Considerations regarding inflation's evolution in Central and Eastern European countries

Lupu, Dan and Asandului, Mircea and Sîrghi, Nicoleta

Alexandru Ioan Cuza University of Iasi, Alexandru Ioan Cuza University of Iasi, West University of Timisoara

30 March 2015

CONSIDERATIONS REGARDING INFLATION'S EVOLUTION IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Dan Lupu
Alexandru Ioan Cuza" University of Iasi, Carol 1 Ave., no. 22, 700505, Iasi, Romania;
E-mail: dan.lupu@uaic.ro

Nicoleta Sîrghi
Faculty of Economics and Business Administration
West University of Timisoara
J.H. Pestalozzi, 16
300115 Timisoara
Romania
Tel: +40-256-592504
E-mail: nicoleta.sirghi@e-uvt.ro

Mircea Asandului*
Alexandru Ioan Cuza University of Iasi, Carol 1 Ave., no. 22, 700505, Iasi, Romania;
E-mail: mircea.asandului@uaic.ro

Dan Lupu, Ph.D. (in Finance) is Assistant Professor within Department of Finance, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iasi. His current research includes the domains of international finance, corporate finance and financial econometrics. Since 2012, he coordinates the Journal of Public Administration, Finance and Law. His articles have been published in various international journals, such as Amfiteatru Economic, Economic Computation and Economic Cybernetics Studies and Research, Transformation in Business and Economics and others.

Nicoleta Sîrghi, ***Ph.D. (in Economics)*** is Associate Professor of Economics at the Faculty of Economics and Business Administration, West University of Timisoara, Romania. Her current research focuses on applied economics, entrepreneurship and the economic analysis, game theory with applications in economics. She has presented a great number of papers in these fields in scientific journals and conference proceedings (IBIMA International Conference, WSEAS International Conference etc.). She has been a regular referee of papers for International Business Information Management Conference (IBIMA). She has published in the International Journal of Bifurcation and Chaos (IJBC), and in the Journal of Eastern Europe Research in Business and Economics (JEERBE).

Mircea Asandului,** ***Ph.D. (in Statistics) is Assistant Professor within Department of Accounting, Business Information Systems and Statistics, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iasi. In 2006 he completed his studies in computer science at the Gheorghe Asachi University of Iasi and in 2011 he earned his PhD in Statistics. His interest areas are financial econometrics, regional development and sampling surveys. Since 2009, he coordinates several activities for the International Conference on Globalization and Higher Education in Economics and Business Administration. His articles have been published in various international journals, such as Emerging Markets Finance and Trade, Economic Computation and Economic Cybernetics Studies and Research, PlosONE Transformation in Business and Economics and others.

Abstract: *Inflation is a macroeconomic phenomenon, intensively experimented by the Central and Eastern European (CEE) countries, new members of the European Union. The analysis was performed on a group of 10 Central and East European countries for the period 1990-2014. The aim of this study is to analyse the inflation phenomenon in this countries in the mentioned period that has been characterized by passing from hyperinflation to deflation. The evolution of inflation rate is extremely important in the present context because of the EU integration and because differences between inflation rates will influence real wages and interest which, in their turn, will affect the capital flows and labour force. The research methodology is new, quitting the classical analyses of ARCH type and instead using the Markov Switching – Auto Regressive (MS-AR) model.*

Keywords: inflation, Markov Switching-Auto Regressive (MS-AR) model, Consumer Price Index, CEE countries
JEL Classification: E30, E31, E37, E39, C43

Introduction

Inflation has been a major economic problem in transitioning economies of East Europe in the last 25 years. The starting point of the transition period, the 90s, witnessed high rates of inflation due to price liberalization and structural reforms, intended to transform the Eastern economies into market economies (Petreski, 2011). Even if subsequently inflation decreased to acceptable values, the EU adherence of the East European countries brought about new perspectives. Sooner or later, all East European countries will have to adopt the Euro as own currency by meeting the criteria specified in the Maastricht Treaty of which one refers to inflation: the country that wishes to adopt the Euro needs to have an inflation rate that should not exceed by 1.5 percentage points the top 3 countries in terms of price evolution (Fountas et al., 2004). But, at this point, few East European countries fulfil this criterion: the causes date back before the crisis and relate to high rates of economic growth, important foreign investments and loan boom.

In the evolution of the inflation rate in East European countries one can distinguish three stages (Drine and Rault, 2006; Viorica, 2014). The first stage comprises the beginning years of the 9th decade when all these countries were faced with high and extremely volatile inflation, sometimes experiencing inflation of 2 or 3 digits. The causes resided in the price liberalization and depreciation of exchange rate; after 1995, all countries passed to single-digit inflation as a consequence of structural reforms and price stabilization.

The second period represented by the first years of the 2000s is characterized by moderate rates of inflation in almost all countries (Hasanov, 2011; Pintilescu et al, 2014). The simultaneous economic shocks caused by the drop in demand from EU and Russia and increase in offer determined by the decrease in oil and food price led to important decreases in inflation rate during this period (De Grauwe and Schnabl, 2008). In exchange, Bulgaria and Romania implemented with much difficulty the structural reforms and therefore these countries witnessed the hyper-inflation phenomenon. After the powerful banking and financial crisis in 1997, Bulgaria introduced the currency board which finally led to inflation mitigation. Romania hardly reached inflation values of one digit during this period; the situation began to change after 2005 (Lupu and Asandului, 2014).

The third period corresponds to the adherence and post-adherence to the EU: in a first stage, inflation rate strongly decreased after which it continuously increased until 2008 under the influence of the credit boom (Caporale, 2014). The global financial crisis strongly hit these countries as well; inflation and namely aggregate demand registered significant decreases. Currently, most of the Eastern countries, being strongly correlated from an

economic point of view with the EU countries, present the negative phenomenon of deflation, for the first time in 25 years.

The previous studies on inflation in the New Member States strongly differ in terms of objective and methodology: most of the studies focus only on eight countries and on the period 1990-2004 (Cihak, 2001); few studies include Bulgaria and Romania in their analysis (Brada et al., 2005; Kocenda et al., 2006; Kutan and Yigit, 2004), or the period after the second extension in 2007 (Becker and Hall, 2009; Siklos, 2010); the analysis of time series by means of ARCH/GARCH models is used exclusively (Fountas et al., 2004; Kutan and Yigit, 2004; Hasanov, 2011; Viorica et al., 2014).

The present research aims to consider following aspects: the period of analysis is relatively long from 1990 until 2014 and comprises the passage to the market economy, the EU adherence and two economic crises; the inclusion of the 10 countries that adhered to the EU during this period; the methodology used is Markov Switching type (only two previous studies use this methodology for these countries).

The paper is structured as follows: Section 1 presents the review of the literature. Here, the attention is focused on highlighting the major contribution the inflation dynamics of East European countries and West European countries. Section 2 describes the methodology of research including its operationalization through the Markov Switching-Auto Regressive (MS-AR) model Section 3 emphasizes the research methodology and results provided by the estimation of MS-AR model for 10 East European countries. Section 4 presents the main conclusions of the research and also the further research directions are provided.

1. Literature review

In the specialty literature there have been fierce debates on the correct use of inflation dynamics and namely the nature of its integration level (Bhar and Hamori, 2004, Butt et al., 2010). An integrated process is a non-stationary one: the exterior shocks on the series values are rather permanent than temporary. This paper uses this type of approach for inflation which is seen as a time series governed by two different regimes that interchange based on a probabilistic process (Markov switching process). The pioneer of the studies in this field is Hamilton (1989), who starting from the restrictions imposed for the ARCH/GARCH processes, develops this methodology. Subsequently, inflation becomes a study object using Markov-type processes for other authors.

Kim (1993) analyzes the inflationist phenomenon in the USA for the period 1958-1990 and shows that especially high inflation has long-term negative effects on inflation volatility. Simon (1996) applies a Markov model to study inflation in Australia for the period 1960-1995 and concludes that this phenomenon can be represented through correlations with past inflation rates and GDP and the inflection points of the indicator are found at the beginning of the years 70s and 90s. At EU level, Thams (2007) studies the phenomenon of inflation transmission in France, Germany, Italy, Netherlands and Spain for the period 1970-2006. The author discovers that during 1970-1980 there were important changes of regime for inflation; after 1990, these changes do not manifest anymore and inflation becomes a stable mechanism.

For East Europe, the studies that use this methodology are scarce and analyse especially the correlations between the inflation of East European countries and West European countries.

The first study that uses the Markov methodology belongs to Białowolski (2006) for Poland during 1992-2005. The author discovers that during high inflation periods the variation of the indicator becomes unstable; the use of non-linear models provides better results than traditional ARCH-type models for that respective country.

Franta, Saxa and Šmídková (2007) analyze inflation for four East European countries, new EU members (Czech Republic, Hungary, Poland and Slovakia) during 1993-2005. The authors show that for these countries there are frequent structural breaks which lead to the non-applicability of traditional analysis models. Starting from these observations, it is discovered that the variations of inflation in the Western and Eastern countries are not as substantial as the previous studies showed, the difference between the two phenomena being given by the previous behaviour of prices in the Eastern countries.

Nath & Tochkov (2011) analyze the Eastern countries from the point of view of inflation convergence related to the fulfilment of the Maastricht Treaty criteria for the adoption of the Euro during the period 1990-2009. The authors conclude that during that period there was a major shift in the Eastern countries and the process was not uniform, splitting the countries in two categories: the first one meeting the convergence criteria and the second one (Bulgaria, Romania) that needed to improve its values in order to reach the European objective.

Mladenović & Nojković (2012) study the phenomenon of inflation persistence in the following countries: Slovakia, the Czech Republic, Poland, Hungary, Romania and Serbia, for the period 1995-2010. The authors reach the conclusion that the Czech Republic and Slovakia have small inflation persistence, while Hungary, Poland, Romania and Serbia experience a moderate indicator; the shifts of the Markov regime go to changes in inflation persistence, and a significant role is played by the previous values and behaviour of inflation.

2. The methodology and the Markov Switching – Auto Regressive (MS-AR) model

In this study, it is used a Markov Switching – Auto Regressive (MS-AR) model, which is an extension to non-linear processes of the AR model. The model was originally developed by Hamilton (1989) to define changes between fast and slow growth regimes in the US economy.

The Markov Switching – Auto Regressive (MS-AR) model assume that the regime switching are exogenous and there are fixed probability for each regime changes. In this type of model, time series can have regular shifts during one regime, where the values and mean of the series may be different. Supposing that r_t is a time series, generated by an autoregressive process of order p, for which the mean and the variance follow a switching regime:

$$r_t=\mu(S_t)+\sum_{i=1}^{p}\phi_i(r_{t-i}-\mu(S_{t-i}))+\sigma^2(S_t)\varepsilon_t$$

where μ (mean) and σ^2 (variance) of the process depend on the regime set at moment t, expressed as a discrete variable S_t, ϕ_i represents the parameters of the model, ε_t is the error term, which follows a process N(0, 1). S_t is a Markov process, taking the values 1….n and represents the following matrix of the probabilities:

$$P=\{p_{ij}\}\ i, j = 1,2, \ldots.n$$

where $p_{ij} = Pr[S_t=j/ S_{t-1}=i]$ with $\Sigma p_{ij}=1$ for all i and j.

The mean (μ) and the variance (σ^2) specific to the Markov regime are given by the following equations:

$$\mu(S_t) = \mu_1(S_{1,t}) +\ldots+ \mu_n(S_{n,t})$$

$$\sigma^2(S_t) = \sigma_1^2(S_{1t}) + \ldots + \sigma_n^2(S_{nt})$$

where S_{it} takes values of 1 when S_t is equal to i and 2 in all the other cases.
Thus, the equation 1 can be re-written as:

$$r_t = \mu_1(S_{1,t}) + \ldots + \mu_n(S_{n,t}) + \gamma_t$$

$$\gamma_t = \sum_{i=1}^{p} \phi_i \gamma_t + (\sigma_1^2(S_{1t}) + \ldots + \sigma_n^2(S_{nt})\varepsilon_t$$

Starting from equation 2, two state transition probability matrix of Markov process is the following:

$$Prob[S_t=1/S_{t-1}=1] = p_{11}$$

$$Prob[S_t=2/S_{t-1}=1] = 1- p_{11} = p_{12}$$

$$Prob[S_t=2/S_{t-1}=2] = p_{22}$$

$$Prob[S_t=1/S_{t-1}=2] = 1- p_{22} = p_{21}$$

Where:
$p_{11} + p_{12} = p_{21} + p_{22} = 1$
p_{11} and p_{22} - represent the probabilities of the time series of being in the regime 1, given the fact that it was in the previous regime 1, respectively in the regime 2;
p_{12} - represents the probability that γ_t passes from the regime 1 of t-1 to the regime 2 in the moment t;
p_{21} - represents the inverse situation.
Furthermore, we will use the MS-AR model to estimate inflation in the considered countries.

3. The estimation of the Markov Switching – Auto Regressive (MS-AR) model

In this paper we use monthly data regarding the Consumer Price Index for 10 East European countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia), for the period January 1990-December 2014. The data are provided by IMF Statistics Outlook and are seasonally adjusted using the Tramo Seats method. Inflation is calculated as $\ln(CPI_t/CPI_{t-1})*1200$.

The Markov Switching – Auto Regressive (MS-AR) model used was that with at least 2 regimes: one for the expansion phase and the other one for the recession phase. Since we used a monthly series we chose the number of lags within the interval 1-12. The results for the 12 MS-AR models, for the countries analysed, are presented in table no.1.

Table no.1 **Comparing alternative MS-AR Models Log-Likelihood**

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
1	-1118.629 (2.551 35.808)	**-142.820 (94.530 73.666)**	**-903.313 (90.829 1.496)**	-844.575 (48.391 1.021)	-1031.195 (3.964 134.647)	-849.894 (66.360 1.497)	**-882.152 (37.949 1.564)**	-1083.326 (69.621 2.727)	**-628.378 (51.422 1.198)**	-734.974 (1.026 38.914)
2	**-1107.020 (94.644 6.225)**	-141.376 (72.474 98.127)	-882.104 (90.582 1.818)	-840.283 (1.010 98.548)	-962.941 (1.365 274.992)	-838.288 (1.661 66.882)	-852.408 (26.033 1.135)	-1069.737 (70.133 2.727)	-626.220 (51.295 1.198)	**-716.722 (88.382 2.488)**
3	-1088.593 (293.203	**-158.384**	-856.102 (89.455	-837.435 (95.018	**-869.078 (90.202**	**-824.556 (88.870**	-845.524 (1.127	-1063.326 (1.000	-621.701 (1.199	-712.030 (120.832

	23.352)		1.331)	1.010)	**1.662)**	**1.662)**	38.760)	89.787)	51.054)	2.062)
4	-1095.078 (92.047 6.214)	-593.661 (17.702 1.059)	-825.830 (1.497 135.179)	**-823.262 (96.800 1.010)**	-879.772 (135.174 3.469)	-799.707 (133.132 1.999)	-829.505 (1.067 148.145)	**-1053.624 (94.970 1.000)**	-617.762 (1.198 51.197)	-707.270 (109.666 16.053)
5	-1086.965 (6.223 94.623)	-591.978 (1.059 17.752)	-810.463 (67.620 1.495)	-813.560 (65.474 1.015)	-804.455 (4.930 273.784)	-778.432 (67.574 1.015)	-825.380 (145.225 1.018)	-1057.893 (67.305 1.726)	-615.760 (1.198 51.255)	-706.096 (2.094 1.914)
6	-1069.129 (24.451 145.518)	-582.110 (1.000 16.517)	-814.807 (2.619 51.648)	-809.483 (1.014 72.227)	-772.955 (38.726 1.341)	-752.846 (1.496 133.398)	-819.862 (135.578 1.000)	-1035.724 (66.374 1.803)	-609.537 (42.775 1.379)	-682.082 (21.588 188.748)
7	-1070.637 (10.665 142.722)	-573.709 (1.060 17.559)	-797.825 (1.770 130.767)	-802.108 (73.352 1.013)	-761.919 (66.289 1.248)	-748.295 (269.931 2.978)	-798.038 (48.533 1.329)	-1030.519 (3.661 55.057)	-600.122 (1.198 49.039)	-669.177 (1.530 2.884)
8	-1068.563 (2.045 58.144)	-570.671 (1.000 16.646)	-794.632 (67.613 2.892)	-778.201 (48.556 1.062)	-757.730 (67.352 1.015)	-750.552 (1.743 135.500)	-773.363 (1.495 35.356)	-1024.332 (2.566 38.838)	-593.158 (1.198 50.672)	-662.545 (2.980 2.158)
9	-1031.057 (353.992 139.863)	-565.468 (17.672 1.059)	-784.359 (1.866 87.377)	-769.163 (1.124 36.136)	-732.372 (262.610 5.683)	-742.676 (1.035 29.074)	-765.379 (31.145 1.466)	-1012.24 (3.345 91.877)	-589.178 (50.462 1.197)	-657.161 (5.064 2.501)
10	-1043.069 (5.425 69.737)	-559.991 (1.000 15.969)	-785.804 (7.565 87.502)	-765.686 (1.016 56.779)	-719.583 (256.798 1.003)	-701.018 (35.963 1.028)	-760.999 (1.585 35.102)	-1011.261 (2.559 38.478)	-588.135 (42.796 1.023)	-643.044 (1.592 2.838)
11	-1032.707 (10.664 142.837)	-552.400 (1.057 18.289)	-772.627 (132.388 1.052)	-750.493 (59.479 1.017)	-702.177 (270.218 1.371)	-683.416 (1.030 33.946)	-722.189 (1.126 18.303)	-1006.106 (80.258 1.976)	-582.809 (43.413 1.023)	-639.215 (3.274 1.998)
12	-1027.200 (6.441 112.193)	-548.992 (18.325 1.057)	-768.892 (21.647 132.327	-682.786 (1.040 25.538)	-688.479 (131.274 1.502)	-659.477 (17.978 1.058)	-711.901 (15.778 1.067)	-1016.740 (2.026 29.459)	-548.478 (1.011 87.664)	-636.631 (1.007 1735.5)

Source: own calculation using Eviews8

At this point, we will make the optimum selection of the number of lags for the AR model. In our case, the selection is performed by combining two criteria: maximum log-likelihood and the sum of the expected periods, 1 and 2. It can be noticed that for the 10 East European countries under analysis, the supplementary addition of a lag leads to the improvement of the maximum log-likelihood.

Still, once the number of lags increases the second indicator, the sum of expected periods, also decreases. Under these conditions, by combining the established criteria, one may choose the models corresponding to the Eastern countries, in the lag interval of 1-4. The optimum Markov Switching model for the Czech Republic, Estonia, Poland and Slovakia is AR (1), for Bulgaria and Slovenia AR(2), for Latvia and Lithuania AR (3), and for Hungary and Romania AR (4).

After the selection of the optimum model we will lay out the MS-AR models specific for each country and the results obtained are presented in table no.2. For all models, the Markov convergence process was achieved; the coefficients for AR are significant.

Table nr.2 **The estimated coefficients for the MS-AR models**

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Regime 1 Coefficient	6.267 (0.261)	123.982 (0.000)	3.782 (0.000)	3.907 (0.000)	3.447 (0.000)	2.291 (0.313)	4.239 (0.000)	11.735 (0.012)	1.884 (0.000)	2.468 (0.000)
Regime 2 Coefficient	74.394 (0.000)	122.028 (0.000)	64.858 (0.000)	30.741 (0.000)	111.026 (0.000)	64.519 (0.000)	24.061 (0.000)	101.034 (0.000)	20.719 (0.000)	17.257 (0.000)
Common										
AR(1)	0.530 (0.000)	0.994 (0.000)	0.578 (0.000)	0.338 (0.000)	0.341 (0.000)	0.607 (0.000)	0.709 (0.000)	0.771 (0.000)	0.421 (0.000)	0.469 (0.000)
AR(2)	0.371 (0.000)			0.195 (0.013)	0.453 (0.000)	0.099 (0.065)		-0.051 (0.489)		0.083 (0.097)
AR(3)				0.882 (0.901)	-0.465 (0.000)	0.159 (0.045)		0.146 (0.039)		
AR(4)				0.221 (0.001)				0.016 (0.761)		
LOG(SIGMA)	2.224 (0.000)	-0.933 (0.000)	1.810 (0.000)	1.314 (0.000)	1.703 (0.000)	1.583 (0.000)	1.412 (0.000)	2.206 (0.000)	0.875 (0.000)	1.125 (0.000)

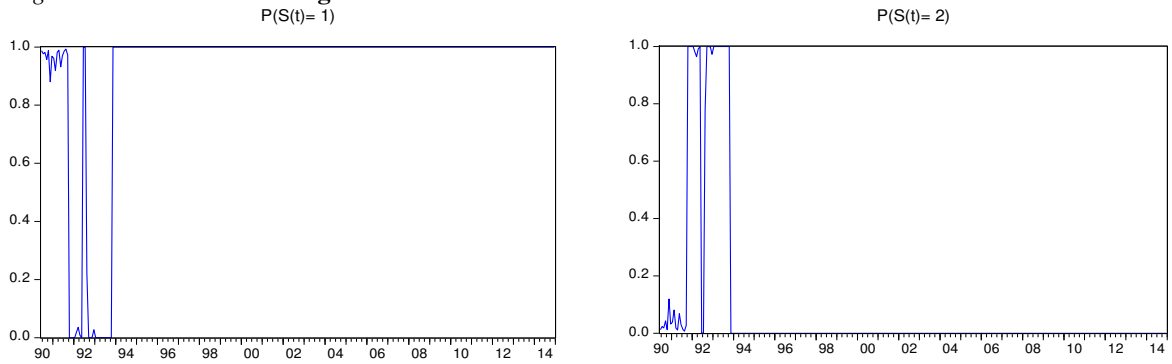
Probability 1	0.989	0.989	0.988	0.989	0.988	0.988	0.973	0.989	0.980	0.988
Probability 2	0.160	0.013	0.668	0.989	0.601	0.614	0.639	0.366	0.834	0.401

Source: own calculation using Eviews8

In what follows, we will present for each country the graphs with the periods of inflation growth and decrease for the period 1990-2014, specific for each MS-AR model.

Bulgaria has known three strong periods of inflation growth (1990M01 – 1991M11; 1992M02-1992M05; 1993M10-1994M11); the periods of inflation decrease correspond to the other periods within the interval 1990-2014.

Figure no.1 **Inflation in Bulgaria**

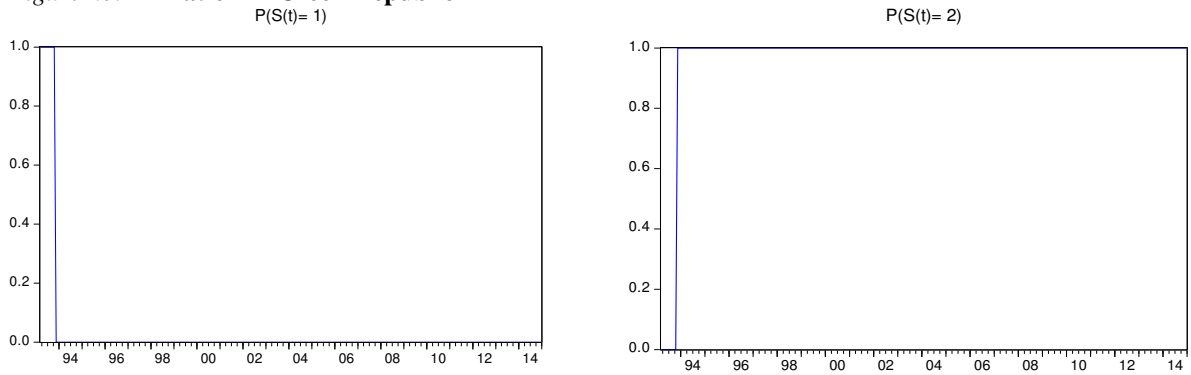


Source: own calculation using Eviews8

During the early period of transition, Bulgaria has recorded a drop of the GDP of 40%, failed privatizations, endemic corruption and inflation rates of over 300% during certain months (figure no.1).

Czech Republic has experienced a single period of strong inflation increase during the period under analysis: 1993M10 – 1994M7.

Figure no.2 **Inflation in Czech Republic**

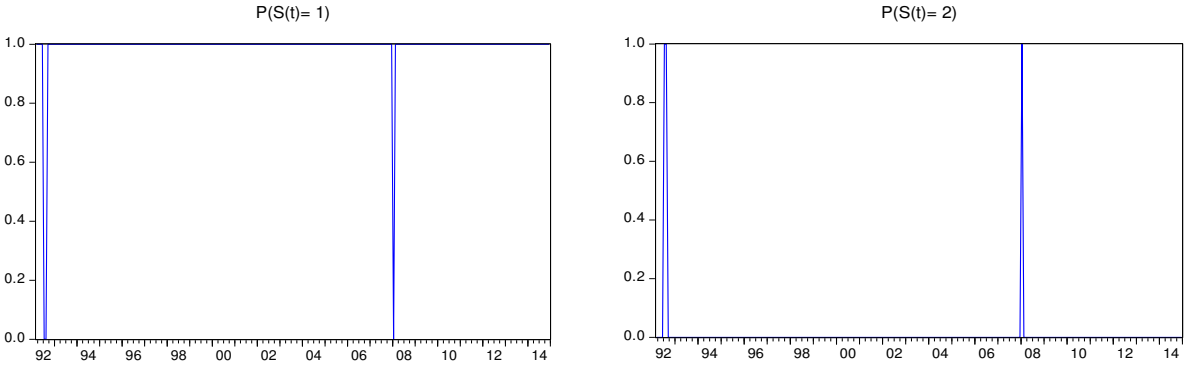


Source: own calculation using Eviews8

After this period, Czech Republic passed to an inflation targeting policy, the inflation rates registering reduced values afterward (figure no.2).

Estonia has experienced hyper-inflation during the period 1992M2-1993M4 (as it can be also noticed in the graph), due to the collapse of the Soviet Union, price liberalization, monetary reform.

Figure no.3 **Inflation in Estonia**

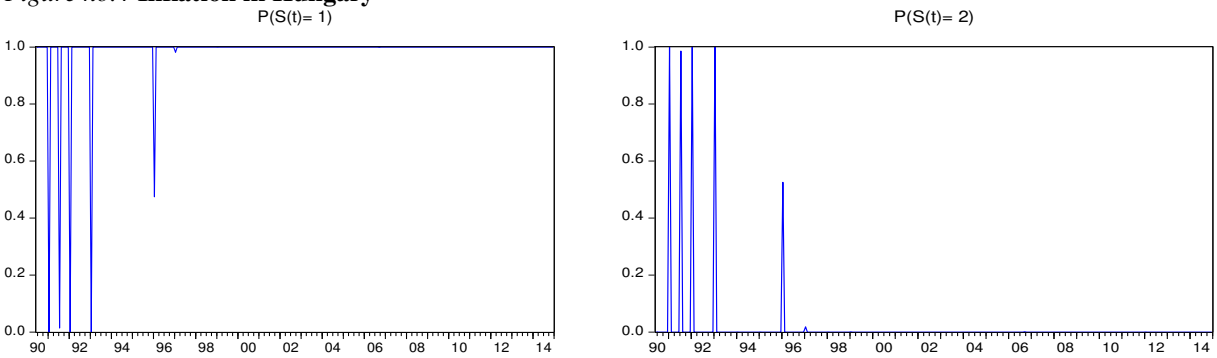


Source: own calculation using Eviews 8

After this period, there is a 16-year time span with inflation decrease and then a short period of increase which manifested through the credit and bank boom in 2007M4-2007M7 (figure no.3).

Hungary has 3 periods of strong inflation increase after 1990 (1990M3-1990M8, 1991M10-1992M5; 1996M2-1996M7) with values over 135%.

Figure no.4 **Inflation in Hungary**

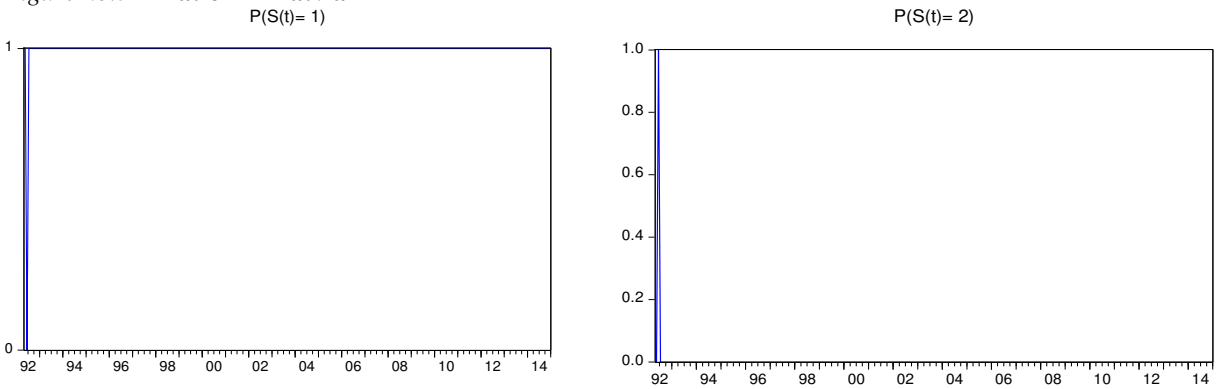


Source: own calculation using Eviews8

In Hungary the phenomenon began to slow down after the years 2000 and reaching values inferior to 10% (figure no.4).

Latvia knows a single period of hyper-inflation (1992M3-1992M11), specific to price liberalization and country's independence in the beginning of the early 90s.

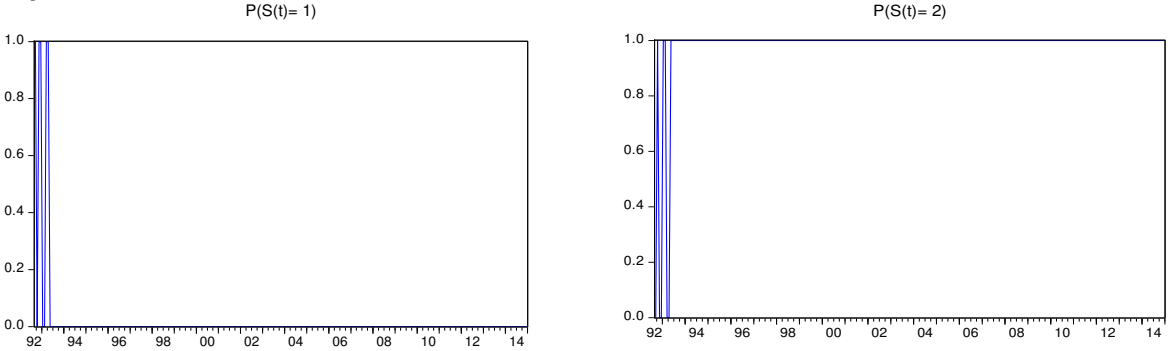
Figure no.5 **Inflation in Latvia**



Source: own calculation using Eviews8

Lithuania experiments two periods of hyper-inflation (1992M3-1992M10 and 1993M6-1993M12) with values over 120% after gaining independence.

Figure no.6 **Inflation in Lithuania**

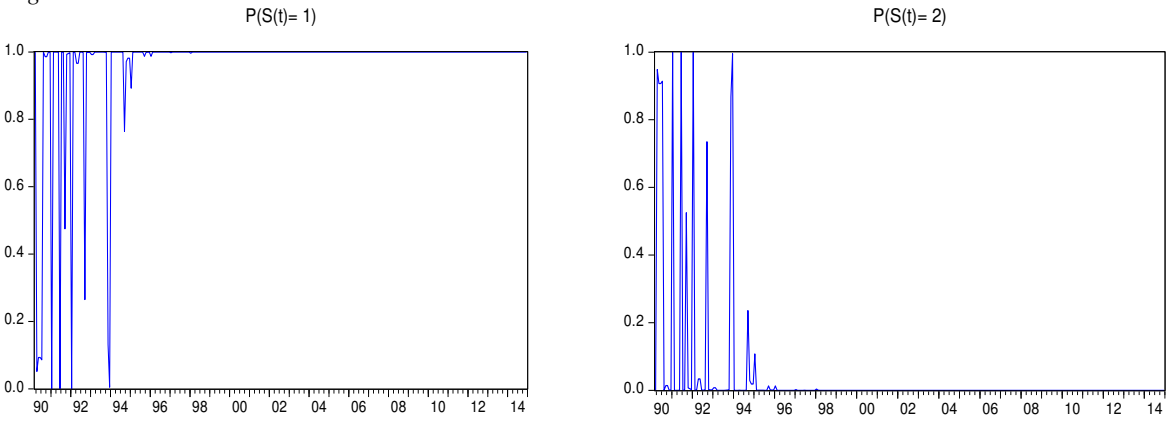


Source: own calculation using Eviews8

In the subsequent periods in Lithuania there are phenomena of disinflation, presently reaching even deflation (figure no.6).

Poland knows strong periods of hyper-inflation during the periods analyzed (1990M3-1990M9; 1991M6-1992M1; 1993M4-1993M8; 1994M7-1994M12; 1995M10-1996M3) corresponding to the passage to the market economy and promotion of the shock therapy.

Figure no.7 **Inflation in Poland**

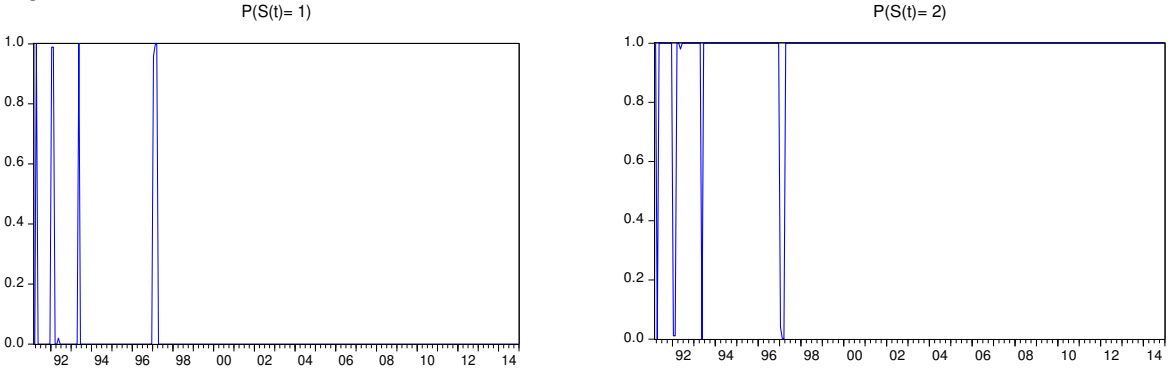


Source: own calculation using Eviews8

After 1997, in Poland, inflation is targeted and in the present the phenomenon registers mitigation until values of below 5% (figure no.7).

Romania has 3 periods of hyper-inflation, corresponding to the periods of economic difficulty the country went through: 1991M2-1991M11 (price liberalization), 1992M11-1993M8 (massive privatization of state companies) and 1997M2-1998M1 (economic crisis combined with high unemployment).

Figure no.8 **Inflation in Romania**

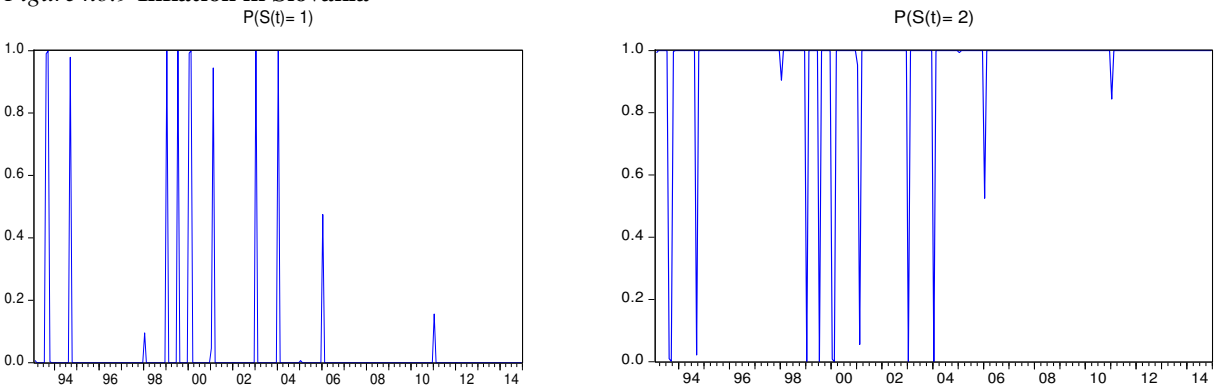


Source: own calculation using Eviews8

Nowadays, inflation in Romania has values under 2% (figure no.8). This can be considered as the results of the inflation targeting policy that begun in 1999.

Slovakia has known 3 periods of increased inflation (1993M7-1994M5; 1998M10-2000M2; 2003M11-2004M6) corresponding to the breaking from the former Czechoslovakia, the crisis in Russia and EU adherence.

Figure no.9 **Inflation in Slovakia**

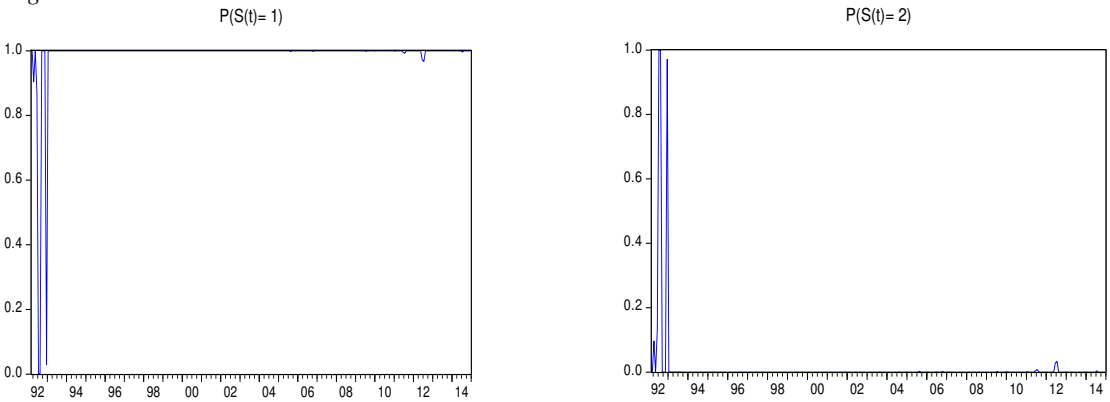


Source: own calculation using Eviews8

After these stages, inflation in Slovalia started to decrease, currently reaching negative values (figure no.9).

Slovenia was faced with only two periods of increased inflation (1991M4-1991M9 and 1992M10-1993M5), subsequent to the gain of independence caused by the economy liberalization and passage to the market economy.

Figure no.10 **Inflation in Slovenia**



Source: own calculation using Eviews8

In Slovenia inflation gradually decreases and nowadays, it is convergent with the inflation in the Western countries (figure no.10).

4. Conclusions and Future Research Directions

Inflation rates vary across the Central and Eastern European (CEE) countries and across time, but inflation has generally exceeded the levels observed in the "old" EU countries in the West.

This paper aims to analyse the inflation phenomenon in Central and Eastern Europe in the period 1990-2014, a time in which the CEE considered countries passed from

hyperinflation to deflation. These countries, that were in the considered period, in transition from a centralized system economy to a free market economy, have struggled with a strong inflationary process, manifesting itself in the first years of transition as corrective inflation, following that persistent imbalance between supply and demand to change it into a structural inflation.

After a turbulent transition period, the considered countries succeeded to become EU members and gradually fulfil the convergence criteria specified in the Maastricht Treaty for the Euro adoption.

The current paper is focused on the examination of the inflation phenomenon in 10 CEE countries from the start of the transition in 1990 until 2014. For the purpose of this analysis, we used certain Markov Switching type non-parametric models, in order to eliminate the inadvertences of traditional methods.

The conclusions of this paper show that in the last 25 years, the inflation phenomenon has gone through all its stages: hyper-inflation, moderate inflation and even deflation, being in a permanent relationship with the local economic events. Despite this, there are significant differences between the 10 countries analysed: if at the beginning of the 90s, hyper-inflation manifested against the backdrop of price liberalization and economic reforms in all East European countries, in the years 2000 the speed and quality of economic reforms led to significant differences between them; after the EU adherence, economic stability led again to the convergence of the inflationist phenomenon between the respective countries, even reaching deflation.

Because in the present study the MS-AR models conducted to convincing results, it is possible to establish future research directions by using the same methodology. One direction would assume the extension of the MS-AR model by introducing more exogenous variables that influence inflation, such as the wages or the unemployment, or by changing the transition probabilities (increasing them). Another direction of research would imply analyzing the causal relationship between inflation and inflation uncertainty by identifying the short term and long term components. Also, in the background of adhering to Eurozone, using the MS-AR model, the inflation persistence and inflation convergence phenomena can be identified and that would give more information to the policy makers in introduction of more efficient measures.

Acknowledgement

This work was financed by Alexandru Ioan Cuza University of Iași, Romania, through project *The analysis of the causal relationships between inflation, economic growth and their uncertainties on emerging economies,* code GI-2014-11, Grants for Alexandru Ioan Cuza University of Iași, Romania young researchers.

References

Becker, B., Hall, S. (2009), "How far from the Euro Area? Measuring convergence of inflation rates in Eastern Europe", *Economic Modelling*, vol.26, no.4, pp.788-798.

Bhar, R., Hamori, S. (2004), "The link between inflation and inflation uncertainty: evidence from G7 countries" *Empirical Economics*, vol.29, no.4, pp.825-853.

Bialowolski, P. Żochowski, D.Ł., (2011), "Modelling Inflation Using Markov Switching Models: Case of Poland, 1992-2005." *Prace i Materiały*, vol.86, no.1, pp.185-199.

Brada, J.C., Kutan, A., Zhou, S. (2005), "Real and monetary convergence between the European Union's core and recent member countries: a rolling cointegration approach", *Journal of Banking & Finance*, vol.29, no.1, pp. 249-270.

Butt, B. Z., Rehman, K., Azeem, M. (2010), "The causal relationship between inflation, interest rate and exchange rate: the case of Pakistan", *Transformation in Business & Economics*, vol.9, no.2.

Caporale, G. M., Skare, M. (2014), "Testing the linkages between output growth, inflation and employment growth: evidence from a panel vector autoregression", *Transformation in Business & Economics*, vol.13, no.2.
Cihak, M., Holub, T. (2001), "Convergence of relative prices and inflation in Central and Eastern Europe", *International Monetary Fund*, No.2001-2124
De Grauwe, P., Schnabl, G. (2008), "Exchange rate stability, inflation, and growth in (South) Eastern and Central Europe", *Review of Development Economics*, vol.12, no.3, pp.530-549.
Drine, I., Rault, C. (2006), "Testing for inflation convergence between the Euro Zone and its CEE partners", *Applied Economics Letters*, vol.13, no.4, pp.235-240.
Fountas S., Ioannidis A., Karanasos M. (2004), "Inflation, Inflation Uncertainty and a Common European Monetary Policy", *The Manchester School*, vol.72, no.2, pp.221–242.
Franta, M., Saxa, B., Šmídková, K. (2007), "Inflation Persistence in New EU Member States: Is It Different Than in the Euro Area Members?", *Czech National Bank, Economic Research Department.*
Hamilton, J.D. (1989), "A new approach to the economic analysis of nonstationary time series and the business cycle", *Econometrica: Journal of the Econometric Society*, Vol. X, No X, pp.357-384.
Hasanov M., Omay T. (2011), "The Relationship Between Inflation, Output Growth, and Their Uncertainties: Evidence from Selected CEE Countries", *Emerging Markets Finance and Trade*, Vol.47, No X, pp.5–20.
Kim, C.J. (1993), "Unobserved-Component Time-Series Models with Markov-Switching Heteroskedasticity: Changes in Regime and the Link between Inflation Rates and Inflation Uncertainty", *Journal of Business and Economic Statistics*, vol.11, no X, pp. 341-349.
Kočenda, E., Kutan, A., and Yigit, T. (2006), "Pilgrims to the Eurozone: How far, how fast?", *Economic Systems*, vol.30, no.4, pp.311-327.
Kutan, A.M., Yigit, T. (2004), "Nominal and real stochastic convergence of transition economies", *Journal of Comparative Economics*, vol.32, no.1, pp.23-36.
Lupu, D., Asandului, M. (2014), "Considerations on the relationship between exchange rates and stock markets in Eastern Europe in time of crisis", *Transformation in Business & Economics*, Vol. 13 Issue 3C, p.430-445.
Mladenović, Z., Nojković, A. (2012), "Inflation persistence in central and southeastern Europe: evidence from univariate and structural time series approaches", *Panoeconomicus*, vol.59, no.2, pp.235-266.
Nath, H.K., Tochkov, K. (2013), "Relative inflation dynamics in the new EU member countries of Central and Eastern Europe", Empirical Economics, vol.45, no.1, pp.1-22.
Petreski, M. (2011), "A Markov switch to inflation targeting in emerging market peggers with a focus on the Czech Republic, Poland and Hungary", *Focus on European Economic Integration*, vol.3, no.11, pp.47-63.
Pintilescu, C., Jemna, D. V., Viorică, E. D., Asandului, M. (2014), "Inflation, Output Growth, and Their Uncertainties: Empirical Evidence for a Causal Relationship from European Emerging Economies", *Emerging Markets Finance and Trade*, vol. 50, sup.4, pp. 78-94.
Siklos, P.L. (2010), "Meeting Maastricht: Nominal convergence of the new member states toward EMU", *Economic Modelling*, vol.27, no.2, pp.507-515.
Simon, J. (1996), "A Markov-switching model of inflation in Australia", No.9611, *Reserve Bank of Australia*.
Thams, A. (2007), "Inflation Transmission in the EMU: A Markov-Switching VECM Analysis", Available at SSRN: http://ssrn.com/abstract=1032108 or http://dx.doi.org/10.2139/ssrn.1032108
Viorica, D., Jemna, D., Pintilescu, C., & Asandului, M. (2014). "The Relationship between Inflation and Inflation Uncertainty. Empirical Evidence for the Newest EU Countries", *PloS ONE*, vol.9, no.3, e91164.

CONSIDERATIONS REGARDING INFLATION'S EVOLUTION IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Dan Lupu, Nicoleta Sîrghi, Mircea Asandului

Summary

Inflation is a macroeconomic phenomenon, intensively experimented by the Central and Eastern European (CEE) countries, new members of the European Union. The analysis was performed on a group of 10 Central and East European countries for the period 1990-2014. The aim of this study is to analyse the inflation phenomenon in this countries in the mentioned period that has been characterized by passing from hyperinflation to deflation. The evolution of inflation rate is extremely important in the present context because of the EU

integration and because differences between inflation rates will influence real wages and interest which, in their turn, will affect the capital flows and labour force. The research methodology is new, quitting the classical analyses of ARCH type and instead using the Markov Switching – Auto Regressive (MS-AR) model. The conclusions of this paper show that in the last 25 years, the inflation phenomenon has gone through all its stages: hyper-inflation, moderate inflation and even deflation, being in a permanent relationship with the local economic events. Despite this, there are significant differences between the analyzed countries: if at the beginning of the 90s, hyper-inflation manifested against the backdrop of price liberalization and economic reforms in all CEE countries, in the years 2000 the speed and quality of economic reforms led to significant differences between them; after the EU adherence, economic stability led again to the convergence of the inflationist phenomenon between the respective countries, even reaching deflation.

Keywords: inflation, Markov Switching-Auto Regressive (MS-AR) model, Consumer Price Index, CEE countries