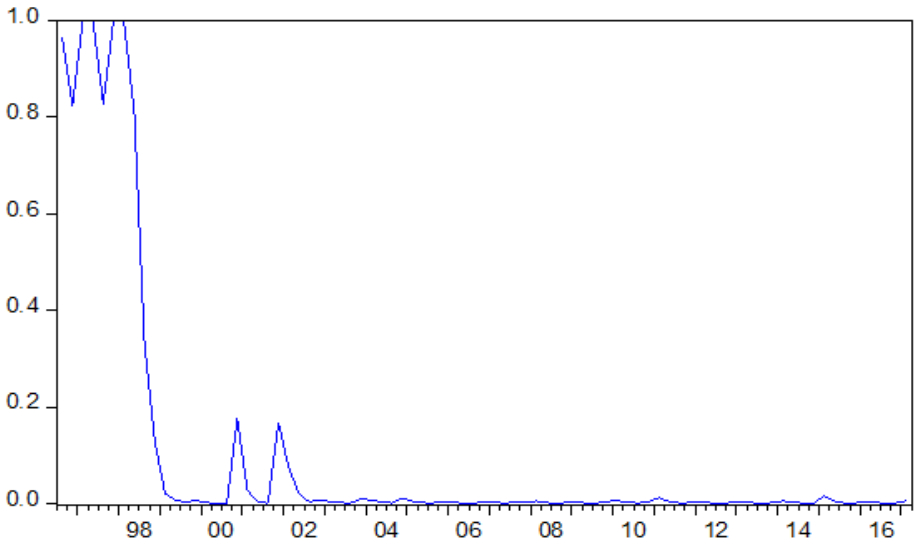
Figure 1: The smoothed probabilities of $s_t=1$, 1996:Q1-2017:Q1



Given the substantial time period throughout which the economy results to be in the low inflation regime (19 years), it is necessary to provide an explanation as to what is intended with low inflation regime.

The low inflation regime includes time periods during which, the economy has been characterized by low inflation rates, slightly below or close to the 3% target, thus s_t=1 includes periods of price stability and slight deviations from it. Alternatively following the approach of Amisano and Fagan (2010c), s_t=1 can also be interpreted as the regime of price stability.

Figure 2: The smoothed probabilities of s_t=2, 1996:Q1-2017:Q1



Similarly, the smoothed probabilities $P(s_t=2|\ Y^T)$ as shown in Figure 2, indicate that after 1998 (1998-2017), the probability of the economy being in the high inflation regime is almost 0 whereas in the preceding years (1996, 1997) these probabilities are very close to 1, suggesting that during the time period 1996-1997 the economy has departed from price stability and has been in the high inflation regime.

These results are further sustained by a closer look at inflation data as illustrated in Table 4. In the case of 2002, the classification of regimes in Table 4 shows that the deviation from target is almost negligible compared to 1996-1997 throughout which the economy results to be in the high inflation regime according to both observed data and the smoothed probabilities. This explains the low value of the estimated smoothed probability $P(s_t=2)$ in 2002 (lower than 0.2) although it is classified as a high inflation regime when relying on observed inflation data.

Table 4: Inflation Regimes in Albania 1992-2016

Year	Inflation[2]	Deviation from Target[3]	Inflation Regime
1992	226	223	High
1993	85	82	High
1994	22.6	19.6	High
1995	7.8	4.8	High
1996	12.7	9.7	High
1997	33.2	30.2	High
1998	20.6	17.6	High
1999	0.4	-2.6	Low
2000	0.1	-2.9	Low
2001	3.1	0.1	Stable
2002	7.8	4.8	High
2003	0.5	-2.5	Low
2004	2.3	-0.7	Stable
2005	2.36	-0.64	Stable
2006	2.37	-0.63	Stable
2007	2.9	-0.1	Stable
2008	3.4	0.4	Stable
2009	2.3	-0.7	Stable
2010	3.6	0.6	Stable
2011	3.5	0.5	Stable
2012	2	-1	Low
2013	1.9	-1.1	Low
2014	1.6	-1.4	Low
2015	1.88	-1.12	Low
2016	2.2	-0.8	Stable

Deviations less than 1% from the set target are classified as periods of price stability; deviations more than 1% below the set target, as periods of low inflation, whereas deviations more than 1% above, as periods of high inflation.

Durance of inflation regimes

Another issue of great importance for policymakers is the durance of each inflation state and the likelihood that the economy departs from the regime of price stability.

[2] Consumer Prices (Annual %) derived from the World Bank Database
[3] As a reference point of price stability the 3% target set by the Bank of Albania in 2015 is taken.

The estimates of the transition probabilities shown in Table 3 indicate that the Albanian economy will remain in the low/stable inflation regime in the next period with probability p_{11}, 0.98. Furthermore, the estimates suggest significant state dependence in the transition probabilities, with a higher probability of remaining in the origin state (0.98 for the low/stable inflation and 0.96 for the high inflation regime). The low/stable inflation regime results to be more persistent than the high one.

Based on the estimations of the expected duration of each inflation regime, the Albanian economy stays longer (twice as long) - approximately $1/1\text{-}p_{11} \approx 50$ quarters in the regime of low/stable inflation- than in that of high inflation (approximately $1/1\text{-}p_{22} \approx 25$ quarters).

CONCLUSIONS

This paper by relying on a Markov regime-switching framework in which the Albanian economy is allowed to shift between regimes of low and high inflation and vice versa, is able to capture the alteration in inflation behavior that is due to the regime switch in contrast to the standard linear approach widely employed in the empirical literature.

The estimated MSAR(1) model provides a good characterization of inflation behavior throughout the different stages of transformation of the Albanian economy from 1996-2017; the strong inflationary pressures of 1996-1997, the disinflation that followed the post-crisis of 1997, the period of stable inflation after 2000 and the era of low inflation rates that followed the global financial crisis of 2008.

The empirical results reveal that the Albanian economy has been in the regime of low/stable inflation for the last 19 years. The probability of departing from price stability in the next period is only 0.02 whereas the probability of remaining in the current regime 0.98, which suggests that the low/stable inflation regime is quite persistent.

Furthermore, the estimates indicate significant state dependence in the transition probabilities with a higher probability of remaining in the origin state and suggest that the Albanian economy stays longer (twice as long) in the regime of price stability than in that of high inflation.

To conclude, in spite of the restrictions posed by the limited availability of data in the case of Albania, Markov-Switching models provide a useful tool in capturing certain nonlinear patterns that have the potential of conveying valuable information for policymaking. Looking forward, in future research the basic Markov Regime-Switching model can be extended to allow for time-varying transition probabilities along with a variable that works as an “early warning” indicator and signals the shift between inflation regimes.

APPENDIX

Table 1: Testing for the Presence of Unit Roots in Inflation 1996:Q1-2017:Q1

Test	ADF t-statistic	
ADF	-5.34	-5.02*
	PP t-statistic	
PP	-8.34	-8.84*
	LM-statistic	
KPS	0.43 (0.46)	0.18* (0.21)

Note: Each test is conducted with and without a time trend, the values in * report each test's t-statistic when a time trend is included. Furthermore, the values in brackets () report the asymptotic critical values in the case of KPS test at the 0.05 significance level and the 0.01 significance level when a time trend is included.

Table 2: The results of the Wald Test on the independence of the state Variables

Null Hypothesis	t-Statistic	F-statistic
$H_0: p_{11}+p_{22}=1$	-9.2	84.7

Table 3: The estimation results of the model MSAR(1) 1996-2017

Parameters	$s_t=1$	$s_t=2$		
α	0.59 (0.002) [0.003]	6.81 (0.018) [0.000]	**Log likelihood=190.58**	
Φ	-0.22 (0.112) [0.045]			
σ	-3.86 (0.085) [0.000]	-2.88 (0.27) [0.000]	AIC=-4.42 SC=-4.21	
Transition Probabilities				
	low	high	Expected Durations	
low	0.98	0.02	1 (low inflation)	2 (high inflation)
high	0.04	0.96	50	25

Note: The reported values in () are the estimated Std. errors whereas the values in [] the estimated p-values

REFERENCES

Amisano, G., & Fagan, G. (2013), "Money growth and inflation: A regime switching approach", Journal of International Money and Finance, 33, 118-145.

Ayuso, J., Kaminsky, G. L., & Salido, D. L. (1998), "Inflation regimes and stabilization policies, Spain 1962-1997", (No. 10), FEDEA.

Bredin, D., & Fountas, S. (2006), "Inflation, inflation uncertainty, and Markov regime switching heteroskedasticity: evidence from European countries", Economic Modeling, 36(9), 112-230.

Domaç, I., & Elbirt, C. (1998),"The main determinants of inflation in Albania",(No.1930),World Bank Publications.

Hamilton, J. D. (2010), "Regime switching models", Macroeconometrics and Time Series Analysis (pp. 202-209). Palgrave Macmillan UK.

Kim, C. J. (1994), "Dynamic linear models with Markov-switching", Journal of Econometrics, 60(1-2), 1-22.

Kota, V. (2011). "The Persistence of Inflation in Albania," Special Conference Paper No. 3, Bank of Greece

Kalra, M. S. (1998),"Inflation and money demand in Albania", (No. 98-101), International Monetary Fund.

Kunst, R. M., & Luniku, R. (1998),"Inflation, its dynamics, and its possible causes in Albania", (No. 57). Institute for Advanced Studies.

Pagliacci, C., & Barráez, D. (2010), "A Markov-switching model of inflation: looking at the future during uncertain times", Análisis Económico, 25(59), 25.

Ricketts, N., & Rose, D (1995), "Inflation, learning and monetary policy regimes in the G-7 economies", (Vol. 95, No. 6), Bank of Canada.

Simon, J. (1996), "A Markov-switching model of inflation in Australia ", (No. rdp9611), Reserve Bank of Australia.