# UNDERLYING FACTORS OF PERSISTENT INFLATION IN ROMANIA

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*ABSTRACT: Price stability has become the main focus of the monetary policy of the candidate countries to the European Monetary Union as the best way to ensure nominal convergence and to promote sustainable economic growth. In our analysis of the inflation evolution we have considered the factors causing persistent inflation over the medium and long term. This paper emphasizes the link between the inflation rate and cost-push, demand-pull and imported inflation. The empirical analysis shows that all the variables are statistically significant and correctly signed and the chosen model explains well the persistent factors of inflation in Romania.*

*Keywords*: *inflation rate, output gap, cost-push inflation, demand-pull inflation*

*JEL Codes: E31*

### Introduction

Inflation is one of the key macroeconomic variables and is closely monitored by both policy makers and the public. Alongside with economic growth, the exchange rate and the unemployment rate helps to create an overview picture of a country's economy and its level of development. Inflation is very important for consumers because it affects their purchasing power and their ability to repay their loans. A higher inflation rate will favor debtors with fixed interest rate and will affect consumers with fixed incomes or debtors with variable interest rate because it is well known that the nominal interest rate is positively correlated with the inflation rate. Policy makers can also benefit from inflation in periods of recession when it helps to reduce wages in real terms and thus contributing to the process of adjustment. In order for the transition countries to join the Economic and Monetary Union, the maintenance of inflation within the limits stipulated by the Maastricht Treaty is one of the prerequisite of the euro adoption decision. Thus, the inflation rate must not outrun by more than 1.5 percentage points the average of the inflation rates registered by the best performing three EU countries in the field of price stability. Moreover, the adoption of inflation targeting regime in many EMU candidate countries highlights once again the importance of price stability. In this context the analysis of persistent and temporary factors that could affect the inflation rate development is an important task which will contribute to the appropriate measure addoption in order to ensure price stability over the medium and long term.

### Underlying factors of inflation – a theoretical perspective

Considering inflation as a continuous and rapidly increase in the price level leads both monetarists and Keynesians to agree with Friedman statement that inflation is a monetary phenomenon. According to this view, the main factor causing inflation is the persistent growth of the money supply. A rise of this variable will determine the aggregate demand curve to shift

rightward. If in the initial situation the economy was at its natural level, now the output will outrun its natural level; thus the unemployment will a experience a decline below the natural level generating higher wages and as a consequence the aggregate supply curve will quickly begin to shift leftward. As a result, a new equilibrium will occur with output returning at its natural level and prices being the only variable higher compared to the initial situation.

Although the Keynesians do not agree totally with the monetarists, their conclusion is the same. They state that a high rate of money growth is the underlying factor of continuous increase in the price level. Still, they conclude that there are also other factors that could influence the price level but not with lasting effects. The fiscal policy and some other supply side phenomena can induce a one-shot rise in the price level but this cannot be the source of a permanent increase. For example, if the government will increase its expenditures at some moment in time and only then, the immediate result will be the movement of the aggregate demand to the right and as a result higher output and higher price level. The aggregate supply will begin to shift leftward untill the emergence of a new equilibrium -corresponding to the natural level of output -, so that just prices will register a higher level . As a conclusion, the effect of a single increase in government expenditures will pass on a single increase in the price level, and will have no effect on future inflation after the economy is reaching its new equilibrium. Taking into account that the government expenditures cannot increase continuously, entitle us to consider that the fiscal policy is not a persistent factor causing inflation. As well, the general view regarding the other component of the fiscal policy – taxes – is that they cannot generate persistent inflation. A one time decrease in taxes will first determine an increase in the aggregate demand and a temporary growth in output. Subsequently the supply will record the proper adjustment triggering thus the emergence of a new equilibrium characterized by the same output and superior price level. The fact that taxes cannot be lowered infinitely emphasize that this factor cannot be seen as a persistent source of inflation.

In the Keynesian view, another factor that could influence inflation is consider to be the supply shock. If, for example an oil shock occurs or the workers demand and receive higher wages the aggregate supply curve will shift leftward and the resulting output will be placed below its natural level, triggering higher unemployment. As a consequence of this new equilibrium, wages will decrease and the initial equilibrium will be reached again. The net result of the supply shock is that we return to full employment and initial price level, without causing persistent inflation.
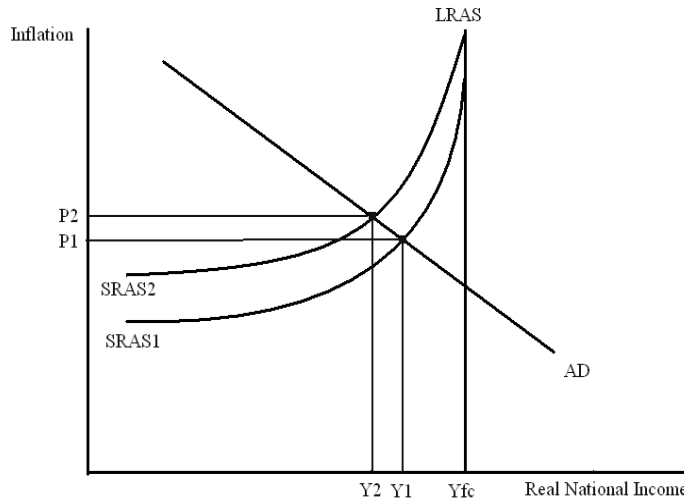
As a conclusion of both monetarist and Keynesians, a persistent inflation is the result of money supply growth. It has to be stated that in our analysis we had considered the money supply to be constant. As we will see, governments have certain incentives not to keep the money supply constant and as a consequence some of the factors considered below, could generate persistent inflation in the extent that they will lead to money creation.

Governments consider different objectives that can be sometime in opposition with the absence of inflation. Promoting economic growth and employment had always been important targets for any policymaker in order to sustain a continuous rise in the living standards. The role assumed by the government in achieving these objectives, especially in stabilizing unemployment can generate two types of inflation, respectively cost-push inflation- which occurs because of negative supply shocks or the workers' demand for higher wages and demand-pull inflation- which results when policymakers pursue policies that shift rightward the aggregate demand curve.

The cost-push inflation occurs when producers, confronted with higher production costs decide to increase the price level of their products in order to keep constant the profit margin. There are several factors that can generate higher production costs as rising labor costs or higher indirect taxes imposed by the government. Rising labor costs occur when the increase in wages outruns the improvements in productivity- this in specially the case for labor-intensive industries. Even though some firms can temporary avoid price increases as a result of higher wages, by cutting costs in some other areas of the businesses, on the long term wage inflation is strongly correlated with price inflation. If the government decides to impose higher indirect taxes- for example a higher level of VAT or a rise in the level of excise duty on alcohol and cigarettes, this will contribute to cost-push

inflation. These taxes are levied on producers who choose to increase the prices depending on the elasticity of the demand. If the demand is highly inelastic, an important amount of the new the taxes will be transferred to the consumers. By contrast, if the demand is elastic, the producers will increase the prices by a lower margin and their profits will decline.
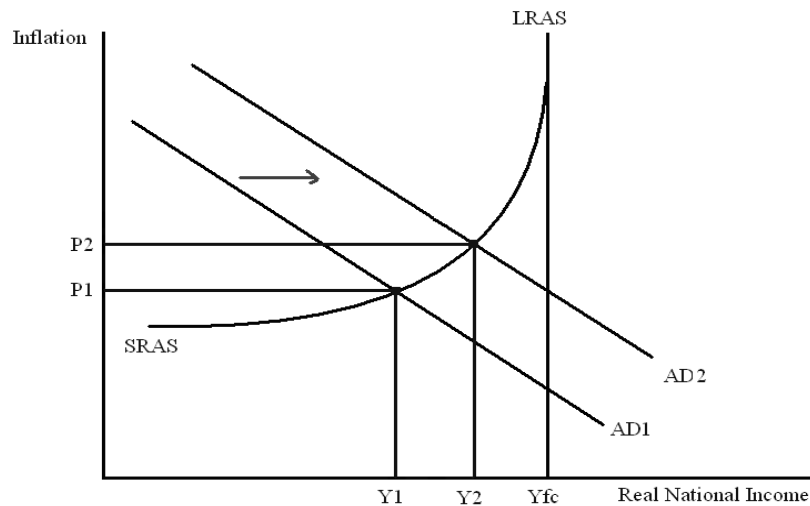
The mechanism of cost-push inflation is shown in the diagram below. A rise in cost-push inflation will cause the short run aggregate supply (SRAS) to shift leftward which, ceteris paribus, will generate the contraction of the national output and a rise in the general level of prices. It has to be observed that, despite this evolution, the long-run aggregate supply (LRAS) and the long term equilibrium remain unchanged.



**Fig. no. 1 - The mechanism of cost-push inflation**

Demand-pull inflation states that a rising level of the aggregate demand (AD) will lead to inflation under the conditions of full employment and an inelastic short run aggregate supply. A rise in the aggregate demand can occur for several reasons which are described below. A reduction in direct and indirect taxation can raise disposable income which will boost consumers demand for goods and services. The rapid growth in the money supply, considered to be the main cause for persistent inflation, can occur as a consequence of low interest rates which will generate a higher quantity of money than the one required to finance the volume of transactions within an economy. A rise in the consumer confidence regarding the future evolution of the economy can promote positive expectations regarding future incomes stimulating thus current consumption with direct effect on aggregate demand growth. Also, there can be external factors that will shift the aggregate demand rightward like for example faster economic growth of foreign countries which could have a direct impact on the demand for domestic goods.

The mechanism of demand-pull inflation is shown in the diagram below. A rise in demand-pull inflation will cause the aggregate demand to shift rightward which, ceteris paribus, will generate the increase of the national output and a rise in the general level of prices. The increase in the level of prices is depending on the elasticity of the short run aggregate supply, having a greater impact on prices in the inelastic case. It has to be observed that the evolution of the aggregate demand modifies the long term equilibrium which will corresond to a higher level of prices.

**Fig. no. 2 - The mechanism of demand-pull inflation**

Expectations regarding the future evolution of the inflation can also be a cause of inflation because workers could choose to consume more in the present as they anticipated the rise in the level of prices and also because most likely workers will demand higher wages in order to protect their purchasing power.

If the aggregate demand is shifted rightward for various reasons and the equilibrium is driven beyond potential GDP, this will cause an inflationary gap. Potential GDP is defined as the maximum possible output that an economy can produce with its given resources and technology while the difference between potential GDP and actual GDP is defined as the output gap. A positive output gap states that the economy is working beyond its capacity and the unemployment is below its natural rate generating inflationary pressures on account of workers demanding and receiving higher wages. The computation of the output gap is very important for policymakers dealing with inflation. In the case of a positive output gap, the proper decisions would consist in the adoption of policies aimd at restricting the aggregate demand. By contrast, if the economy is below its natural level and thus the economy is facing a negative output gap, the policymakers should try to boost the aggregate demand through various measures, such as the reduction of indirect or direct taxation.

Besides cost-push inflation and demand pull inflation, the participation of a country to international commerce could represent another important factor causing the rise of the price level. This type of inflation is called imported inflation and it occurs through the exchange rate channel or because of the rising prices of imports. The exchange rate channel can be an important source of inflation if the national currency is facing a rapid depreciation as it makes imported goods more expensive. Moreover, the impact of national currency depreciation on inflation will translate more strongly in the case of a country highly dependent on imported goods or if the foreign currencies are very present in the economy. The foreign inflation will transfer on domestic inflation if the importers will choose to incorporate the rise of external prices in the domestic market prices, taking into account that such a decision  also depends on the demand elasticity.

**Econometric analysis of the underlying factors of persistent inflation in Romania**

In order to empirically test the underlying factors of persistent inflation in Romania, we have considered proxies for cost-push, demand-pull and imported inflation. In the case of cost-push inflation, the unit labor cost (ULC) has been chosen as the best proxy. According to OECD definition, the unit labor cost represents the average cost of labor per unit of output and is calculated as the ratio of total labor costs to real output. We have chosen this proxy because labor costs are the most significant factor of cost-push inflation over the long term. In our analysis we have calculated

the unit labor cost as the average net earning divided by the labor productivity, computed as real GDP per worker. Unit labor costs represent a direct link between productivity and the cost of labor used in generating output. An increase in the unit labor costs reflects a higher reward for the employees to output and represents a threat to the cost competitiveness of a firm if other costs are not adjusted. It is generally accepted that a rise of unit labor costs has a certain impact over the inflation on the long term.

Demand-pull inflation can be studied through the evolution of the output gap. If the output gap is positive, the economy is operating beyond its capacity and the workers are able to demand and receive higher wages. This will shift the aggregate demand to the right, with a new equilibrium characterized by a higher level of prices. This is considered to be a good proxy for the Romanian economy because is generally accepted that the economy growth beyond potential has triggered an excess aggregate demand which generated inflationary pressures. Another argument for using this proxy is that, unlike a temporary low interest rate, a positive output gap generates persistent influences over the inflation,. The output gap is defined as the ratio of the difference between real GDP $(Y_t)$ and potential GDP $(Y_t^p)$ and potential GDP:

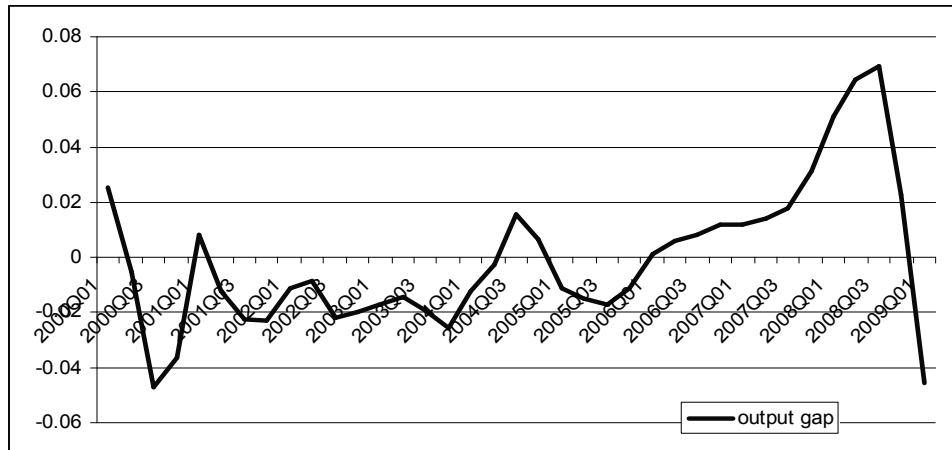$$GAPY_t = 100 * (Y_t - Y_t^p) / Y_t^p \tag{1}$$

The output gap is not directly observable since the potential GDP is not a value that can be observed and therefore it has to be estimated. In this paper, we will apply a univariate approach which consist in the use of time series data of the actual output in order to determine a trend which will be considered as potential output. Fitting a linear trend or fitting a quadratic trend is the simplest of the univariate approaches. Hodrick and Prescott (1997) suggested a detrending procedure to find out the potential output, which is now widely known as Hodrick and Prescott (HP) filter. This involves minimization of a quadratic loss function with a chosen weight for smoothing the series. What makes the filtered series a potential one, is freeing it of the cyclical fluctuations.

The Hodrick-Prescott (HP) filter selects the series of potential output component of the output that minimizes the following loss function, L. It involves fitting the trend path for $y_t^p$ (log of $Y_t^p$) subject to the constraint that sum of the squared second differences of the trend series is not too large:

$$L = \sum_{t-1}^{s} (y_t - y_t^p)^2 + \lambda \sum_{t=2}^{s-1} (\Delta^2 y_{t+1}^p)^2 \tag{2}$$

Here, $\lambda$ is the smoothing parameter on the potential output growth and s is the sample size. The selection of $\lambda$ also depends upon the frequency of the data with a value of 1600 suggested for quarterly data.

The evolution of the output gap in 2000-2009 period can be seen below:

**Fig. no. 3 - The evolution of the output gap; Source: own calculation**

The economy has generally grown below potential in the 2000-2006Q1 period with the exception of the 2000Q1-2000Q3 and 2004Q3-2004Q4 periods. After 2006Q1 the economy experienced rapid and beyond potential growth which has generated inflationary pressures. The first quarter of 2009 marked the entry in a recession caused by the global financial crisis.

Imported inflation can be proxied by the evolution of the EUR/RON exchange rate. A depreciation of the local currency will cause an increase in the price of imports which will also generate price inflation. In the case of Romania, many domestic goods have their prices denominated in euro so the exchange rate channel has a greater impact over the inflation compared to other economies.

The evolution of the EUR/RON exchange rate and the inflation rate over the analyzed period can be seen in the next graph:



**Fig. no. 4 - The evolution of the EUR/RON exchange rate and the inflation rate;**
Source: Eurostat

As it can be seen from the table there is not a directly observable link between inflation rate and the exchange rate but this can be explained by the fact the other factors had also an important effect over the inflation rate in the analyzed period. Nonetheless, if we consider some specific periods (for example 1998Q1- 2000Q4 and 2005Q1- 2008Q4) the two variables are moving in the same direction.

In order to empirically test the relation between the inflation rate and unit labor costs, the output gap and the exchange rate we have used data for the period 1998Q1-2009Q1. The source of the data is Eurostat, the frequency is quarterly and all the series have been seasonally adjusted using

Census X12. It has to be mentioned that the dependent variables are expressed in terms of relative evolution from the previous quarter.

In order to test the relationship between the inflation rate and its explanatory variables a series of preliminary tests were made for selecting the best regression model. First step was to test if the variables are stationary by running ADF and PP tests. The results are shown in the table below:

**Table no. 1**

**Stationary tests for the regression variables**

| Variable | Test | t-statistic | p-value |
|---|---|---|---|
| **HICP** | ADF | -2.312584 | 0.4184 |
| | PP | -5.487981 | 0.0003 |
| | KPSS | 0.463000 | 0.005 |
| **EUR/RON exchange rate variation** | ADF (constant) | -3.009857 | 0.0419 |
| | PP (constant) | -3.009857 | 0.0419 |
| **ULC** | ADF (constant) | -6.600831 | 0.0000 |
| | PP (constant) | -6.343018 | 0.0000 |
| **OUTPUT GAP** | ADF (constant) | -4.127748 | 0.0023 |
| | PP (constant) | -3.885279 | 0.0045 |

All variables used in our analysis proved to be stationary. It the case of HICP, the ADF test has not rejected the presence of a unit root but the Philips-Perron and KPSS tests proved the stationarity of this series. Further it was observed that for the dependent variable (HICP) the partial autocorrelation function showed a dependence in the first two lags; as a consequence for better results we included in the regression the first and second AR terms. After running several regression equations which included different lags for the dependent variables we found that the following equation describes the best the relationship between the variables considered:

HICP = C(1)*HICP(-1) + C(2)*HICP(-2) + C(3)*CURS(-1) + C(4)*ULC + C(5)*OUTPUT_GAP(-2) + C(6)*DUMMY_00Q03                                              (3)

Note that the ecuation includes a dummy variable for 2000Q3 so that the ocurance of abnormal information to be excluded. The regresion equation was choosen on criteria of statisical significance, minimal variance and information criteria (Akaike and Swartz criterion). The regression results are shown in the next table:

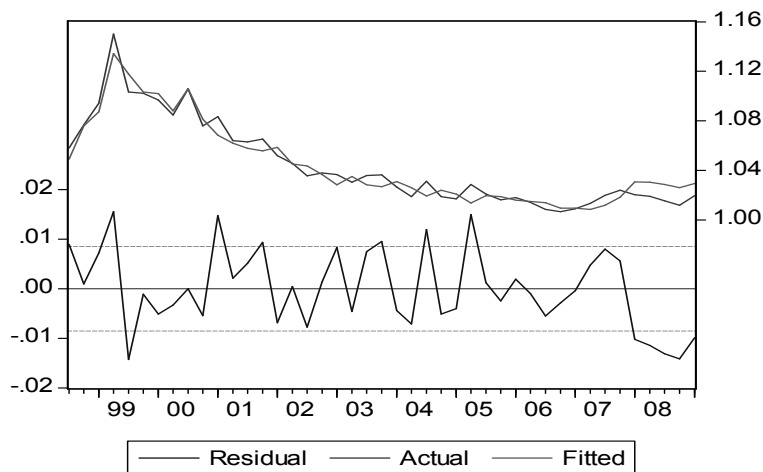**Table no. 2**

**The regression results**

| Dependent Variable: HICP | | | | |
|---|---|---|---|---|
| Method: Least Squares | | | | |
| Date: 09/21/09   Time: 19:48 | | | | |
| Sample (adjusted): 1998Q3 2009Q1 | | | | |
| Included observations: 43 after adjustments | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| HICP(-1) | 0.601227 | 0.078617 | 7.647542 | 0.0000 |
| HICP(-2) | 0.236736 | 0.067212 | 3.522243 | 0.0012 |
| EXCHANGE RATE(-1) | 0.066725 | 0.033737 | 1.977810 | 0.0554 |
| ULC | 0.101015 | 0.024437 | 4.133722 | 0.0002 |
| OUTPUT_GAP(-2) | 0.212532 | 0.033553 | 6.334228 | 0.0000 |
| DUMMY_00Q03 | 0.029607 | 0.009139 | 3.239592 | 0.0025 |

| | | | |
|---|---|---|---|
| R-squared | 0.945862 | Mean dependent var | 1.044562 |
| Adjusted R-squared | 0.938547 | S.D. dependent var | 0.034299 |
| S.E. of regression | 0.008503 | Akaike info criterion | -6.568087 |
| Sum squared resid | 0.002675 | Schwarz criterion | -6.322338 |
| Log likelihood | 147.2139 | Durbin-Watson stat | 1.683824 |

All the coefficients are statistically significant and correctly signed.

The depreciation by one percentage point of the exchange rate will determine a rise in inflation by 0.067 percentage points with a delay of one period. If we consider the evolution of the EUR/RON exchange in the previous four quarters (% rise of the single currency) we can conclude that the average effect on inflation was around 0.078 percentage points. According to our model, the most important explanatory variable is the output gap. Thus, a one percent growth rate over potential will cause the inflation to rise by 0.2071 percentage points. If we consider the severe recession of the Romanian economy in 2009, the effects on inflation will be important, respectively between 2 and 3 percentage points. It must be stated that the output gap affects price changes with a delay of 2 quarters. As it can be seen from the estimation results, a rise in the labor costs that outruns productivity growth by one percent will determine 0.10 percentage point rise in the observed inflation. In the past four quarters the growth rate of the wages was superior to the growth rate of the productivity by 22 percents, so the average effect on inflation was around 2.2 percentage points. We must note that the dependent variable follows an autoregressive process which proves the persistence of inflation with a lag of one and two quarters. This means that inflation can be modeled by using past values suggesting that other factors which were not included in our analysis can be responsible for the changes in inflation.

The high value for R-squared means that the explanatory variables describe well the variation of inflation. Still it should be emphasize that the model high explanatory power is attributed in a certain extent to the persistence of inflation. Moreover, the fact that the development of inflation is adequately surprised by our model it is shown by the next graph:



**Fig. no. 5 -  Actual-fitted residual graph**
*Source: Own calculation*

In order to test the quality of regression we performed several tests. Thus, the Jarque-Bera test indicated that residuals follow the normal distribution, the correlogram of residuals showed no autocorrelation, while the White test revealed that the errors are homoskedastic. Furthermore it was run CUSUM test which indicated that the residuals are stable under the analyzed period. The same

result occurred when the CUSUM test was applied to the estimated coefficients. Therefore, both the estimated parameters which are consistent with the economic theory and the tests outcomes entitle us to consider that the results are reliable so that our model is capable to improve the understanding of the inflationary process.

**Conclusions**

The analysis of the underlying factors of persistent inflation in Romania is very important in the context of ensuring an inflation rate consistent with the Maastricht inflation criterion. In order to promote price stability by proper means, the central banks consider primarily the factors with medium and long term influence over the inflation rate. This paper found that in Romania these factors are the output gap as a measure for demand pull inflation, the unit labor costs as a measure for cost push inflation and exchange rate as a measure for imported inflation. In the econometric analysis all the explanatory variables proved statistically significant and correctly signed. According to our model, the most important factor causing persistent inflation is the output gap, followed by the exchange rate modifications and the change of the unit labor costs.

These results are very important for policy makers, especially for the central bank which will use its monetary policy tools in order to promote price stability in accordance to the factors with a medium and long term effect on the inflation rate. On the background of a severe recession, the central bank will likely lower its key interest rate but caution is recommended because a sudden drop in the interest rates will affect the nominal exchange rate which could generate inflationary pressures. Thus, a correct determination of the precise relation between the inflation rate and its explanatory factors is crucial in promoting price stability over the medium and long term.

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