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Correlation Relationship Between Regional Macroeconomic Indicators and the Number of Universities in the Russian Regions

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Abstract: The correlation linear relationships between regional macroeconomic indicators (gross regional product, population) and the number of universities in the regions of Russia was obtained which may be used in the planning process of creation, liquidation or merging of regional or local universities.

Key words: Linear regression relationship, Russian regions, gross regional product, population, coefficient of determination, regional distribution, higher education institutions, universities

INTRODUCTION

The problems of regional distribution of universities and its standards, unbalanced, polarization and planning are under an active study in China (Jun, 2011; Hai-ling, 2009; Hongliang and Xianyun, 2013; Hongmin and Qiushi 2008; Min, 2013; Mingke, 2006; Xu *et al*., 2010; Yongfei, 2008; Yunpeng, 2008; Zhao *et al*., 2007).

This is connected with the need to provide equal access to higher education for the vast majority of young people in China.

Some researchers by Chinese researchers deal with the comparative study of China-US regional distribution of Higher Education Institutions (Zhao *et al*., 2007; Hailing, 2009), with the first article studying regional distribution of universities and colleges from the point view of population and GDP. A similar approach is used in the research of Chun-lei (2011) in which correlations between GDP and population and indicators of Higher Education resources for three parts of China were obtained (Eastern, Middle and Western, 1998-2008).

Planning and optimizing distribution of Higher Education resources is devoted to the researches of Mingke (2006) and Xu *et al*. (2010), Min (2013) in his research makes an interesting observation stating that "lack of good teachers is often the chief reason why some provinces lagged behind in higher education development".

Unfortunately, all the above researches have been published in Chinese, which makes it difficult for other scholars to study them. As for other publications, we have found the only research supported by the grant no 322/2006 from the grant Agency of Charles University by the researches of Franta and Guzi (2008). According to this research, Czech Republic exhibits a high geographical variation of both human capital and universities. It studied a potential source of human capital spatial disparities: the unequal access to tertiary education caused by the absence/presence of a local university. It also reveals that heterogeneous information plays a significant role in admission to university.

All the above researches were identified with the help of search Engine "Google Scholar" Advanced Search. The objective of this study is to identify the correlations between gross regional product and population and a number of universities in the Regions of Russia, within the framework of regional distribution of Russian universities.

MATERIALS AND METHODS

Regional distribution of Russian universities has been done according to Webometrics University Rankings data (as of July, 2015) as well as to university web-sites. The data was preliminary refined (non -Russian universities were excluded) and corrected resulting in 1,482 universities (Webometrics database contains 1,484 Russian universities), distributed in 82 regions. According to Russian Federal State Statistics Service (ROSSTAT) as of late 2013, in respect to these Russian regions under study, data was obtained concerning the number of population and gross regional product in million rubles. Correlation analysis between the above macroeconomic indicators and the number of universities were made with Standard Excel options with the calculation coefficient of determination.

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The analysis of gross regional product distribution in regions of Russia enables to exclude the statistical outliers concerning oil and gas fields in the East and North and to make a correlation analysis for smaller number of regions 76. This enabled to obtain a better correlation coefficient between gross regional product and number of universities in the regions of Russia. In a similar way, in correlation between the population and the number of universities excluding capital regions of Russia with excessive number of universities.

RESULTS AND DISCUSSION

Table 1 shows the distribution of the number of universities and Gross Regional Product in the regions of Russia.

Table 2 shows the distribution of the number of universities and population in the regions of Russia.

Table 1: Distribution of the number of universities and gross regional product in the regions of Russia

Russian regions	No. of universities	GRP (2013) million rub.
Moskva	309	11,632,506.4
Sankt-Peterburg	110	2,496,549.1
Moskovskaya oblast'	67	2,551,284.2
Rostovskaya oblast'	46	923,531.7
Krasnodarskij kraj	43	1,617,875.9
Sverdlovskaya oblast'	40	1,586,228.7
Samarskaya oblast'	36	1,040,713.5
RespublikaTatarstan (Tatarstan)	34	1,547,151.7
Respublika Bashkortostan	30	1,266,983.0
Novosibirskaya oblast'	28	821,415.4
Stavropol'skij kraj	27	478,368.0
Krasnojarskij kraj	27	1,256,674.5
Chelyabinskaya oblast'	25	879,274.0
Volgogradskaya oblast'	24	606,122.6
Voronezhskaya oblast'	24	606,667.7
Omskaja oblast'	24	553,242.7
Respublika Dagestan	24	429,510.6
Nizhegorodskaya oblast'	23	925,832.9
Permskaya oblast'	23	893,409.8
Irkutskaja oblast'	20	796,587.0
Orenburgskaya oblast'	20	709,523.7
Kemerovskaya oblast'	19	668,311.9
Altajskij kraj	18	410,824.6
Yaroslavskaya oblast'	18	360,731.5
Ryazanskaya oblast'	17	278,731.8
Habarovskij kraj	17	473,695.2
Tyumenskaya oblast'	16	854,797.9
Saratovskaya oblast'	15	528,676.4
Smolenskaya oblast'	15	225,594.8
Leningradskaya oblast'	13	692,798.6
Astrakhanskaya Oblast	12	267,511.5
Ivanovskaya oblast'	12	157,735.1
Murmanskaya oblast'	12	307,459.3
Udmurtskaya Respublika	12	404,833.7
Hanty-Mansijskij AO-Jugra	12	2,789,654.0
Kaliningradskaya oblast'	11	277,362.6
Kaluzhskaya oblast'	11	293,433.8
Kurskaya oblast'	11	272,238.0
Primorskij kraj	11	575,615.4
Tverskaya oblast'	11	291,408.1
Tul'skaya oblast'	11	347,060.2
Belgorodskaya oblast'	10	569,414.1
Kirovskaya oblast'	10	224,726.5
Respublika Severnaya Osetiya-Alaniya	10	112,138.5
Bryanskaya oblast'	9	223,324.3
Respublika Komi	9	490,741.1
Tomskaya oblast'	9	402,546.1
Vologodskaya oblast'	8	341,137.6
Lipetskaya oblast'	8	314,790.4
Penzenskaya oblast'	8	270,854.1
Pskovskaya oblast'	8	114,246.5
Chuvashskaya Respublika-Chuvashiya	8	224,447.6
Vladimirskaya oblast'	7	307,486.0
Orlovskaya oblast'	7	164,525.8
Respublika Buryatiya	7	177,692.0
Respublika Sakha (Yakutiya)	7	569,131.6
Tambovskaya oblast'	7	235,859.7
Kurganskaya oblast'	6	165,150.3
Amurskaya oblast'	5	211,224.4
Arhangel'skaya oblast'	5	512,393.6
Zabajkal'skij kraj	5	229,782.0
Kamchatskij kraj	5	131,560.6
Respublika Mordoviya	5	149,331.7
Ul'yanovskaya oblast'	5	260,340.6
Respublika Kareliya	4	175,975.0
Kabardino-Balkarskaya Respublika	3	113,229.8
Kostromskaya oblast'	3	143,108.2
Novgorodskaya oblast'	3	177,930.1
Respublika Marij Èl	3	124,400.2
Respublika Hakasiya	3	143,534.2
Chechenskaya Respublika	3	118,150.7
Karachaevo-Cherkesskaya Respublika	2	62,704.4
Respublika Adygeya (Adygeya)	2	72,011.6
Respublika Kalmykiya	2	41,136.8
Respublika Tyva (Tuva)	2	41,749.2
Sahalinskaya oblast'	2	673,775.4
Evrejskaya avtonomnaya oblast'	1	37,885.4
Magadanskaja oblast'	1	88,490.1
Respublika Ingushetiya	1	45,171.0
Yamalo-Nenetskij Avtonomnyj Okrug	1	1,373,494.9
Nenetskij avtonomnyj okrug	0	171,771.9
?hukotskij avtonomnyj okrug	0	46,989.7
Total	1482	-

Table 2: Distribution of the number of universities and population (thous.people) in the regions of Russia

Russian regions	No. of universities	Population (thous. people), 2013
Moskva	309	12,108
Sankt-Peterburg	110	5,132
Moskovskaya oblast'	67	7,134
Rostovskaya oblast'	46	4,246
Krasnodarskij kraj	43	5,404
Sverdlovskaya oblast'	40	4,321
Samarskaya oblast'	36	3,211
RespublikaTatarstan (Tatarstan)	34	3,838
Respublika Bashkortostan	30	4,070
Novosibirskaya oblast'	28	2,731
Stavropol'skij kraj	27	2,794
Krasnojarskij kraj	27	2,853
Chelyabinskaya oblast'	25	3,490
Volgogradskaya oblast'	24	2,569
Voronezhskaya oblast'	24	2,329
Omskaja oblast'	24	1,974
Respublika Dagestan	24	2,964
Nizhegorodskaya oblast'	23	3,281

Table 2: Continue

Russian regions	No. of universities	Population (thous. people), 2013
Permskaya oblast'	23	2,636
Irkutskaja oblast'	20	2,418
Orenburgskaya oblast'	20	2,009
Kemerovskaya oblast'	19	2,734
Altajskij kraj	18	2,391
Yaroslavskaya oblast'	18	1,272
Ryazanskaya oblast'	17	1,141
Habarovskij kraj	17	1,340
Tjumenskaya oblast'	16	3,546
Saratovskaya oblast'	15	2,497
Smolenskaya oblast'	15	968
Leningradskaya oblast'	13	1764
Astrakhanskaya oblast	12	1017
Ivanovskaya oblast'	12	1043
Murmanskaya oblast'	12	771
Udmurtskaya Respublika	12	1,517
Hanty-Mansijskij AO -Jugra	12	1,597
Kaliningradskaya oblast'	11	963
Kaluzhskaya oblast'	11	1,005
Kurskaya oblast'	11	1,119
Primorskij kraj	11	1,938
Tverskaya oblast'	11	1,325
Tul'skaya oblast'	11	1,522
Èhukotskij avtonomnyj okrug	0	51
Belgorodskaya oblast'	10	1,544
Kirovskaya oblast'	10	1311
Respublika Severnaya Osetiya-Alaniya	10	704
Bryanskaya oblast'	9	1242
Respublika Komi	9	872
Tomskaya oblast'	9	1070
Vologodskaya oblast'	8	1193
Lipetskaya oblast'	8	1160
Penzenskaya oblast'	8	1361
Pskovskaya oblast'	8	657
Chuvashskaya Respublika-Chuvashiya	8	1240
Vladimirskaya oblast'	7	1413
Orlovskaya oblast'	7	770
Respublika Buryatiya	7	974
Respublika Sakha (Yakutiya)	7	955
Tambovskaya oblast'	7	1069
Kurganskaya oblast'	6	877
Amurskaya oblast'	5	811
Arhangel'skaya oblast'	5	1192
Zabajkal'skij kraj	5	1090
Kamchatskij kraj	5	320
Respublika Mordoviya	5	812
Ul'yanovskaya oblast'	5	1268
Respublika Kareliya	4	634
Kabardino-Balkarskaya Respublika	3	859
Kostromskaya oblast'	3	656
Novgorodskaya oblast'	3	623
Respublika Marij Èl	3	688
Respublika Hakasiya	3	534
Chechenskaya Respublika	3	1346
Karachaevo-Cherkesskaya Respublika	2	470
Respublika Adygeya (Adygeya)	2	446
Respublika Kalmykiya	2	282
Respublika Tyva (Tuva)	2	312
Sahalinskaya oblast'	2	491
Evrejskaya avtonomnaya oblast'	1	171
Magadanskaja oblast'	1	150
Respublika Ingushetiya	1	453
Yamalo-Nenetskij Avtonomnyj Okrug	1	540
Nenetskij avtonomnyj okrug	0	43
Chukotskij avtonomnyj okrug	0	51
Total	1482	

In both tables, regions are ranged in descending order specifying the respective number of universities.

The linear regression relationships (equations) in Fig. 1 and 2 are shown taking into account both table data (82 regions) and statistical outliers (76 regions). Among the regions excluded are Tyumen region, Kaliningrad region, The Sakha Republic (Yakutiya), Sakhalin region, Yamal-Nenets Autonomous district and Nenets Autonomous District.

As we can see, in the second case the coefficient of determination was a little higher.

In Fig. 3, the linear regression relationships (equations) are shown taking into account Table 2. As compared to previous calculations (Fig. 1 and 2), the coefficient of determination has been reduced by 16-20%, though is still high.

In Fig. 3, we can see two distinct points for Moscow and St.Petersburg, which distorts the real linear trend significantly.

If these two regions are excluded from the analysis, we can see obtain a much better correlation (Fig. 4).

This means that the number of universities in two capital regions of Russia (Moscow and St. Petersburg) are in much excess of what they really need. Students from all over Russia as well as from many foreign countries study at universities of these regions.

A rough visual analysis of Table 2 shows that the number of universities in Krasnodar Territory, Republic of Bashkortostan, Chelyabinsk region, Republic of Dagestan, Nizhniy Novgorod region, Kemerovo region, Tyumen region, Saratov region, Primorisky Territory, The Circassia Republic is low and disproportionate compared to the number of population.

Therefore, to improve access to Higher Education for the population it would be appropriate to establish new local universities in these regions.

On the other hand Yaroslavl regions, Smolensk region, Ryazanskaya region, Murmansk region, Kaliningrad region, etc. have got an excessive number of universities in respect to the population, which may be taken into account when decisions are taken to close out some universities or merge them; a more precise analysis can be made if we can calculate the deviation of coordinates of specific regions from straight line of the regression equation shown in Fig. 3.

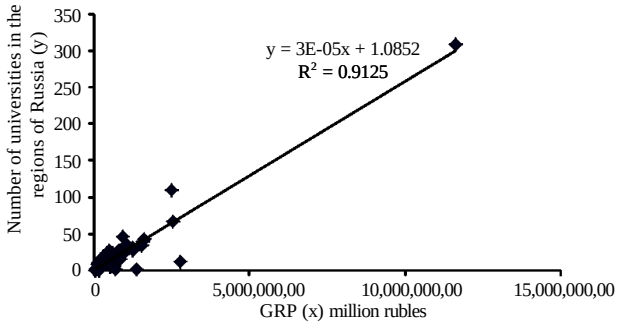

Fig 1: Linear Regression Relationship between Gross Regional Product (2013) and a number of Universities in 82 Regions of Russia (2015)

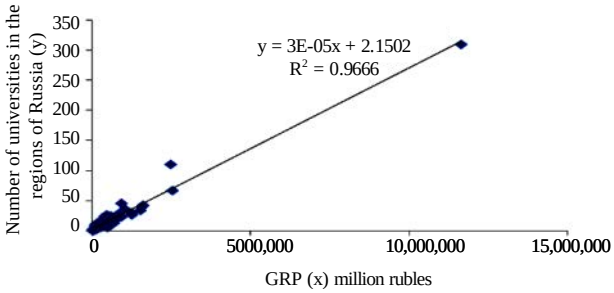

Fig. 2: Linear Regression relationship between gross regional product (2013) and a number of universities in 76 regions of Russia (2015)

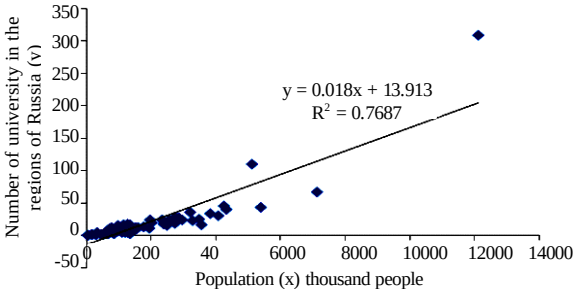

Fig. 3: Linear regression relationship between population (thous. People, 2013) and a number of Universities in 82 Regions of Russia (2015)

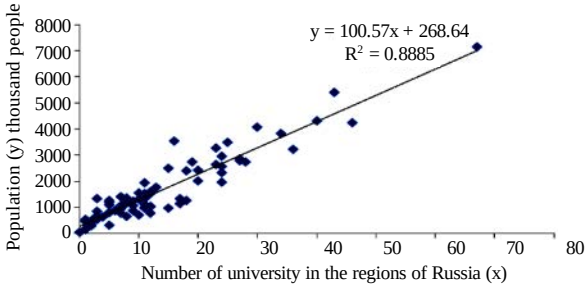

Fig. 4: Linear regression relationship between population (thous. People, 2013) and a number of Universities in 80 Regions of Russia (2015)

CONCLUSION

The correlation linear relationships between regional macroeconomic indicators (Gross Regional Product, population) and the number of universities in the regions of Russia was obtained which may be used in the planning process of creation, liquidation or merging of regional or local universities.

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