MEASURES OF CORE INFLATION USED BY THE NATIONAL BANK OF ROMANIA

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Abstract: *The inflationary process has become a phenomenon that has a significant influence on society in general and it is therefore important to be managed in an efficient manner. The objective of this study is to analyze the core inflation measures in Romania, after the adoption of direct inflation targeting regime in August 2005. In order to identify the causal link between the core inflation measures and inflation quantified by the Consumer Price Index (CPI), the Granger causality test is used. The study results indicate that only on the short-term the CORE 1 inflation (calculated using the Consumer Price Index from which the administered prices are eliminated) has influence on the total inflation, among the other core inflation measures and total inflation rate, the statistical relationships being insignificant.*

Keywords: core inflation, Consumer Price Index, Granger causality test
JEL Classification: C22, E31

Introduction

After 1990, most central banks from the European Union have adopted the direct inflation targeting strategy that has as main objective to maintain price stability. To meet this goal, we first need to measure the phenomenon by means of indices, which are intended to record, as accurately as possible, the price changes that people notice over a period of time.

The main categories of price dynamics measurement indices in an economy are: Consumer Price Index (CPI), Producer Price Index (CPI), Export and Import Price Index (IPE and IPI). The indices are used to measure the purchasing power of the currency in various categories of transactions involving goods and services.

Based on these, central banks and governments adopt measures for the monetary and fiscal policy of a state. In the direct inflation targeting regime, the Consumer Price Index (CPI) is the most widely used index in terms of availability. Production Price Index comprises the total production, including individual consumption and value added, and is useful in analyzing the trading price of the first stage.

The Central Bank of a country, through the decisions taken, cannot fully control the inflationary phenomenon, because there is an inflation component that is influenced by shocks on the aggregate offer.

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The structure of the article is as follows: section 1 presents the main definitions of core inflation from the specialized literature, and in section 2 a comparison between the structure of the consumer basket in Romania and the euro area is performed, as well as the highlight of the core inflation measures in Romania. Based on Granger causality test results, one notices the power of predictability of core inflation measures for the CPI inflation. The last part presents the conclusions of the study.

1. Literature review

In the specialized literature, it is generally accepted that in the short term, the inflation rate may be influenced by shocks produced outside the control of the monetary authority (the variation in administered prices and taxes, evolution of the weather conditions on agricultural production, oil price variation on the international market). For a more efficient control of the phenomenon, the central bank analyzes the total inflation by dividing it into a core component *(core inflation)* and a transitory component. Through the adopted monetary policy measures, the central bank influences the dynamics of the core inflation (Bilke and Stracca, 2008; Constantinescu, 2007; Mishkin, 2007; Bullard, 2011).

The term "core inflation" was first defined in 1980 by Otto Eckstein, who divided inflation into three components: a core component reflecting the persistent sources of inflationary pressures (π^s) a component that is affected by shock effects of changes in the food prices, energy, taxes and charges (πs) and an inflation component through demand (π^d) (Dolmas and Wynne, 2008, p. 3):

$$\pi = \pi^c + \pi^d + \pi^s$$

After 1990, the first major studies belonged to Bryan and Pike (1991) who proposed using the average consumer price changes as a measure of core inflation. The development of the concept of core inflation was determined by the adoption of direct inflation targeting regime in most countries, the primary objective of monetary policy becoming to ensure and maintain price stability. The specialized literature offers a wide range of approaches to *core inflation*. Certain research focuses on the theoretical approach, taking into account the basic determinants of the core inflation and other studies address the methods for measuring core inflation.

Roger (1997) emphasized the main criteria for selecting the optimal method for measuring core inflation:

- the measure should not be the subject of frequent reviews;
- high credibility and accessibility of understanding by the general public;
- the measure must not provide false signals that would prevent achieving price stability.

The problem of the separation of the persistent sources from the transitional ones is often in the attention of the central banks. For example, a late reaction to the onset of the inflationary pressures may lead to a sustained increase in inflation in the future, while an over-reaction to a temporary increase in price can lead to an unjustified slowdown and a possible decline of the economic activity. Change in administered prices and taxes, the production of international oil market shocks are reversible and do not affect inflation anticipations (Dias, 2010).

According to the research performed by Wynne (2008) and Crone *et al.* (2011) there is a variety of core inflation measures that are built using either the statistical approach or the approach based on an econometric model. In most analyzes core inflation measures are used by performing a statistical approach because they can be more easily explained to the general public, ensuring a greater transparency in the conduct of the monetary policy.

The most widely used method to estimate core inflation is the exclusion method, which involves removing certain categories of goods and services that are found in the consumer basket, but which are influenced by various transitory shocks. The energy price and unprocessed food prices are considered highly volatile and are excluded from the calculation of the core inflation.

A negative aspect of the measures obtained by exclusion is the possibility of omitting important information on core inflation by entirely isolating certain price categories. The exclusion is based on past information concerning the related volatility, and thus the measurement of the core inflation will be determined in the future based on this data.

As an alternative to the core inflation measures that eliminate some subgroups of products, the *trimmed mean* method was proposed, which means a statistical distribution of the inflation rate, every month (Brischetto and Richards, 2007; Bryan, 2007). Simultaneously, the lowest and highest price changes variations of the goods in the consumer basket are eliminated. Then, the average of the remaining distribution, which represents the core inflation measure itself, is determined. The *trimmed mean* method has the disadvantage that it eliminates goods with the prices that have the highest deviation from the average distribution.

This disadvantage can be eliminated by using an Edgeworth type index, which gives an importance coefficient to each component exhibiting high volatility. Thus, the components with high price variations will be associated with low shares.

Another statistical method is the *weighted mean*, through which the shares related to the prices of the considered statistical distribution, starting from the highest price fluctuations, calculating the inflation rate for which the sum of the shares is 50%.

The criteria most commonly used to assess the core inflation measures are: ease of design, predictability power on different time horizons, insofar as they seek the best the trend inflation (Faust and Wright, 2011).

In conclusion, central banks use, in order to control the inflationary phenomenon, both the consumer price index as well as various core inflation measures in order to analyze price shocks and to optimize monetary policy decisions.

2. Inflation measurement and consumer's perception concerning the inflationary phenomenon

Consumer price indices measure the price changes of the goods and of the fees for the services used by the population in the current period compared with the previous period, also called reference period.

Consumer price indices are used as a means of estimating the average variation of the prices of the goods and services purchased by the population; they allow us to measure inflation in the sphere of consumption and to determine the purchasing power of incomes, wages. Also, they have a role in the calculation of real interest and in establishing social protection measures.

Folkertsma and Hubrich (2001), in their study, define consumer price index as an index of the "cost of living", which quantifies how much a consumer has spent on consumer goods in the current period, compared to the base period, in order to maintain the same standard of living.

The easiest way of calculating a price index is using the fixed base one, obtained from the ratio of the two values calculated for the same amount, but using different prices for the two periods compared (0 - base period and 1 - for the current period) (Anghelache *et al.*, 2012, p. 60):

$$IPC = \frac{\Sigma p_{i1} q_{i0}}{\Sigma p_{i0} q_{i0}}$$ (Laspeyres index - keeps the shares in the base period)

$$IPC = \frac{\Sigma p_{i1} q_{i1}}{\Sigma p_{i0} q_{i1}}$$ (Paasche index - keeps the shares in the current period)

where: p_i represents the prices of the goods and services bought during the base period (p_{i0}), respectively during the current period (p_{i1})

q_{i0} represents the quantities bought during the base period

q_{i1} represents the quantities bought during the current period

One can notice that in the case of the Paasche index the quantities of goods and services purchased are updated. The inflation rate calculated with the help of the Laspeyres index tends to be

higher because it does not take into account the ability of a household to reduce the consumption of products whose prices rise very quickly (Stendel, 1997).

Based on price indices other indicators such as inflation rate, the average annual inflation, because central banks may issue inflation target, are determined.

Next, we will present the main features of the two consumer prices indices calculated for Romania.

2.1. The Harmonised Index of Consumer Prices (HICP)

The Harmonised Index of Consumer Prices (HICP) is used to measure inflation in the European Union and is calculated by Eurostat, based on a harmonized methodology for all Member States. This index is particularly important because the definition of price stability in the euro area is made based on the value of the HICP. Also, by using HICP one may asses whether a country is ready to join the euro area (the convergence criterion), making a comparison between the inflation rates of the European Union countries.

The index includes the expenses of the households on the territory of a State, including both resident and non-resident households. HICP is a Laspeyres-type fixed base index, using the COICOP classification (Classification of Individual Consumption According to Purpose) in order to make comparisons between the Member States. The index is composed of 12 divisions consisting of 39 groups and 93 classes of goods and services.

From table 1, it can be seen that the divisions “Housing, water, electricity, gas and other fuels”, “Food and beverages” and “Transport” have significant shares of over 15% each.

Table 1 - Expenditure weights included in the Harmonised Index of Consumer Prices for the Euro area

Categories	Euro area
Food and beverages	15.7%
Alcohol, tobacco	4.0 %
Clothing, shoes	6.3%
Housing, water, electricity, gas and other fuels	16.3%
Furnishing, household equipment and routine maintenance of the house	6.6%
Health	4.3%
Transport	15.2%
Communication	3.0%
Recreation, culture	9.4 %
Education	1.0 %
Restaurants, hotels	9.1%
Miscellaneous	8.6%

Source: European Central Bank

HICP quantifies the changes taking place at the level of the goods and services prices traded within a country in the European Union, in the European Economic Area as well as for the acceding states to the European Union. The share of the necessary coefficients in order to calculate HICP is determined by the structure of the expenditures incurred by both residents and nonresidents.

In calculating the HICP the state taxes owed, the interest and fees of the loans granted are excluded, but the value added tax on the goods and services purchased by the buyer is included.

In order to obtain comparable results, the European Union countries have implemented common rules for the calculation of the Harmonised Index of Consumer Prices. For the euro area countries, the index is used for the adoption of monetary policy measures.

2.2. The Characteristics of the Consumer Price Index in Romania

The Consumer Price Index at a national level is used for the economic analysis, for the establishment of the monetary and fiscal policy decisions, for indexing the commercial contracts, benefits and financial instruments. The CPI calculation is based on the structure of consumer expenses of only residents, made in the country or abroad.

Starting with 1997, the National Statistics Institute sends to Eurostat the HICP data set needed for the calculation of HICP for Romania. As I mentioned, the two indices are calculated simultaneously because each of them serve different objectives. Between the CPI calculated according to the national definition and the HICP determined based on a harmonized approach are the following differences:

- consumption expenses covered by HICP are made by residents/non-residents compared to national CPI, which reflects the evolution of the goods and services prices purchased only by residents, whether they are made within the country or abroad;

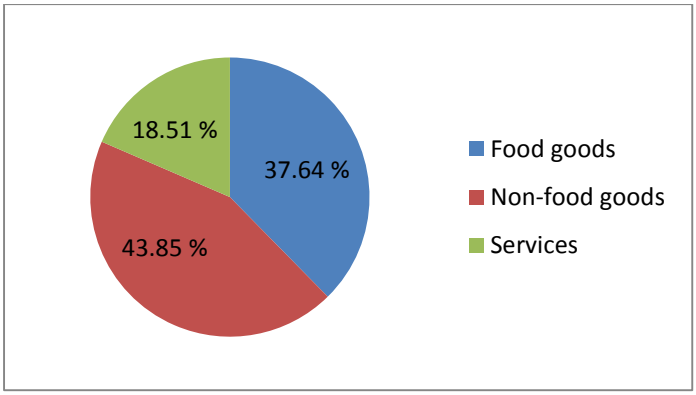
- the national Statistical Institutes in some countries use different ways of calculating the CPI index according to the national definition;

- expenses for health care, social security and education are included in the HICP inflation measure. The harmonized treatment of these expenses within HICP has been a major achievement;

- different approaches to the introduction of new categories of products in the consumer basket, their share, the change in the product quality do exist.

The Household Budget Survey is performed each year and it provides information about the situation and the time evolution of individuals and households to which they belong. Based on data taken from this investigation, the shares used for the CPI calculation are obtained; they result from of average monthly expenses structure made by a household for the purchase of goods and public service that are needed. Given the characteristics of the survey, at the beginning of each year *t* the shares resulted from the structure of the year *t-2* expenses are available.

Figure 1 - The share of the aggregation levels corresponding to the national Consumer Price Index



Source: National Institute of Statistics

For the calculation of the national CPI, 3 levels of aggregation are used[*]:

- group of food products comprised of 54 items and 360 varieties;

- group of non- food products comprised of 112 items and 947 varieties;

- group of services comprised of 56 items and 423 varieties.

In what concerns the shares of the 3 groups in CPI, one may notice that the group of non-food products has the highest rate, while services account for only 18.51% of the total.

Table 2 - Expenditure weights included in the national Consumer Price Index for Romania

Categories	Romania
Food and beverages	31.0%
Alcohol, tobacco	6.4%
Clothing, shoes	5.0%
Housing, water, electricity, gas and other fuels	11.3%
Furnishing, household equipment and routine maintenance of the house	4.7%
Health	7.3%
Transport	12.4%
Communication	5.8%
Recreation, culture	5.9%
Education	2.7%
Restaurants, hotels	3.1%
Miscellaneous	4.0%

Source: European Central Bank

If we make a comparison between the shares of the 12 divisions in the composition of HICP in Romania and the "European basket" from the euro area (Table 1), one may notice that the share of the group "Food and non-alcoholic beverages" is 31% versus 15.7% for share of the euro area. Other significant differences are found in the divisions "Restaurants and hotels", "Transport" and "Housing maintenance, water, electricity, gas and other fuels". These shares are consistent with the specific consumption in Romania.

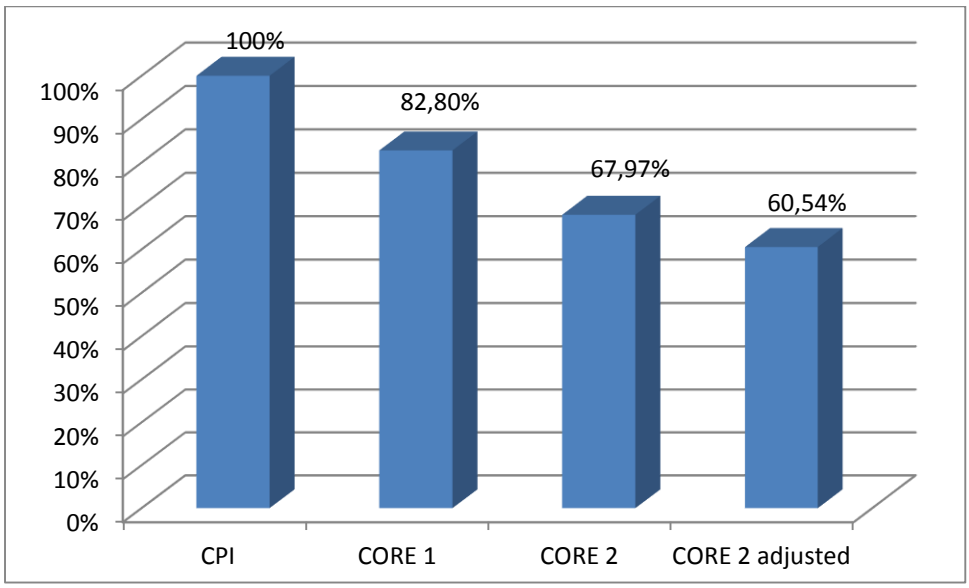
It may be noted that in Romania, a greater amount of food goods and energy goods is purchased, compared with the euro area average. Some of these prices are extremely volatile, which strongly influences the dynamics of inflation and the Central Bank has a difficult task in controlling the phenomenon. Also, the services represent, in Romania, only 18.51% of the HICP structure compared to 40% in the euro area.

[*] ***(2007). The comparative analysis between national and harmonized index of consumer prices for Romania. Analyses of the National Bank of Romania, in February, p. 2.

3. Core inflation measures in Romania

In order to obtain core inflation we use the exclusion method that requires the removal from the consumption basket of the products with administered prices (the CORE 1 measure is obtained), with prices that are characterized by extremely high volatility (the CORE 2 measure is obtained) and those influenced by changes of the tax regime such as changes in excise duties or indirect taxes (the CORE 2 adjusted measure is obtained). A special attention is given to the CORE 2 adjusted measure of the core inflation because it is influenced only by the decisions taken by the central bank.

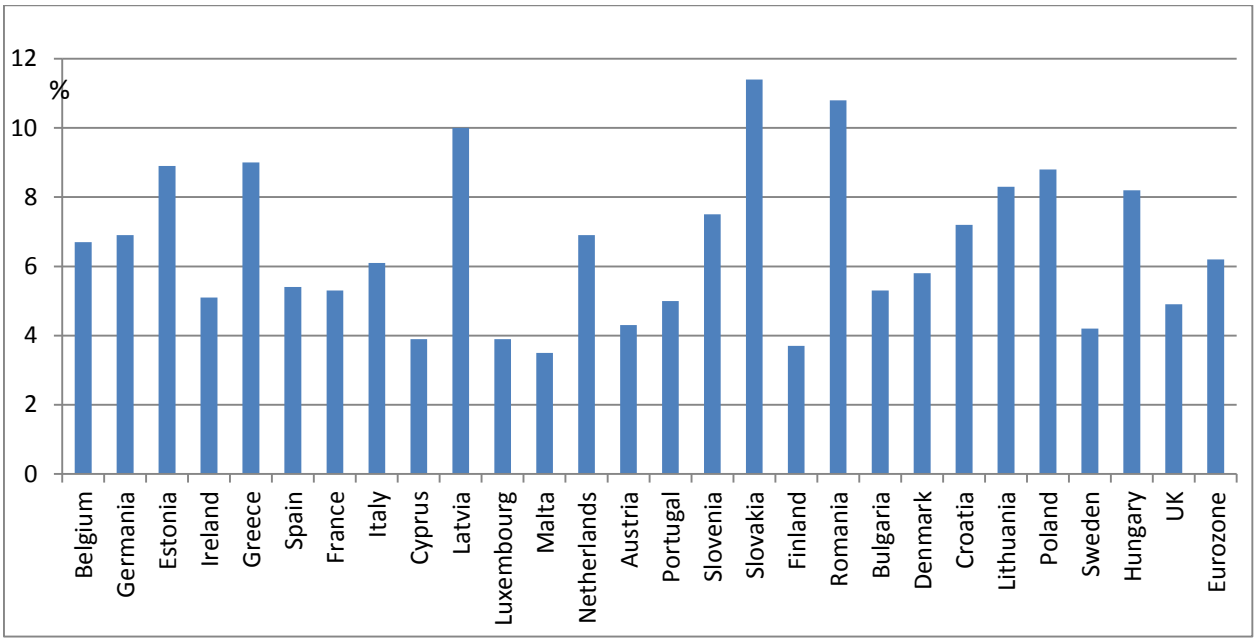
Figure 2 - Core inflation measures in Romania



Source: National Bank of Romania

In figure 2 I have presented the three measures of core inflation. Inflation CORE 2 adjusted (core inflation), which can be directly controlled by the National Bank of Romania, has a share of 60.54% in the CPI basket, marking the price changes that present low volatility. The share of administered prices is of 17.2%, of the high volatility goods (fruits, vegetables, eggs, fuel) is of 14.83%, while the share of the excisable products is 7.43% in the CPI basket. In Romania, the share of what is considered to be traditionally volatile food (fruits, vegetables) is very high compared to other European Union countries, which makes it difficult for the central bank to control the inflation phenomenon (Dumitru, 2011). Furthermore, figure 3 shows that Romania ranks second among European Union countries in what concerns the share of high volatility goods (fruit, vegetables and fuels).

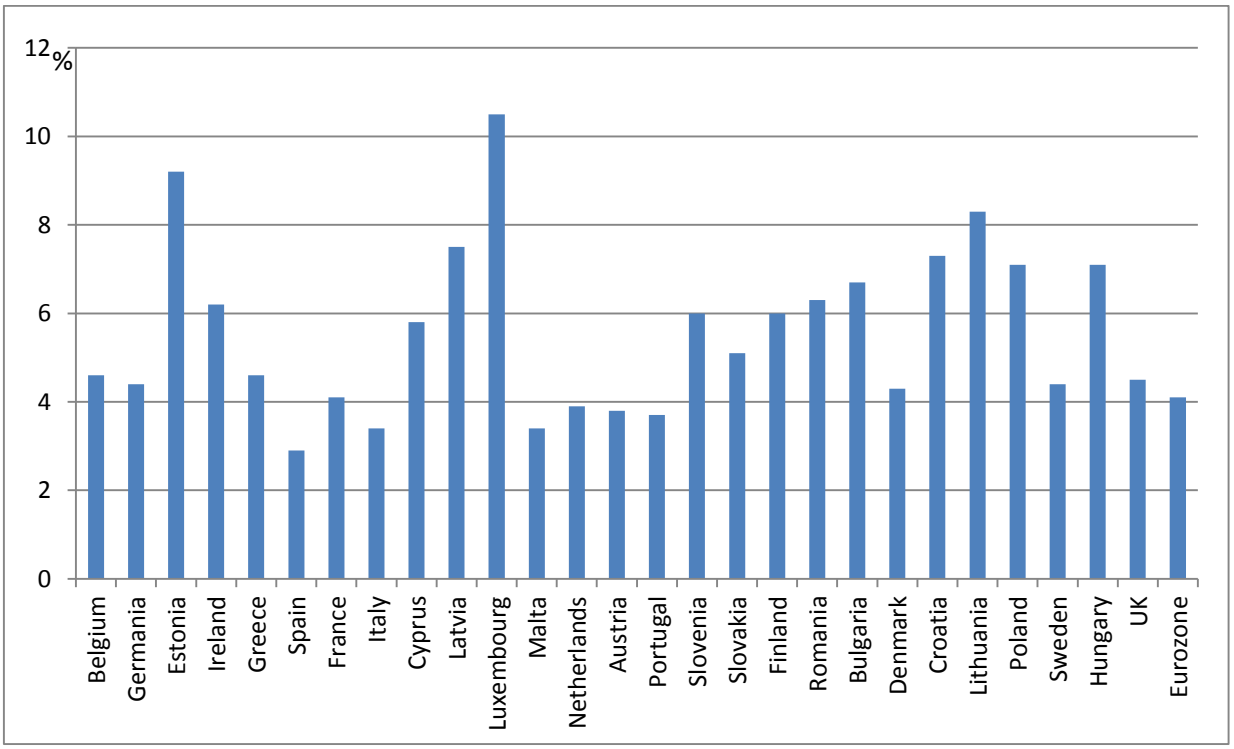
Figure 3 - The share of high volatility goods in HICP (%)



Source: European Central Bank

In what concerns the excisable goods, the share in the HICP for Romania is above the European average, a rise of the costs of these products having a greater impact on the value of the inflation rate.

Figure 4 - The share of excisable goods (alcohol, tobacco) in HICP (%)



Source: European Central Bank

With the help of the Granger-type causality, we will see what CORE measure has the highest predictability power on the inflation rate expressed by CPI. We will analyze the causal relationship between the three core inflation measures and the CPI inflation rate, testing the connection between them for a number of 2, 4, 8 and respectively 12 lags. The analyzed period is August 2005 - September 2014, using monthly data obtained from the annual reports of the National Bank of Romania. The choice of the period is based on the adoption of the direct inflation targeting regime by the Central Bank in August 2005.

The Granger causality can be expressed by the hypothesis that the variable X causes variable Y, indicating the impact of the past values of the variable X on variable Y. In order to test whether the variable X Granger-causes variable Y, we consider the following equation:

$$Y_t = \alpha_0 + \alpha_1 y_{t-1} + \ldots + \alpha_k y_{t-k} + \beta_1 x_{t-1} + \ldots + \beta_k x_{t-k} + u_t$$

where: k represents the chosen number of lags for establishing the time horizon

α, β - coefficients

The first step is to test the following hypothesis: $\beta 1 = \beta 2 = \ldots = \beta k = 0$. If the hypothesis is rejected, then it results that variable X Granger-causes variable Y, in other words the current value of Y is explained to a great extent by the past values of X.

Table 3 - Granger causality test values

	2 lags	**4 lags**	**8 lags**	**12 lags**
CORE 1 does not granger Cause CPI	0.009	0.064	0.640	0.851
CORE 2 does not granger Cause CPI	0.280	0.336	0.481	0.219
CORE 2 adjusted does not granger Cause CPI	0.238	0.162	0.206	0.287

Source: data compilation using E-views

From Table 3 results that the probabilities associated to the acceptance of the null hypothesis according to which there is no significant causal relationship between the core inflation measures (CORE 2 and Core 2 adjusted) and the CPI inflation are higher than the significance threshold (0.05) and thus validates this hypothesis, for all lags considered. In what concerns the CORE 1 measure, it can be seen as a CPI inflation predictor for the short term only.

3.1. Consumer's Perception on Inflation

Consumers face daily price changes in various goods and services that they purchase. Thus, each person develops its individual perception on the inflation, whether or not there is a rapid increase in prices. Among the factors contributing to the perception of a higher inflation than the value measured by the harmonized index of consumer prices (HICP) the persistence of inflation perceptions, ignoring the qualitative changes, the stronger memory of the increases of prices rather than price reductions, the influence of certain social factors are distinguished.

Because the shares of goods and services purchased from the CPI basket are representative for a consumer pattern, the inflation rate perception by the population may differ from the official figures presented by the Central Bank. Inflation measured by the index is not the same as the general price level changes faced by each consumer.

The perceptions on inflation are important because they contribute to people's behavior as consumers, investors, savers and employees.

Giovane and Sabbatini (2005) analyze the effects of the existence of the difference between the measured and perceived inflation. First, consumers are unable to correctly identify prices of goods, resulting in a decrease in the efficiency allocation of prices. The credibility of monetary policy may be affected when measuring inflation indices indicates the correct values of inflation, and if the euro zone can undermine confidence in public acceptance and the stability of the currency.

There are a number of cases where people have a misperception about inflation, meaning overestimation price changes. When the individual's standard of living has increased, it will compare the prices of goods purchased high quality with lower prices of goods purchased in the previous period, the price difference is not due to inflation. And the financial crisis when the lending rate is high, or the amount of capital held decreases, consumers have a misunderstanding of the phenomenon of inflation.

Pelinescu and Dospinescu (2008) analyzed the relationship between the official inflation and inflation perceptions in Romania, 2002-2005, in the context of transition economies. By using regression method were constructed series of perception and expectation consistent with CPI inflation. Results indicate that between 2002-2005 disinflation was not correlated for the perception of inflation, the consumer has received a price decrease smaller than in reality.

Romania’s consumption behavior is different from that estimated for the European Union as there are differences between standard purchasing and between data sources underlying the estimation weighting system. Although the issue of the difference between measured and perceived

inflation is widely debated in the European Union, Romania has put more emphasis on analysis methods for official inflation measure.

Conclusions

Core inflation is a useful indicator when establishing monetary policy measures because it offers a more conclusive picture on the component of the inflationary phenomenon that can be effectively controlled by the central bank. It also increases the transparency of the monetary authority by providing all this information that characterizes the inflationary process. However, due to the general public familiarity with the Consumer Price Index (CPI) the inflation target is established through this indicator.

The most used estimation method for the core inflation is the exclusion methods from the consumption price of the products that have volatile prices (fruits, vegetables, eggs), of the goods and services with administrative prices, as well as of the excisable goods (tobacco and alcohol).

By means of Granger causality test, on the basis of monthly three measures data for core inflation, we obtained that CORE 1 can be used as a predictor for overall inflation, only for the short term.

After the implementation of inflation targeting strategy in August 2005, the National Bank of Romania has succeeded to control inflationary phenomenon by means of a mix of macroeconomics policies, affecting the gradual decreasing of inflation rate, to a historical minimum level of 0.41% in January 2015.

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