Audit financiar, XV, Nr. 2(146)/**2017**, *266-275*
ISSN: 1583-5812; ISSN on-line: 1844-8801

Sectorial evolutions in former communist economies, current EU members

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Abstract

In this paper, the author assumes the analysis of the economic sectors that contribute to the formation of Gross Value Added for eight selected countries, former communist economies, which are members of the European Union. The study outlines the impact of each factor across the analyzed interval and then, through multiple regression, a panel of independent variables is selected from the basic set of ten, classified on NACE Rev. 2, and the impact of those variables on the main indicator, Gross Value Added, is measured.

Keywords: *contribution, factor, industry, regression, gross value added*

JEL Classification: *C51, E01*

To cite this article:
Motofei, C. (2017), Sectorial evolutions in former communist economies, current EU members, *Audit Financiar*, vol. XV, no. 2(146)/2017, pp. 266-275,
DOI: 10.20869/AUDITF/2017/146/266

To link to this article:
http://dx.doi.org/10.20869/AUDITF/2017/146/266
Received: 15.01.2017
Revised: 20.03.2017
Accepted: 21.03.2017

Introduction

The Gross Value Added (GVA) is one of the main components of the Gross Domestic Product (GDP), according to the production method. The GVA contributes to the formation of GDP together with the net taxation. Net taxation is taxation less subsidies related to the production measured through the GVA. According to Eurostat, GVA "is defined as output value at basic prices less intermediate consumption valued at purchasers' price" (http://ec.europa.eu/eurostat/web/products-datasets/-/teina404_r2). The Eurostat methodology details the value of this indicator by ten components, in compliance with NACE Rev. 2.

Our analysis followed two methods: first, we have pursued the contribution of each factor to the formation of the main indicator and then, by applying the multiple regression method, we have measured the impact of four factors.

In the last section of the paper, we have realized an econometric analysis of the influence exerted by the four most important factors on the GDP of the respective countries.

1. Literature review

The book authored by Anghelache, Mitruț and Voineagu (2013) includes a comprehensive presentation of the indicators related to macroeconomic results. Astafieva (2014) discusses on the factors that influence the value added in industry. Bălănescu (2013) evaluates the position of the SMEs in the context of the Romanian economy. Iachimov (2013) analyzes the characteristics of data and information sources for regional level studies. Piroi and Păunică (2015) evaluate the impact of technology on the deficit of the Romanian budget. Lehmann and Wohlrabe (2013) study the forecast of GVA per sectors, at regional level. Melihovs and Kasjanovs (2011) develop on the evolution of convergence process in Latvia. Motofei (2017) has analyzed a group of factors that contribute to the structure and evolution of GDP for several countries. Pawlas (2015) presents some characteristics on the Visegrad Countries and European Union membership. Stoykova-Kanalieva (2010) evaluates, from a comparative viewpoint, the Romanian and Bulgarian economies. Păunică et al. (2009) develop on performance in the public administration sector.

2. Research methodology and data

The research methodology is based on the resources that contribute to the formation of the GVA, whose influence is subsequently applied to the evolution of GDP. The classification of the indicators is based on NACE rev 2. According to the Eurostat, NACE represents "the statistical classification of economic activities in the European Community" (http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF), being "subject of legislation at the European Union level, which imposes the use of the classification uniformly within all the Member States" (http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF). Thus, the groups of indicators taken into consideration, as influence factors, are the following:

- Agriculture, forestry and fishing;
- Industry (except construction);
- Construction;
- Wholesale and retail trade, transport, accommodation and food service activities;
- Information and communication;
- Financial and insurance activities;
- Real estate activities;
- Professional, scientific and technical activities; administrative and support service activities;
- Public administration, defense, education, human health and social work activities;
- Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies.

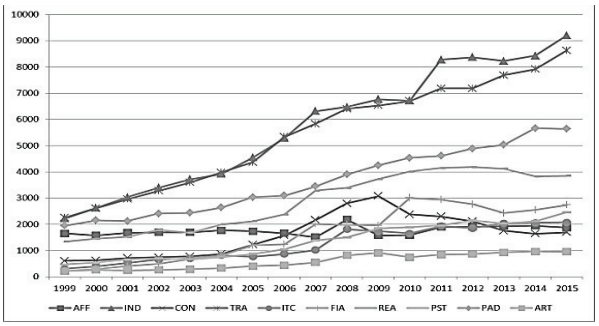
The data were extracted from the Eurostat online database and processed through a data analysis software.

3. Results and discussions

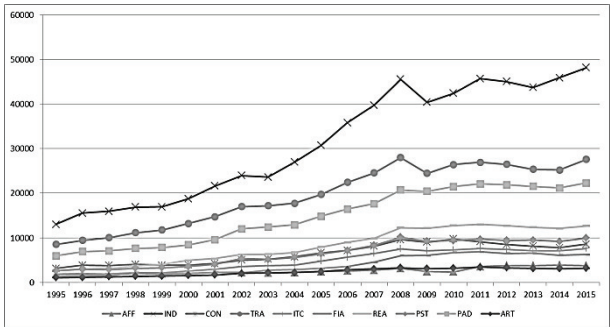
The datasets for each country are presented in a separate chart. We have calculated and discussed also on the aggregated values, corresponding to the entire period in **Table no. 1**.

Table no. 1. The contribution by categories of resources to the formation of the GVA

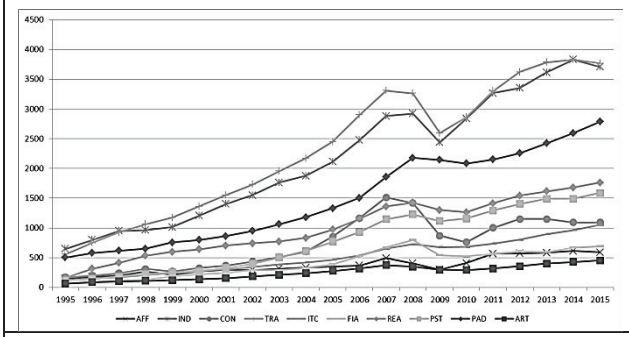
BULGARIA



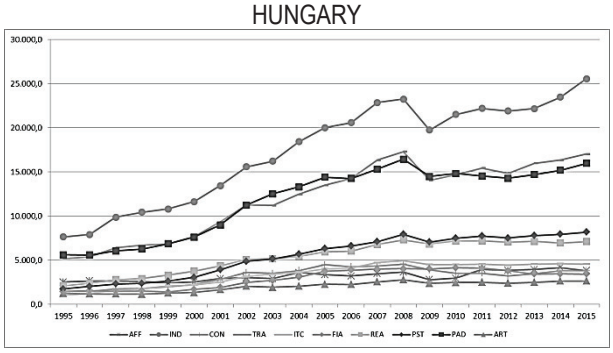
CZECH REPUBLIC



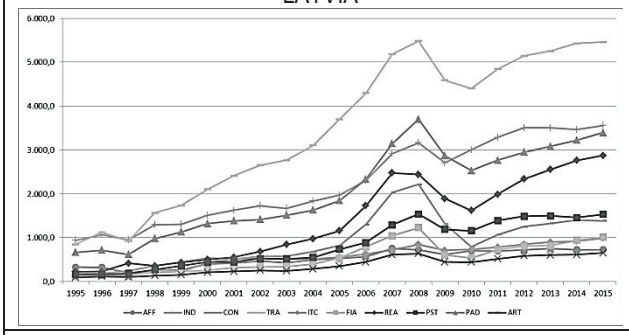
ESTONIA



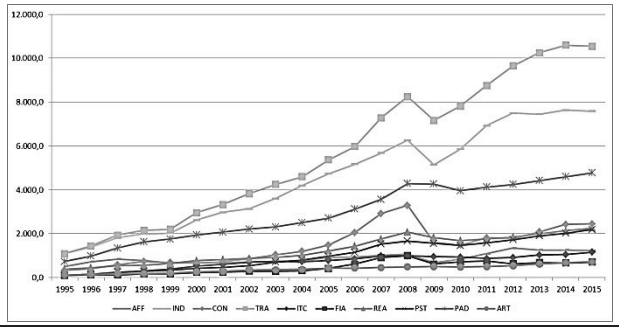
HUNGARY



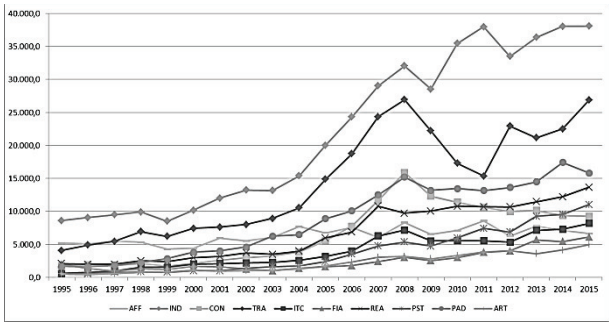
LATVIA



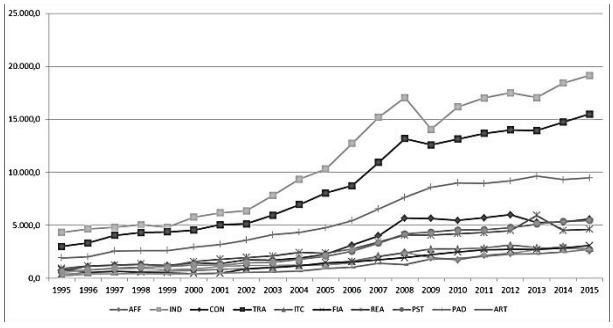
LITHUANIA



ROMANIA



SLOVAKIA



Data source: Eurostat, graphical representation by the author

*Dataset: National Accounts aggregates by industry (up to NACE A*64) [nama_10_a64], extracted March 16th, 2017*

The Bulgarian economy is influenced in a major proportion by the industry and the trade outcomes. These two indicators, for the total amounts of the analyzed interval, hold a total share of more than 43%. The least significant factor is the *Arts, entertainment and recreation etc.*, with a weight slightly above 2%.

Regarding the situation of the Czech economy, there can be observed the significant contribution of industry, close to a third (in terms of aggregated amount, 31.09%) for the 1995-2015 period. The second position in the hierarchy corresponds to trade activity, while the *Arts, entertainment and recreation etc.* is placed on the last position (2.37%).

Estonian dataset reveals a somehow different pattern, with a high contribution of the trade related activities (23.12% for the total period), followed closely by the industrial sector (21.56%), and the last position is held by the *Arts, entertainment and recreation etc.*

For the Hungarian economy, the industry holds the first position (26.99%), with the trade activities (17.97%) on the second place within the hierarchy. We note the weight of the factor *Public administration, defense, education, human health and social work activities*, which is almost equal to the trade (17.70%). As in the case of the other analyzed economies, the smallest contribution is associated with the *Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies*, that is little over 3%.

In Latvia, the most prominent factor, from the viewpoint of our analysis methodology is the trade, accounting for almost 27% for the entire interval considered. The second place is held by the *Industry (except construction)* activity, with 17.40%, and the *Public administration, defense, education, human health and social work activities* is the third in the top. The least sizable influence corresponds to *Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies*, below 3%.

The Lithuanian economy is highly influenced by the factor *Wholesale and retail trade, transport, accommodation and food service activities*, that is the same situation with the other Baltic former soviet countries. The contribution of this sector amounts, for the entire period, to 29.35%. Following, on the second and third position, are the *Industry (except construction)* and *Public administration, defense, education, human health and social work activities*, with 23.31% and 15.13% respectively. As in the case of other economies, the sector *Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies*, has the smallest contribution, little above 2%.

In Romania, the most visible contribution belongs to *Industry (except construction)*, with 28.50%, with the trade and public administration related activities taking the second and third positions, respectively.

In Slovakia, we can observe the significant weights for *Industry (except construction)*, and *Wholesale and retail trade, transport, accommodation and food service activities*, who amount for almost half of the GVA for the entire analyzed interval. The weakest influence is associated with *Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies*, whose weight is less than 3%.

Then, we have analyzed the contribution of the first four factors to the evolution of the GVA, by using multiple regression. The data source was kept the same, and the variables were defined, for software-assisted processing purposes, as the following set:

- Agriculture, forestry and fishing (AFF);
- Industry (except construction) (IND);
- Construction (CON01);
- Wholesale and retail trade, transport, accommodation and food service activities (TRA).

The multiple regression model is constructed on the basis of the following equation:

$$GVA = \alpha_0 + \alpha_1 \cdot AFF + \alpha_2 \cdot IND + \alpha_3 \cdot CON01 + \alpha_4 \cdot TRA$$

The regression models were estimated on the basis of the least squares method. The results are presented in the **Table no. 2**.

Table no. 2. Estimation of regression equation – individual country case

BULGARIA

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/17/17 Time: 13:28
Sample (adjusted): 1999 2015
Included observations: 17 after adjustments
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-879.8759	2313.851	-0.380265	0.7104
C(2)	0.880221	1.444290	0.609449	0.5536
C(3)	2.394875	0.746146	3.209658	0.0075
C(4)	1.629295	0.425833	3.826138	0.0024
C(5)	1.629665	0.870254	1.872632	0.0857

R-squared	0.994462	Mean dependent var	25870.24
Adjusted R-squared	0.992616	S.D. dependent var	9973.835
S.E. of regression	857.0789	Akaike info criterion	16.58487
Sum squared resid	8815010.	Schwarz criterion	16.82993
Log likelihood	-135.9714	Hannan-Quinn criter.	16.60923
F-statistic	538.6800	Durbin-Watson stat	1.234870
Prob(F-statistic)	0.000000		

CZECH REPUBLIC

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 18:49
Sample: 1995 2015
Included observations: 21
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-13852.08	4289.556	-3.229256	0.0052
C(2)	5.595142	2.453157	2.280793	0.0366
C(3)	1.146196	0.477770	2.399055	0.0290
C(4)	5.023415	1.350020	3.720993	0.0019
C(5)	1.628523	0.467813	3.481141	0.0031

R-squared	0.998592	Mean dependent var	100497.1
Adjusted R-squared	0.998241	S.D. dependent var	40222.27
S.E. of regression	1687.155	Akaike info criterion	17.90373
Sum squared resid	45543867	Schwarz criterion	18.15243
Log likelihood	-182.9892	Hannan-Quinn criter.	17.95770
F-statistic	2837.798	Durbin-Watson stat	1.467636
Prob(F-statistic)	0.000000		

ESTONIA

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 18:53
Sample: 1995 2015
Included observations: 21
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	52.37488	202.0525	0.259214	0.7988
C(2)	-4.014868	1.701812	-2.359172	0.0314
C(3)	4.198683	0.627660	6.689421	0.0000
C(4)	1.376138	0.543975	2.529782	0.0223
C(5)	0.588484	0.713924	0.824295	0.4219

R-squared	0.997364	Mean dependent var	10077.06
Adjusted R-squared	0.996705	S.D. dependent var	5035.951
S.E. of regression	289.0588	Akaike info criterion	14.37539
Sum squared resid	1336880.	Schwarz criterion	14.62409
Log likelihood	-145.9416	Hannan-Quinn criter.	14.42937
F-statistic	1513.612	Durbin-Watson stat	1.487661
Prob(F-statistic)	0.000000		

HUNGARY

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 18:58
Sample: 1995 2015
Included observations: 21
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1946.039	2551.261	0.762775	0.4567
C(2)	-0.694939	1.180666	-0.588600	0.5643
C(3)	1.521039	0.541300	2.809973	0.0126
C(4)	1.850277	0.787805	2.348650	0.0320
C(5)	2.890525	0.799225	3.616660	0.0023

R-squared	0.996818	Mean dependent var	66787.69
Adjusted R-squared	0.996022	S.D. dependent var	22176.66
S.E. of regression	1398.717	Akaike info criterion	17.52876
Sum squared resid	31302555	Schwarz criterion	17.77745
Log likelihood	-179.0519	Hannan-Quinn criter.	17.58273
F-statistic	1252.905	Durbin-Watson stat	0.896361
Prob(F-statistic)	0.000000		

LATVIA

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:00
Sample: 1995 2015
Included observations: 21
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1042.611	251.6676	-4.142810	0.0008
C(2)	-0.707085	1.493049	-0.473585	0.6422
C(3)	3.109730	0.320150	9.713349	0.0000
C(4)	2.745873	0.273693	10.03267	0.0000
C(5)	1.394366	0.254565	5.477440	0.0001

R-squared	0.998646	Mean dependent var	12942.84
Adjusted R-squared	0.998307	S.D. dependent var	6518.854
S.E. of regression	268.2124	Akaike info criterion	14.22569
Sum squared resid	1151006.	Schwarz criterion	14.47439
Log likelihood	-144.3698	Hannan-Quinn criter.	14.27967
F-statistic	2949.621	Durbin-Watson stat	0.821209
Prob(F-statistic)	0.000000		

LITHUANIA

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:02
Sample: 1995 2015
Included observations: 21
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	2624.619	363.6753	7.216931	0.0000
C(2)	-2.382124	0.625455	-3.808627	0.0015
C(3)	1.034402	0.287005	3.604121	0.0024
C(4)	1.854762	0.155585	11.92119	0.0000
C(5)	2.021511	0.191757	10.54203	0.0000

R-squared	0.999185	Mean dependent var	19366.92
Adjusted R-squared	0.998981	S.D. dependent var	9687.210
S.E. of regression	309.2078	Akaike info criterion	14.51016
Sum squared resid	1529752.	Schwarz criterion	14.75886
Log likelihood	-147.3567	Hannan-Quinn criter.	14.56413
F-statistic	4903.569	Durbin-Watson stat	1.346381
Prob(F-statistic)	0.000000		

ROMANIA

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:04
Sample: 1995 2015
Included observations: 21
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2989.825	3146.627	-0.950168	0.3562
C(2)	0.061038	0.603815	0.101088	0.9207
C(3)	2.420255	0.107806	22.45004	0.0000
C(4)	-0.003225	0.312716	-0.010312	0.9919
C(5)	1.842486	0.175428	10.50280	0.0000

R-squared	0.998113	Mean dependent var	77309.51
Adjusted R-squared	0.997642	S.D. dependent var	42212.67
S.E. of regression	2049.923	Akaike info criterion	18.29325
Sum squared resid	67234955	Schwarz criterion	18.54194
Log likelihood	-187.0791	Hannan-Quinn criter.	18.34722
F-statistic	2116.217	Durbin-Watson stat	1.472939
Prob(F-statistic)	0.000000		

SLOVAKIA

Dependent Variable: GVA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:06
Sample: 1995 2015
Included observations: 21
GVA=C(1)+C(2)*AFF+C(3)*IND+C(4)*CON01+C(5)*TRA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1544.522	711.8626	-2.169691	0.0454
C(2)	1.754461	1.212953	1.446437	0.1674
C(3)	0.358228	0.354178	1.011433	0.3269
C(4)	1.133757	0.696320	1.628213	0.1230
C(5)	3.578648	0.637005	5.617931	0.0000

R-squared	0.997953	Mean dependent var	40442.93
Adjusted R-squared	0.997441	S.D. dependent var	21409.33
S.E. of regression	1083.049	Akaike info criterion	17.01720
Sum squared resid	18767924	Schwarz criterion	17.26590
Log likelihood	-173.6807	Hannan-Quinn criter.	17.07118
F-statistic	1949.799	Durbin-Watson stat	1.620466
Prob(F-statistic)	0.000000		

Data source: Eurostat, *Dataset: National Accounts aggregates by industry (up to NACE A*64) [nama_10_a64], extracted March 16th, 2017*

For Bulgaria, the most important factor in the context of the multiple regression is the *Industry (except construction)*, with a quotient of over 2.39. That is, the increase of the value added in industry with one monetary unit is to produce, over time, a multiplied impact on the GVA. The *Constructions* and *Trade* factors have sensible close influences, with their parameters being over 1.62. The least significant impact is corresponding to *Agriculture, forestry and fishing*, whose regression quotient is below unit. The free term has a very high value, which is also negative, evidence of the other factors, not taken into consideration at the construction of this model, which exert, on the overall, a non-favorable influence on the main indicator's evolution.

The Czech Republic model reveals the significant contribution of the sector *Agriculture, forestry and fishing*, with a corresponding quotient higher than 5.59. Also, we can appreciate as important the contribution of the *Constructions* factor, characterized by a regression quotient of over 5. The *Industry (except construction)* and *Wholesale and retail trade, transport, accommodation and food service activities* factors have influences that are situated within the interval 1.14 – 1.62. The negative and sizable value of the free term indicates the presence of additional factors whose influence on the GVA is negative. The *R-squared* and *Adjusted R-Squared* tests have values very close to reference 1, therefore the model is suitable for further analyses and forecasts.

The situation in the case of Estonia is characterized by the presence of the negative influence exerted by the *Agriculture, forestry and fishing* factor, whose regression quotient is slightly lower than -4.00. To be noted that all other independent variables have favorable influences, and the free term is positive, even if not so significant, as value, when compared to the quotients of the four factors, denoting the positive influence of the group of potential factors not taken into consideration within this model. The tests associated to the regression model allow us to favorably appreciate its reliability.

In Hungary, the first factor of the model, that is *Agriculture, forestry and fishing*, has a negative impact on the main indicator, in the context of this model. The *Construction* is the factor with the most significant positive value, having a regression quotient of over 1.85. The other two factors also exert positive influences, with lower amplitude. The high values of the *R-squared* and *Adjusted R-Squared* qualify this model as relevant for the scope of the analysis. Also, the complex of factors not included at this stage, whose impact is revealed by the free term, are favorable, as influences, to the GVA.

The Latvian model is influenced in the highest degree by the *Industry (except construction)* factor, with a regression quotient higher than 3. The *Constructions'* quotient is close by, being higher than 2.74. Therefore, we emphasize the combined influence of these two factors. The agriculture is characterized by a

non-favorable impact, even if the regression quotient has a low value. The *Wholesale and retail trade, transport, accommodation and food service activities* has a positive influence on the evolution of the main indicator. As expression of other factors that have impact on the GVA, the free quotient is negative. The main tests of the model have high values, close to 1, so the model is reliable enough.

For Lithuania, the *Agriculture, forestry and fishing* factor has a negative influence on the overall evolution of the main indicator, with a regression parameter that, in absolute value, is higher than the parameters associated with the other three factors, which have a favorable impact on the main indicator. The free term has a high value and is positive, so there are other independent variables that influence the GVA, in a favorable manner. Also, the *R-squared* and *Adjusted R-Squared* indicate the quality of the model, which can be used in further studies.

The Romanian regression estimation reveals the major contribution of the industry to the evolution of the GVA, with a quotient over 2.42. The *Constructions* factor has a minor negative influence. The impact of the *Agriculture, forestry and fishing* factor is positive, but minor, while the *Trade* factor is characterized by a quotient over 1.84. The value of the free term is negative and significant, and synthesizes the negative influence of additional factors. The quality of the model is proven by the elevated levels of the *R-squared / Adjusted R-Squared* tests.

For Slovakia, all factors exert a positive influence on the GVA, while the "hidden" factors are revealed to have a less than favorable impact. The free term is negative and high enough to support this assessment. *Trade* is the most important influence factor, with a regression quotient of more than 3.57, and then we have the *Industry* and *Constructions.* Also, the model is reliable enough, if we observe the high values of the *R-squared / Adjusted R-Squared* coefficients.

The next step of our analysis is the measure, by similar econometric tools, of the influence of sectorial value added on the GDP. We shall take into consideration the most important factors, for all countries, based on the results discussed in the previous sections. The quick interpretation of basic data reveals that those factors are:

- Industry (except construction) (IND);
- Wholesale and retail trade, transport, accommodation and food service activities (TRA);
- Public administration, defense, education, human health and social work activities (PAD).

The general structure of the regression model is detailed by the following formula:

$$GDP = \alpha_0 + \alpha_1 \cdot IND + \alpha_2 \cdot TRA + \alpha_3 \cdot PAD$$

The estimation of the parameters was made according to the least squares method, and the results are presented in **Table no. 3**.

Table no. 3. Estimation of regression equation – individual country case, influences on GDP

BULGARIA

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:15
Sample (adjusted): 1999 2015
Included observations: 17 after adjustments
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-42.40918	1208.340	-0.035097	0.9725
C(2)	1.709233	1.216131	1.405467	0.1833
C(3)	3.787803	1.460577	2.593360	0.0223
C(4)	-0.113685	1.418607	-0.080139	0.9373

R-squared	0.988395	Mean dependent var	29956.49
Adjusted R-squared	0.985717	S.D. dependent var	11606.17
S.E. of regression	1387.085	Akaike info criterion	17.51012
Sum squared resid	25012058	Schwarz criterion	17.70617
Log likelihood	-144.8360	Hannan-Quinn criter.	17.52961
F-statistic	369.0635	Durbin-Watson stat	0.800717
Prob(F-statistic)	0.000000		

CZECH REPUBLIC

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:17
Sample: 1995 2015
Included observations: 21
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1623.508	1116.951	-1.453517	0.1643
C(2)	1.533158	0.208688	7.346635	0.0000
C(3)	0.826613	0.295584	2.796539	0.0124
C(4)	3.273971	0.409366	7.997659	0.0000

R-squared	0.999338	Mean dependent var	110895.8
Adjusted R-squared	0.999221	S.D. dependent var	44882.67
S.E. of regression	1252.964	Akaike info criterion	17.27405
Sum squared resid	26688603	Schwarz criterion	17.47301
Log likelihood	-177.3776	Hannan-Quinn criter.	17.31723
F-statistic	8548.725	Durbin-Watson stat	1.042527
Prob(F-statistic)	0.000000		

ESTONIA

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:19
Sample: 1995 2015
Included observations: 21
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-591.6469	110.7345	-5.342932	0.0001
C(2)	0.291714	0.495282	0.588985	0.5636
C(3)	3.087714	0.348352	8.863779	0.0000
C(4)	2.839533	0.328829	8.635289	0.0000

R-squared	0.998878	Mean dependent var	11464.88
Adjusted R-squared	0.998680	S.D. dependent var	5802.743
S.E. of regression	210.8467	Akaike info criterion	13.70978
Sum squared resid	755757.3	Schwarz criterion	13.90874
Log likelihood	-139.9527	Hannan-Quinn criter.	13.75296
F-statistic	5043.760	Durbin-Watson stat	1.055767
Prob(F-statistic)	0.000000		

HUNGARY

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:20
Sample: 1995 2015
Included observations: 21
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-267.4341	1031.329	-0.259310	0.7985
C(2)	1.767699	0.495961	3.564185	0.0024
C(3)	2.043693	0.762279	2.681029	0.0158
C(4)	1.972495	0.448393	4.399029	0.0004

R-squared	0.997931	Mean dependent var	78294.67
Adjusted R-squared	0.997566	S.D. dependent var	26339.43
S.E. of regression	1299.422	Akaike info criterion	17.34687
Sum squared resid	28704471	Schwarz criterion	17.54583
Log likelihood	-178.1421	Hannan-Quinn criter.	17.39005
F-statistic	2733.515	Durbin-Watson stat	0.727268
Prob(F-statistic)	0.000000		

LATVIA

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:21
Sample: 1995 2015
Included observations: 21
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-873.7654	398.3269	-2.193589	0.0425
C(2)	1.473139	0.662737	2.222812	0.0401
C(3)	1.325432	0.566184	2.340993	0.0317
C(4)	3.656430	0.854875	4.277149	0.0005

R-squared	0.993309	Mean dependent var	14570.15
Adjusted R-squared	0.992128	S.D. dependent var	7231.723
S.E. of regression	641.6138	Akaike info criterion	15.93549
Sum squared resid	6998361.	Schwarz criterion	16.13445
Log likelihood	-163.3227	Hannan-Quinn criter.	15.97867
F-statistic	841.2581	Durbin-Watson stat	1.486304
Prob(F-statistic)	0.000000		

LITHUANIA

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:23
Sample: 1995 2015
Included observations: 21
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-48.54487	812.2901	-0.059763	0.9530
C(2)	1.647497	0.763324	2.158320	0.0455
C(3)	1.086172	0.628080	1.729352	0.1019
C(4)	2.725856	0.757893	3.596625	0.0022

R-squared	0.994609	Mean dependent var	21550.06
Adjusted R-squared	0.993657	S.D. dependent var	10675.94
S.E. of regression	850.2576	Akaike info criterion	16.49860
Sum squared resid	12289947	Schwarz criterion	16.69756
Log likelihood	-169.2353	Hannan-Quinn criter.	16.54178
F-statistic	1045.376	Durbin-Watson stat	0.914908
Prob(F-statistic)	0.000000		

ROMANIA

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:24
Sample: 1995 2015
Included observations: 21
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2920.436	1357.982	-2.150570	0.0462
C(2)	2.496890	0.197004	12.67431	0.0000
C(3)	1.803209	0.205977	8.754423	0.0000
C(4)	1.007817	0.588639	1.712114	0.1051

R-squared	0.998429	Mean dependent var	86922.34
Adjusted R-squared	0.998152	S.D. dependent var	48240.44
S.E. of regression	2073.781	Akaike info criterion	18.28178
Sum squared resid	73109679	Schwarz criterion	18.48073
Log likelihood	-187.9587	Hannan-Quinn criter.	18.32496
F-statistic	3601.825	Durbin-Watson stat	1.715103
Prob(F-statistic)	0.000000		

SLOVAKIA

Dependent Variable: GDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/23/17 Time: 19:26
Sample: 1995 2015
Included observations: 21
GDP = C(1)+C(2)*IND+ C(3)*TRA+C(4)*PAD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1837.734	302.3971	-6.077219	0.0000
C(2)	1.089920	0.214402	5.083545	0.0001
C(3)	2.182835	0.459158	4.753995	0.0002
C(4)	2.696115	0.415311	6.491802	0.0000

R-squared	0.999441	Mean dependent var	44738.20
Adjusted R-squared	0.999342	S.D. dependent var	23521.46
S.E. of regression	603.4163	Akaike info criterion	15.81274
Sum squared resid	6189891.	Schwarz criterion	16.01169
Log likelihood	-162.0337	Hannan-Quinn criter.	15.85591
F-statistic	10124.18	Durbin-Watson stat	1.296307
Prob(F-statistic)	0.000000		

Data source: Eurostat, Datasets: National Accounts aggregates by industry (up to NACE A*64) [nama_10_a64], GDP and main components (output, expenditure and income) [nama_10_gdp], extracted March 16th, 2017

The interpretation of the regression estimations emphasizes the following situations:

In Bulgaria, the value added corresponding to *Wholesale and retail trade, transport, accommodation and food service activities* has the most significant influence on the GDP. An increase by one euro of this independent variable shall lead to an increase of the main indicator by more than 3.78 euro. The *Industry (except construction)*also presents a favorable influence, its regression quotient is 1.70. The only factor whose impact is negative is *Public administration, defense, education, human health and social work activities*, however the quotient has a small value when compared to the previous two (-0.11). The free term is negative and much higher than the regression quotients, therefore we conclude that there are other factors with a non-favorable impact on the GDP of Bulgaria.

In the case of the Czech Republic, we outline the major influence of the factor *Public administration, defense, education, human health and social work activities*, which is characterized by a coefficient of more than 3.27. Next in the hierarchy, we have the *Industry (except construction)*, whose growth by one unit will induce an increase by 1.53 of the main indicator and the least sizable influence corresponds to *Wholesale and retail trade, transport, accommodation and food service activities*, having a quotient of 0.82. All factors have therefore a favorable influence on the GDP, and there is to be noted the position of the industrial-related sector, which is a pillar of sustainable development of this country. The value of the free term is negative and very high (considered as absolute level).

Estonia's economy is characterized by the high and positive influence of the *Wholesale and retail trade, transport, accommodation and food service activities* factor, which has a coefficient higher than 3.08, the other two factors also have positive regression quotients. While the *Industry (except construction)* is associated with a lower coefficient, that is 0.38, the *Public administration, defense, education, human health and social work activities* factor shall generate an increase of the GDP by more than 2.83 units, in the case in which its own value would grow by one unit. The free term is negative, and also has a significant value, over 591 in absolute value.

The regression coefficients estimated for the Hungarian model show relatively similar influences for the three factors considered, and all these influences are positive. That is, the first place in the hierarchy is held by *Wholesale and retail trade, transport, accommodation and food service activities* factor, its coefficient being 2.04, then we have *Public administration, defense, education, human health and social work activities* (1.97) and, on the last position, *Industry (except construction)*, with a coefficient of 1.76. The value of the free term is negative and some 100 times higher than the most prominent regression quotient of the model.

In Latvia, the regression model outlines the prominence of *Public administration, defense, education, human health and social work activities*, whose favorable influence was measured with a regression quotient of 3.65. The second factor in the hierarchy is the *Industry (except construction)*, whose coefficient is 1.47 and the *Wholesale and retail trade, transport, accommodation and food service activities* trails on the third place with a close value, of 1.32. Also in this case, there is a sizable and negative influence of additional factors, proven by the major value of the free term.

For Lithuania, the GDP has the *Public administration, defense, education, human health and social work activities* as the most important factor, in the scope of our analysis. It's regression coefficient is 2.72. The *Industry (except construction)* has a less sizable influence, with a coefficient of 1.64, while the weakest factor is the *Wholesale and retail trade, transport, accommodation and food service activities* (1.64). The free term is negative, but smaller in size when compared to the other countries' cases.

The model estimated for Romania reveals the positive and prominent impact of *Industry (except construction)*, a factor with a regression coefficient of 2.49. The other two independent variables have quotients below 2, that is 1.80 for the factor *Wholesale and retail trade, transport, accommodation and food service activities* and 1.00 for *Public administration, defense, education, human health and social work activities*. The high level of the industrial factor's coefficient offers reliable incentive for measures aimed towards the further development of this group of sector within the Romanian economy. The model is characterized by a significant, negative, free term.

In the case of Slovakia, the most important factor is Public administration, defense, education, human health and social work activities, as its coefficient has a value of 2.69. Next, we have Wholesale and retail trade,

transport, accommodation and food service activities, while the weakest impact is associated with Industry (except construction), with regression coefficients of 2.18 and 1.08, respectively. To be observed, the negative and significant value of the free term.

All models presented have significant values of the tests *R-Square*d and *Adjusted R-Square*d, the smallest value within the panel being however above 0,98. We, thus, take into account the fact that the models are well founded and indicate significant links between independent variables and the GDP.

Conclusions

While *Industry (except construction)* and *Wholesale and retail trade, transport, accommodation and food service activities* are the most significant influence factors for all economies analyzed, the trade has the highest impact on the three former soviet Baltic countries. The sector with the least major contribution is the *Arts, entertainment and recreation etc.*, for all economies. All regression models are characterized by high values of *R-Squared*, over 99%, which allows us to consider that the models are reliable and can be applied in further analyses. In some cases, the free parameter has negative values, while in other cases is positive.

Regarding the impact of the selected factors on the GDP, they act in a different manner at the level of countries analyzed. We observe that the independent factor *Industry (except construction)* has the strongest influence in Romania, the GDP in the case of the other countries is mainly influenced by on of the other two factors.

The author assumes to further study the sectorial evolution for this panel of countries, by applying multiple regression-based models to other groups of factors and, as more data becomes available, by extending the datasets subjected to analysis.

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