Darko B. Vukovic*'s response to the comment on: Correlation analysis of indicators of regional competitiveness: The case of Republic of Serbia (2013)

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After the suggested criticisms on the article Correlation analysis of indicators of regional competitiveness: The Case of the Republic of Serbia, which was published in the journal *Economic Horizons*, Volume 15, Number 3, in 2013, this text contains the answers to the remarks, with certain corrections. The article Correlation analysis of indicators of regional competitiveness: The Case of the Republic of Serbia belongs to the narrower area of the regional economy, where the statistical analysis only is used as a method of the studied problem. Therefore, the primary and largest part of the paper is devoted to the regional economy which has affected that some of the statistical procedures are excluded (bearing in mind that the statistics in this paper have a lower theoretical significance). In this text, I am going to present the

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omitted explanations or the results of the analysis (testing the significance of the correlation of the researched indicators). There are also some errors, which will be corrected.

The remark stating that the correlation analysis does not examine the frequency of the connections but rather a quantitative agreement between the phenomena is accepted. The remark for p. 201 in the second paragraph is rejected. This was about the complexity of the analysis rather than about how reliable or unreliable it is.

The correlation coefficient is an often used statistical method which determines the existence of quantitative stacking as well as the strength of stacking between variables. In the case of the existence of a linear correlation between two phenomena, it is a simple linear correlation. Pearson's coefficient of simple linear correlation is the best-known measure that expresses the degree of linear quantitative stacking between two phenomena. During the testing of the significance of this coefficient, it is assumed that the common layout of researched variables is normal. The expression of Spearman's correlation coefficient is shown in the article Correlation analysis of indicators of regional competitiveness: The Case of the Republic of Serbia, which is an error. Therefore, this remark is accepted. The following formula is used for the computation of Pearson's coefficient of the sample (which is omitted in the operation):

$$r = \frac{n \cdot \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - \left(\sum x\right)^2} \cdot \sqrt{n \sum y^2 - \left(\sum y\right)^2}}$$

The testing of Pearson's linear coefficient of correlation was carried out by using the IBM SPSS Statistics software. Version 20, which is available on the Internet (http://ibm-spss-statistics.soft32.com/download/file/id/796185/?&no_download_manager=true) was used. This computational operation is exercised by all the versions of the SPSS, so it was not considered necessary to mention which version was used. Moreover, for the purpose of this analysis, Microsoft Excel 2010 is also sufficient, which can provide an adequate testing of Pearson's linear correlation coefficient.

At the end of the article (in the Apendix), the values obtained through the survey are shown. Surveys may not include the Likert scale (the encryption of 1 to 5, although the Likert scale may include 7 modalities of answers); they, however, may also offer a different system of answers. In this case, the survey offers a possibility of an index evaluation, as a subjective (qualitative) assessment of participants. The further processing of the data I do not want to explain since it was used for the purposes of another analysis, which is not the subject of this paper.

Further in the text, the testing of the significance of the correlation of the investigated indicators will be displayed, which testing indicates a statistically significant correlation among the greatest number of indicators.

As a relative measure of quantitative stacking between the gross domestic product (GDP) of the region and the number of companies, Pearson's correlation coefficient was used. On the basis of the obtained values of this coefficient , it was concluded that there is a high degree of direct linear correlation in the sample. In testing the significance of the obtained correlation, the obtained value is less than 0.05. This indicates that at the respective level of significance between these variables there is a statistically significant correlation (Table 1).

Table 1 The correlation of the GDP in the region with the number of companies

Correlations

		Regional GDP	The number of companies
Regional GDP	Pearson Correlation	1	,998**
	Sig. (2-tailed)		,002
	N	4	4
The number of companies	Pearson Correlation	,998**	1
	Sig. (2-tailed)	,002	
	N	4	4

** Correlation is significant at the 0.01 level (2-tailed)

Source: Author

A similar conclusion comes up with testing the significance of the obtained correlations in the sample

between indicators of the number of employees in region and regional GDP (Table 2). The analysis showed that there is a high correlation between regional GDP and the number of employees in a certain region.

The further testing of the sample showed that investment in capital assets have a medium positive correlation (r = 0.726). The growth of investments is positively correlated with GDP growth, but not to the extent that they have companies and the number of employees. The indicator related to the number of entrepreneurs in the region is slightly correlated with regional GDP (r = 0.391). This means that there is less quantitative stacking between these indicators. Correlation analysis of these indicators showed logical and expected results.

By testing the significance of correlations in the employment sample, the conclusion is that there is a statistically significant positive correlation with indicator budgetary expenditures in education (Table 3). This relationship indicates that there is a high statistical significance of the quantitative stacking between employment (the number of employees in region) and government invests in education (budgetary expenditures in education).

Table 2 The correlation of the GDP in the region with the number of employees in the region

Correlations

		Regional GDP	The number of employees in region
Regional GDP	Pearson Correlation	1	,981*
	Sig. (2-tailed)		,019
	N	4	4
The number of employees in region	Pearson Correlation	,981*	1
	Sig. (2-tailed)	,019	
	N	4	4

** Correlation is significant at the 0.05 level (2-tailed)

Source: Author

Table 3 The correlation of the number of employees and budgetary expenditures in education

Correlations

		The number of employees in region	Budgetary expenditures in education
The number of employees in region	Pearson Correlation	1	,988*
	Sig. (2-tailed)		,012
	N	4	4
Budgetary expenditures in education	Pearson Correlation	,988*	1
	Sig. (2-tailed)	,012	
	N	4	4

** Correlation is significant at the 0.05 level (2-tailed)

Source: Author

On the other hand, there was a slightly positive correlation between an investment in education and employment growth (r = 0.631); by testing this correlation, however, it was confirmed that it is not statistically significant - $p > 0.05$ (Table 4).

Table 4 The correlation of investments in education and the number of employees in region

Correlations

		Investments in education	The number of employees in region
Investments in education	Pearson Correlation	1	,631
	Sig. (2-tailed)		,369
	N	4	4
The number of employees in region	Pearson Correlation	,631	1
	Sig. (2-tailed)	,369	
	N	4	4

Source: Author

By analyzing the quantitative stacking in the sample between the indicators of employment with indicators of working age population (r = -0.177) and population with higher education (r = -0.197), it has been shown that coefficients were strongly negative.

Tables 5, 6 and 7 show that the correlation between the business environment indicators indicates the expected results. In fact, with the significance level of 0.01, statistically significant quantitative stackings between the extent of the clusters and the quality of the state services as well as between the quality of the state services and the attractiveness of the business environment have been proven.

Table 5 The correlation of the the extent of clusters and quality of state services

Correlations

		The extent of clusters	The quality of state services
The extent of clusters	Pearson Correlation	1	,994**
	Sig. (2-tailed)		,006
	N	4	4
The quality of state services	Pearson Correlation	,994**	1
	Sig. (2-tailed)	,006	
	N	4	4

** Correlation is significant at the 0.01 level (2-tailed)

Source: Author

The same conclusion is reached in the case of the analysis of correlation between the attractiveness of the business environment and the extent of clusters (Table 7).

Table 6 The correlation of the quality of the state services and the attractiveness of the business environment

Correlations

		The quality of state services	The attractiveness of the business environment
The quality of state services	Pearson Correlation	1	,996**
	Sig. (2-tailed)		,004
	N	4	4
The attractiveness of the business environment	Pearson Correlation	,996**	1
	Sig. (2-tailed)	,004	
	N	4	4

** Correlation is significant at the 0.01 level (2-tailed)

Source: Author

Table 7 The correlation of the attractiveness of the business environment and the extent of clusters

Correlations

		The attractiveness of the business environment	The extent of clusters
The attractiveness of the business environment	Pearson Correlation	1	1,000**
	Sig. (2-tailed)		,000
	N	4	4
The extent of clusters	Pearson Correlation	1,000**	1
	Sig. (2-tailed)	,000	
	N	4	4

** Correlation is significant at the 0.01 level (2-tailed)

Source: Author

The high value of the coefficient in the observed sample also indicate connectivity of air transportation with foreign countries and the independence of the judiciary, but testing has shown that the correlation was not statistically significant - $p > 0.05$. Almost all innovation indicators showed high positive values of the Pearson coefficient of the sample (over 0.9), except indicators the number of registered patents and published scientific research papers, which have weak positive correlation. The high degree of positive correlation between regional BDP and the extent of clusters is confirmed as statistically significant (Table 8).

Table 8 The correlation of the GDP in the region with the extent of the clusters

Correlations

		Regional GDP	The extent of clusters
Regional GDP	Pearson Correlation	1	,999**
	Sig. (2-tailed)		,001
	N	4	4
The extent of clusters	Pearson Correlation	,999**	1
	Sig. (2-tailed)	,001	
	N	4	4

** Correlation is significant at the 0.05 level (2-tailed).

Source: Author

Finally, the significance of the correlation between tourism and the specific indicators of the infrastructure is tested. In this sense, no statistically significant correlation between tourism and the largest number of the indicators of the infrastructure has been proven. The only statistically significant correlation, based on the sample data, has been proven to exist among the indicators of investments in water supply, investments in water supply and waste water management and the amount of hazardous waste in the region (Table 9).

Table 9 The correlation of investments in water supply and waste water management with the amount of hazardous waste in the region

Correlations

		Investments in water supply and waste water management	The amount of hazardous waste in the region
Investments in water supply and waste water management	Pearson Correlation	1	,975**
	Sig. (2-tailed)		,003
	N	4	4
The amount of hazardous waste in the region	Pearson Correlation	,975**	1
	Sig. (2-tailed)	,003	
	N	4	4

** Correlation is significant at the 0.05 level (2-tailed).

Source: Author

Based on the results of testing the significance of the correlation of the researched indicators, the validity of the article Correlation analysis of indicators of regional competitiveness: The Case of the Republic of Serbia, which was published in the journal *Economic Horizons*, Volume 15, Number 3, in 2013, can be verified.

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