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**CALCULATION OF THE CORE INFLATION RATE IN
MONTENEGRO – METHODOLOGICAL AND PRACTICAL
CONSIDERATIONS**

Authors: Nikola Fabris, PhD, Zorica Kalezić, MA, Mirjana Đuranović

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Bulevar Svetog Petra Cetinjskog 6
81000 Podgorica
Telephone: +382 20 665 331
Fax: +382 20 665 336*

WEB SITE: <http://www.cb-cg.org>

*PREPARED BY: Nikola Fabris, PhD,
Zorica Kalezić, MA,
Mirjana Đuranović*

The views expressed in this paper are those of the authors and do not necessarily reflect the views and policies of the Central Bank of Montenegro.

TRANSLATED BY: Maja Biljurić

DESIGNED BY: Andrijana Vujović

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1. Inflation indicators

Majority of central banks today have some kind of mandate to achieve price stability. Inflation and deflation can have a “high cost” for the economy. Therefore, all central banks are interested in establishing and forecasting inflation trends. However, when establishing inflation, it is very important to differentiate between inflation caused by the single shocks and inflation of a more lasting nature.

Inflation indicators can be different: Retail Price Index (RPI), Cost of Living Index (COLI), Consumer Price Index (CPI) and Harmonized Index of Consumer Prices (HICP). Most frequently used are CPI and HICP as the indicators that can clearly illustrate the inflation in a country and compare it to the inflation in other countries. Although the classification of products is the same (COICOP – Classification of Individual Consumption by Purpose) there is a certain difference in the calculation of both indexes. Namely, CPI is used more as a national price index, while HICP is used as an index for comparison with other countries. HICP was designed for international comparison of consumer prices inflations.

Consumer Price Index - CPI is the number that shows changes in prices of goods and services that a household has purchased or acquired in some other way, which are used to meet household needs in a direct or indirect manner. CPI can serve for several purposes: measuring of inflation, comparison with inflation rate trends in other countries, indexing of salaries, deflating of specific categories of national accounts and other statistic series, various analytic purposes, while the **harmonized consumer price index** is used for creation of monetary policy.

Therefore, both indicators - HICP and CPI have a basic purpose, which is the measuring of inflation, i.e. monitoring changes of goods and services prices in a specific time period. HICP and CPI use the same database, but measure inflation with different objectives. Generally, CPI is used as a national index that is not entirely comparable with other countries CPI. For the EU, HICP is the only true indicator of inflation between different countries. Therefore, basic purpose of both indexes is the same, but in practice there are specific differences¹, such as scope measurements of taxes, fees and services and the scope of households' consumptions.

¹ See *Harmonization of CPI-paper by Eurostat, Luxembourg, March 2007*

However, in addition to these two indicators of inflation measurement, there is another indicator that is getting more and more attention, namely the *core inflation indicator* or better known by economists as “core inflation“. Although the concept of core inflation is frequently used in theory, there is no generally accepted definition or model for measuring this inflation. Term “core inflation” is widely used by economists, academicians and national bankers.

2. Core inflation rate concept

Core inflation rate is the inflation rate that excludes the movements of specific product categories. Core inflation rate concept enables the differentiation between temporary price shocks and long-term inflation. Therefore, core inflation is used as an indicator of long-term or future inflation rate developments. Today, there are many definitions of core inflation rate:

- **Bryan and Cechetti (1993)** – core inflation is a long-term or permanent component of the measurement of price indexes, which is in a way connected to the growth of money.
- **Blinder (1997)** – relates core inflation with durable part of inflation.
- **Quah and Vahey (1995)** – core inflation is a component that cannot have a long-term impact on the real output.
- **Smith (2004)** – Core inflation is the best forecaster of inflation.

Core inflation rate concept was introduced for the first time in 1975 by the famous economist R. Gordon. Previously, inflation calculations had excluded developments of food and energy prices. Since then, the concept of core inflation rate has been largely developed and today it is used by a large number of countries worldwide. Products categories that are excluded most often are those whose pricing is not affected by usual economic developments, which can be affected by monetary policies measures; instead, they are the result of certain specificities. Therefore, calculation usually excludes, for example, agricultural and food products (their development is mainly the result of climate developments), energy (predominantly affected by the shocks on the demand side), administratively controlled prices (results of changes of decisions of economic policy makers), interest rates (increase of interest rates in order to reduce inflation could be treated as inflation growth), effects of tax changes, effects of price changes that are the result of one-off shocks (measures such as changes of customs rates, subsidies, etc.), seasonal impacts, etc.

With increasing popularity of inflation targeting, calculation of core interest rate has gained additional importance, since the impact of monetary policy (and economic policy in general) is much more efficient on the core inflation rate than on the total inflation rate. Creation of the current inflation rate can often be affected by the factors that cannot be influenced by the current economic and monetary policies. Core inflation rate provides an answer to the creators of economic policy to the question whether the change of inflation is the result of a short-term shock or is part of a long-term trend. Answer to this question is very important for the creation of

economic and monetary policy. Also, when projecting future inflation developments, it is much easier to base the projection on the core inflation rate, since this eliminates one-off shocks that are difficult to forecast.

However, there is no generally accepted international definition of the core inflation rate concept. Calculation of the core interest rate is generally adjusted to national specificities. For example, in some countries, all agricultural and food products are excluded, while some countries exclude only seasonal agricultural and food products. Canada, for example, excludes eight categories of products: fruits, vegetables, gas, petrol, oil, diesel intercity transport, tobacco products and interest. Serbia excludes the following products from the calculation of the core interest rate: fresh vegetables, fruits, eggs, fish, bread, milk, cigarettes, electricity, coal, heating oil, medicines, oil derivatives, utility services, TV subscription, social welfare services, transportation and postal services (Fabris, 2007).

There are many methods for calculation of the core inflation rate in practice: exclusion model, trend assessment method, method for assessment of limited impact, etc. However, the most widely used method is the exclusion method, which implies the exclusion of prices of specific product categories from the calculation of inflation rate. Reasons for the biggest popularity of this model is relatively simple calculation, it is understandable to the public, control and verification of the calculation can be conducted relatively easy, it has a high degree of transparency, etc. This method will be applied in our case.

In some countries, calculation of this index is performed by the central bank, while in others by the statistical bureaus. Generally, in all countries, methodology for the calculation of the core inflation rate is prepared by the central bank (Silver, 2007). Today, large number of countries are using core inflation rate as an additional indicator of inflation developments, however, some countries, such as Serbia, Czech Republic, Canada, Finland, Thailand, etc., are using core inflation rate as an operational target within inflation targeting.

However, relying exclusively on the core inflation rate can be wrong, since the inflation that consumers, economy and other economic entities see is total inflation rate and not the core inflation rate. Consumers notice first the change of prices of food products. In other words, inflation expectations are not formed by the core inflation rate, but the total inflation rate. Therefore, it is best to combine both inflation rates. This means that core inflation rate should not be the ultimate objective of monetary policy, instead it should be an intermediary target (Rich, 2005.). Core inflation should be a good indicator of current and future inflation trends.

3. Empirical experiences of other countries

Empirical studies show that the methodology for calculation of core inflation of one country should be completely applicable in another country. However, similar principle of exclusion of products is used, which shows extreme volatility within total components for calculation of official inflation. Products that are excluded most frequently are electricity and food.

Table no. 1 – Products that are excluded from the Cost of Living Index for the calculation of core inflation by countries

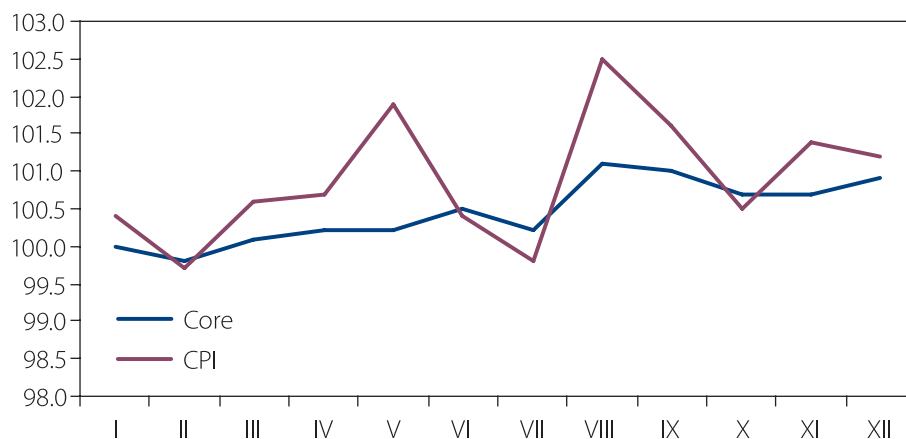
Country	Measurement of core inflation
USA	COLI – food and energy
Canada	COLI – food, energy, indirect taxes
Japan	COLI – fresh food
Germany	COLI – indirect taxes
Spain	COLI– energy and unprocessed food
Portugal	COLI– unprocessed food and energy
Peru	COLI – food, fruit, vegetables and city transport
Hungary	COLI – unprocessed food (pork meat, flour, cereals and bacon from the processed food), other seasonal products, electricity, fuel, pharmaceutical products
Croatia	COLI – food (agricultural products), electricity, oil derivatives, etc.
Serbia	RPI – seasonal food products, flour, electricity, cigarettes, fuel, medicines, etc.
Thailand	COLI – fresh food and energy
Columbia	COLI – agricultural products, public services and transportation

Source: Statistical bureaus and central banks

Serbia

For the calculation of core inflation rate, Serbia, as majority of countries, is using the system of exclusion of specific products whose prices are administratively regulated, as well as certain food products (seasonal food products, flour and some flour products, electricity, cigarettes, fuel, medicines, administratively regulated services). Index is calculated in the Statistical Office of the Republic of Serbia.

Graph no. 1 – Chain indexes for 2007

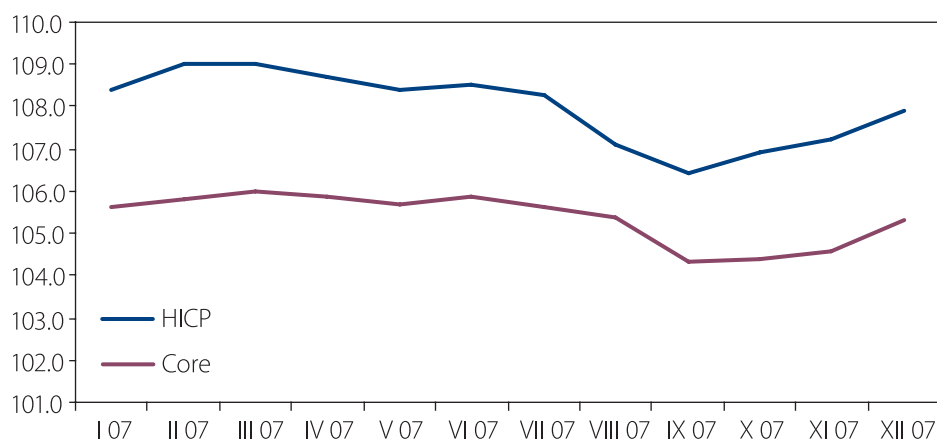


Source: Statistical Office of the Republic of Serbia

Hungary

Core inflation rate is calculated by excluding from the existing basket of consumer price indexes the following: unprocessed products, pork meat, flour, cereals and bacon from processed food, electricity, gas, other fuel, other seasonal products, pharmaceutical products that are compensated by the social insurance, etc. After the exclusion of these products, the sum of their ponders is proportionally distributed, in order for the sum to be 100% again.

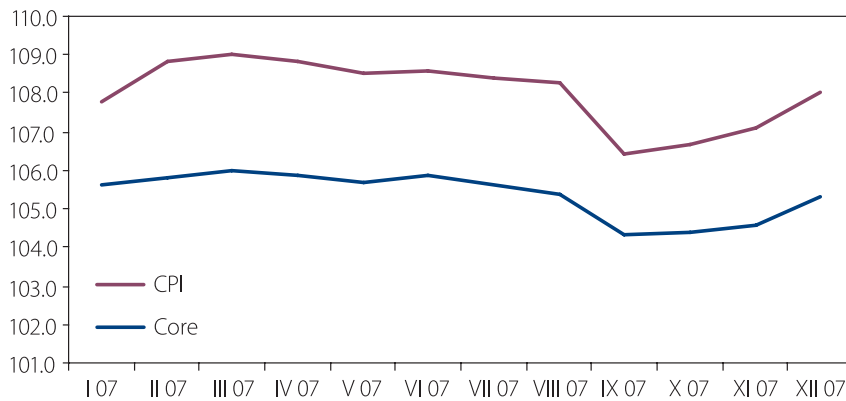
Graph no. 2 – Annual growth rate (month of 2007 compared with the same month of 2006)



Source: Bureau of Statistics of Hungary

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Graph no. 3 – Annual growth rate (month of 2007 compared with the same month of 2006)



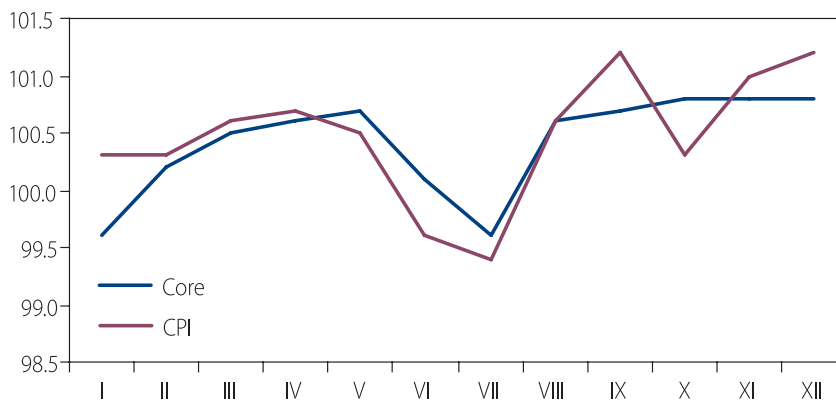
Source: Hungarian central statistical office

Presented graphs relate to the harmonized consumer prices index and consumer price index where it can be clearly seen that a difference between these indexes is negligible and that they equally show the relation between current and core inflation.

Croatia

Core inflation rate is calculated by the State Bureau of Statistics. It is obtained by excluding prices of agricultural products and administratively regulated prices from the basket of goods and services (used for calculation of total consumer price index). Administratively regulated prices, among other things, include electricity prices and prices of oil derivatives. Basket that is used for the calculation of consumer price index excludes 111 goods and services (basket for 2005). Highest percentage of excluded goods and services relates to administratively regulated prices. Zero ponder method has been applied.

Graph no. 4 - Chain indexes for 2007



Source: Bureau of Statistics and National Bank of Croatia

4. Methodology for calculating core inflation in Montenegro for 2007

Considering that the inflation measured by the cost of living amounted 7.7% in 2007, primarily due to the external shocks, the idea of creating the core inflation index is directed towards the achievement of two objectives:

1. Identify to what extent the Montenegrin economy is sensitive to external shocks of the increase of specific products prices of on the international markets (oil and oil derivatives), increase of administrative or specially regulated goods (electricity, fixed telephone impulses, medicines, utility services, etc), as well as to price movements of seasonal agricultural products. Therefore, basic objective is to quantify relative impact of prices of specific product categories (monetary policy has a limited impact) on the total inflation, expressed by the cost of living index.
2. Identify the level up to which the monetary instruments can impact the inflation, i.e. whether the predominant reasons for last year inflation in Montenegro were of external nature, or this is the case of long-term inflation.

Since the literature and international practice do not provide general consensus as to the exact number of products or product categories that should be excluded from the total basket, simulations have been developed based on the comparative analysis of forming core inflation in the neighboring, considering the specificities of Montenegrin economy.

First step in creation of the core inflation was the grouping of the basket of products that make up the cost of living index. In that regard, products have been divided to 81 groups of products, i.e. time series. Basic aim of this procedure was to determine volatility of movements of specific components of the cost of living index, in order to determine whether it is necessary to exclude some other groups of products that do not belong to those groups that, according to the theory, are excluded from the core inflation calculation.

Based on the comparative analysis and theoretical grounds, potential groups of products have been identified, which will be excluded from the creation of core inflation, namely: (i) agricultural products, (ii) administratively controlled products (medicines, flour, electricity, and fixed telephony), (iii) oil and oil derivatives. These products also represent important items in the Montenegrin import.

In accordance with the expectations, during the checking of time series in the period 2005 – 2007, it has been determined that these product groups can be divided into three subgroups. First group of products are those that have a stationary character (administratively established electricity prices) with significant structural breaks. Other group includes products that have a more significant fluctuation with long-term growing trend (oil prices), while the third group of products has a distinct seasonal character (seasonal fruits and vegetables).

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On the other hand, it is also necessary to check other product groups. Namely, if a group of products with important share (ponder) in the total cost of living index has a large fluctuation, core inflation will “capture” fluctuation of that group of products, i.e. it will not reflect the “average” movements of the group of products that make up the core inflation.

As shown in Table 2, the average cost of living index (excluding ponders of this group of products) amounted 107.07 on the annual level, while the standard deviation amounted 7.61 on average, or 6.75% of the index, which shows the significant fluctuation of the cost of living index on the annual level.

When we had excluded the products that are not part of core inflation from the total group of products that make up a basket of cost of living index, it was established that the basic fluctuation is positioned in these products.

Table no. 2 – Comparison of variability of total average cost of living index and external cost of living index

	Total (average) cost of living index	External cost of living index*
Average index value**	107.07	110.6
Average standard deviation	7.61	13.57
Share of standard deviation in the total index value (%)	6.75	11.81

** External cost of living index relates to the products that should be excluded from the core inflation, according to the prevailing practice (seasonal products, administrative, i.e. non-market defined products and products whose process is created on the international markets)*

*** Average index value implies the value of the cost of living index, where same ponder is given to each group of products*

Namely, average value of the core inflation index (not considering their ponders in the total cost of living index) of excluded products amounted 110.6, standard deviation 13.57, i.e. 11.81% of the index, which demonstrates that these products have the fluctuation that is significantly higher than the average. Out other products from the basket of core inflation index, only sugar has large fluctuation, with standard deviation of 18.02, i.e. 16.5% of the average value of the cost of living index, related to this product. Considering that the cost of this product is determined on the international commodities market, this was an additional argument for exclusion of this product. However, considering that the ponder of this product makes less than 1% of the total basket of goods (86 out of 10000), this product has not been excluded yet from the basket of goods, which is used as a basis for calculation of the core index of the cost of living. However, movements of the cost of living index for this product will be monitored as a potential product that doesn't belong to the basket of core inflation index.

4.1. Calculation of core inflation in Montenegro for 2007 and results obtained

Following the assessment of movements of the time series of basket of products that make up the cost of living index for 2007, we had two methodological options for creation of the core inflation index for 2007.

First methodology relates to the procedure of eliminating all products that are presumably not included in the core inflation index and to linear increasing of ponders of other products that are included in the index. Second approach is based on the redefining of ponders that are included in the cost of living index. According to this methodology, all products that are used for creation of the cost of living index, remain in the basket of goods of the core index of the cost of living. However, ponders that have been related to the cost of living index are changed in a way that each group of products is given new ponders whose size is inverse to the value of standard deviation of each group of products. Therefore, products that have large oscillations get smaller ponder, while the more “static” ones are given the bigger ponder. Both methods are very similar, where the main difference is that the first one is based on the theoretical assumptions of what the core inflation should represent, with the focus on monetary activity, while the second method is more sophisticated regarding the technical approach to the core inflation, i.e. the focus is not on the group of products that, as a rule, have to be excluded from the core inflation, but on the variability of time series of the group of products that have the impact on the fluctuation of total inflation.

Considering that in Montenegro products with highest values of standard deviations are products determined for exclusion from the basket of goods of core inflation index, it has been decided to apply the first method for the creation of the core inflation index.

In the simulation for 2007, two core inflation indexes have been created. First index is excluding agricultural products (permanent and seasonal), products with administratively established prices and products whose price is established on the international markets. Second index includes agricultural products in the core inflation, considering that the highest fluctuations in the previous period relate to the products with administratively regulated prices, as well as products whose price is established on the international markets.

Our assumption is that the core inflation index in the previous year was drastically lower than the cost of living index, considering that the increase of electricity, oil and oil derivatives, as well as some agricultural products, has caused the inflation in the second half of 2007. Obtained results are presented in the graph 5 and table no. 3.

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Graph no. 5 - Comparison of the cost of living index 2007-06 and core cost of living index 1 and external cost of living index

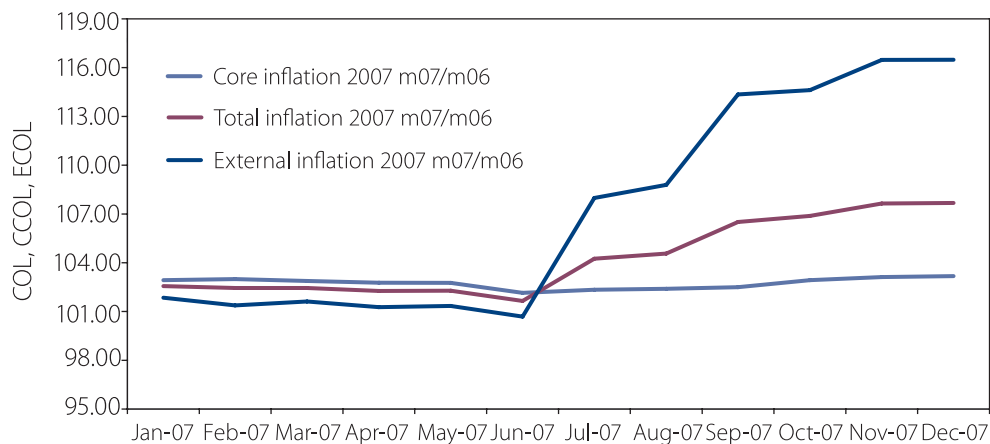


Table no. 3 – Comparison of the cost of living index 2007-06 and core cost of living index 1 and external cost of living index

Months	Core cost of living index 1 m07/m06	Cost of living index m07/m06	External cost of living index07/m06
Jan-07	102.9	102.6	101.8
Feb-07	103.0	102.5	101.4
Mar-07	102.9	102.5	101.6
Apr-07	102.8	102.3	101.3
May-07	102.8	102.3	101.3
Jun-07	102.1	101.7	100.7
Jul-07	102.3	104.3	108.0
Aug-07	102.4	104.6	108.8
Sep-07	102.5	106.5	114.4
Oct-07	102.9	106.9	114.6
Nov-07	103.1	107.6	116.5
Dec-07	103.2	107.7	116.5

In accordance with the expectations, external inflation, as we have called the index of movements of prices of products that have been excluded from the basket of products that make up the core inflation index, until July 2007 has been lower than the cost of living index (0.7 % that is 1.7%). However, after the increase of electricity prices, fixed telephone impulses and oil prices, core inflation has become significantly lower than the total inflation (3.2% that is 7.7% at the end of 2007), while the external inflation amounted 16.5%.

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Second core cost of living index includes agricultural products in the core inflation basket. The aim of monitoring of the second core inflation index was to isolate the group of products with the highest variability or structural changes (administratively, i.e. non-market determined prices), and that, at the same time, have a significant position in the total cost of living index. In this case, the difference between the core cost of living index and total cost of living index becomes more pronounced.

Graph no. 6 - Comparison of the cost of living index 2007-06 and core cost of living index 2

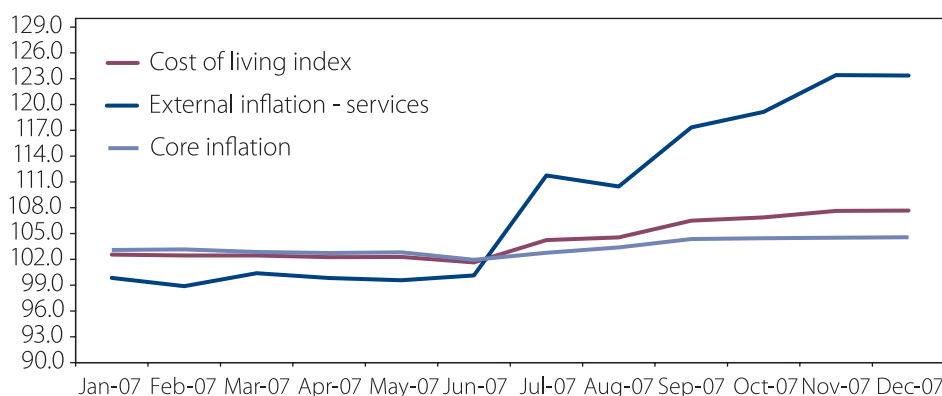


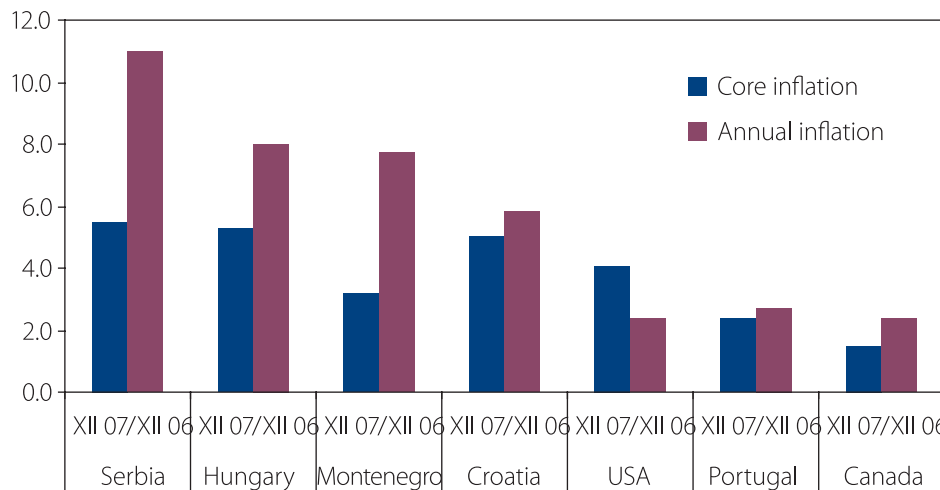
Table 4 – Comparison of the cost of living index 2007-06 and core cost of living index 2 and external cost of living index

Months	Core cost of living index1 m07/m06	Cost of living index 2 m07/m06	External cost of living index m07/m06
Jan-07	103.1	102.6	99.9
Feb-07	103.2	102.5	98.9
Mar-07	102.9	102.5	100.4
Apr-07	102.7	102.3	99.8
May-07	102.8	102.3	99.6
Jun-07	102.0	101.7	100.1
Jul-07	102.8	104.3	111.8
Aug-07	103.4	104.6	110.5
Sep-07	104.4	106.5	117.3
Oct-07	104.5	106.9	119.1
Nov-07	104.5	107.6	123.4
Dec-07	104.6	107.7	123.4

As shown in Graph 6 and Table 4, with the exclusion of agricultural products, core cost of living index is getting closer to the total cost of living index (4.6% that is 7.7%), while the value of the external cost of living index becomes significantly higher (23.4% in December 2007) which is

confirming the assumption that most of price variations that have caused the inflation in the second half of the year relates to the change of prices of electricity and fixed telephone lines (non-market determined prices). However, we think that more importance should be given to the first index, since in the next period greater fluctuations are expected of the prices of agricultural and food products on the international market.

Graph no. 7 – Comparison with other countries



Source: Bureaus of statistics and central banks

5. Concluding remarks

Establishing core inflation represents a step forward in the analysis of the inflation in Montenegro, considering the limited impact of monetary policy in the euroised economy. This will also provide additional information for the creation of monetary policy and economic policy in general.

It is very important to identify which inflation elements cannot be treated, under any circumstances, with the limited monetary or fiscal policy instruments. Based on the analysis of the core inflation, it becomes clear that the impact of administratively established prices is very strong. To be more precise, structural breaks of these prices make the inflation variation in Montenegro very pronounced (December 2005 and July 2007). In that regard, gradual approach should be considered for the harmonization of these prices, because the increase (especially without prior announcement) of prices of products and services of 100% (telephone services at the end of 2004) or the increase of electricity prices of more than 30% (in July 2007), particularly if it happens together with some other external shocks (increase of oil and oil derivatives prices) has a negative impact on the inflation expectation and projections. Gradual elimination of price disparities will

have an impact on the lower level of inflation expectations. Also, it should be considered that it is very important for Montenegro to eliminate all price disparities prior to joining the European Union, in order to “qualify” for the membership in the European monetary union as soon as possible. Such policy inevitably leads to the higher inflation rate. In any case, useful experience of some Baltic countries that have been meeting the inflation criteria for years, and once they joined the European monetary union, they didn’t managed to meet this criteria.

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