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# ANALYSIS OF THE RELATIONS BETWEEN SCIENTOMETRIC AND ECONOMIC INDICATORS OF RUSSIAN UNIVERSITIES' PERFORMANCE

Daniil SANDLER, Dmitry GLADYREV *

*Graduate School of Economics and Management, Ural Federal University, Ekaterinburg, Russia*

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**Abstract.** *Purpose* – The study focuses on the relationship between universities' publication activity and such indicators of their economic performance as revenues from extrabudgetary sources and revenues from research.

*Research methodology* – The study relies on the economic, structural and scientometric data of 49 large Russian universities in a four-year period obtained from the Monitoring of the Efficiency of Higher Education Institutions and the analytical tool SciVal. The research method is a regression analysis with panel data models.

*Findings* – The study has brought to light some interesting relations between scientometric and economic indicators: among other things, it was shown that higher rates of internationally co-authored publications are positively related with the share of universities' revenues from extra-budgetary sources. The rates of citation of universities' publications in journals indexed in major international databases are positively associated with revenues from research. Interestingly, there was a negative relationship between the share of nationally co-authored and the revenue from research.

*Practical implications* – The results can be used for the strategic management of universities and for developing national policies in the sphere of higher education and science.

*Originality/Value* – Apart from the most frequently used scientometric indicators such as the number of publications and citations, the following indicators were also included in the analysis: the share of internationally and nationally co-authored (domestic) publications, the share of publications in economics and management, in physics, arts and humanities.

**Keywords:** economics of universities, higher education management, scientometrics, internationalization of universities, Russia, higher educational institutions, HEIs.

**JEL Classification:** I22, I23, I28, H52, F65.

## Introduction

In the twenty-first century, the Russian government realized several initiatives aimed at developing the system of higher education. These included the creation and development of federal universities (a special category of universities that consolidate major scientific and

*Corresponding author. E-mail: *d.a.gladyrev@urfu.ru*

educational activities of regions), the program of national research universities (the status assigned to universities with a big research output), 5–100 Russian Academic Excellence Project (a large-scale project focused on the promotion of selected universities in major world universities rankings) and some other projects like "Universities as Centres of Innovation" and "Flagship Universities". Analysis of the target models and figures described by these universities' programs shows that these initiatives and programs heavily rely on one key assumption – the assumption that academic performance (publication activity) and economic efficiency of universities are closely tied (Sandler et al., 2019).

The indicators specified in federal universities' programs of development include the indicators related to publication activity, for example, the rate of publications in journals indexed in major international databases per 100 faculty members, and the indicators related to economic performance such as universities' revenues from extrabudgetary sources[1]. The same goals can be found in research universities' programs and in programs for the enhancement of international competitiveness of universities. Nevertheless, practice shows that the connection between these indicators is not as straightforward as one might think due to the severe time lag and the fact that a rise in publication activity has but an indirect effect on the economic performance of universities. It should be noted, however, that the majority of federal initiatives prioritize scientometric indicators (Sandler et al., 2019).

These initiatives are parts of national projects, and in 2020 they are going to enter a new stage, which is what makes the analysis of the relationship between these indicators particularly relevant. Moreover, a better understanding of these relations can be useful for designing and updating university development programs.

This study is aimed at identifying the objective connections between academic performance and human potential, on the one hand, and economic efficiency of universities, on the other. The study places a special emphasis on scientometric indicators, including those that have so far been underexplored in the research literature.

## 1. Literature review

Due to the historical, structural and conceptual peculiarities of the Russian higher education system, it is quite difficult to extend the results of international studies to the Russian context. Nevertheless, since in Russia, the research on this topic is relatively scarce, in this paper, we are going to rely primarily on international findings.

Many studies of the relationship between universities' research performance and their economic results either focus on specific cases (Smith, 1999) or take a more general perspective, discussing major trends and drivers in universities' economic activities (Geiger, 2004). Salmi's model of a world-class university explicitly relies on the connection between the university's economic potential and economic parameters (Salmi, 2009).

[1] Methodological Guidelines for the Development and Updating of Development Programs for Universities Classified as a "Federal University" or "National Research University" № АК-20/05-вн of 13.03.2015

A large-scale study of European universities revealed the factors that affected the number of university patents and spin-offs (Riviezzo et al., 2019). The majority of the factors characterizing the contributions of different research fields were not proved to be significant with the only exception of the medical field, which exhibited a positive relationship with the number of patents. Another factor that affected the number of patents was the average faculty age (inverse relationship). The number of spin-offs generated by a university is positively related to the size of the university and the home country's overall expenditures on research.

Another study based on OECD data used the number of patents, spin-offs and research contracts as dependent variables. Among the variables characterizing the contributions of different research fields, the majority of variables were not proved to be significant, except for engineering, which had a positive relationship with the number of patents. In all the models, the variable of the number of WoS publications was significant (its significance, however, was weaker for the number of spin-offs) (Van Looy et al., 2011).

A number of other studies demonstrated a positive relationship between the publication and entrepreneurial activities of universities (Calderini & Franzoni, 2004; Meyer, 2006; Van Looy et al., 2006; Azoulay et al., 2007; Czarnitzki et al., 2007; Stephan et al., 2007; Fabrizio & Di Minin, 2008; D'Este et al., 2010). It can be supposed that the number of patents, the amount of research and the number of publications are related with the same variable which can be referred to as "research effort and competencies" (Breschi et al., 2005).

Another factor that determines the success of a university's entrepreneurial activities is the number of research collaborations (Bozeman et al., 2013). Some studies, however, show that the relationship between research collaborations and the economic performance of universities is more complex and less straightforward than it may seem (Franklin et al., 2001; Dietz & Bozeman, 2005).

A comprehensive analysis of the use of scientometric and economic indicators in world university rankings' methodologies was conducted by Polikhina and Trostyanskaya (2018).

## 2. Data and methodology

This study relies on economic, structural and scientometric data of 49 Russian universities in a 4-year period (2015–2018).

The sample (see Table 1) includes all federal universities (except for the Crimean Federal University), all national research universities (NRUs) (except for St. Petersburg Academic University of the Russian Academy of Sciences), all participants of the 5–100 Project, and other universities included in world rankings QS and THE.

Most of the data were obtained from the Monitoring of the Efficiency of Higher Education Institutions[2]. We selected three variables characterizing a university's economic performance:

- revenues from commercial activities per faculty-member;
- revenue from research (excluding state budget funds and funds from state programs for science support) per faculty member;
- share of the university's revenues from extrabudgetary sources.

[2] Monitoring of the Efficiency of Higher Education Institutions http://indicators.miccedu.ru/monitoring/?m=vpo

Table 1. Russian universities included in the sample

| | University | 5-100 | Federal universities | NRUs |
|---|---|---|---|---|
| 1 | Immanuel Kant Baltic Federal University | + | + | |
| 2 | Belgorod State National Research University | | | + |
| 3 | Voronezh State University | | | |
| 4 | Higher School of Economics | + | | + |
| 5 | Far Eastern Federal University | + | + | |
| 6 | Irkutsk National Research Technical University | | | + |
| 7 | Kazan Federal University | + | + | |
| 8 | Kazan National Research Technical University | | | + |
| 9 | Kazan National Research Technological University | | | + |
| 10 | Ogarev Mordovia State University | | | + |
| 11 | Moscow Aviation Institute | | | + |
| 12 | Moscow State Institute of International Relations (MGIMO) | | | |
| 13 | Moscow State University of Civil Engineering | | | + |
| 14 | Bauman Moscow State Technical University | | | + |
| 15 | Moscow State University | | | |
| 16 | Moscow Institute of Physics and Technology | + | | + |
| 17 | Moscow Power Engineering Institute | | | + |
| 18 | National University of Science and Technology (MISiS) | + | | + |
| 19 | National Research University' Moscow Institute of Electronic Technology' | | | + |
| 20 | National Research University of Information Technologies, Mechanics and Optics (ITMO) | + | | + |
| 21 | National Research Nuclear University MEPhI | + | | + |
| 22 | Lobachevsky State University of Nizhny Novgorod | + | | + |
| 23 | Novosibirsk State Technical University | | | |
| 24 | Novosibirsk State University | + | | + |
| 25 | I.M. Sechenov First Moscow State Medical University | + | | |
| 26 | Perm State University | | | + |
| 27 | Perm National Research Polytechnical University | | | + |
| 28 | Gubkin Russian State University of Oil and Gas | | | + |
| 29 | Russian Presidential Academy of National Economy and Public Administration | | | |
| 30 | Pirogov Russian National Research Medical University | | | + |
| 31 | Peoples' Friendship University of Russia | + | | |
| 32 | Plekhanov Russian University of Economics | | | |
| 33 | Samara National Research University named after academician S.P. Korolev | + | | + |
| 34 | St.Petersburg Mining University | | | + |

*End of Table 1*

| | University | 5-100 | Federal universities | NRUs |
|---|---|---|---|---|
| 35 | St.Petersburg State University | | | |
| 36 | St.Petersburg Electrotechnical University' LETI' | + | | |
| 37 | Peter the Great St. Petersburg Polytechnic University | + | | + |
| 38 | Saratov State University n.a. N.G.Chernyshevsky | | | + |
| 39 | Northern (Arctic) Federal University | | + | |
| 40 | North-Eastern Federal University | | + | |
| 41 | North-Caucasus Federal University | | + | |
| 42 | Siberian Federal University | + | + | |
| 43 | Tomsk State University | + | | + |
| 44 | Tomsk Polytechnical University | + | | + |
| 45 | Tyumen State University | + | | |
| 46 | Ural Federal University | + | + | |
| 47 | Financial University under the Government of the Russian Federation | | | |
| 48 | South Ural State University | + | | + |
| 49 | Southern Federal University | | + | |

To explain these variables, a set of factors were selected, including 16 variables in two categories:

*Variables based on the data from the Monitoring of the Efficiency of Higher Education Institutions*

1. Average USE score of full-time state-funded students admitted to Bachelor's and Specialist's programs (except for students admitted following the quotas of target admission and students with privileged admission status) – *measures the quality of admissions.*
2. Share of students holding a Bachelor's, Specialist's or Master's degree earned at another university and enrolled in Master's, PhD, residency training, assistantship and traineeship programs in the total number of students enrolled in Master's, PhD, residency training, assistantship and traineeship programs – *measures the university's ability to attract young researchers from other organizations.*
3. Share of faculty without a Candidate or doctoral degree below the age of 30; share of faculty holding a Candidate degree below the age of 35; and the share of faculty holding a doctoral degree below the age of 40 in the total number of faculty – *measures the research potential of the younger faculty.*
4. Share of faculty who defended their Candidate and doctoral dissertations in the reporting period in the total number of faculty – *measures the faculty's participation in professional development.*

5. Number of journals, including electronic journals, published by the university – *measures the university's performance in research and publishing.*
6. Number of grants received by the university in the reporting year per 100 faculty members – *measures the university's performance in competition for grants.*
7. Share of international graduates from Bachelor's, Specialist's, and Master's programs in the total number of students – measures the university's ability to attract international students.
8. Share of international faculty in the total number of faculty – *measures the university's ability to attract international faculty.*
9. Ratio of the faculty's average salary (from all sources) to the average wage level in the region – *measures the salary level at the university.*
10. Share of faculty members holding a Candidate or doctoral degree in the total number of faculty (excluding part-time faculty and short-term contract faculty) – *measures the faculty quality.*
11. Number of citations of Scopus articles published in the last five years per 100 faculty members.

*II. Scientometric variables from SciVal, a research impact analysis tool*

12. Percentage of internationally co-authored Scopus publications.
13. Percentage of nationally co-authored Scopus publications.
14. Percentage of Scopus publications in arts and humanities.
15. Percentage of Scopus publications in physics and astronomy.
16. Percentage of Scopus publications in economics, econometrics and finance and business, management and accounting.

Although the Monitoring of the Efficiency of Higher Education Institutions was launched in 2013, the first two reports used different sets of indicators, which made them difficult to use. Therefore, for our analysis, we used the data for the period between 2015 and 2018.

The primary method of research is regression analysis with panel data models. We did not consider lagged variables since, due to the small number of observations, they would have negatively affected the sample's representativeness. Regression analysis involved building three panel data models with three economic variables as dependent variables – revenues from commercial activities per faculty-member, revenue from research per faculty member and share of the university's revenues from extrabudgetary sources.

## 3. Results

In all the models, Hausman and Wald's tests have shown that the panel data model with fixed effects is the optimal model type, which reflects the distinctive nature of Russian universities.

*First model. Revenue from commercial activities per faculty-member*

In the first model (see Table 2) we built, only four factors exhibited a high level of significance (at 1 and 5%). We found that there is an explicit connection between a university's revenues and the ratio of the average faculty salary to the average wage in the region. A possible explanation is that higher pay increases the faculty's productivity due to greater motivation.

Table 2. Model for the variable of a university's revenues from commercial activities per faculty member

| Dependent variable: Revenues from commercial activities per faculty-member | |
|---|---|
| Average USE score of full-time state-funded students admitted to Bachelor's and Specialist's programs (except for students admitted in accordance with the quotas of target admission and students with privileged admission status) | 9.67<br>(13.58) |
| Share of students holding a Bachelor's, Specialist's or Master's degree earned at another university and enrolled in Master's, PhD, residency training, assistantship and traineeship programs in the total number of students enrolled in Master's, PhD, residency training, assistantship and traineeship programs | –1.32<br>(1.14) |
| Share of faculty without a Candidate or doctoral degree below the age of 30; share of faculty holding a Candidate degree below the age of 35; and the share of faculty holding a doctoral degree below the age of 40 in the total number of faculty | 8.58<br>(6.43) |
| Share of faculty who defended their Candidate and doctoral dissertations in the reporting period in the total number of faculty | –83.3**<br>(34.8) |
| Number of journals, including electronic journals, published by the university | 14.72<br>(9.84) |
| Number of grants received by the university in the reporting year per 100 faculty members | 19.26**<br>(8.66) |
| Share of international graduates from Bachelor's, Specialist's, and Master's programs in the total number of students | –15.52<br>(14.85) |
| Share of international faculty in the total number of faculty | 29.86<br>(25.07) |
| Ratio of the faculty's average salary (from all sources) to the average wage in the region | 7.79***<br>(1.21) |
| Share of faculty members holding a Candidate or doctoral degree in the total number of faculty (excluding part-time faculty and short-term contract faculty) | 18.56**<br>(9.39) |
| Number of citations of Scopus articles published in the last five years per 100 faculty members | 0.04<br>(0.049) |
| Percentage of internationally co-authored Scopus publications | 1.99<br>(7.69) |
| Percentage of nationally co-authored Scopus publications | –1.62<br>(6.81) |
| Percentage of Scopus publications in arts and humanities | –5.00<br>(7.96) |
| Percentage of Scopus publications in physics and astronomy | –4.53<br>(5.10) |
| Percentage of Scopus publications in economics, econometrics and finance and business, management and accounting | 0.30<br>(5.50) |
| Intercept | –2142.599<br>(1131.538) |

*Notes*: Fixed effects regression.
Standard errors are in parentheses.
*** significant at 1%, ** significant at 5%, * significant at 10%.

Another finding worth considering is the positive relationship between a university's revenues and the number of grants per 100 faculty members won in the reporting year. We may suppose that the number of grants won by a university reflects its level of research and the efficiency of its management.

The rest of our findings may seem quite paradoxical: for example, there is a positive relationship between the share of faculty holding degrees and the universities' revenues and a negative relationship between the revenues and the share of faculty who defended their dissertations in the current year. The reason behind this result could be that the preparation and defence of a dissertation is a time- and resource-consuming process, both for the researcher and his or her department. Thus, all other conditions being equal, having faculty who defend dissertations in the reporting year may negatively affect the university's revenues.

All scientometric variables in this model were not proved to be significant, possibly because the education component prevails over research in the structure of the leading universities' activities and revenues.

*Second model. Revenues from research (excluding state budget funds and funds from state programs for science support) per faculty member*

In the second model (see Table 3), seven factors exhibited a high level of significance (at 1 and 5%). The positive relationship between the revenue from research and the ratio of the average salary at the university to the average wage in the region may be explained by higher faculty motivation.

The paradoxical result that we observed for the previous model was reinforced: the percentage of young researchers and the faculty holding degrees has a positive relationship with the revenue from research. In contrast, for the percentage of faculty who have defended their dissertations in the reporting year, the relationship is negative. The explanation, in this case, can be the same as for the previous model: a large number of defences requires professors and their departments to spend more resources.

Interestingly, we found that the number of academic journals published by a university has a positive relationship with its revenues from research, which could be explained by the fact that the number of academic journals reflects the university's level of research excellence. Moreover, universities engaged in the publication of journals may become centres of academic activity both on the national and international levels. The reputation for academic excellence thus gained can affect external stakeholders' choice of the university as a site for research and development.

Two scientometric indicators displayed a positive relationship with revenues from research. We found a positive relationship between citation rates of papers indexed in international databases and universities' revenues from research, which could be explained as follows: high citation rates and related factors are among the criteria of professors' eligibility for participation in research projects. Another more surprising result was the negative relationship between revenues from research and the number of nationally co-authored articles. It could be explained by looking at the reasons behind the high rates of such publications: high rates of nationally co-authored publications may be caused by the low levels of research activity at certain universities, which means that their faculty are simply unable to publish independently in Scopus-indexed journals.

Table 3. Model for the variable of the revenue from research per faculty member

| Dependent variable: Revenues from research (excluding state budget funds and funds from state programs for science support) per faculty member | |
|---|---|
| Average USE score of full-time state-funded students admitted to Bachelor's and Specialist's programs (except for students admitted in accordance with the quotas of target admission and students with privileged admission status) | 2.51<br>(6.67) |
| Share of students holding a Bachelor's, Specialist's or Master's degree earned at another university and enrolled in Master's, PhD, residency training, assistantship and traineeship programs in the total number of students enrolled in Master's, PhD, residency training, assistantship and traineeship programs | –1.01*<br>(0.56) |
| Share of faculty without a Candidate or doctoral degree below the age of 30; share of faculty holding a Candidate degree below the age of 35; and the share of faculty holding a doctoral degree below the age of 40 in the total number of faculty | 6.86**<br>(3.16) |
| Share of faculty who defended their Candidate and doctoral dissertations in the reporting period in the total number of faculty | –35.61**<br>(17.10) |
| Number of journals, including electronic journals, published by the university | 10.89**<br>(4.83) |
| Number of grants received by the university in the reporting year per 100 faculty members | 3.71<br>(4.25) |
| Share of international graduates from Bachelor's, Specialist's, and Master's programs in the total number of students | –0.19<br>(7.29) |
| Share of international faculty in the total number of faculty | –11.80<br>(12.32) |
| Ratio of the faculty's average salary (from all sources) to the average salary in the region | 3.66***<br>(0.60) |
| Share of faculty members holding a Candidate or doctoral degree in the total number of faculty members (excluding part-time faculty and short-term contract faculty) | 10.78**<br>(4.62) |
| Number of citations of Scopus articles published in the last five years per 100 faculty members | 0.06**<br>(0.02) |
| Percentage of internationally co-authored Scopus publications | –4.23<br>(3.78) |
| Percentage of nationally co-authored Scopus publications | –8.00**<br>(3.34) |
| Percentage of Scopus publications in arts and humanities | 0.0004<br>(3.91) |
| Percentage of Scopus publications in physics and astronomy | 1.78<br>(2.50) |
| Percentage of Scopus publications in economics, econometrics and finance and business, management and accounting | –0.19<br>(2.70) |
| Intercept | –1062.90<br>(1131.54) |

*Notes*: Fixed effects regression.
Standard errors are in parentheses.
*** significant at 1%, ** significant at 5%, * significant at 10%.

*Third model. Share of the university's revenues from extrabudgetary sources*

The third model (see Table 4), like the previous ones, shows the negative relationship between a university's revenue and the percentage of faculty who have defended their dissertations in the reporting year at the highest level of significance. This time, however, neither the share of faculty holding a degree nor the share of young researchers is significant.

The model also shows the negative relationship between a university's revenue and the share of Master's and PhD students with degrees earned at other HEIs, probably because such mobility is more typical of those disciplines where development is not closely linked to substantial extrabudgetary revenues. At the same time, all the variables corresponding to specific research fields were not proved to be significant.

One of the most significant variables is the ratio of the faculty's average salary to the average wage in the region: it has a positive relationship with the university's revenue from extrabudgetary sources, which could be explained in terms of the higher motivation of the faculty and their involvement in various development projects.

Yet another result, which is quite similar to the one we obtained for the variable of revenues from research, is the positive relationship with the number of academic journals published by the university. The number of academic journals published by a university reflects its level of research activity and its role as a platform for communication and exchange of ideas with the national and international academia. This, in turn, makes the university more attractive for external stakeholders as a site for research and development, resulting in higher revenues, including those from tuition and fees.

Another impressive result was the negative influence of the share of international students, although the significance level was 10%, which means that this finding maybe not as accurate as the others mentioned above.

Table 4. Model for the variable of the share of a university's revenues from extrabudgetary sources

| Dependent variable: Share of the university's revenues from extrabudgetary sources | |
|---|---|
| Average USE score of full-time state-funded students admitted to Bachelor's and Specialist's programs (except for students admitted in accordance with the quotas of target admission and students with privileged admission status) | 0.19<br>(0.25) |
| Share of students holding a Bachelor's, Specialist's or Master's degree earned at another university and enrolled in Master's, PhD, residency training, assistantship and traineeship programs in the total number of students enrolled in Master's, PhD, residency training, assistantship and traineeship programs | –0.04**<br>(0.02) |
| Share of faculty without a Candidate or doctoral degree below the age of 30; share of faculty holding a Candidate degree below the age of 35; and the share of faculty holding a doctoral degree below the age of 40 in the total number of faculty | 0.02<br>(0.12) |
| Share of faculty who defended their Candidate and doctoral dissertations in the reporting period in the total number of faculty | –1.72***<br>(0.64) |
| Number of journals, including electronic journals, published by the university | 0.45**<br>(0.18) |
| Number of grants received by the university in the reporting year per 100 faculty members | 0.05<br>(0.16) |

*End of Table 4*

| Dependent variable: Share of the university's revenues from extrabudgetary sources | |
|---|---|
| Share of international graduates from Bachelor's, Specialist's, and Master's programs in the total number of students | –0.49* (0.27) |
| Share of international faculty in the total number of faculty | –0.57 (0.46) |
| Ratio of the faculty's average salary (from all sources) to the average wage level in the region | 0.06*** (0.02) |
| Share of faculty members holding a Candidate or doctoral degree in the total number of faculty (excluding part-time faculty and short-term contract faculty) | 0.10 (0.17) |
| Number of citations of Scopus articles published in the last five years per 100 faculty members | 0.0014* (0.0009) |
| Percentage of internationally co-authored Scopus publications | 0.35** (0.14) |
| Percentage of nationally co-authored Scopus publications | 0.14 (0.12) |
| Percentage of Scopus publications in arts and humanities | –0.07 (0.15) |
| Percentage of Scopus publications in physics and astronomy | 0.01 (0.09) |
| Percentage of Scopus publications in economics, econometrics and finance and business, management and accounting | 0.04 (0.10) |
| Intercept | –4.73 (20.71) |

*Notes*: Fixed effects regression.
Standard errors are in parentheses.
*** significant at 1%, ** significant at 5%, * significant at 10%.

## Conclusions

Our study has shown that some scientometric variables affect such economic indicators as revenues from research and the share of revenues received from extrabudgetary sources. For instance, we found a positive relationship between the number of citations per 100 faculty members and universities' economic performance. The findings related to publications written in collaboration are particularly interesting in this respect: we found that international collaborations have a positive effect on the share of extrabudgetary revenues of universities while national collaborations have a negative impact on the level of revenues from research per faculty member.

In all likelihood, the economic effect is not created by these indicators but by the underlying mechanisms. To achieve the desired economic impact, it may, therefore, be productive to stimulate these mechanisms by addressing the indicators discussed above. On a practical level, our study has also identified those target indicators that can be combined in the university's development and correspond to its current strategic priorities. It is essential that the goals set by universities should not contradict each other and create a synergistic effect.

We would not go as far as to recommend to increase the share of internationally co-authored publications in order to boost universities' revenues from extrabudgetary sources. Nevertheless, our findings suggest that internationalization in the research sphere and an increase in extrabudgetary revenues usually go hand in hand. As for the negative relationship between the number of nationally co-authored publications and the revenue from research, it does not mean that any specific measures are required to address this situation, but it does mean that the existing Russian collaborations need some considerable revision and rebuilding. It may also signify that an efficient university usually has authors who are able to publish their research independently in international journals, which means that a viable strategy would be to attract, foster and build talent. As our model has shown, a growth in publication activity of universities usually accompanies an increase in their revenues from research, which may mean that both of these processes are linked to the realization of the same strategic task.

Remarkably, the variables characterizing the contributions of specific research fields were not proved to be significant in all models. This result can be interpreted in the following way: mechanisms of achieving economic goals are universal for all university types and can be used by universities specializing in STEM, economics or humanities alike.

The analysis of non-scientometric data also brought some impressive results. One of these findings may seem quite paradoxical at first sight: the share of faculty holding a degree (for all models) and the share of young researchers (for the model of revenue from research) have a positive influence on the given economic variables while the share of faculty who defended their dissertations in the reporting year, a negative impact. Such contradiction may be explained by the time it takes for a university to start benefiting from the dissertations defended by its faculty: the faculty spending time, effort and resources on their professional development in the current period may distract them from other spheres, for instance, contract research, which explains the negative relationship between this indicator and the university's economic performance.

It should be noted that the relations we discovered may be characteristic only of Russian universities, more precisely, large Russian universities (this may be due to the fact that we used a panel data model with fixed effects). This does not, however, diminish the importance of our findings since these universities constitute the core of Russian education and science. The results of our study can be used not only for the strategic management of these universities but also for developing national policies in the sphere of higher education and science. Moreover, they can be applicable in countries that have similar systems of higher education, in particular, CIS. More research is needed, however, to confirm these findings and elaborate upon them in the context of other countries.

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