STUDY OF THE CORRELATION BETWEEN GROSS DOMESTIC PRODUCT AND INFLATION

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Abstract

The national economy operates primarily on the basis of factors of production as defined by Cobb Douglas in the theory of the function of production. The harmonization of the correlations between the three factors of production (capital, labour and resources) is likely to ensure economic growth as well as maintaining macrostability.

Any outburst of the correlation between the three factors can lead to distortions of the national economy and to the appearance of other phenomena of decrease or negative influence of the economic situation.

The purpose of this article is precisely to ensure that the correlations between the main sectors of activity of the national economy with a focus on the supervision of the National Central Bank and the very important correlation between the required money supply and the existing money supply on the market.

The article highlights a number of issues that come to substantiate the views expressed by the authors in this study.

Keywords: *factors of production, macrostability, correlations, sectors of activity, money supply, national economy, crises.*

JEL classification: *E20, E50.*

Introduction

Macrostability is a matter of great importance for any country's economy. In the case of Romania, macrostability also suffered in the context of the economic and financial crisis from 2008-2011. Then the incomes decreased, the expenses increased and consequently the satisfaction of the needs of the quality of life deteriorated.

Understanding from Cobb Douglas's work on the production function that there must always be a close correlation, interdependence, between the three elements, namely capital, labour and resources, we realize that in conditions of crisis resources begin to appear, especially financial ones from increasingly low and also, the gross formation of fixed capital is a difficulty.

This is the aim of this article to emphasize that destabilization occurs through the deterioration of these elements at the macroeconomic level.

Macroeconomic stability is an important element because the fundamental law of the free market shows that there must be a permanent correlation between supply and demand, but in crisis conditions this correlation is affected and therefore we must look at how the correlations must be established. That is why we followed this aspect taking into account several aspects regarding macroeconomic correlation, which must be stabilized or at least controlled and influenced in order to ensure macrostability.

As a methodology we used statistical methods that reveal the macroeconomic proportions that are established between the macroeconomic aggregates, seeking to influence through macroeconomic programs the situation. Also, comparative studies as well as graphical representations are an important element in the methodology used.

This topic is one that remains relevant and should be deepened in the coming periods, adding new data and extending the research stage to more than has been done in this article.

Literature review

The macroeconomic proportions and correlations are adjusted in the market economy according to its fundamental law, the correlation between supply and demand. In any field of the national economy the correlations between different sides (branches) are adjusted according to this legitimacy of the free market. Maintaining proportions and correlations is the basic condition for ensuring macrostability at the level of any country. A number of researchers, over time and internationally, have paid attention to the way in which macroeconomic proportions and correlations have evolved and their effect on macroeconomic stability. Thus, Anghelache, C., Anghel, MG (2016) published a paper on aspects of macroeconomic correlations, in the broader context of statistical-economic analysis, and Anghelache, C., Mitrut, C. and Voineagu, V. (2013) undertake a study on the system of national accounts, giving ample space to the presentation of macroeconomic correlations and proportions and their effect on maintaining macro-stability at the macroeconomic level. Bardson, G. and collaborators (2005) address these issues in a paper that addresses the use of econometric models in the study of macroeconomic phenomena. Heiberger, RM, Holland, B. (2004) publish a study on statistical analysis using databases, and Koukkiotis, A., Lyroudi, K., Papasyriopulus, N (2012) undertake an analysis on the correlation that exists between inflation , Gross Domestic Product and the effect on economic growth in the member countries of the European Union. Romer, C, and Romet, D. (2010) address issues regarding correlations in the context of the effect of the taxation system on economic growth, and Sergent, T. (1999) refer to

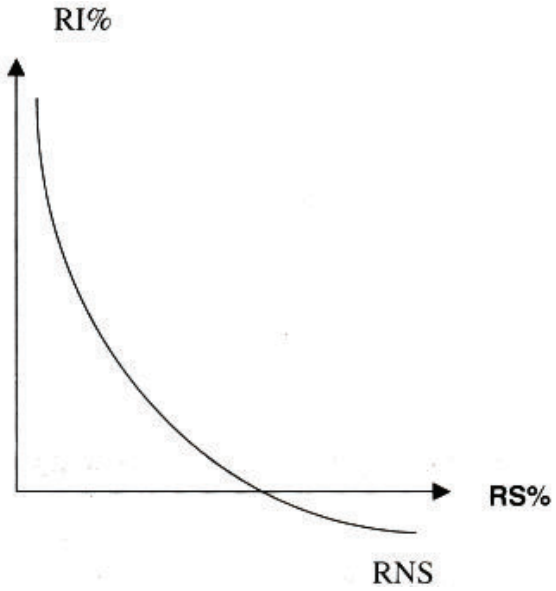
macroeconomic proportions and correlations in the paper on macroeconomic theories and studies. Of course, other economists and researchers approach this topic, but I limited myself to presenting only a few of them, which seemed to me to be representative.

Methodology, data, results and discussions

The analysis of the series of statistical data, especially those in developed countries until 1913 when the oil shock occurred, highlighted the existence of an inverse, simple and stable correlation between the inflation rate and the unemployment rate. In other words, there would be a compensatory relationship between inflation and unemployment, which is that lower unemployment can be achieved by accepting higher inflation or inflation can be reduced by accepting more unemployment. This inverse correlation is shown by the Philips curve, shown in graph number 1.

Short-term Philips curve

Chart 1



The compensation relationship of the type shown graphically is valid only in the short term and has the following form:

$$RI_t = RI_{t-1} + \alpha(RS_t - RNS) \quad (1)$$

In these conditions, the current inflation rate (*RI*) depends on two factors, namely an inertial component, defined by the expected inflation, which can be replaced by the previous inflation. (RI_{t-1}) and a cyclical component, defined by the deviation of current unemployment (RS_t) compared to the natural unemployment rate (RNS).

It is observed from the formula that as long as unemployment remains at its natural level, the inflation rate does not change. Correspondingly, if the unemployment rate rises above its natural level, then the inflation rate will register a certain reduction that depends on the parameter α (the decreasing slope of the Philips curve).

After the oil shock of the 1970s, it was noticed that the relationship between inflation and unemployment is not so simple. The inflation rate is actually influenced by a third factor (ε) namely the shocks felt in aggregate supply (changes in nominal GDP due, for example, to sharp increases in prices for some products).

$$RI_t = RI_{t-1} - \alpha(RS - RNS) + \varepsilon \quad (2)$$

Thus, in the long run, inflation and unemployment may not respect the inverse correlation deduced by Philips in certain periods. The evolution of the two variables will be based on a series of Philips curves drawn on the subperiods (short term).

The average levels recorded on the inflation rate and the unemployment rate in Romania can be analysed through the prism of the Philips curve.

In the same vein, in order to highlight the correlation that exists between the evolution of the Gross Domestic Product and inflation in Romania, we further resorted to a statistical-econometric analysis that can highlight the dependence that exists between the two macroeconomic indicators. Thus, the data on the evolution of the two variables over a period of sixteen years were structured in table number 1.

Evolution of GDP and inflation in the period 2005-2020

Table 1

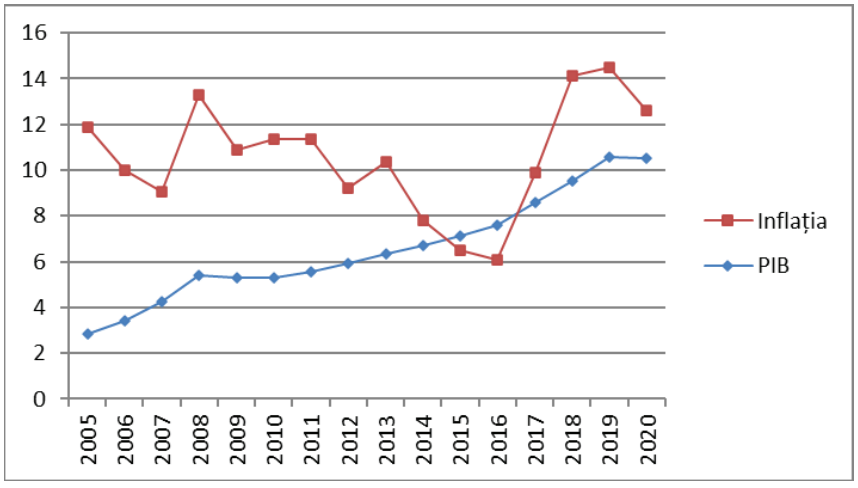
Year	GDP	Inflation
2005	286861,9	9
2006	342762,6	6,6
2007	425691,1	4,8
2008	539834,6	7,9
2009	530894,4	5,6
2010	528514,5	6,1
2011	558889,9	5,8
2012	591799,1	3,3
2013	634967,8	4
2014	669703,9	1,1
2015	711929,9	-0,6
2016	763652,5	-1,5
2017	857895,7	1,3
2018	951728,5	4,6
2019	1058190,3	3,9
2020	1053881,4	2,1

Source: INS. Data processed by the author

For a better visualization of the evolution of the two indicators, graph number 2 was made.

Evolution of GDP and inflation in the period 2005-2020

Chart 2

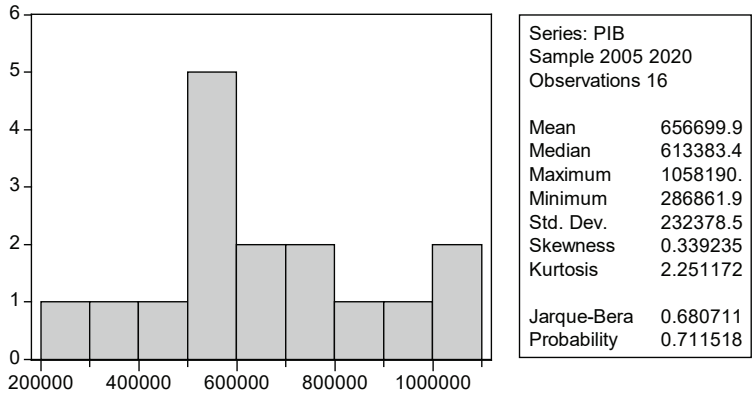


Interpreting the data structured in table number 1 and represented in graph number 2 we find that the Gross Domestic Product had a positive trend in the period under analysis with some syncope's during the financial crisis

of 2008-2010 and the current economic and financial that was generated of the pandemic crisis of 2019. At the same time, inflation had an oscillating evolution, and in 2020 registering a certain decrease, although the trend changes according to the data we have for 2021. Next in graph number 3 is presented the histogram of the evolution of the Product Gross Domestic Product of Romania in the period 2005-2020.

Histogram of the evolution of the Gross Domestic Product of Romania in the period 2005-2020

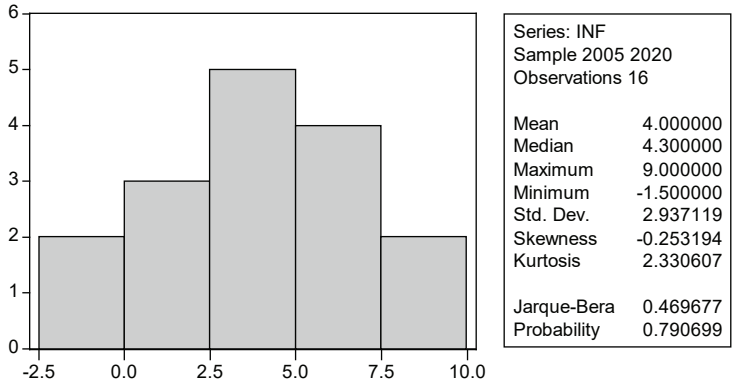
Graph 3



Interpreting the data from graph number 3 we find that regarding the Gross Domestic Product of Romania in the period between 2005 and 2020, it has a slower distribution aspect confirmed by the value of 2.25 less than 3 of the Kurtosis test and symmetrical aspect confirmed by the Skewness test.

Histogram of the evolution of inflation in the period 2005-2020

Chart 4

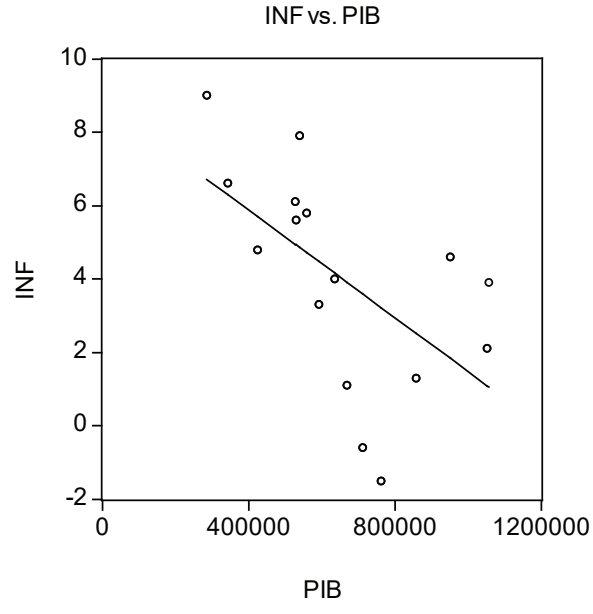


Interpreting the data from graph number 4 we find that inflation in the period between 2005 and 2020 has a slower distribution confirmed by the value of 2.33 less than 3 of the Kurtosis test and symmetrical aspect confirmed by the Skewness test.

The correlation between GDP and inflation is shown in graph number 5.

Correlation between GDP and inflation

Chart 5



In graph number 5 it can be seen that the point cloud related to the values recorded by the two macroeconomic indicators studied a straight line, which allows us to continue the study, making a statistical-econometric analysis, using a linear simple regression model, which has the following form:

$$PIB = a + b \cdot INF + \varepsilon \quad (3)$$

Where: PIB (Gross Domestic Product) is the dependent variable;
INF (Inflation) is the independent variable;
a and b are the regression parameters;
ε represents the residual variable.

Both for estimating parameters *a* and *b*, respectively $\hat{a}$ and $\hat{b}$, using the least squares method, as well as to test the significance of the model we used the statistical-econometric analysis program EViews, and the results are presented in figure number 1.

Results of the GDP dependence analysis of inflation

Figure 1

Dependent Variable: PIB
Method: Least Squares
Sample: 2005 2020
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	840567.8	84465.93	9.951560	0.0000
INF	-45966.99	17210.19	-2.670917	0.0183
R-squared	0.337554	Mean dependent var		656699.9
Adjusted R-squared	0.290236	S.D. dependent var		232378.5
S.E. of regression	195773.0	Akaike info criterion		27.32377
Sum squared resid	5.37E+11	Schwarz criterion		27.42034
Log likelihood	-216.5901	F-statistic		7.133796
Durbin-Watson stat	0.427288	Prob(F-statistic)		0.018267

According to the results presented in figure number 1, I conclude that the model is a good one and can be used in estimating the evolution of GDP. This aspect is confirmed both by the values significantly different from zero recorded by the estimated parameters, and by the statistical tests F-statistic and t-Statistic whose values are higher than those tabulated. In the same order of ideas, according to the data in figure number 1, we can estimate the theoretical values of the dependent variable, according to the relation:

$$\widehat{PIB} = 840567.8 - 45966.99 \cdot \widehat{INF} + \varepsilon \quad (4)$$

The minus sign of the inflation coefficient indicates the negative effect that this independent variable has on the evolution of the Gross Domestic Product.

Conclusions

From the study of the article ***Study of the correlation between Gross Domestic Product and inflation*** carried out on the basis of extensive research taking into account what other researchers have developed before the author, some conclusions emerge. First of all, maintaining macrostability is an essential element of macroeconomic management. Measures must be taken in the sensitive links of macroeconomics, in risk areas to avoid the degradation of variables or branches of the national economy that no longer meet the requirements of maintaining macro-stability.

At the same time, the correlation between the main sectors of activity is one that must be supervised from a financial-monetary point of view. It is well known that when the correlation between the required money supply and the money supply in circulation deteriorates in one direction or another, inflationary problems arise, problems arise with regard to other distortions in the functioning of the free market. The National Bank of Romania is the one that you have to see permanently when maintaining these correlations at the level of the national economy.

References

1. Anghelache C., Anghel M.G. (2016). *Bazele statisticii economice*. Concepte teoretice și studii de caz, Editura Economică, București.
2. Anghelache C., Mitruț C., Voineagu V. (2013). *Statistică macroeconomică. Sistemul Conturilor Naționale*, Editura Economică, București.
3. Bardsen, G. și colaboratorii (2005). *The Econometrics of Macroeconomic Modelling*, Oxford University Press, ISI Newsletter, Volume 31, Number 2(92)/2007.
4. Heiberger R.M., Holland B. (2004). *Statistical Analysis and Data Display*, Springer, Berlin.
5. Koulakiotis A., Lyroudi K., Papasyriopoulos N. (2012). „*Inflation, GDP and Causality for European Countries*", International Advances în Economic Research, Volume 18, Issue 1, 53-62.
6. Romer C. and Romer D. (2010). „*The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks*", American Economic Review, no. 100 (3), 763–801.
7. Sargent T.(1999), *Macroeconomic Theory*, Second Edition, Academic Press, Boston