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## Inflation Dynamics in Romania - a New Keynesian Perspective

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By

Nicoleta Ciurilă<sup>1</sup>, Bogdan Murarușu<sup>2</sup>

**Abstract:**

*The objective of this paper is to identify the main factors which drive inflation in Romania: inflation persistence, inflation expectations and real economy variables. We estimate a reduced form hybrid New Keynesian Phillips Curve in order to determine the degree of inertia and the impact of forward looking expectations. As a proxy for real economic activity, we alternatively use the output gap, the unemployment gap, the unit labour cost, the capacity utilization rate and the economic sentiment indicator. We focus on the role of the monetary policy in controlling the various sources of inflation.*

**Key words:** New Keynesian Phillips Curve, Inflation dynamics, GMM estimation

**JEL Classification:** E31; E52

### 1. Introduction

The analysis of inflation dynamics is extremely important as it aims to determine the variables that might exert inflationary pressures both in the short and in the long run. This analysis is also important in the view of forecasting the inflation rate and its components. The Phillips Curve has become a standard framework for the analysis of short and medium term inflation for at least three reasons. First of all, the Phillips curve explains inflation using variables describing real economic activity such as real marginal cost, excess demand, output gap, unemployment, capacity utilization, unit labour cost or the economic sentiment indicator. Secondly, all macroeconomic models used by central banks incorporate a certain type of Phillips Curve. Thirdly, as a wide range of empirical analyses show, the Phillips Curve can be successfully used as a tool for forecasting inflation (Stock and Watson, 1999 or Matheson, 2008).

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<sup>1</sup> Assoc. Prof., Money and Banking Department, Academy of Economic Studies Bucharest, Mihail Moxa st., no. 11, Moxa E, 509, telephone no. +40745063731, fax no. +403191899, nciurila@yahoo.com.

<sup>2</sup> Assoc. Prof., Money and Banking Department, Academy of Economic Studies Bucharest, Mihail Moxa st., no. 11, Moxa E, 408, telephone no. +40723036965, fax no. +403191899, bogdanmurarasu@yahoo.com.

The early specifications of the Phillips Curve (Phillips, 1958 and Samuelson and Solow, 1960) are based on an empirically found relationship between the inflation rate or the nominal wage growth rate and the unemployment rate. However, the statistical relationship between the variables was found to be instable and even to break down in the 1970's. The development of the New Keynesian economics, based on micro-foundations and rational expectations, proved the theoretical relationship between aggregate economic activity and inflation expectations.

The New Keynesian Phillips Curve (NKPC) is based on the seminal work of Taylor (1980) and Calvo (1983) and is explicitly derived from an optimization process, assuming staggered price setting by forward looking, monopolistically competing firms. As a result of the optimization process, current inflation is related to future expected inflation and real marginal cost. Also, the parameters of the NKPC are directly linked to the behavior of agents and are thus exempt from the Lucas critique. The hybrid version of the NKPC is due to Gali and Gertler (1999) and it additionally incorporates inflation inertia in order to explain the link between nominal and real variables.

In the following sections, we will estimate a reduced-form hybrid NKPC for the Romanian economy. Because the real marginal cost is not statistically available at aggregate level, there is much controversy in the literature regarding the appropriate proxy for this variable. Gali and Gertler (1999) and Gali, Gertler and Lopez-Salido (2005) use the unit labour cost as a proxy, while Gwin and VanHoose (2007) and Matheson (2008) investigate the use of a number of other variables as proxy for the real marginal cost. Taking into account the characteristics of the domestic economy and the availability of the data for Romania, we selected a number of explanatory variables to be used alternatively as a measure of aggregate economic activity: the output gap as a proxy for excess demand, the unit labour cost, the unemployment gap and the economic sentiment indicator<sup>3</sup>.

The rest of the paper is organized as follows: in section 2 we discuss the characteristics of inflation dynamics in Romania and the reason for including some specific economic variables in our analysis, in section 3 we describe the methodological approach used to conduct our analysis, section 4 presents the results of the estimations, while section 5 concludes.

## **2. Characteristics of inflation dynamics in Romania**

Determining the causes of inflation is particularly important in case of the New Member States of the European Union as they attempt to fulfill the Maastricht criteria in the view of acceding to the European Monetary Union. As an emerging economy, there are some specific features which characterize the disinflationary process in Romania as well as in other inflation targeting countries from Central and Eastern Europe (CEE-IT).

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<sup>3</sup> The economic sentiment indicator is provided by the European Commission as a survey indicator.

An important feature of Romanian economy refers to the high share of administered prices in the consumption basket<sup>4</sup>. The necessity of aligning the price of certain goods such as heat energy, gas, electricity, to European levels, still necessitates price adjustments which influence CPI inflation. Also, the discretionary way in which administered prices are set, induces volatility in the evolution of CPI inflation.

The vulnerability to supply shocks characterizes the entire region which Romanian economy belongs to. This mainly refers to the way that the price of oil and unprocessed food affects CPI inflation. The higher the share of fuel and food in the consumption basket, the more significant effect does a sharp rise in these prices have on headline inflation. This effect is especially important since monetary policy cannot curb inflationary pressures resulting from a surge in raw material prices. The only effect that the monetary policy has is on the second round effects. Romania has a consumption basket which comprises a high share of goods with prices that cannot be directly affected by monetary policy measures – 485 points out of the 1000 points of the consumption basket is represented by goods with administered prices, food and energy.

The catching-up process which all New Member States have embarked on refers to the reduction of the existing gaps of GDP per capita, wages and prices compared to the euro area countries. The high rate of GDP growth requested for an appropriate convergence towards euro area income levels could lead to an overheating of the economy and to major fiscal and external imbalances. Also, wage increases in excess of productivity growth could result in higher production costs and, hence, in higher inflation and loss of international competitiveness.

The rapid expansion of the economic activity in CEE-IT countries was triggered by high foreign direct investment inflows and the fast increase of financial intermediation – especially on the back of corporate and household loans. Graph 1 in the Appendix presents the year-on-year increase of real GDP in Romania and other CEE-IT countries.

While this is necessary in order to ensure real convergence towards the euro area, it can also generate inflationary pressures if the economy works above its potential.

The role of monetary policy is extremely important in the case of controlling excess demand. Especially in an inflation targeting environment, the central bank should curb excess demand using the monetary policy inflation rate. Consequently, the effectiveness of the monetary policy is determined by the effectiveness of the monetary policy transmission mechanisms.

The real convergence process could also induce inflation pressures through the non-tradable goods prices, specifically through the Balassa - Samuelson effect.

Inflation expectations determine the way in which wages and prices are set, hence influencing future inflation. Typically, inflation expectations are modeled as a combination between forward looking and backward looking expectations. However, the proportion awarded to the forward and backward

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looking components is crucial. The more important the backward looking component is in the formation of inflation expectations, the more persistent inflation will be and, hence, monetary policy will be less effective in lowering the inflation rate. The way that inflation expectations are formed is also determined by the credibility of monetary policy: more weight on forward looking expectations is an indicative that wage- and price-setters are confident in the ability of the central bank to achieve its goal, while more backward looking expectations have the exact opposite meaning. In the next section, we will measure the relative importance of inertia and forward looking expectations in the formation of current inflation in Romania.

Regarding the empirical analysis of the Romanian disinflationary process, we decided to use headline CPI inflation as the explained variable although it contains highly volatile components because this is the target inflation rate of the National Bank of Romania. However, as an instrument in our estimations we use Core2 inflation which excludes from the headline consumption basket goods with administrative prices, volatile food prices (vegetable, fruit and eggs) and fuels prices. It is the common view of practitioners and theoreticians that regulated prices as well as vegetables, fruit and eggs and fuels prices depend mainly on factors exogenous to the economy and, hence, distort CPI inflation especially if they have an important contribution to the basket. In Romania, goods with administrative prices have currently a contribution of 21.4% to the CPI basket, fuels represent 5.42% of the consumption basket and vegetable, fruit and eggs 6.76%. Graph 2 presents the development of different quarterly year on year inflation measures in Romania in the period of 2001-2008. We can easily notice the high volatility of the inflation for administrative prices, fuels and vegetable, fruit and eggs compared to the smooth development of Core2 inflation. Taking this into consideration, we will estimate the NKPC for CPI inflation, but we will use as an instrument the Core2 inflation.

### 3. Methodology

In order to analyze inflation dynamics in Romania, we employ the classic version of the reduced form hybrid NKPC developed by Galí and Gertler (1999) and extended for open economies by Leith and Malley (2007):

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E[\pi_{t+1}] + \lambda mc_t + \varepsilon_t \quad (1)$$

where  $\pi_t$  is inflation at time  $t$ ,  $E[\pi_{t+1}]$  is the rational expectation of inflation for the next period,  $mc_t$  is the real marginal cost and  $\varepsilon_t$  is the error term.

The open economy version of (1) also includes the real cost of imported goods:

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E[\pi_{t+1}] + \lambda^l (w_t - a_t) + \lambda^m q_t + \varepsilon_t \quad (2)$$

where  $(w_t - a_t)$  is the real wage corrected for labour augmented technology, while  $q_t$  is the real cost of a unit of imported goods.

The coefficient  $\gamma_b$  shows the inflation persistence or inflation inertia, while  $\gamma_f$  shows the relative importance of forward looking expectations in the formation of current inflation. We will determine the appropriate variable describing aggregate economic activity by estimating equation (1) with different proxies for the real marginal cost: the deviation of real GDP from a Hodrick-Prescott filter (the output gap), the unemployment rate, the change in unit labour costs, the rate of capacity utilization and the economic sentiment indicator.

As we have previously mentioned, we will estimate the NKPC for the CPI inflation. The estimation is performed on quarterly data for the period of 1998Q1-2008Q2. The data series come from the NBR, the Eurostat and the European Commission databases. We seasonally adjusted Core2 inflation using the Census X12 procedure.

Considering the presence of rational expectations in equation (1), we will estimate it using the GMM procedure. For each model estimated, we employed the following instruments: two lags of the Core2 inflation (t-1,t-2), a lag of the real interest rate (t-4), three lags of the real exchange rate gap (t-1,t-2,t-3) and two lags of the endogenous variables.

#### 4. Results

The results of the estimations for equation (1) are summarized in Table 1. We report the values of the estimated parameters and the p-value for each coefficient. Each equation estimated with a certain measure of real economic activity is labeled with a number from 1 to 5.

A few important conclusions emerge from this table. The coefficients corresponding to the output gap, the change in the unemployment rate, the change in the capacity utilization rate, the unit labour cost and the economic sentiment indicator are statistically significant and have the economically correct sign which means that they explain inflation dynamics in Romania. Forward looking expectations and inflation inertia in all estimated equations are statistically significant. In models 1, 2, 4 and 5, the inflation inertia coefficient is bigger than the forward looking component while in model 3 the forward looking component is slightly bigger than the inflation inertia coefficient showing the fact that in Romania persistence was more important than expectations in explaining inflation dynamics. This result is sustained by other analyses performed on transition countries. Lendvai (2005) for Hungary, Ribon (2004) for Israel and Arratibel et al. (2002) for a number of New Member States find that the weights of persistence and expectations in explaining inflation are roughly equal. Because Romania has experienced high inflation rates and has started the disinflationary process only in 2000, inflation expectations are still highly adaptive. Other countries, characterized by low and stable inflation rates and where expectations are firmly anchored have a much smaller contribution of inertia to inflation (Gali, Gertler, Lopez-Salido (2001, 2005)).

The coefficient of the capacity utilization rate is positive. An increase in the percentage utilization of the production capacity generates additional costs and fosters inflationary pressures. On the other hand, an increase in the unemployment rate signifies a decrease of wage pressures and, hence, a deceleration of inflation.

We also tested the following restriction on the coefficients describing inflation inertia and inflation expectations:  $\gamma_b + \gamma_f = 1$ . This restriction insures the fulfillment of the neutrality principle which suggests that real variables don't influence nominal variables in the long run.

## 5. Conclusions

The present paper characterizes inflation dynamics in Romania in the period of 1998Q1-2008Q2 using the reduced form version of the closed economy hybrid New Keynesian Phillips Curve. We explain CPI inflation using a lag of its own, the expected CPI inflation for the next quarter and a measure of real economic activity. As a proxy for the latter variable we use the output gap, the change in the unemployment rate, the change in the capacity utilization rate, the economic sentiment indicator and the unit labour cost. We find statistically significant coefficients for all variables considered. We conclude that the output gap, the unit labour cost, the capacity utilization rate, the unemployment rate and the economic sentiment indicator are successful in explaining the dynamics of CPI inflation. We find that in Romania inertia was more important than expectations in characterizing inflation dynamics. This is common in case of transition economies that experienced high rates of inflation and where inflation expectations have a high adaptive component. Also, the inflation persistence coefficient and the inflation expectation coefficient statistically sum to one proving the fact that the data sustain the principle of neutrality.

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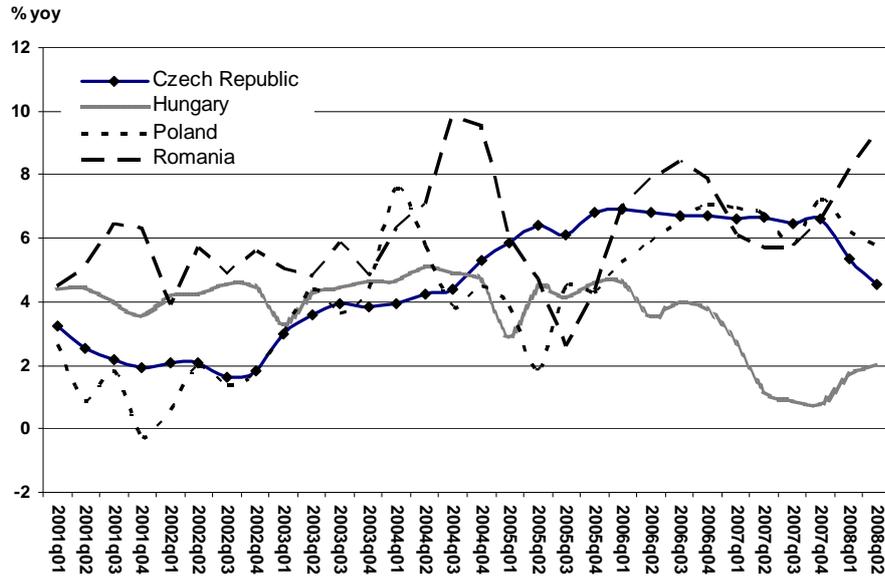
## APPENDIX

**TABLE 1: The value and significance of estimated coefficients for equation (1)**

Proxy for real marginal cost		$\gamma_b$	$\gamma_f$	$\lambda$
1. Output gap	Coefficient	0.601*	0.359*	0.552*
	<i>p-value</i>	0.0000	0.0028	0.0356
2. Change in unemployment rate	Coefficient	0.585*	0.418*	-0.731*
	<i>p-value</i>	0.0000	0.0000	0.0000
3. Change in the capacity utilization rate	Coefficient	0.456*	0.493*	0.454*
	<i>p-value</i>	0.0000	0.0000	0.0001
4. Unit labour cost	Coefficient	0.530*	0.443*	0.238*
	<i>p-value</i>	0.0006	0.0260	0.0063
5. Economic sentiment indicator	Coefficient	0.789*	0.204*	0.238*
	<i>p-value</i>	0.0000	0.0394	0.0000

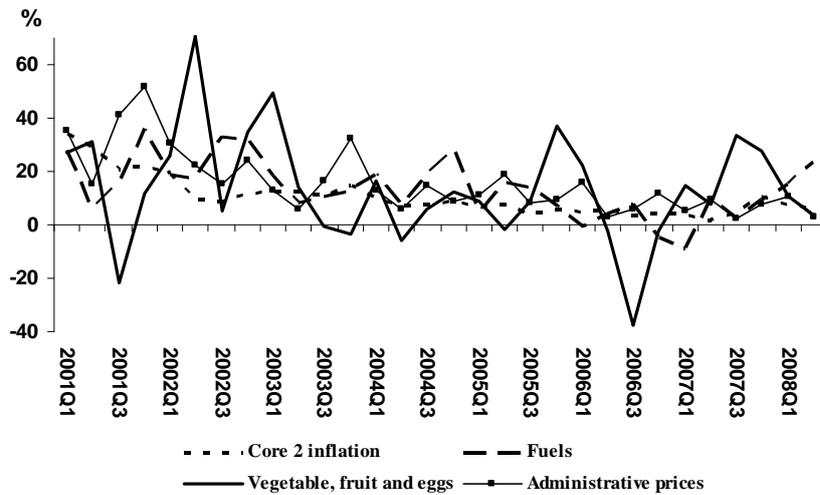
\* denotes significance at 5% significance level

**Figure 1:** Annual real GDP growth in Czech Republic, Hungary, Poland and Romania



Source: Eurostat database

**Figure 2:** The development of quarterly inflation in Romania during 2001-2008



Source: National Bank of Romania and own calculations