

OPPORTUNITIES FOR ANALYTICAL COMPARISON IN THE NATIONAL ECONOMIES OF BULGARIA AND ROMANIA

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Abstract

In the current economic situation the comparison of the degree of economic development between the countries in United Europe is becoming more up-to-date. New approaches and tools for such comparison are being developed.

This article offers a possible approach, focusing on the statistic analysis of growth and differences. It is based on the modification of this method of analysis, proposed by V. Tzonev and T. Kunaliev. The method has been adapted for the needs of international comparative analyses in order to compare the GVA growth (Gross Value Added) based on growth sources in R. Bulgaria and R. Romania for the period from 2002 to 2007. The adjusted method is (has been) applied in three directions of analysis, focusing on their cognitive values. This specific comparative study has taken them into consideration, interpreting in details the obtained results.

Keywords: analysis of growth, analysis of the growth of average and total value of indicator by source of growth, sub-total source of growth, structural effect, Gross value added at constant prices, employed by economic sectors, value added by employee

JEL classification: C43, F43

1. INTRODUCTION

The economic changes in Europe that have been observed since the end of the XXth century through the beginning of XXIst century confront the statisticians with new assignments, related to the international comparative studies. The globalization processes, the establishment of a single European Union and the different degrees of economic development of the various EU Members States challenge the statistic research technologists. They deal mainly with generation of data, which enable the comparison of different macroeconomic indicators, characterizing a variety of aspects of the development of the Member States. The EU enlargement, including a new group, the so-called "newly acceded countries" gave rise to the issue of the introduced structural changes in these economies which are still under way.

R. Bulgaria and R. Romania belong to this group of Member States. Both countries have a lot of similarities and differences. The main differences are related to the various structures of the national economies and the levels of labour productivity per sector, at the time when the changes in their economies were initiated. The researchers are interested in the issue of the degree of efficiency of the structural changes carried out in both countries. How the degree of difference in these structures has been changing in the course of the years? Are there any alignment processes observed? This article is dedicated to these issues.

2. REGARDING A POSSIBLE METHOD FOR ANALYTICAL COMPARISONS OF NATIONAL ECONOMIES

There are different approaches and aspects to compare the degree of economic development of the different countries. In the statistic theory and practice, several methods of comparison of the Gross Domestic Product (GDP) of different countries were offered and applied under the *International Comparison Project*, which has been implemented since 1968. Most of the methods enable the comparison of the levels and the structures of the ultimately used GDP; however they are not applicable for the comparison of the level of labour productivity at the sector level, but only for the economy in general. As it is well known in order to compare the levels of the physical volume of GDP in different countries some prerequisites are necessary, which are difficult to achieve in the part of uniform price level for evaluation of GDP. This problem is settled by the statistic literature by means of the index method of analysis. Therefore structures related with the purchasing power parity of the currencies are applicable. This is the target group of the method of M. Gilbert and I. Kravis, used in their famous studies on comparing the national product and the price level [Gilbert, Kravis 1954, 337], the method of Geary-Khamis¹, the EKS² method - named after the three scholars Eltető, Köves and Szulc et al. The last one was adopted by Eurostat and OECD within the Program on European Comparative Studies (PECS). In general the above-mentioned comparison methods are "evaluation methods" related to GDP revaluation.

Other international comparisons make use of the so-called "Short-Cut" Methods, most of which are based on the regression and correlation methods of analysis. They result in comparatively rapid and relatively precise estimates of the levels of economic development in different countries. As a rule, this group of methods is treated not as an alternative, but to a certain extent as supplementary methods for revaluation of the indicators [Sirakov, Raynova, Radev, 1989, 69]. Here we could point out the method of I. Kravis, A. Heston and R. Summers [Kravis, Heston and Summers, 1982, 116]³, the method of F. Janossi [Janossi, 1971]⁴, further developed by E. Ehrlich [Ehrlich, 1968, 207] et al.

A third group of methods are based on the multiple analysis methods, applying the so-called mixed indicators, in order to resolve the difficulties associated with the single currency expression of the macroeconomic indicators and the problems arising thereof⁵.

This article offers another possible approach, stepping on the statistical analysis of growths and differences. **The Method of Analysis of Growths and Differences** is not a new method for the Bulgarian statistic society. This method was proposed by V. Tzonev and T. Kunaliev and it is being discussed in the Bulgarian statistic studies. The key ideas of the method were focused by T. Kunaliev [1974, 173-203]; [1976, 77-92]; [1978, 18-36]; [2003, 31-44]; [2005, 3-21] V. Tzonev [1970, 3-15], [1971, 35-44]; V. Tzonev and T. Kunaliev [1972, 11-25]; [1978, 23-38] et al. Here we shall try to present its new opportunities in carrying out international statistical comparisons (ISC)⁶.

Which are the characteristic features and the advantages of the ISC method?

The classical type of the method is based on the decomposition of the total growth for a period of time of a definite indicator, treated as a total value of an indicator per population (for instance GDP or Gross Value Added (GVA)) into several components, due to different sources of growth. The main idea is to take into consideration the contribution of various sources of growth, forming sub-total growths within the total growth of the total value of indicator (for instance GVA⁷). Without going into details I shall try to clarify the key aspects and some schemes of decomposition of the total growth for a fixed period of time of a summarizing indicator.

V_0 and V_1 indicate the GVA levels (total value of indicator) during the years “0” and “1”;

Y_0 and Y_1 - the levels of labour productivity for the economy in general⁸ in the years “0” and “1” and

N_0 and N_1 - the number of persons employed during the same years. As evident in this case, data are available for the total value of indicator (V) for the years “0” and “1”, with the average value of this indicator (Y) and with the volumes of population (N) for the same years. According to the concepts of the two authors of the method, there are several main schemes of decomposition of the total absolute growth by sources of growth⁹, and here I shall focus on three of them, which I think could be applied successfully in the international comparative analyses.

According to the **first scheme** the total absolute growth in a certain total value of indicator, (such as GVA) in the monosectoral model of link, is decomposed into two main components, due to two sources of growth - intensive and extensive. The scheme is:

$$(1) \quad \Delta_V = N_1 \Delta_Y + \Delta_N Y_0$$

where:

Δ_V - Total absolute growth of GVA for the period (0;1)

Δ_Y - Growth in the average labour productivity per person employed for the period (0;1)

Δ_N - Growth of the number of persons employed for the period (0;1)

$$\Delta_V = V_1 - V_0$$

$$\Delta_Y = Y_1 - Y_0$$

$$\Delta_N = N_1 - N_0$$

$N_1 \Delta_N$ - Sub-total growth associated with the so-called intensive source of growth in GVA (the change of the average productivity of the quantity of labour input during the surveyed year)

$\Delta_N Y_0$ - Sub-total growth, associated with the so-called extensive source of growth in GVA (the change of the volume of quantity of labour at constant basic average level of productivity per person employed)

The second possible scheme appears to be a further development of the first scheme in a way, including a very important source of growth – the effect relative to the changes in the structure of the quantity of labour by sectors. Therefore, the surveyed population should be divided in advance into subpopulations pursuant to a classification (structure-forming) indicator. For example GVA and the number of persons employed in the national economy could be differentiated by economic sectors (subpopulations). Without going into mathematical details and explanations the second possible scheme for decomposition of Δ_V is:

$$(2) \quad \Delta_V = N_1 \sum_a d_0 \Delta_y + N_1 \sum_b \Delta_d y_1 + \Delta_N \sum_c d_0 y_0$$

where:

d_i - Relative portion of the volume of quantity of labour by economic sectors during a certain year t_i ($i = 0;1$) out of the total quantity of labour. In this case this is the relative portion of the number of persons employed in each of the economic sectors by years during the compared period

y_i - the labour productivity per person employed per economic sector for the years “0” and “1” ($i = 0;1$)

$N_1 \sum d_0 \Delta_y$ - sub-total absolute growth within the volume of GVA in the surveyed year compared to the basic year, in view of the change in the levels of labour productivity per person employed by sectors at the basic structure of the number of persons employed in the surveyed year

$N_1 \sum \Delta_d y_1$ - sub-total absolute growth in Δ_V , linked with the change in the structure of the number of persons employed in the survey period and in view of the productivity per person employed by sector within the surveyed period, i.e. this is the so-called structural effect on Δ_V

$\Delta_N \sum d_0 y_0$ - sub-total absolute growth in Δ_V , linked with the change in the total number of persons employed Δ_N at constant basic labour productivity per person employed $\sum d_0 y_0$, i.e. this is the growth, resulting from the so-called extensive source of growth.

The third scheme offered appears to be a detailed version of the second scheme, including seven sources of growth, measuring both the changes in the labour productivity by sectors, and the changes resulting from the changes in the structure of the number of persons employed. If N_1 ; d_1 and y_1 are represented as:

$N_1 = N_0 + \Delta_N$; $d_1 = d_0 + \Delta_d$; $y_1 = y_0 + \Delta_y$, the new scheme is:

$$(3) \quad \Delta_V = N_0 \sum_1 d_0 \Delta_y + \Delta_N \sum_2 d_0 \Delta_y + N_0 \sum_3 \Delta_d y_0 + \Delta_N \sum_4 \Delta_d y_0 +$$

$$+ N_0 \sum_5 \Delta_d \Delta_y + \Delta_N \sum_6 \Delta_d \Delta_y + \Delta_N \sum_7 d_0 y_0$$

where:

$N_0 \sum d_0 \Delta_y$ - sub-total absolute growth in Δ_V , during the surveyed year compared to the basic year, linked with the change in the labour productivity by sectors at the basic structure of the number of persons employed during the basic year

$\Delta_N \sum d_0 \Delta_y$ - sub-total absolute growth in Δ_V , during the surveyed year compared to the basic year, linked with the change in the labour productivity by sectors at the basic structure of the number of the additional labour quantity input in the economy during the surveyed year

$N_0 \sum \Delta_d y_0$ - sub-total absolute growth in Δ_V , linked with the change in the structure of the number of persons employed during the surveyed year and in view of the labour productivity by sectors during the basic year

$\Delta_N \sum \Delta_d y_0$ - sub-total absolute growth in Δ_V , during the surveyed year compared to the basic year, linked with the change in the structure of the persons employed during the surveyed year and in view of the productivity by sectors in the basic year of the additional labour quantity

$N_0 \sum \Delta_d \Delta_y$ - sub-total absolute growth in Δ_V , during the surveyed year compared to the basic year in view of the simultaneous change of the structure of the persons employed and productivity by sectors at the basic structure of the number of the persons employed

$N_0 \sum \Delta_d \Delta_y$ - sub-total absolute growth in Δ_V , during the surveyed year compared to the basic year in view of the simultaneous change of the structure of persons employed and the productivity by sectors of the additional labour quantity input in economy during the surveyed year

$\Delta_N \sum d_0 y_0$ - Already known.

It is evident, that between the second and the third scheme a direct relation is available. When merging sub-total growths 1. and 2, the first sub-total growth (a) is obtained in scheme (2). The merging of sub-total growths 3, 4, 5 and 6 results in the second growth (b) in scheme (2), and sub-total growth 7 is equal to the third sub-total growth (c) from the second scheme. The positive aspect in scheme (3) is that the structural component in the total growth of GVA could be evaluated in details both of the basic labour quantity input in economy, and of the additional labour quantity input in the economy during the surveyed year.

The above-mentioned schemes are standard. The obtained sub-total growths, due to the different sources are expressed in value, which in the different countries is usually calculated in different currencies. Even if calculated in the unified currency the evaluated sub-total growths for the different countries are not in direct correlation (at least due to their different scales). Therefore they should be transformed in relative (percentage) quantities.

For the needs of the international comparative studies, schemes (1), (2) and (3), presenting the total absolute growth, decomposed in sub-total absolute growths, due to different sources could be transformed in:

$$(4) \quad \frac{\Delta_v}{\Delta_v} 100 = \frac{N_1 \Delta_y}{\Delta_v} 100 + \frac{\Delta_N Y_0}{\Delta_v} 100; \quad ^{10}$$

$$(5) \quad \frac{\Delta_v}{\Delta_v} 100 = \underbrace{\frac{N_1 \sum d_0 \Delta_y}{\Delta_v} 100}_a + \underbrace{\frac{N_1 \sum \Delta_d y_1}{\Delta_v} 100}_b + \underbrace{\frac{\Delta_N \sum d_0 y_0}{\Delta_v} 100}_c$$

$$(6) \quad \frac{\Delta_v}{\Delta_v} 100 = \underbrace{\frac{N_0 \sum d_0 \Delta_y}{\Delta_v} 100}_1 + \underbrace{\frac{\Delta_N \sum d_0 \Delta_y}{\Delta_v} 100}_2 + \underbrace{\frac{N_0 \sum \Delta_d y_0}{\Delta_v} 100}_3 +$$

$$+ \underbrace{\frac{\Delta_N \sum \Delta_d y_0}{\Delta_v} 100}_4 + \underbrace{\frac{N_0 \sum \Delta_d \Delta_y}{\Delta_v} 100}_5 + \underbrace{\frac{\Delta_N \sum \Delta_d \Delta_y}{\Delta_v} 100}_6 + \underbrace{\frac{\Delta_N \sum d_0 y_0}{\Delta_v} 100}_7$$

In view of more detailed evaluations and comparisons, here we could use another scheme to present the sub-total growth by sources into the components in relative expression. It is the decomposition of the sub-total absolute growth, due to intensive sources of growth into two components in compliance with scheme (2), namely:

$$(7) \quad \frac{N_1 \Delta_y}{N_1 \Delta_y} 100 = \frac{N_1 \sum d_0 \Delta_y}{N_1 \Delta_y} 100 + \frac{N_1 \sum \Delta_d y_1}{N_1 \Delta_y} 100$$

The interpretation of the contents of the relative quantities obtained from schemes (4), (5) and (6) should be identical with the results, obtained by means of schemes (1), (2) and (3).

Of special interest at the current historical stage of economic development of the countries is the profound study of the intensity of structural changes in the national economies, as well as their direction according to a set effectiveness criterion, as well as the ultimate result out of these changes.

Therefore it is possible and advisable the corresponding comparisons between the countries to be made and conclusions to be drawn. In this respect an analytical equation could be used, reflecting the relation between the structural effect and the determining parameters, namely:

$$(8) \quad N_1 \sum \Delta_d y_1 = \sigma_{\Delta_d} \sigma_{y_1} r_{\Delta_d y_1} N_1 S$$

where:

σ_{Δ_d} - measures the intensity degree of the structure of the national economy by labour

quantity), evaluated through
$$\sigma_{\Delta_d} = \sqrt{\frac{\sum \Delta_d^2}{S}}$$

σ_{y_1} - degree of difference between labour productivity by sectors, calculated by means of the formula of non-weighted average deviation. For comparisons between different countries it is advisable to use the variation coefficient

$r_{\Delta_d y_1}$ - linear correlation coefficient between the change in the structure of the persons employed by sectors and the level of labour productivity by sectors. It measures the target degree of the structural changes regarding the levels of labour productivity by sectors and the closer it is to 1, the higher the target and it is more favourable under equal other conditions.

S - the number of sectors;

- the other symbols are known

The above-mentioned scheme (2) might serve as a starting point for many other comparisons between the economies of different countries. To a great extent they are relative, but could provide interesting and important evaluations of the degree of development of the countries.

The analysis of the dynamics of the total average productivity of a person employed in the national economy might be of top interest for the comparative studies. Its growth Δ_Y for a certain period of time could also be decomposed into two components as follows:

$$(9) \quad \Delta_Y = \sum_{A.} d_0 \Delta_y + \sum_{B.} \Delta_d y_1$$

where:

$\sum d_0 \Delta_y$ - sub-total absolute growth of the average labour productivity, the source of which is correlated with the change in the productivity by sectors at constant basic labour structure.

$\sum \Delta_d y_1$ - sub-total absolute growth of the average labour productivity, derived from the source of growth measuring the impact of the change on the structure of input labour by economic sectors, in view of the labour productivity in the surveyed year

Due to the above-mentioned reasons, in view of ISC it is better to evaluate the separate sources of growth in relative (percentage) quantities, namely:

$$(10) \quad \frac{\Delta_y}{\Delta_Y} 100\% = \frac{\sum d_0 \Delta_y}{\Delta_Y} 100 + \frac{\sum \Delta_d y_1}{\Delta_Y} 100 = 100$$

In addition to the above-mentioned characteristic features, some additional details could be evaluated as well, having also important cognitive capabilities. For example, the sub-total absolute growth could be calculated based on the formula $N_1 \sum d_0 \Delta y$, whereas the actual values of d_0 for a given country are replaced with the values of another country, being of interest for the comparison.

In other cases, it could be of interest for the corresponding comparison to trace in time the degree of difference of the structures by economic sectors (branches) between the two countries. Therefore we could use a modified formula of $\sigma_{\Delta d}$, namely:

$$(11) \quad \sigma_{d,A/B} = \sqrt{\frac{\sum (d_{iA} - d_{iB})^2}{S}}$$

where:

- d_{iA} - structure of the sectors in country "A" for the i -th year;
- d_{iB} - structure of the sectors in country "B", for the same year
- S - number of sectors

The comparison of the structures of the two countries enables us to evaluate a conditional structural effect on GVA according to the formula:

$$(12) \quad E_{str} = N_{1B} \sum (d_{1A} - d_{01B}) y_{1B}$$

in order to compare it with the actual structural effect in the respective year and to reach essential conclusions.

The following conditions are required to apply the above method of analysis, when comparing the indicators (total values of an indicator) between different countries:

- equal defining of the value of the indicator (total value of the indicator),
- equal accounting of the indicator (total value of the indicator),
- equal classification (structure forming) indicator, with equally defined sub-populations,
- the comparison should cover the same periods of time, for all countries compared.

Under the conditions of contemporary international comparisons, comparing an indicator of the type of GVA, the first, the third and the fourth requirements could be fulfilled easily. As far as the second requirement is concerned, it is not always available, as the evaluation of GVA is not always equally comprehensive for all countries. Usually in countries with a large share of not-monitored economy the evaluation of GVA is underestimated. Regarding the EU Member States this requirement is available too.

3. COMPARATIVE STUDY OF THE DYNAMICS OF GROSS VALUE ADDED BETWEEN R. BULGARIA AND R. ROMANIA FOR THE PERIOD 2002 – 2007

Based on the above schemes of analysis a comparative study was carried out on the dynamics of Gross Value Added (GVA) from different sources between R. Bulgaria and R. Romania for the period 2002-2007. The comparison covers five couples of years: 2002-2003.; 2003-2004.; 2004-2005.; 2005-2006 and 2006-2007. Its target is to monitor the changes of GVA, influenced by different sources of growth, both in couples of years, and for the entire analyzed period in both countries compared. On the grounds of the obtained results, the similarities and differences between the economies of both countries will be highlighted. The degree of alignment of the processes between them could be established.

Data¹¹ were used from the classification¹² of six economic sectors for the volume of the generated GVA, totally and by sectors¹³, as well as for the number of persons employed- totally and by sectors for both countries compared, for the above-mentioned years. According to the calculations obtained under the equations (1), (2) and (3) and the formulas (4), (5) and (6) used, the results are presented in Tables 1 - 7.

General conclusions based on the analysis of the obtained results:

First, in both countries a positive absolute growth is observed in the total volume of GVA for all the compared couples of years during the surveyed period. The highest absolute growth in Bulgaria was in 2006 compared to 2005, in Romania – for 2007, compared to 2006, being as twice as high for both countries compared against the absolute growth in 2003, compared to 2002.

Second, the total absolute number of persons employed in Bulgaria was increasing throughout all the years of the surveyed periods, while in Romania a decrease in this number was monitored in the second and third year of the period, and an increase in the next three years.

Third, the comparison of the results from the analysis of the absolute growth in GVA, according to separate compared couples of years for the period 2002 - 2007 (See Table 1) in Bulgaria and Romania shows major differences in the impact of the separate sources of growth. For example in Bulgaria for most of the compared years the sources of growth associated with the rising number of persons employed in the national economy has a key contribution to the total absolute growth of GVA. In 2003 compared to 2002, the relative contribution is over 72%, gradually stepping down to about 51% in 2006 compared to 2005. Just in 2007, compared to the previous 2006 the relative contribution by the source of growth associated with an increase in the total productivity per person employed has a share exceeding 51%, which could be accepted as a positive fact. For the same surveyed period in Romania the results from the analysis show that, most of the absolute growth of GVA by separate compared years is linked with the increase in the total average labour productivity per person employed. Thus for instance, the contribution of this source of growth in 2003 compared to 2002 has a share exceeding 100%. Despite the certain fluctuations in the separate compared years the contribution of the above-mentioned source remains very high, being 80% in 2007 compared to 2006. In conclusion, throughout all the compared years of the surveyed period in Romania the factors enabling a more rapid growth of labour productivity per person employed have been utilized in a more efficient way than in Bulgaria.

Table no.1 - Total absolute growth in GVA and sub-total relative growths therein by sources of growth for Bulgaria and Romania - by separate compared years.

Compared couples of years	Total Absolute Growth $\Delta_V = V_1 - V_0$		Sources of Growth (in %, $\Delta_V = 100$)			
			$\frac{N_1 \Delta_y}{\Delta_V} 100$		$\frac{\Delta_N Y_0}{\Delta_V} 100$	
	Bulgaria (bln BGN)	Romania (bln RON)	Bulgaria	Romania	Bulgaria	Romania
2003/2002	1118.00	38718.60	27.53	100.98	72.47	-0.98
2004/2003	1376.00	45290.40	46.28	103.17	53.72	-3.17
2005/2004	1540.00	34301.40	47.59	88.12	52.41	11.88
2006/2005	2072.00	49037.10	49.36	95.10	50.64	4.90
2007/2006	1954.00	61696.90	51.59	85.03	48.41	14.97

Fourth, the above conclusion is confirmed to a great extent also by the results obtained from the analysis in Table no. 2. The presented results show, that most of the total absolute growth of GVA in Romania in each of the compared years was linked with the increase in the labour productivity per person employed by sectors and despite the downward trend of this contribution it is very high. In 2003 compared to 2002 it exceeded 90% and stepped down to 71% in 2007 compared to 2006. It should be pointed out, that for the same period in Romania for separate compared years relatively low effects from the structural changes were reported in the number of persons employed by sectors, whereas the share of such effects by separate compared years varies within a rather wide range, without noting a clearly outlined trend. For each of the compared years the share of the structural effect varies between 2% and 20%.

Table no. 2 - Sub-total relative growths linked with the changes in the labour productivity by sectors, the number and the sector structure of the employed in the total growth of GVA in Bulgaria and Romania by separate years compared.

Compared couples of years	Sources of Growth (in %, $\Delta_V = 100$)					
	$\frac{N_1 \sum d_0 \Delta_y}{\Delta_V} 100$		$\frac{N_1 \sum \Delta_d y_1}{\Delta_V} 100$		$\frac{\Delta_N \sum d_0 y_0}{\Delta_V} 100$	
	Bulgaria	Romania	Bulgaria	Romania	Bulgaria	Romania
2003/2002	18.58	90.24	8.95	10.74	72.47	-0.98
2004/2003	9.18	89.92	37.10	13.25	53.72	-3.17
2005/2004	28.05	85.78	19.54	2.34	52.41	11.88
2006/2005	28.15	75.30	21.21	19.80	50.64	4.90
2007/2006	17.98	70.83	33.61	14.20	48.41	14.97

The evaluated results for Bulgaria are much different from the results for Romania. It was established, that in some of the compared years the share of the structural effect prevails compared to the share of the effect, linked with the increase in the labour productivity by sectors. Such results were obtained for the comparison of 2004 against 2003, as well as in 2007 against 2006. Meanwhile for other compared years the effects of these sources of growth are similar. The results in 2006 compared to 2005 could be given as an example.

A conclusion could be made from the compared results presented in table 2, that for the surveyed period, the monitored structural changes were effective in Bulgaria and have a relatively higher impact on the total absolute growth of GVA.

Fifth, the differences in the contribution of the structural changes on the number of persons employed by sectors between both compared countries could be explained with the analysis of the main parameters, determining the corresponding structural effect (see Table no. 3, Table no. 4 and Table no. 5). The review of the data in Table no. 3 demonstrates, that in Romania in general more essential changes in the structure of the number of the persons employed by compared years were observed during the surveyed period. However they are characterized by irregular intensity. At the same time in Bulgaria the intensity of the structural changes is lower, but more regular than in Romania, for the different compared years. While in Romania the intensity of the structural changes varies by separate compared years between 0,7% -1,2%, i.e with a difference of 0,5 points, in Bulgaria the variation is approximately between 0,5% and 0,7%, i.e. the difference is just 0,2 points.

Table no. 3 - Coefficients of intensity of the changes in the structure of the number of the persons employed (σ_{Δ_d}) by sectors in Bulgaria and in Romania by separate compared years

Compared couples of years	$\sigma_{\Delta_d} = \sqrt{\frac{\sum \Delta_d^2}{S}} 100$	
	Bulgaria	Romania
2003/2002	0.72	0.79
2004/2003	0.51	1.26
2005/2004	0.53	0.73
2006/2005	0.60	1.08
2007/2006	0.45	0.86

Sixth, as already mentioned, the difference of labour productivity among the sectors also has an impact on the structural effect. In order to make a comparison between the two countries, the relative variation coefficients between the labour productivity per person employed by sectors were calculated and compared (see Table no. 4). A conclusion could be made out of these data, that during all the compared years the degree of difference in the labour productivity by sectors is much higher in Bulgaria than in Romania. The mean difference is about 20 points. It could be explained also with the higher relative contribution of the structural changes in Bulgaria compared to Romania on the total absolute contribution in GVA during the compared couples of years.

Table no. 4 - Degree of variation of the labour productivity per person employed by sectors (V_{y_1}) in Bulgaria and in Romania by different years for the period 2002-2007.

Years	$V_{y_1} \% = \frac{\sigma_{y_1}}{\sum y_1} 100$	
	Bulgaria	Romania
2002	80.46	77.08
2003	81.35	63.01
2004	76.67	59.32
2005	80.78	64.68
2006	85.96	61.15
2007	86.37	58.83

Seventh, according to equation (8) the target degree of the structural changes of the number of the persons employed by sectors also has an impact on the structural effect, in terms of the quantity of the labour productivity per person employed by sector during the surveyed year (See Table no. 5). The comparison of these parameters by separate compared couples of years between Bulgaria and Romania shows certain differences. While in Romania except for one of the compared couples of years (2005 against 2004), a relatively high target of the structural changes of the number of the persons employed by sectors is observed, which is relatively regular (the coefficient $r_{\Delta_d y_1}$ ranges between 0,46 and 0,62), in Bulgaria this target coefficient by separate compared couples of years shows striking differences (between 0,28 and 0,61). The conclusion could be made, that in most cases the input labour in Romania's economy has been restructured to the sectors with higher labour productivity by sector.

Table no. 5 - Degree of direction of the structural changes of the number of the persons employed by sectors in view of the labour productivity per person employed by sectors ($r_{\Delta_d y_1}$) in Bulgaria and Romania by the separate compared years.

Compared couples of years	$r_{\Delta_d y_1} = \frac{\sum \Delta_d \left(y_1 - \frac{\sum y_1}{S} \right)}{\sigma_{\Delta_d} \sigma_{y_1} S}$	
	Bulgaria	Romania
2003/2002	0.07	0.57
2004/2003	0.55	0.46
2005/2004	0.28	0.08
2006/2005	0.32	0.62
2007/2006	0.62	0.61

Eight, in view of the more detailed study of the effects linked with the changes in the labour productivity per person employed by sectors and the effect linked with the structural changes (number of persons employed by sectors) scheme (6) could be used as well.

Table no. 6 - Sub-total relative growths in the total absolute growth of GVA by the detailed scheme (6) of the analysis for Bulgaria and Romania in 2007, compared to 2002.

Compared couples of years	Sources of Growth 100 (in %, $\Delta_v = 100$)					
	$\frac{N_0 \sum d_0 \Delta_y}{\Delta_v} 100$		$\frac{\Delta_N \sum d_0 \Delta_y}{\Delta_v} 100$		$\frac{N_0 \sum \Delta_d y_0}{\Delta_v} 100$	
	Bulgaria	Romania	Bulgaria	Romania	Bulgaria	Romania
2007/2002	16.24	75.42	2.48	3.60	21.76	8.20

Table no. 6 (continuation)

Sources of Growth (in %, $\Delta_v = 100$)							
$\frac{\Delta_N \sum \Delta_d y_0}{\Delta_v} 100$		$\frac{N_0 \sum \Delta_d \Delta_y}{\Delta_v} 100$		$\frac{\Delta_N \sum \Delta_d \Delta_y}{\Delta_v} 100$		$\frac{\Delta_N \sum d_0 y_0}{\Delta_v} 100$	
Bulgaria	Romania	Bulgaria	Romania	Bulgaria	Romania	Bulgaria	Romania
3.32	0.39	3.73	9.11	0.57	0.43	51.90	2.85

I am going to illustrate the opportunities of a more detailed analysis of the sources of growth by means of the data for analysis of the absolute growth of GVA in 2007 compared to 2002, for Bulgaria and Romania, demonstrated in Table 6. Without making a detailed comparative evaluation of the obtained results a conclusion could be made, that, with a few exceptions for most sources of growth, considerable differences between the two compared countries are observed in the total absolute growth of GVA. This is evident from the data in the table. For instance the relative growth of the dynamics of labour productivity per person employed by sectors at the quantity of labour input from the basic year 2002 - in Bulgaria it is about 16%, while in Romania this share exceeds 75%. It is also evident, that the relative contribution of the change in the structure of the persons employed by sectors in view of the basic productivity per person employed by sectors at the labour input for the basic year 2002 in Bulgaria exceeds 21%, while the similar contribution in Romania is about 8%. The obtained results from this scheme confirm the above conclusions.

Ninth, in the economic theory it is considered, that the process of alignment of the structures of the national economies in the different countries enables the more effective international economic cooperation. It is quite important, when the countries belong to the same economic community, as it is the case with Bulgaria and Romania. This process could be analyzed by different economic and social indicators. This article evaluates the degree of alignment (difference) of the structure of the persons employed by sectors in the national economies of Bulgaria and Romania. (see Table no. 7).

Table no. 7 Degree of difference between the structures of the number of the persons employed by sectors ($\sigma_{d_i A/B}$) in Bulgaria and Romania by separate years.

Years	$\sigma_{d_i A/B} = \sqrt{\frac{\sum (d_{iA} - d_{iB})^2}{S}} 100$
2002	6.54
2003	6.45
2004	5.56
2005	5.60
2006	4.95
2007	4.51

The analysis of the data in the table unambiguously shows that there is a clear trend of alignment of the structure of the sectors in both economies. While in 2002 the coefficient of the difference between both structures was evaluated at 6.5%, in 2007 this percentage was 4.5% - there was a decrease in the degree of difference of about 2 points.

The analysis has not utilized completely all the opportunities offered by this approach for performing international statistical comparisons. The analysis could be supplemented and extended by comparative research of each economic sector. This aspect of study is however beyond the present article.

4. CONCLUSIONS

Finally, I would like to highlight some of the major advantages of the surveyed approach when carrying out international statistical comparative studies. They refer to:

First, all the advantages, concerning the essence of the method of analysis of growths in the average or total value of the indicator of population. They refer to the consequential use of the fundamental statistical concepts: population and subpopulation. But the fact, that under this method the contribution of each source of growth is expressed by means of a link between two or more parameters, influencing at a given investigated growth the total value of indicator and therefore, the used additive form of presentation of the results of the analysis of the surveyed growth, regardless of its algebraic form (absolute or relative) completely coincides with the interpretation by sources.

Second, the advantage of the offered approach and method is due to the fact, that it is not difficult to obtain the required information about its application. I would like to point out, that the evaluation of the sub-total growths, due to different sources is effected in the form of relative shares (percentages) of the total absolute growth. Thus they should not be reevaluated in a single currency, resulting in a lot of problems¹⁴ as everyone knows. Actually, even if evaluated in a single currency, the comparison of the separate components of the growth of such an indicator like GVA (resp. GDP) for different countries requires the use of schemes (4), (5) and (6).

Third, the proposed method of analysis enables us to estimate how effective are the performed structural changes in the economies of different countries, weather there is any unification of the structures of the persons employed within certain economic unions (such as the European Union), to what extent the structural changes in one country are more-effective than in another country and why.

Fourth, the explored approach and method of analysis could also be used for comparative studies by different economic sectors. Thus more detailed evaluations could be obtained at a higher level of aggregation in the economy.

Fifth, the investigated method of comparative analyses for different countries could give rise to useful and important time and cost-effective results. In my opinion this fact is important and should not be ignored.

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Notes

¹ The method is stated in details and discussed by T. Todorov [1991, 132-133]; Y. Ivanov [1974, 96-97]

² The method is stated in details and discussed by J. Barbolova [2005, 82-86]; Y. Ivanov [1976, 43]

³ The method was applied in Bulgaria by M. Raynova to evaluate the real GDP level in Bulgaria. See Sl. Sirakov, M. Raynova, T. Radev [1989, 71-89]. See also R. Rangelova [1995, 15];

⁴ The method was discussed and applied as an experiment in Bulgaria by I. Parchev [1982, 66-67]

⁵ A possible variant of such an approach is demonstrated as an experiment by I. Kostov and Al. Videnov [1985, 46-60]

⁶ Its opportunities for application in international statistical comparisons were discussed by T. Kunaliev [1974, 187-188, 190-191, 198-199]; [1976, 90-92] and A. Stoykova-Kanalieva [2006, 279-288]; [2009].

⁷ For the international statistical comparisons GVA could be accepted as a better indicator, as it does not consider the impact of the different levels of taxes and subsidies on the products in the different countries.

⁸ Here the level of labour productivity is expressed by means of GVA per person employed in the national economy.

⁹ See T. Kunaliev, [1974, 181-183, 193-194]; [1976, 78-89] [1978, 23-26]; [2003, 31-40]; [2005]. V. Tzonev and T. Kunaliev [1972, 11-25]; Tzonev [1970, 3-15]; (1971, 35-44) et al.

¹⁰ Scheme (4) could also be used for analyses and comparison among separate sectors and branches of the national economies of the countries.

¹¹ Source data taken from the official websites of the Bulgarian National Statistical Institute (<http://www.nsi.bg>) and the Romanian Institutul National de Statistica (<http://www.insse.ro>)

¹² The sectors are: 1. Agriculture, Hunting and Silviculture. Fishery and Pisciculture; 2. Mining and Processing Industry (including Electric and Thermal Energy, Gas and Water); 3. Construction; 4. Trade, Repairs of Cars and Household Appliances; Hotels and Restaurants. Transport, Storage and Communications; 5. Financial Intermediations. Real Estate Transactions, Renting and Service Activities mainly rendered to enterprises; 6. Public Administration and Defence. Education. Health and Social Assistance. Other activities of national economy.

¹³ GVA for both countries is expressed in the respective national currency.

¹⁴ see. V. Todorov [2005]