ANALYSIS OF THE INTERDEPENDENCE BETWEEN GDP AND INFLATION

Assoc. prof. Mădălina-Gabriela ANGHEL PhD.
„ARTIFEX” University of Bucharest
Assoc. prof. Florin Paul Costel LILEA PhD.
„ARTIFEX” University of Bucharest
Maria MIREA PhD. Student
Bucharest Academy of Economic Studies

Abstract

The Gross Domestic Product, considered to be the most complex indicator of results at the level of a country depends, in its chronological evolution, on a series of factors. Thus, it is important to establish the participation of each resource to the formation of GDP, quarterly and/or annually. Also, it is interesting to ascertain what is the structural influence on the evolution of GDP, of all uses, in the analysis of economic growth. As a principle, three possibilities exist. The growth on the expense of consumption consists in the fact that, by increasing consumption, more taxes are collected and, thus, the incomes to the general consolidated budget will grow. Also, the en-gross and retail trade will increase and thus, the gross value added, as source of budget incomes orientation, will grow. The modality to economically increase, in a simpler manner, the GDP, on the basis of consumption, is specific to the countries having a weakly structured economy, with low general incomes at the level of population. In such states, as is Romania, the increase of incomes, especially of the salary (minimum, net average or gross average), leads to the increase of consumption and finally, to economic growth. The second path of economic development is the increase of investments, in general, and especially of the foreign direct investments. The safest way to achieve investments’ growth is the attraction of foreign capital and the access to structural funds, as member of the European Union (UE-28). This alternative is limited and depends on the conditions provided by Romania, the guarantee of foreign investments, of the capital and possibility to regenerate the profit and the realized investments. Therefore, the legal framework, as provision and stability, forms an argument in attracting foreign direct investments. The third variant of economic growth is the mixed on, that is on the basis of correlated increase of consumption and investments depending on the economic potential of the country in that moment. As conclusion, we can state that the increase of GDP is desirable and if a positive evolution is ensured, then economic growth is realized.

Key words: Gross Domestic Product, inflation, correlation, variable, consumption, investment.

JEL Classification: E31, E60
Introduction. Literature review

Gross Domestic Product, for each period, is calculated in current prices but, for comparisons over time, the effects of the inflation, the market stability, must be considered.

For these necessities, GDP is deflated, that is the removal of the inflation’s effect. Thus, between GDP and inflation rate, a reverse statistical correlation exists. As the inflation ratio is higher, the value of GDP in real terms decreases.

In this paper, following the correlation analysis based on data series and graphical representation of data, we have developed a study using the simple linear regression model, in which GDP ($Y_i$) is the dependent resultant variable, while the inflation ratio ($X_i$) is the factor variable. The linear regression function follows the shape:

$$Y_i = a_i + b_i x_i + \varepsilon_i$$

where:
- $a_i$ = free regression parameter;
- $b_i$ = correlation parameter (coefficient);
- $Y_i$ = dependent variable, GDP in this case;
- $X_i$ = factorial variable, the inflation ratio;
- $\varepsilon_i$ = residual variable.

By taking into account these aspects, the function of the simple linear regression model ensures a complete, analytical approach, through the use of calculated regression parameters.

is a reference document for economic modeling. Arcidiacono and Miller (2011) research some characteristics of the dynamic discrete choice models. Ascari and Ropele (2009) pursue a study on the trend inflation. Dobrodolac (2011) considers the role of econometric models as support for the forecast function of the management. Tugcu and Ozturk (2015) analyze the macroeconomic impact of the policies oriented towards inflation targeting, their study is supported by evidence from countries with income above middle level.

Research methodology and data

The last time there was a development of studies to analyze the link between inflation and how it affects economic development. It is known that between inflation and economic growth in the long term there is a negative relationship.

In the analysis that we made in this research we considered GDP as the dependent variable and its influence on the inflation rate (as the independent variable) on a series of dates between the years 1991 to 2016, data was published by the National Institute Statistics.

Annual consumer price index measures changes of prices for purchased goods and tariffs for services used by the population in the current year over the previous year (or another year chosen as the reference period). This index is calculated as a ratio, expressed as a percentage, between the average price index for the current year and the average index of the previous year (or another year chosen as the reference period). Since 1992, the average price index of a given year is calculated as the simple arithmetic average of the monthly indices that year, calculated as against the same basis (October 1990 = 100).

The annual inflation rate is calculated by subtracting 100 from the annual index of consumer prices.

GDP and inflation rate in Romania during 1991-2015

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</thead>
<tbody>
<tr>
<td>GDP in comparable prices (mil lei)</td>
<td>74,7</td>
<td>201,06</td>
<td>612,13</td>
<td>2082,35</td>
<td>5332,61</td>
<td>7953,1</td>
<td>10911,4</td>
<td>25152,9</td>
<td>37108,3</td>
</tr>
<tr>
<td>Inflation rate (RI)%</td>
<td>170,2</td>
<td>210,4</td>
<td>256,1</td>
<td>136,7</td>
<td>32,3</td>
<td>38,8</td>
<td>154,8</td>
<td>59,1</td>
<td>45,8</td>
</tr>
</tbody>
</table>
Years  | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  
GDP in comparable prices (mil lei) | 56808,2 | 85820,2 | 124461,5 | 161061,7 | 215374,8 | 259125,1 | 313889,3 | 370821,8 | 453638,3 
Inflation rate (RI) % | 45,7 | 34,5 | 22,5 | 15,3 | 11,9 | 9,1 | 6,6 | 4,9 | 7,9 

GDP in comparable prices (mil lei) | 487331,1 | 506446,5 | 539520,4 | 568719,4 | 616393,3 | 656318,6 | 692617,4 | 759227,6 
Inflation rate (RI) % | 5,6 | 6,1 | 5,8 | 3,4 | 3,2 | 1,4 | -0,4 | 1,4 

Source: National Institute of Statistics

Consider a simple linear regression function $Y = f(X)$, where $Y = GDP$ is endogenous variable, dependent, and $X = the \ inflation \ rate$, an exogenous and independent variable.

The regression function obtained from model has the form:

$$ GDP = a + b \ RI + \epsilon $$

Using a dedicated econometric analysis software we studied the evolution of GDP and inflation in the period 1991-2016, through graphics, but also through descriptive indicators.

The results of statistical tests performed to GDP during 1991-2016

In the period 1991-2016 the average value of GDP in Romania was 267,577 mn, a range with 74.7 million lei in 1991 and 759,227.6 million lei in 2016, with a standard deviation of 262,557.7 million lei. Analyzed time series values do not follow a normal distribution, Skewness asymmetry coefficient value of 0.45 is higher than zero, series presenting an asymmetry to the left.
The average value of inflation during 1991-2016 was 49.58% with a variation interval between 256.1% (peak in 1993) and -0.4% (minimum level reached in 2015) and a standard deviation by 72.16 percentage points. Skewness asymmetry coefficient is 1.66, resulting in a positively skewed to the left.

Statistical tests on inflation ratio (RI), 1991-2016

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<tbody>
<tr>
<td>Mean</td>
<td>49.58077</td>
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<tr>
<td>Median</td>
<td>13.6000</td>
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<tr>
<td>Maximum</td>
<td>256.1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.4000</td>
<td></td>
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<tr>
<td>Std. Dev.</td>
<td>72.16634</td>
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<tr>
<td>Skewness</td>
<td>1.662792</td>
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<tr>
<td>Kurtosis</td>
<td>4.500260</td>
<td></td>
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<td></td>
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<tr>
<td>Jarque-Bera</td>
<td>14.41948</td>
<td></td>
<td></td>
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<tr>
<td>Probability</td>
<td>0.000739</td>
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</table>

Representation of the two indicators, and the coefficient C (2) = -2165.13, show us the meaning of the relationship between the two variables, we can say that there is a inverse correlation between GDP and the inflation rate, meaning that an increase in the inflation lead to a drop in GDP and opposite, with a decrease of the inflation, the GDP value is higher.

GDP and RI correlation

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Analysis of the two series was made using the specialized software and the results are shown in the table below.

**Regression parameter estimation**

<table>
<thead>
<tr>
<th>Dependent Variable: GDP</th>
<th>Method: Least Squares (Gauss-Newton / Marquardt steps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: 03/11/17</td>
<td>Time: 10:26</td>
</tr>
<tr>
<td>Sample: 1991-2016</td>
<td></td>
</tr>
<tr>
<td>Included observations: 26</td>
<td></td>
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<tr>
<td>GDP = C(1)+C(2)*RI</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>382316.9</td>
<td>49514.47</td>
<td>7.721317</td>
<td>0.0000</td>
</tr>
<tr>
<td>C(2)</td>
<td>-2314.200</td>
<td>573.0470</td>
<td>-4.038412</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

R-squared, lower than 0.4046, is the coefficient of determination; thus 40.45% shows the influence of inflation on GDP, the difference shows influences of other factors.

The standard errors calculated, corresponding to the estimated parameters (standard error C(1) and standard error = 49,514.47 C(2) = 573.04) parameters are used to test the significance of the regression function. The two estimators meet test as probability values Prob (F-statistic) = 0.000478.

In testing the validity of the model is used F statistics, which is calculated through three variations: the variation explained by the model, the residual variance and the total variance. F = 16.30 value model is statistically significant for a probability of 95% guarantee results because F significance has a value (0.000478) is very close to zero.

\[
\text{GDP} = 382,316.9 - 2314.200 \times \text{RI}
\]

The negative value of the parameter b (C2) results an inverse relationship between GDP and inflation rates, moreover if the inflation rate would increase by 1 percentage point, the GDP would decrease by 2134.200 million.

R-squared, lower than 0.4046, is the coefficient of determination; thus 40.45% shows the influence of inflation on GDP, the difference shows influences of other factors.
Conclusions

Using the simple linear regression we discover that between National Gross Domestic Product and the national rate of inflation is a strong correlation, which has an inverse influence. During the analyzed period there were years with high rate of inflation with an influence on the evolution (reduction) of National Gross Domestic Product. For a short period (2014-2016) as a result of same administrative measure, the rate of inflation decreased or recorded a stability. We can’t consider that the economy of Romania was in a period of disinflation, as it is defined scientifically.

As a general conclusion we say that the econometric model of simple linear regression is an efficient one and the result of the analysis is confident enough for national macroeconomic management.

References