ANALYSIS OF THE CORRELATION BETWEEN THE GROSS DOMESTIC PRODUCT AND THE NUMBER OF UNEMPLOYED

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Abstract

Any economic strategy must include a set of measures aimed at maintaining macroeconomic proportions and correlations for employment, the use of the capital factor, as well as the resources available to Romania.

Failure to comply with macroeconomic proportions and correlations may at some point lead to the creation of unsalable stocks, insufficient production in some areas of activity and especially employment by categories of specialization and qualification.

Of course, the calculated statistical indicators highlight precisely these possibilities to respect the macroeconomic proportions and correlations. There are a number of proportions that need to be interpreted statistically such as the correlation between GDP growth and unemployment, the correlation between growth and inflation, the basic correlation of economic growth or the study of the interconnections of external balance of payments indicators and macroeconomic aggregates of results. At the same time, at the level of the national economy, the aim must be to maintain the correlation stage and the monetary field. Therefore, the connections established between the sources of monetary and banking data must be carefully monitored, which must ensure a fair relationship between the need for money supply and the existing money supply in the market. This task falls primarily to macroeconomic management, but also to central banks.

The monetary situation is of the utmost importance, especially in the context in which it is known that the financial economic crisis of 2008-2010 was caused by the money supply surplus, especially in dollars, existing on the world market in accordance with the money supply needs expressed in dollars that the world economy needed.

At the same time, the monetary situation and the connection between the consolidated money supply and the balance of internal and external payments must be carefully monitored, so that there is no excess money supply on the market, which will eventually lead to inflation.

At the same time, at the level of the national economy, the main correlations that are established between the monetary aggregates must be

taken into account, so that the money market is fairly managed and fed with a surplus of money or withdrawal of money from the market.

In this article we have sought to substantiate the need to maintain macroeconomic correlations and proportions, so as to avoid macroeconomic destabilization. This danger is all the greater today as we face a developing health and financial-monetary crisis.

Introduction

Macroeconomic proportions and correlations are a lever, the basis of the evolution of any country's economy. Of course, under free market conditions, the main correlation between supply and demand is established by the market with periods that can lead to some negative effects until this correlation is re-established.

There are other correlations that must be analysed and studied each time in order not to exceed the possibility of ensuring their maintenance in a controllable bed. For example, a country's financial situation depends very much on its own resources and the resources it has at its disposal.

In the conditions of the economic-financial and pandemic crisis, the governments like the one of Romania in extreme situations resort to loans, sometimes with quite high interest rates. This will increase Romania's internal and external public debt and speaking of it is currently 57% of Gross Domestic Product. When it will approach 60% or exceed this threshold we can talk about entering into insolvency.

The purpose of this article, the main objective, was to establish the current state of macroeconomic proportions and correlations, how they have evolved so far and especially to detect evolutionary trends for the next period. These must be done, first of all, in close correlation with the effects that the health and economic-financial crisis will have, which will continue throughout 2021, but maybe also in the following years.

That is why the study of this evolution must be done very carefully using the methodology provided by the National Institute of Statistics and Eurostat using a series of statistical methods and models such as index method, comparison method, structural analysis method, correlation analysis method. or the use of regression.

The method of graphical representation will help even more to properly understand and interpret the situation in the Romanian economy.

Literature review

Macroeconomic proportions and correlations are a basic condition for maintaining macrostability. In certain periods of time, disturbances appear that influence the maintenance of these correlations and determine the impairment of the macroeconomic balance. This aspect was researched by a number of specialists, who started from various aspects to identify the causes of destabilizing effects. This problem of maintaining macroeconomic proportions and correlations arises especially in times of crisis, such as the pandemic and financial-economic crisis that the world economy is currently going through. Thus, Anghelache, C., Capanu, I. (2000) approached extensively aspects regarding the economic indicators used in the micro and macroeconomic analyzes, and Anghelache, C. Mitrut, C., Isaic-Mniu., Al., Voineagu, V .and Dumbrava, M. (2007) conducted and published a comprehensive macroeconomic analysis on correlations and macrostability in the national economy. Anghel, .M.G., Anghelache, C. (2019) conducted a study on the effect of the external balance of payments on economic growth, in other words the correlation between net exports and changes in Gross Domestic Product. Faigelbaum, P., Grossman, G. and Heplman, F. (2011) published a study on income distribution, quality of products and services in international trade. Hili, A., Lahmandi-Ayed, R., Lasram, H. (2016) conducted a study on the correlation of the labor factor with other production factors domestically and internationally. Jones, Ch., Klenow, P. (2010) performed an analysis on the evolution over time of the population's well-being according to the macroeconomic results over time. Moreno-Galbis, E., Tritah, A. (2016) paid attention to the influence of immigration within the European Union on the stability of the workforce in each country, as well as on the community as a whole. Walker, A., Maltby, T (2012) conducted extensive research in the field of demography focusing on the prospect of population growth in European Union member states.

Methodology, data, results and discussions

Any economic program includes a set of policy measures designed to achieve the main objectives of macroeconomic policy, which are usually: growth, employment, price stability and improving the external balance of payments. These objectives are quantified by four fundamental variables, also called key macroeconomic variables, which measure, correlate and analyse the performance of any economy, namely GDP growth rate, unemployment rate, inflation rate and current account balance of payments.

The four objective variables allow the assessment of the main internal and external macroeconomic imbalances, the monitoring of the changes that

have taken place in the economy and the formulation of the corresponding policies in order to achieve the future objectives.

Important macroeconomic correlations are established between the four variables. There are also close links between them and other macroeconomic indicators.

Next, we will analyse the correlation between the GDP growth rate and the unemployment rate.

Theoretically, the connection is clear: when an economy is in a recessionary phase, characterized by a slowdown in GDP growth (GDP), the unemployment rate (RS) increases; when economic expansion takes place, GDP increases, while RS decreases. This inverse (negative) correlation is known as Okun's law. Analysed in the conditions of the US economy, the law materialized in the following relation:

$$RPIB_{t/t-1} = 3\% - 2(RS_t - RS_{t-1}) \tag{1}$$

where: $RPIB_{t/t-1}$ represents the growth rate of GDP in period t compared to period t-1
3% represents the GDP growth trend (relative trend over time)
RS_t, RS_{t-1} represents the unemployment rate in period t, respectively t-1

So, if unemployment remains the same, GDP will increase by about 3%. For each percentage point increase in the unemployment rate, the GDP rate will decrease by 3 percentage points compared to 3%. For example, if RS increases in the current period from 6% to 8%, then real GDP will be -1%: *RPIB* = 3-2(8-6) = -1%

The previous relationship can be written in another way:

$$RS_{t-1} = RS_t - 0,5(RPIB_{t/t-1} - 3) \tag{2}$$

It is observed that unemployment in the current period will be higher or lower compared to the previous period, as GDP will be higher or lower than the growth trend (3%). In other words, if the scrubbing is to be reduced by 1 percentage point, the GDP must reach 5%:

$$RS_{t-1} = RS_t - 0,5(5 - 3) \tag{3}$$

This relationship has a statistical character, not being valid for any country, but only for the USA and only for the stage in which Okun did the research. Such a statistical relationship can be deduced for each country, depending on the specific conditions of the stage it goes through.

The analysis of statistical data, in the conditions of the Romanian economy in recent years, led us to the conclusion that the Okun law is valid, but in a specific form. First, the trend of economic growth was considered the average annual rate of GDP growth in the period 1980-1989, calculated at the level of 1.4%. Secondly, in the period 1990-1993 no stable statistical relationship can be determined between the GDP growth rate and the unemployment rate, so the inverse correlation between the two variables is obvious. Thirdly, since 1994, an Okun-type relationship can be established between the change in the unemployment rate and the change in the growth rate of GDP relative to the trend, with the specification that the link is time lag (out of phase): GDP growth in period t, above the trend (1.4%), led to a reduction in unemployment in the next period t + 1. Thus, the deduced relationship is as follows:

$$RS_{t-1} = RS_t - \alpha(RPIB_{t/t-1} - 1,4) \tag{4}$$

where: $\alpha \in (-0,4; -0,45)$

In other words, the increase of the GDP rate in year t by 1% above the trend level ensured a reduction of the unemployment rate in year t + 1 by about 0.4%. Moreover, the change in GDP only partly explains the evolution of the unemployment rate. Much stronger was the influence it exerted on the unemployment rate than the average bank interest rate on loans to businesses. A direct correlation with a strong intensity was identified between the two variables.

Next, we structured in table number 1 the data regarding the evolution of GDP and the number of unemployed in the period 2005-2020.

**Evolution of GDP and number of unemployed in the period 2005-2020**

Table 1

Year	GDP	Nr. Unemployed
2005	286861,9	522967
2006	342762,6	460495
2007	425691,1	367838
2008	539834,6	403441
2009	530894,4	709383
2010	528514,5	626960
2011	558889,9	461013
2012	591799,1	493775
2013	634967,8	512333
2014	669703,9	478338
2015	711929,9	436242
2016	763652,5	418237
2017	857895,7	351105
2018	951728,5	288896
2019	1058190,3	257865
2020	1053881,4	296051

Source: INS. Data processed by the author

For a better visualization of the evolution of the two indicators, graph number 1 was made.

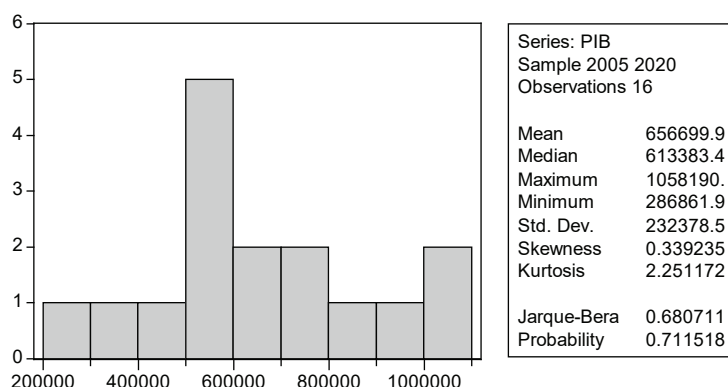**Evolution of GDP and number of unemployed in the period 2005-2020**

Chart 1
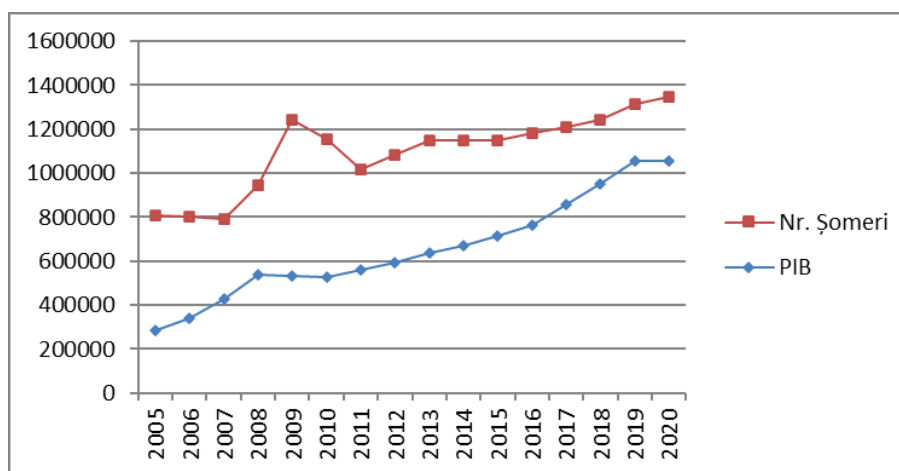
Interpreting the data structured in table number 1 and represented in graph number 1 we find that the evolutions of the two macroeconomic indicators have an inverse proportional relationship, fact confirmed by the increase in the number of unemployed during periods of crisis when Gross Domestic Product decreases and also decreases of the unemployed during periods of economic recovery. Next I will present and analyse the histograms of the two indicators subject to analysis.

Histogram of the evolution of the Gross Domestic Product of Romania in the period 2005-2020
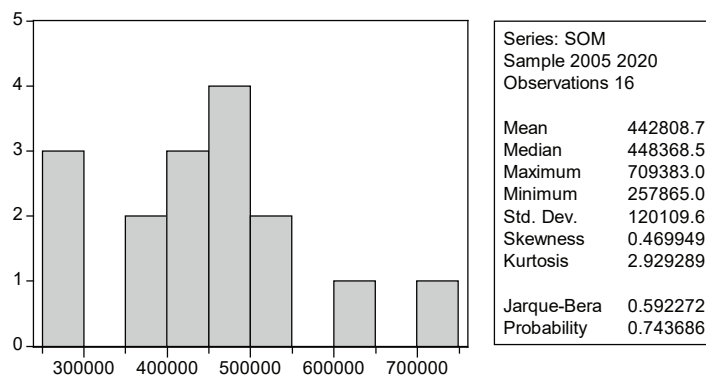
Graph 2

Series: PIB	
Sample 2005 2020	
Observations 16	
Mean	656699.9
Median	613383.4
Maximum	1058190.
Minimum	286861.9
Std. Dev.	232378.5
Skewness	0.339235
Kurtosis	2.251172
Jarque-Bera	0.680711
Probability	0.711518

We find that regarding the Gross Domestic Product of Romania in the period between 2005 and 2020, it has a symmetrical distribution aspect confirmed by the Skewness test and a slightly slower aspect confirmed by the value of 2.25 of the Kurtosis test.

Histogram of the evolution of the number of unemployed in the period 2005-2020

Graph 3

|	
Series: SOM	
Sample 2005 2020	
Observations 16	
Mean	442808.7
Median	448368.5
Maximum	709383.0
Minimum	257865.0
Std. Dev.	120109.6
Skewness	0.469949
Kurtosis	2.929289
Jarque-Bera	0.592272
Probability	0.743686

We find that the evolution of the number of unemployed in the period between 2005 and 2020 has a somewhat symmetrical distribution confirmed by the Skewness test and a slightly slower aspect confirmed by the value of 2.92 of the Kurtosis test.

The correlation between GDP and the number of unemployed is shown in graph number 4.

Correlation between GDP and the number of unemployed

Graph 4

SOM vs. PIB
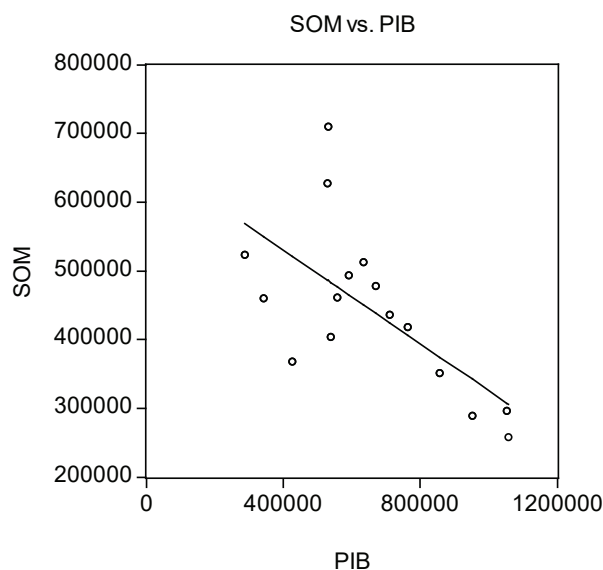
We notice in the graph above that the point cloud related to the values recorded by the two macroeconomic indicators studied a straight line, which allows us to continue the study, making a statistical-econometric analysis, using a simple linear regression model, which has the following form:

$$PIB = a + b \cdot SOM + \varepsilon \tag{5}$$

where: PIB (Gross Domestic Product) is the dependent variable;
SOM (number of unemployed) is the independent variable;
a and b are the regression parameters;
ε represents the residual variable.

To estimate the regression parameters and to test the significance of the model we used the statistical-econometric analysis program EViews, and the results are presented in figure number 1.

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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1221377.	178030.1	6.860508	0.0000
SOM	-1.275216	0.388860	-3.279370	0.0055
R-squared	0.434441	Mean dependent var		656699.9
Adjusted R-squared	0.394044	S.D. dependent var		232378.5
S.E. of regression	180890.8	Akaike info criterion		27.16564
Sum squared resid	4.58E+11	Schwarz criterion		27.26222
Log likelihood	-215.3252	F-statistic		10.75427
Durbin-Watson stat	0.512518	Prob(F-statistic)		0.005483

From the analysis of the results obtained and presented in figure number 1 we find that the values recorded by the estimated parameters are significantly different from zero and the statistical tests F-statistic and t-Statistic have higher values than those tabulated, which implies that the model is one good and can be used to estimate GDP growth. The estimation of the theoretical values of the dependent variable is done according to the relation:

$$\widehat{PIB} = 1221377 - 1.275216 \cdot \widehat{SOM} + \varepsilon$$

(6)

The high value of the free time coefficient indicates that there are other factors that influence the evolution of the Gross Domestic Product, which were not taken into account. Also, the minus sign of the coefficient of the variable number of unemployed indicates the negative effect that this independent variable has on the evolution of the Gross Domestic Product.

Conclusions

The data presented in this article, ***Analysis of the correlation between the Gross Domestic Product and the number of unemployed***, leads to a series of theoretical and practical conclusions. First of all, it is found that during the pandemic and economic-financial crisis there is a danger of distortions between the main correlations and macroeconomic proportions.

This can happen in the relationship between supply and demand, in correlating income with the consumer price index, to bring in real income, the correlation between consumption and investment, and between the need for jobs to absorb unemployment and lack of financial resources which should be the basis for the creation of new jobs and in this way the improvement of the situation of the Romanian economy.

Macroeconomic propositions and correlations can deteriorate rapidly in the context of no action being taken where the trend is out of control.

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