

STATISTICAL ANNALISYS OF THE CORRELATION BETWEEN GDP, PRODUCTIVITY AND BRUTE INVESTMENTS AT THE LEVEL OF OLTENIA REGION*

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Abstract: This article try to put in debate the problem of obtaining a balanced development of the regions from a country by using correlation models which include variables like: GDP, productivity, brute investments etc. The purpose is to find the most important variables that can strongly influence the evolution of GDP at the regional level and also can be use to do that in practice. The base of this debate is a statistical analysis realized on Oltenia region at general level and at the level of almost every activity sectors.

Key words: GDP, productivity, brute investments, correlation, statistical analysis

Every country of the world wants to have a balanced development of their regions. This fact is not so easy to achieve because of many factors. First, we have to measure the actual development stage of each region, using dedicated set of variables that can be utilized at the level of each region. Second, we have to identify that variables what can influence the development of each region at the general level and activity sector level also. In fact, we must build a model for development at level of each region. That work can be started by building models based on correlation between the variables what can measure the development of region and variables what can cause this effect.

Romania is not an exception, it have the same problem of development. It has many regions with very different stage of development and it want to obtain a balanced development that correspond to the European policy also.

Even we go gradually by focusing first only on one region and try do build such a correlation model we must override many obstacle like: choosing the variable what will be included in the model, determining the availability of data at the level of region, at the level of each activity sector from the region and for entire period of time also.

For this initial study we were selected the South-West region of Romania: the Oltenia region.

Like we anticipated, the choice of the variables that can be included in the correlation model was hard to do because of the restrictions. One of that was the impossibility of obtaining data corresponding to the entire period of time at the level of all economical sectors and at the level of Oltenia region for all variables included initially. Also, even for the selected variables it does not succeed the study of all economical sectors because of the impossibility of collecting the necessary data. An

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example for this kind of sector, with an important weight (15,87%) in formation of the regional GDP is the *Agriculture, hunting and silviculture* sector.

For eliminating the distortions generated by the inflation, the influence of inflation was eliminated at the level of all affected variables included in the correlation, for the entire studied period of time, by recalculating their values in comparable prices at the level of 2005 year. From all the variables selected initially, only the productivity (W) and brute investments (IB) was the variables that can be used.

The analysis of the correlation between of the GDP and the productivity and brute investments highlighted the following:

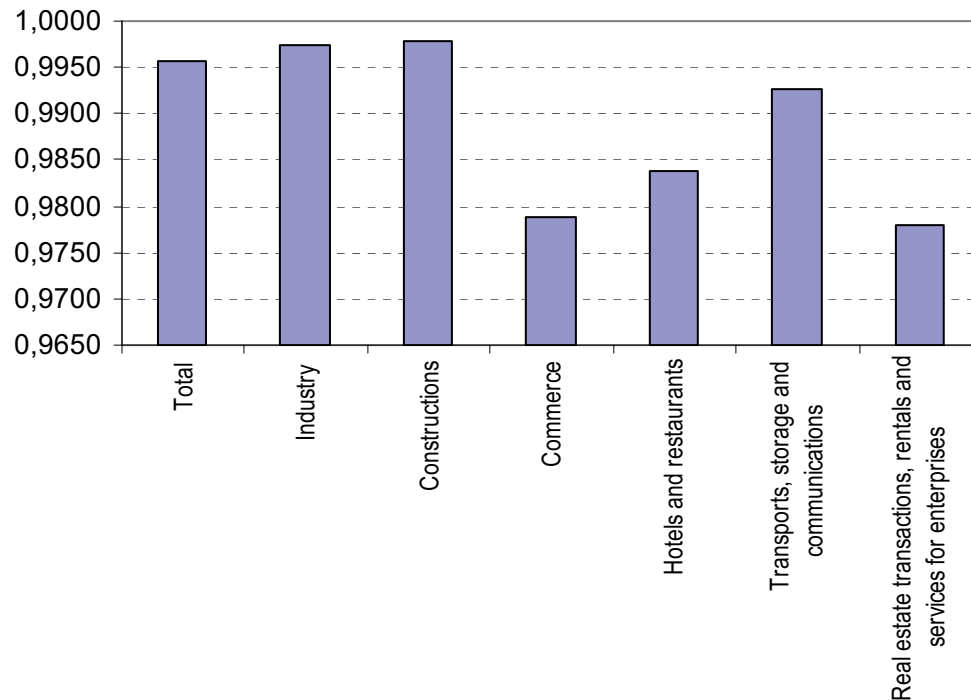


Figure no.1. The multiple correlation rapport for each economical sector at the level of Oltenia region

At general level there are a very strong dependence between the cause variables and GDP (determination coefficient 0.9916, multiple correlation rapport 0.9958). The identified regression model is presented below:

$$PIB = 0,1361 \times IB + 229136,9974 \times W$$

We must underline from the beginning that the IB variable has a small influence about the change of GDP comparing with the W variable. This fact is due to the way that the cause variables act on the effect variable. While the W variable has an immediate influence on GDP (the effect can be observed in the same year), the influence of IB variable on GDP is not visible, and the exception is the last analyzed sector.

After testing the correlation rapport, is turned out that its value is significant. Testing the signification of the regression coefficients we found that the value of regression coefficient associated with IB variable cannot be considered significant. By continuing the analysis and determining the partial correlation coefficients we confirm this conclusion. Based on their values we can say that the GDP is significant influenced

by the W variable (the value of the partial correlation coefficient 0.7638), while for IB variable the value of partial correlation coefficient is -0.03. This situation is not a normal one and it can be explained by the fact that the investments realized does not produced the waited results, case in witch we can say that either the investments were normal finalized but the insertion of them were not in that sectors witch would be permit the obtaining of significant and long duration effect, or the investments were not proper finalized even if them were realized in the sectors witch would be permit the obtaining of the desired effects.

At the economical sector level, like at the general level, the dependence between analyzed variables is visible, direct and is characterized by a strong intensity (with values between 0.9978 and 0.9979).

The obtained results are presented in the following table:

| Economical sector | R | R ² | Partial correlation coefficients | | Regression model |
|----------------------------------------------------------------|---------------|----------------|----------------------------------|---------------|-------------------------------------------|
| | | | PIB←IB | PIB←W | |
| Total | 0,9958 | 0,9916 | -0,0304 | 0,7638 | PIB = 0,1361 × IB +229136,9974 × W |
| Industry | 0,9974 | 0,9948 | -0,4335 | 0,7378 | PIB = -0,0641 × IB +83287,1806 × W |
| Constructions | 0,9978 | 0,9955 | 0,2023 | 0,9599 | PIB = 0,1304 × IB +24921,5237 × W |
| Commerce | 0,9788 | 0,9580 | 0,4829 | -0,2916 | PIB = -0,6866 × IB +14324,3977 × W |
| Hotels and restaurants | 0,9838 | 0,9678 | 0,3337 | -0,4452 | PIB = -1,3347 × IB +6081,928 × W |
| Transports, storage and communications | 0,9927 | 0,9854 | 0,0154 | 0,6571 | PIB = 2,3599 × IB +13909,7604 × W |
| Real estate transactions, rentals and services for enterprises | 0,9779 | 0,9563 | 0,8771 | -0,4565 | PIB = 2,2736 × IB +58333,8171 × W |

After testing, the correlation rapport proved to be significant at the level of each sector. Analyzing the regression coefficients values corresponding to the two variables we observe again that the productivity variable (W) is the one with the greatest influence. Also, we must highlight the fact that the sector where W has the greatest influence is the *Industry* sector, followed by the *Real estate transactions, rentals and services for enterprises*. The productivity variable has the lowest influence at the level of *Hotels and restaurants* sector.

Going deeper with the correlation analyze by using the partial correlation we highlight that the IB variable has a low influence on GDP. The exception is the last analyzed sector (*Real estate transactions, rentals and services for enterprises*) where the recorded value is 0.8771.

In the W variable case, the partial correlation confirmed the direct and strong dependence but not in the following sectors:

- *Commerce*
- *Hotels and restaurants*
- *Real estate transactions, rentals and services for enterprises*

where the dependence highlighted would be an inverse and weak intensity one. However the W variable evolution is an ascendant one in all three situations, the GDP

does not following the same trend because it is stronger influenced either by the IB (see the case of the last analyzed sector) or by other variables not included in regression model.

Finally, we can say that the determined model permit a limited control on GDP. There are a few elements which permit to achieve greater values for that, like:

At the general level

- the main utilization of productivity factor for obtaining an immediate effect on GDP
- the utilization of IB factor for obtaining durable effect on GDP

At the level of activity sectors

- the use of resources for increase the values of IB and W first in the sectors what determine the main modification of Oltenia region's GDP. The right order of these sectors is:
 1. *Industry*
 2. *Agriculture*
 3. *Real estate transactions, rentals and services for enterprises*
 4. *Transports, storage and communications*
 5. *Commerce*
 6. *Constructions*

Only one from all elaborated and tested models achieve the greatest precision at the region level but also at the level of each analyzed activity sectors. By using this model we realized the prognosis for 2006-2008 period. The conclusions are presented below:

At the regional level:

- the number of employees, after 2004 (year with the smallest value) will slowly grow. In 2008 the number of employees will raise at the level close to the one recorded in 1998;
- the turnover will continue to grow, like it done it along entire analyzed period of time, highlighting the fact that the economical sector has already a solid base made by the small and medium enterprises;
- the brute investments - the factor what was unvalued along analyzed period of time, will suffer important changes having a 4 years periodicity. The year 2008 will be the nearest year when the brute investments will heavy grow;
- the productivity will continue to slowly grow along of the 2006-2008 period. In 2008 will reach values twice bigger than the values recorded in the 1998;
- based on the evolution presented above, the GDP will slowly grow in the years 2006-2008.

At the activity sectors level

- the GDP will grow at the level of every activity sectors, except the *Hotels and restaurants* sector where the GDP level will maintain constantly. The biggest grows of GDP will be recorded at the level of *Industry* and *Real estate transactions, rentals and services for enterprises* sector;
- the IB factor had an accentuated variation at the level of every sector. In almost all cases the tendency was to maintain constant values (this is the case for *Transports, storage and communications* sector) or to slowly increase (this is the case for *Real estate transactions, rentals and services*

for enterprises and Hotels and restaurants sectors). The exception is the *Industry* sector where the tendency was a non-linear one with a minimum point in 2002. For this sector, in the 2006-2008 period, the tendency of IB is to grow more than in the rest of the sectors. The growth of IB in the *Commerce* sector follows after growth of IB in the *Industry* sector.

- the productivity has recorded at the level of every sector a growing tendency that will maintain even in the 2006-2008 period of time. The biggest grows was determined at the level of the following sectors (in descendent order):
 - *Commerce*
 - *Industry*
 - *Hotels and restaurants*
 - *Transports, storage and communications*
 - *Real estate transactions, rentals and services for enterprises*

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