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THE INFLATION RATE DETERMINED AS A CHANGE IN THE GDP DEFLATOR AND IN CPI

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Abstract: *The paper aims at presenting two of the most applied methods in determining the inflation rate, based on the GDP deflator and Consumer Price Index, and comparing the calculation proceedings, advantages and drawbacks of each of them. Even if the results are close as a value, the structures of consumption taken into account in measuring each index are quite different, one of them evaluating the price raise for all the goods/services produced inside the country borders, the other starting the calculations by composing a typical market basket for a typical urban consumer.*

Key words: *GDP deflator, consumer price index, typical market basket, inflation rate.*

1. Introduction

In economics, inflation is a rise in the general level of prices of goods and services in an economy over a period of time. At the consumer level, inflation is perceived as a decline in the purchasing power of the money. Important to be measured, different methods to estimate price raise amplitude have been used, but two of them are customary: inflation rate starting from the GDP deflator, and from consumer price index. The calculation method is different in each case, and also the results vary in some limit, depending on the chosen system.

2. Objectives

The inflation rate calculated from the CPI and GDP deflator, even if it does not vary too much as a value, presents a significant difference between the abilities of each index to capture a consumer's consumption choices when a change in price occurs. The CPI uses a fixed basket of goods from some base year, meaning that the quantities of goods and services consumed remain the same from year to year in the CPI composition, while the price of goods and services changes. This type of index, where the basket of goods is fixed, is called a Laspeyres index.

The Laspeyres price index, P_L, is defined as:

$$P_L = \frac{\sum_{i=1}^{n} p_i^t q_i^0}{\sum_{i=1}^{n} p_i^0 q_i^0} = \sum_{i=1}^{n} (p_i^t / p_i^0) s_i^0$$

where s_i^0 denotes the share[4)] of the actual expenditure on commodity i in period 0: that is $p_i^0 q_i^0 / \sum p_i^0 q_i^0$.

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The GDP deflator, on the other hand, uses a flexible basket of goods that depends on the quantities of goods and services produced within a given year, while the prices of the goods are fixed. This type of index, where the basket of goods is flexible, is called a Paasche index.

The Paasche index, P_P, is defined as:

$$P_P = \frac{\sum_{i=1}^{n} p_i^t q_i^t}{\sum_{i=1}^{n} p_i^0 q_i^t} = \left\{ \sum_{i=1}^{n} \left(p_i^t / p_i^0 \right)^{-1} s_i^t \right\}^{-1}$$

where s_i^t denotes the actual share of the expenditure on commodity i in the period t; that is, $p_i^t q_i^t / \sum p_i^t q_i^t$. The Paasche index is a weighted harmonic average of the price relatives that uses the actual expenditure shares in the later period t as weights.

While both of these indices (GDP deflator and CPI) work for the calculation of inflation, neither is perfect. The paper aims at presenting the calculation steps in both cases, and the differences between them regarding the covering area, accuracy, drawbacks or advantages.

3. Material and Methods

Inflation is defined as the process of considerable and persistent growth of the price level.

Price increase during the interval is a tendency, not a rule for all the goods and services meant to be sold, meaning that some products may present reductions in the price level, others may remain at the same price, but the general effect is an increase in the average level of the prices.

The subject of price measurement is constituted by all goods and services intended to be sold on the market, but their structure on categories, range, quantities varies depending on the calculation method selected. There may be taken into account either all the goods and services from the internal production, or a predetermined (typical) basket of goods which represents the average expenditure for consumption of a typical urban consumer. In the first case, the calculation of the inflation rate is based on the GDP deflator, in the second case it is based on the Consumer Price Index (CPI).

GDP is calculated as:

- the sum of the added value at every stage of production (the intermediate stages) by all the industries within the country, during a year;
- the sum of total expenditure for all final goods and services produced within the country, during a year (private consumption, investment, government spending and net exports);
- the sum of the income generated by production in the country, during a year.

Using market value in finding GDP has both advantages and disadvantages. The advantages stem from the possibility of totalizing quantities of different items, evaluated by different measurement units. The disadvantages result from the irrelevancy of data time series comparison, because the obtained values, named nominal values, include at the same time price changes during the period, and the real internal product growth.

In the attached table (Annex 1) is presented the nominal GDP evolution, during 1989-2007. Analysed only in itself, the data series cannot provide a real image of the economy's yearly productive capacity. Even if constantly nominal GDP values are above the previous ones, statistical data have only small fluctuations, in addition or in minus, of the real GDP size. Therefore, by applying the real GDP growth rate to the previous real GDP, is generated a data series for the annual internal production volume,

evaluated in the current year prices. In this manner, inter-temporal comparisons may be made.

In order to determine the GDP deflator, it is also necessary to calculate real GDP data series, not related to a common, a base year, but to the previous year, for estimating the value of the same volume of products and services in a year with the prices from the previous year. By dividing the nominal GDP to the real GDP value, results the GDP deflator, and after subtracting 100 from the GDP deflator we may have the image of the annual growth rate of the prices, for the goods and services that compose the GDP.

Another manner to determine the annual inflation rate consists of analyzing the price evolution of the goods and services considered to be part of the typical market basket of a typical urban consumer, during a year[1)]. The economic indicator is entitled Consumer Price Index (CPI), calculated for Romania by the National Institute of Statistics (NIS).

To determine CPI and the inflation rate, one must follow these steps:

- settling the composition of the market basket for a typical consumer;
- finding prices for the goods and services composing the basket;
- calculating the total cost of the market basket;
- choosing a base year and calculating CPI;
- determining the inflation rate.

CPI is a Laspeyres type index of a fixed base, calculated by the Romanian National Institute for Statistics as a price average based on a goods and services basket, its structure being modified at the beginning of the current year (t) with the results of Family Budgets Statistical Survey made two year ago (t-2). In this manner, a good/service frequently consumed will have a greater weight inside the consumption basket, and its price change will determine a stronger impact on the CPI. The basket is divided into 3 groups (food, non-food and services), classified in 35 subgroups, totalizing about 92-94 expenses positions [2)].

Inside the typical market basket, the managed prices items category occupies a quite big percentage (in 2006, food group had 40,7% in total, and non-food and services with managed prices had 20,6%).

Statistical survey uses the following samples [6)]:

- sample of localities: comprises 42 localities from urban area, from which have been selected 68 surveying centres;
- sample of observation units: about 6400 units of which 86% are under private ownership;
- sample of goods and services: 1730 assortments having significant weight in population consumption.

One of the main reasons for compiling a CPI was to compensate wage-earners for inflation by adjusting their wage rates in proportion to the percentage change in CPI, a procedure known as indexation. For this reason, official CPIs tended to become the responsibility of ministries of labour worldwide, but most are now compiled by national statistical offices. A CPI that is specifically intended to be used to index wages is known as a compensation index.

Even if GDP deflator and CPI are indicators measuring the same thing (price level), they have different values. The difference results from the distinct structure of the goods and services composing every each of them.

1) While GDP deflator refers to goods and services produced within the country, CPI reflects the prices of goods

and services bought by consumers, including the imported ones [3)].

2) GDP deflator has a covering area bigger than CPI, including price movement in all national economy, but it is a belatedly indicator, due to the period of time after that information regarding GDP are available, and successive variants emitted regarding the level of accuracy.
3) GDP deflator compares the price of the goods and services produced in the current period, with the prices of the same items from a base period.

CPI compares the price of the typical market basket with the one registered in the previous period. NIS changes the composition of the market basket only after a long interval of time. However, even the shares of different items quantities remain the same, during a year, because of the price changes substitution processes are occurring, leading to the alteration of the weights of different goods/services are counted with in the mass of the index.

4) Also for GDP deflator, and for CPI, price growth is measured in a gross manner, only for its volume, without underlining the part of prise raise due to the technologic evolution, quality improvement, innovation, novelty. For instance, in statistics are registered only price raises for electronic equipments, without taking into account their technologic evolution. But the price raise due to the performances improvement is not a inflation process.
5) The accuracy of measuring inflation based on CPI depends on de representativity of the market basket. However, even if at the beginning this was representative, in time the structure of the consumption often change, but the typical basket is maintain the same, consequently its representativity will decrease.

Innovation leads to more goods and services on the market, persons have to choose between many more alternatives, and the consumers allocate money more efficient in the process of taking the purchase decision, in order to keep up the same standard of living. By holding the same typical market basket, CPI doesn't reflect the change in the purchasing power of the money.

Inflation rate has different values depending on the calculation method, and is different felt among diverse social categories. The perception of price increase is subjectively and varies from a consumer to another. A family with low income feel the inflation pressure by the food price raising, while a household with medium or high incomes also perceive the services price increase [3)].

In the urban area, persons are strong affected by the price increase at public utilities (gas, electricity, water). In rural area, people are more affected by base products price increase, or for the price increase of those activities or resources that contribute in the agricultural labour.

In the next table is presented the price evolution (CPI evolution) for the categories composing the typical market basket of the consumer, during 1998-2006.

It may be noticed that at the beginning of the interval, the highest increase rates were registered for education, communication, hotels-restaurants expenses, gradually the index rearranged, in the last years the highest increases were for utilities and dwelling maintenance, beverages and tobacco, transport expenses.

Consumer price indices, for groups of goods and services according to COICOP[1)] classification Table 1

	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Food and soft drinks	147,6	126,2	144,0	136,1	118,3	114,6	109,4	106,1	103,8
Beverages and tobacco	149,8	161,5	129,7	131,1	117,4	122,1	116,2	112,1	117,9
Clothing and footwear	171,6	132,2	129,8	128,0	115,6	111,8	107,6	104,8	103,9
Dwelling maintenance, water, electricity, gas and other fuels	172,1	195,1	163,6	134,2	136,5	119,8	121,5	119,1	114,4
Furniture and household appliances(including repairs)	153,2	143,2	131,8	127,7	118,3	110,6	107,5	105,6	102,7
Health	164,8	141,6	159,0	137,6	119,5	113,9	98,2	102,0	98,8
Transport	151,9	164,0	141,6	139,2	131,1	118,0	112,9	114,0	106,2
Communications	302,6	189,5	152,8	135,6	112,4	113,4	110,4	98,0	98,6
Leisure, rest and culture	162,1	159,2	150,6	126,3	119,9	102,0	109,7	107,2	105,5
Education	361,4	305,1	153,5	140,7	121,8	111,8	112,0	106,1	109,5
Hotels, restaurants and cafes	211,1	158,4	152,1	143,9	127,4	116,6	114,1	113,1	107,9
Miscellaneous goods and services	161,7	158,7	140,0	130,3	121,3	113,6	109,3	106,5	104,2

[1)] COICOP classification means Classification of Individual Consumption by Purpose, used by EUROSTAT.

Source: Romania Statistical Yearbook 2007, National Institute for Statistics, Romania.

4. Conclusions

Both CPI and GDP deflator are current methods in determining inflation rate. GDP deflator may be used in order to cover the price movement of all the intern production, while CPI is a better image of a bigger expense of a consumer in procuring the necessary goods and services for living.

Statistically, inflation rates published are those calculated starting from CPI, one of the reasons being the possibility of adjusting the level of incomes with the same percentage as the price raise, this way maintaining the purchasing power of the consumers. Another important reason is that CPI has the same structure in every year, while GDP is a macroeconomic indicator affected both by quantities variation, and price increase.

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Calculus of inflation rate using GDP deflator and CPI

Annex 1

Years	Nominal GDP (ROL billion, RON million since 2002)	GDP annual growth rate (as percentage against previous year)	Real GDP (against 1989) (ROL billion)	Real PIB (against previous year) (ROL billion, RON million since 2002)	GDP Deflator	CPI	Inflation rate (based on GDP deflator)	Inflation rate (based on CPI)
1989	800		800,0	800,0	100,0	101,1	0,0	1,1
1990	858	-5,6	755,2	755,2	113,6	105,1	13,6	5,1
1991	2.204	-12,9	657,8	747,3	295,0	270,2	195,0	170,2
1992	6.029	-8,8	599,9	2.010,0	300,0	310,4	200,0	210,4
1993	20.036	1,5	608,9	6.119,4	327,4	356,1	227,4	256,1
1994	49.773	3,9	632,6	20.817,4	239,1	236,7	139,1	136,7
1995	72.136	7,1	677,6	53.306,9	135,3	132,3	35,3	32,3
1996	108.920	3,9	704,0	74.949,3	145,3	138,8	45,3	38,8
1997	252.926	-6,1	661,0	102.275,9	247,3	254,8	147,3	154,8
1998	373.798	-4,8	629,3	240.785,6	155,2	159,1	55,2	59,1
1999	545.730	-1,2	621,8	369.312,4	147,8	145,8	47,8	45,8
2000	803.773	2,1	634,8	557.190,3	144,3	145,7	44,3	45,7
2001	1.167.687	5,7	671,0	849.588,1	137,4	134,5	37,4	34,5
2002	152.017	5,1	705,2	122.723,9	123,4	122,5	23,4	22,5
2003	197.428	5,2	741,9	159.921,9	119,4	115,3	19,4	15,3
2004	247.368	8,5	805,0	214.208,9	115,8	111,9	15,8	11,9
2005	288.955	4,2	838,8	257.757,5	112,2	109,0	12,2	9,0
2006	344.651	7,9	905,0	311.782,0	110,6	106,6	10,6	6,6
2007	412.762	6,2	961,1	366.018,9	112,7	104,8	12,7	4,8

Source: statistical data provided by National Institute for Statistics and National Bank of Romania, and own calculations.