Subtheme: **University economic impacts**

Stepan P. Zemtsov[1]*, Vladimir A. Eremkin[2]

[1] Senior scientist, Institute of applied economic research, The Russian Presidential Academy of National Economy and Public Administration, Prospect Vernadskogo 82, 119571, Moscow, Russia

[2] Scientist, Institute of applied economic research, The Russian Presidential Academy of National Economy and Public Administration, Prospect Vernadskogo 82, 119571, Moscow, Russia

* **Corresponding author (**e-mail: spzemtsov@gmail.com)

WHAT FACTORS DETERMINE THE COMPETITIVENESS OF THE LEADING RUSSIAN UNIVERSITIES?

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The concept of the "Triple Helix" considers an ability of universities to create new ideas and translate them into new products as a result of interaction between university, government and business. But does the innovative activity of a university really influence the main indicator of its competitiveness, which is the demand among students?

In this paper, the authors try to identify the main factors, determining the competitiveness of the university, expressed in average and minimum scores of the Unified State Examination (the USE) for enrolled students. This work is based on the monitoring data of the Ministry of Education and Science of Russia in 2013 and our own research. To conduct the study the authors have collected a database of the country's leading universities (top 100 universities of Russia in 2013 by an assessment of the analytical centre "Expert RA").

The average and the minimum scores of the USE (AveUSE and MinUSE) serve as indicators of competition among the universities. If the average score characterizes the behaviour of the average applicants, the minimum score characterizes the preferences of students above average learning rate. Percentage of participants, who won All-Russian school learning competitions, or olympiads (Olimp), shows the choice of students, who have reached the unique achievements and can become an elite of the universities. The average USE scores are strongly positively associated with the minimum scores (0.69), but poorly with the share of the school olympiad participants (0.23). Three models, according three variables, have been proposed. Unfortunately, the data allowed us to construct only a binary dependent variable for the third model.

Based on the previous theoretical and applied research, the competitiveness, associated with the preferences of applicants, determined by the function of human capital development (F_{HC}) and signal function (F_{Sign}). The first function is associated with determinants, describing the universities' ability to prepare high-performance specialists. The main factors are the characteristics of teaching staff, students, curriculum and infrastructure. The second function is related to the perception of applicants and employers, and the main factors are the brand, and the cost of the most expensive programs.

Taking into account the theory of the "triple helix", the model include innovation characteristics (F_{Innov}), as well as the factors, which characterize the interaction with public authorities (F_{Gov}) and industrial enterprises (F_{Ind}). Characteristics of the region (F_{Regn}) and educational specialization (F_{Edu}) are used as additional proxy variables.

Thus, the first model as well as the others, describing the choice of the applicant, can be expressed in the following equation:

$$AveUGE = F_{HC} + F_{Sign} + F_{Innov} + F_{Gov} + F_{Ind} + F_{Reg} + F_{Edu} \quad (1)$$

Characteristics of a teaching staff are their number per 1000 students, the PhD degree per employees; the proportion of young scientists; the foreign academic staff per 1,000 employees.

Students' characteristics consist of the number of students; the share of full-time, foreign and studied abroad students. Process of education was assessed by the number of specialties. Scientific performance of the universities was evaluated according to its publication activity and citation. The success of the universities can also be determined by its income characteristics. The infrastructure was characterized by the dormitory availability; laboratory space per student; personal computers per students; share of the cost of modern equipment per total cost of the equipment and the area available for scientific research per 1,000 students.

As 'signal' for the future employers the price of the most expensive program can be used; the brand were characterized by the overall rating of the web-site in "Webometrics", the citation index for the site according to "Yandex", and the number of searches, according to "Yandex", per 100 students.

The success of the graduates was assessed according to the average expected salary after 5 years following graduation (according to the job seeking portal "SuperJob"), and the share of graduates in 2012, who have applied for assistance in finding suitable work.

Innovation activity of the university includes R & D spending per employees and the share of patent revenues in the income.

The indicators of government-university interaction are the status of national research or federal university; the ratio of budget and commercial incomes and the budget sources per the teaching staff. The indicators of enterprise-university interaction are the number contracts for training per 1000 students and the number of the bases of practice per 1,000 students.

Regional proxies are capital city, regions – "high innovators" (according the assessment of the Association of the Russian innovation regions) and the regions with agglomerations (more than 1 million citizens). Educational proxies are the economic and technical specialization.

All indicators are log-transformed. The authors compiled the correlation matrix for every dependent variable. Initially, the authors excluded indicators with a weak (less than 0.05) correlation with the dependent variables.

The excluded indicators of the first model include: the availability of dormitories, the laboratory facilities and new equipment, the share of foreign teachers, the proportion of PhDs, and foreign income from research activities. Additionally for the second model, the proportion of exchanges, the provision of computers, book collection, R & D, budget expenditures, international citations, high teacher salaries, and unemployment among graduates were not significant. For the third model, similar factors are insignificant as well as commercial income and income per employee.

Then the authors discarded one of the indicators, which was less associated with the dependent variable, if both indicators were cross-correlated (coefficient of correlation was more than |0.5|).

According to cross-correlation analysis, selection of university is determined by brand, which was assessed as the number of search queries, but the endogeneity is possible. Students moved to the largest metropolitan areas, which at the same time are the most innovative regions (the latter figure has been excluded due to multicollinearity). The price of education in a large extent can be determined by the quality of students, and not vice versa, but the endogeneity problem is not solved. The more teachers there are, the higher the quality of education is, and the more competitive university will be. High incomes of the universities lead to the ability to attract the best lecturers and new educational programs, which in turn attracts more students.

Students from the CIS countries and from other countries are going to the same universities (0.61), but students from the CIS are much stronger increase competition (0.28 and 0.18).

Potential wages are not the primary motivation when choosing a university ($k = 0.12$). However, the correlation coefficient is higher for the minimum scores of the USE and the school competitions' participants (0.30 and 0.21, respectively)

Competition in the economic universities is higher, they have more commercial incomes. The participants of the olympiads do not seek nor economic, nor technical careers, but prefer the natural sciences. Many applicants choose Moscow universities.

Although scientific career is not a priority (negative correlation with R & D and international publications); the quality of the scientific staff, evaluated by citation still plays an important role. These factors are more significant for the third model. Status of the research university, confirmed by high correlation with R & D and publication activity, yet has little positive impact on their competitiveness.

The number of specialties, which is cross correlated with the number of students, is a negative factor in choosing a university. Variety of disciplines (classical high school) is preferable for the former school competition's participants.

Finally, the first model explains 56% (adjusted R^2) of the total variation. The main factors are: the number of teachers per students, expected salary and unemployment of graduates. The USE score are higher in economic universities and lower in technical. Important role played an agglomeration effects. Unfortunately, the actions to reveal the "triple helix" effect are failed. In the second model (adjusted $R^2 = 0.35$), the expected wage and the number of searches are the main factors. The revenues from patent activity and the variety of specialties have a low negative effect. The third probit model was the least explained (adjusted $R^2 = 0.05$). Only potential wage, web citation and agglomeration effect can be considered as positive significant.

The study found that innovation activity and elements of the "triple helix" have practically no influence in the leading universities in Russia on students' demand. One of the most important conclusions is that the applicants are non-oriented to the production of innovative products and the implementation of research and development. The leading universities are focused on training of the highly specialized future employees (accountants, lawyers, etc.). For the former school competition participants, who more likely to choose a scientific profession, innovation activity can be also considered as an insignificant factor. As a result, innovation-active technical colleges are the least competitive.