# The impact of research collaboration on academic performance: An empirical analysis for Russian Universities

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# The Impact of Research Collaboration on Academic Performance: An Empirical Analysis for Russian Universities

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**Abstract**

The aim of this paper is to investigate the impact of external research collaborations on the scientific performance of academic institutions. Data are derived from the international SCOPUS database. We consider the number of citations of publications to evaluate university performance in Russia. To this end, we develop a non-overlapping generations model to evidence the theoretical idea of research externalities between academic institutions. Moreover, we implement different empirical models to test for the effect of external scientific collaborations on the institutional research quality. The results confirm an important positive impact of co-authoring process.

**Keywords:** Academic institutions; Productivity; Research externalities.

**Jel Codes:** I21; D2.

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## 1. Introduction

As observed in most countries, scientific performance has become the most important topic for science policy. There is an increasing trend in collaborations between individuals and organizations (Beaver, 2001; Rosenblat and Mobius, 2004; Grayal et al., 2006; Carillo, Papagni and Sapio, 2013). This collaboration considers researchers belonging to the same department and between institutions (Katzand Martin, 1997; Adams et al., 2005).

As recalled in Katz and Martin (1997) and Bonaccorsi and Daraio (2005), policy makers have supported initiatives to favors collaborations among researchers and academic institutions.

In this paper, our research question is what forms of collaboration are more effective at raising scientific Universities in Russia. In particular, we select top 50 Russian Universities according to National Ranking of Universities 2016 prepared by Interfax for two years 2015 and 2016 to identify formal collaborations instead of informal ones. In this way, we try to learn whether the investigation of a single researcher is better than the University, as the unity of analysis.

In order to satisfy our goal, we implement both econometric models for count data, and panel data model with clustered errors. Finally, we run also an instrumental variable model, where the number of students in mobility is used as an instrument for collaborations variable. The findings are particularly interesting: more external collaborations positively affect the Universities performance, measured by the number of citations.

The paper is structured as follows. Section 2 reviews the main findings on influence of scientific collaboration onto research performance, research productivity and citations of publications. Section 3 describes the data. Section 4 presents the theoretical framework and Section 5 deals with the empirical strategy. The results of empirical investigation are showed in Section 6, while Section 7 discusses the policy implication of analysis and deserves some remarks for further research.

## 2. Literature review on influence of collaboration on research performance

Collaboration in different forms supports the development of research quality and quantity of organisation or a specific research topic. There are many evidences for support this statement. Riahi et al. (2014) in their bibliometric study on the research performance of Iran in Immunology and Microbiology for 2000 – 2012 state that: "… scientific collaborations with researchers in other countries could play a major role in enhancing the level of knowledge of our researchers." . Sweile et al. (2016) doing the worldwide overview of tramadol studies says that " … Collaboration among pharmaceutical industry, clinical researchers and academic institutions can improve research quantity and quality on tramadol." . One of the findings in Kodama, Watatani, and Sengoku (2013) in their analysis of stem cell-related research is: " … we demonstrated a research assessment by proposing and introducing key performance indicators and found that a certain degree of interdisciplinarity and internal collaboration may bring about high research productivity." . Graue et al. (2013) in their analysis of Diabetes research in four Nordic countries (Denmark, Iceland, Norway and Sweden) from 1979 – 2009 show that " … International collaborative research networks facilitate funding opportunities and contribute to further development of professional research competence." . Stein et al. (2006) analyzing the brain-behaviour research in South Africa state that : " … Local and international collaboration may be useful in increasing research capacity in South Africa, and ultimately in improving mental health services".

Research Collaboration in different ways: international as well as national and intraorganisational is necessary for the increase the general research productivity of organizations. The examples of positive influence of research collaboration on research productivity and capacity can de found in many bibliometric studies that cover publications of different countries and research organisation in different fields of science and topics. Elhorst and Zigova (2014) measuring the research productivity of academic economists employed at 81 universities and 17 economic research in Austria, Germany and Switzerland state that "…empirical results support the hypotheses that collaboration and that the existence of economies of scale increase research productivity". Chakravarty and Madaan

(2016) in their analysis of research performance of Chandigarh city affiliations in 1964 – 2014 state: " … An important finding of the paper undertaken is that foreign collaborations and foreign journals have remained the epicenter of the research activity. … . National and international collaborations also form the basis of growth of research productivity." . Zucker and Darby (2011) in their study on research activity or M.R. Japanese biotechnology firms show: " … we find that identifiable collaborations between particular university star scientists and firms have a large positive impact on firms' research productivity, increasing the average firm's biotech patents by 34 percent, products in development by 27 percent, and products on the market by 8 percent as of 1989-1990".

Collaboration (primarily collaboration with developed countries) can also help less developed countries to build their research capacity and increase research performance. , Zdravkovic, Chiwona-Karltun and Zink (2016) measuring the research performance of five southern African Universities in fields of mathematics, physics, chemistry in 1995 – 2014state: " … We conclude that supporting international and national collaboration which includes increased scientific mobility, strong scientific groups and networks, are key factors for capacity building of research in southern African Universities." .

Collaboration also in general leads to the increase of levels of citations. Collaborated (especially internationally collaborated) publications receive higher number of citations the single-authorship papers. Evidence of positive influence of collaboration on the level of citation can be found in different studies. O'Leary et al. (2015) in their analysis of University of Toronto's Faculty of Medicine research performance for 2008–2012 show that " … The academic departments with the highest levels of collaboration and interdisciplinary research activity also had the highest research impact." . Fu et al. (2012) analyzing the Acupuncture research for 1980-2009 state that "… International collaborative papers are the most frequently cited." . Isiordia-Lachica et al. (2015) in the analysis of research performance of Universidad de Sonora (Mexico) for 2000 – 2009 state that "… International co-authorship produced higher citation rates.". Chuang, and Ho (2015) analyzing highly cited publications in Taiwan state that "… International collaboration was responsible for the increasing number of highly cited papers over the years." . Obamba and Mwema (2009) in their analysis of poli□□ of African academic partnerships state the following: " … This paper suggests that strategic international research collaboration between research communities located within Africa and those in developed countries, as well as regional partnerships among African universities themselves, represent the most productive framework for reinvigorating and strengthening research capacity within sub-Saharan universities." .

Collaboration also increases the visibility of research. Collaborative publications are in general more visible than purely national or one-author papers. Geracitano, Chaves, and Monserrat (2009) studying the success of Latin America in environmental studies for 1999 – 2008 show that: " … the establishment of collaborative studies could be one of the strategies to improve Latin American visibility in environmental studies." . Olmeda-Gómez et al. (2008) measure the research performance of Catalonian universities, for 2000 – 2004 and show that "… As a whole, they prefer to collaborate with institutions in the United States, the United Kingdom, France, Germany and Italy, and obtain better visibility when publishing with English-speaking authors." .

## 3. Methodology

To set the best Russian universities in our model we take them from National Ranking of Universities. This Ranking is formed every year since 2009/2010 by Interfax (privately-held independent major news agency in Russia). National Ranking of Universities is a Special project of Interfax Group launched in 2009 to develop and test new mechanisms for independent Russian universities rating system. This project was initially supported by Federal Education and Science Supervision Agency (Rosobrnadzor). Since 2010 the Ranking is implemented as the own project of Interfax with the participation of radio station 'Ekho Moskvy`. National Ranking of Universities combine six sub-indices (Educational activity rank; Research Activity rank; Research commercialization; and Innovation activity rank; Internationalisation and communications rank; Social Activity rank; Branding Rank). In 2010 National Ranking of Universities rates 51 Russian universities.

In 2016 database was expanded to 2014 universities. In our analysis we take top 50 Universities from the Ranking of 2016[1]. The total Rank score of these universities varies from 501 to 1000 points.

Than main problem was the availability of comparable and reliable data on Russian universities. To ensure the comparability and reliability of data we take the data from Monitoring of efficiency of activity of educational organizations of higher education that was launched in 2013 by Information-computing Centre of Ministry of Education and Science of the Russian Federation[2]. The purpose of Monitoring is the formation of information and analytical materials on the basis of information about the educational organizations of higher education and their branches on the basis of their performance indicators. The objects of Monitoring are educational organizations of higher education of the Russian Federation. The principles of monitoring:

- openness and publicity of events and data in Monitoring$

- continuity and comparability of indicators;

- accounting of the specificities of activity of educational organizations;

- the possibility of documentary evidence of the quality of data provided by educational organizations;

- the availability of data about educational organizations from external sources.

Data in Monitoring are collected and provided on yearly basis since 2013. IN 2015 the set of data was seriously expanded. In our model we take (for top-50 universities from Interfax National Ranking of Universities) indicators for 2015 and 2016. In 2016 Monitoring encompasses 830 educational organizations of higher education and 932 their campuses in Russia and 35 organisation abroad. In 2015 and 2016 data on 121 indicators of educational organizations of higher education of the Russian Federation are available in Monitoring.

WE take bibliometric activity indicator from Russian Science Citation Index (RSCI). RSCI is the largest Russian information and analytical portal in science, technology, medicine and education/ It

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[1] National Ranking of Universities for 2016 is available on http://univer-rating.ru/rating_common.asp?per=9&p=1 Website is in Russian language.

[2] The official web portal of Monitoring of efficiency of activity of educational organizations of higher education is available here http://indicators.miccedu.ru/monitoring/?m=vpo Website is in Russian language.

is electronic library of scientific publications, with rich capabilities of search and information gathering. RSCI is created by order of the Ministry of Education and Science of the Russian Federation. RSCI is a free public tool to measure and analyze the publication activity of scientists and organizations. RISC developed and supported by the company "Scientific electronic library". RSCI contains abstracts and full texts of more than 24 million scientific and technical publications (journal articles, conference proceedings, books, book series, monographs, analytical reports, scientific reports, dissertations etc.) including electronic versions of more than 5,200 Russian scientific and technical journals, including more than 3800 journals in open access[3].

In our model we take the 31 indicators (from the whole sample of 121 indicators available in Monitoring) that fit our theoretical framework (list of indicator used in our model is presented in Table A.1 in Appendix. Basic indicators of Russian Universities in our model are presented in Table A.2 in Appendix). Our indicators can be spitted onto several clusters: Research activity; Internationalisation: Collaboration; Students; Personnel and Infrastructure.

## 4. Theoretical framework

This section, according to a significant strand of literature (Acemoglu 1996, Aldieri and Vinci 2016), we present a basic Non-Overlapping Generation Model where Institutions of higher education consist of two different types of academic units both of them normalized to unity. In each university, all of academic researchers, assumed to be risk-neutral and with an inter-temporal preference rate equal to zero, live for two periods. In the first period, in order to improve their research expertise, they will choose their talents; in the second period scientific papers occur in a form of a partnership of two researchers belonging to the two different types of Schools. Benefits from the scientific partnership will be availed at the end of this second period.

A scientific research takes place according to the following functional forms:

$$P_{i,j,t} = Ae_{i,t}^{\alpha}e_{j,t}^{(1-\alpha)} \quad (1)$$

[3] Russian Science Citation Index portal is available on http://elibrary.ru/defaultx.asp Website is in Russian language.

with: $0 < \alpha < 1$, and where $P_{i,j,t}$ stands for scientific research output, $e_{i,t}$ and $e_{j,t}$ measure respectively the talent of the *i-th* and *j-th* researchers. *A* may captures effects due to technological and geographical proximities, public supply of Research Funds.

Moreover the statement of randomness of the researchers' matching function, will involve for all the *i-type* researchers the same probability of meeting *j-type* researchers, and then is too costly to break it up the above co-operation in order to find a new co-author for each researcher. The consequential anonymity of contracts, will imply that *j(i)-type* researchers' decisions, concerning talent skills, depend on the whole distribution of talent across all the *i(j)-type* ones.

The utility functions will be the following:

$$U_{i,t} = P^{e}_{i,j,t} - \frac{\theta_i e_{i,t}^{(1+\gamma)}}{(1+\gamma)} \quad (2)$$

$$U_{j,t} = P^{e}_{i,j,t} - \frac{\lambda_j e_{j,t}^{(1+\gamma)}}{(1+\gamma)} \quad (3)$$

where $\theta_i$ and $\lambda_j$ are a positive taste parameter capturing disutility of accumulating research competences. The above may be rewritten as:

$$U_{i,t} = Ae_{i,t}^{\alpha} \int e_{j,t}^{(1-\alpha)} dj - \frac{\theta_i e_{i,t}^{(1+\gamma)}}{(1+\gamma)} \quad (4)$$

$$U_{j,t} = Ae_{j,t}^{(1-\alpha)} \int e_{i,t}^{\alpha} di - \frac{\lambda_j e_{j,t}^{(1+\gamma)}}{(1+\gamma)} \quad (5)$$

from which we may derive:

$$e_{i,t} = \left\{\frac{A\alpha \int e_{j,t}^{(1-\alpha)} dj}{\theta_i}\right\}^{\frac{1}{\gamma+1-\alpha}} \quad (6)$$

$$e_{j,t} = \left\{\frac{A(1-\alpha) \int e_{i,t}^{\alpha} di}{\lambda_j}\right\}^{\frac{1}{\gamma+\alpha}} \quad (7).$$

From inspection of eqs. (6) and (7) we can state:

***Proposition 1*[4]:** *Assuming $\theta_i = \theta, \lambda_j = \lambda$:*

1. *There exists a unique equilibrium, Pareto inefficient, given by:* $(e_j{}^*, e_j{}^*)$.
2. *Social increasing returns, in the sense that small variations in talent's investments of all agents will make every one better off. Moreover when a small group of j-type (i-type) researchers invest more in research skills, other researchers will answer back, and the equilibrium rate of return of all will improve.*

[4] See Acemoglu (1996) for a formal proof of Prop. 1.

## 5. Empirical results

The model that is estimated is the following:

$C_{i,k} = C\ (Coll,\ x_{i,k}\ ,\ z_i\ ,\ w_k\ )$ (8)

Our empirical analysis aims to estimate the marginal effect of external collaborations (Coll) on quality indicator of Russian universities, measured by number of citations (C) of own papers, controlling for sources of heterogeneity across research units, research institutions and academic fields.

University-specific characteristics (vector $x_{i,k}$) include the number of PhD students (Phd) and post-doctoral fellows (Post), the amount of funds received for scientific activity (Funds) and the average age of member staff (Age_staff).

The institution-specific characteristics that affect the quality of a unit's publications ($z_i$) consider the "age" of an academic institution (Age), i.e. the years elapsed from its establishment up to 2010, and the number of faculty staff (staff).

Moreover, we take into account also universities potential by adding size (number of students) and the number of publications (Pub).

The input and output variables above are organized in a panel of Russian universities (years 2015 and 2016). Summary statistics for the selected variables are reported in Table 1.

Scientific fields ($w_k$) are grouped into 10 sectors: Chemical sciences, Engineering, Geological and chemical sciences, Medical sciences, Medical-Social-Economic sciences, Multidisciplinary, Natural sciences, Physics, Social and economic sciences and Mathematics.

**Table 1. Description statistics**

| Variable | Mean | Std. Dev. |
|---|---|---|
| $\log C_i$ | 5.93 | 0.921 |
| logColl | 3.15 | 0.436 |
| logPub | 5.03 | 0.663 |
| logSize | 9.58 | 0.483 |
| logPhd | 5.90 | 3.490 |
| logPost | 6.39 | 0.595 |
| logFunds | 13.52 | 0.914 |
| Log_Age_staff | 32.00 | 7.005 |
| Log_Age | 4.56 | 0.498 |
| Log_staff | 8.12 | 0.592 |

Note: 100 observations; variables in log terms.

As the dependent variable, the number of citations to own papers, is a count variable and not is normally distributed, OLS is not opportune (Greene, 1994; Winkelmann and Zimmermann, 1995). For this reason, we should implement the Poisson model corrected for heteroskedasticity. However, there are usually some very large values that contribute substantially to overdispersion. In this case, it is difficult to specify a model with a conditional mean and variance that captures the main features of the data. For this reason, we also estimate a negative binomial (NB)[5]. Finally, we compare Poisson and NB estimates using AIC (*Akaike's* information criterion) and BIC (*Bayesian* information criterion).

**6. Empirical results**

In Table 2, we report the results of the analysis based on Russian Universities data. As explained in the previous section, we compute Poisson and NB estimates. In order to identify the best model, we take into account the AIC and BIC information criteria in Table 3. On the basis of this procedure, the NB model is preferred, because of lower AIC and BIC.

**Table 2. Count Model results**

| | **Poisson** | | **NB** | |
|---|---|---|---|---|
| **Variable** | **Coeff.** | **s.e.**[a] | **Coeff.** | **s.e.**[a] |
| logColl | 0.89*** | (0.339) | 0.83*** | (0.258) |
| logPub | 0.30** | (0.158) | 0.41*** | (0.143) |
| logSize | -0.13 | (0.261) | -0.09 | (0.319) |
| logPhd | -0.01 | (0.038) | 0.01 | (0.077) |
| logPost | 0.01 | (0.001) | -0.01 | (0.001) |
| logFunds | -0.35*** | (0.118) | -0.35** | (0.141) |
| Log_Age_staff | 0.03** | (0.013) | 0.03*** | (0.013) |
| Log_Age | 0.07 | (0.179) | 0.04 | (0.211) |
| Log_staff | 0.01 | (0.001) | 0.01* | (0.001) |
| Pseudo $R^2$ | 0.58 | | 0.06 | |

a: *** Coefficient significant at the 1%, ** Coefficient significant at the 5%, * Coefficient significant at the 10%.
b: Scientific dummies are included in the estimation procedure. Chemical sciences is the reference country.
c: standard errors are corrected for heteroscedasticity.

[5] See Cameron and Trivedi (2013) for a technical discussion of Poisson and NB models.

**Table 3. Comparison based on Information criteria**

| Information criteria | Poisson | NB |
|---|---|---|
| AIC | 16795.997 | 1426.816 |
| BIC | 16858.521 | 1491.945 |

As we may observe, the regression results confirm the importance of external collaborations on the quality academic performance. This finding shows that academic production in quality determines an important scientific externality: it leads to a higher own performance index but also to higher performance of other academic institutions. The scientific collaborations represent a relevant channel for the diffusion of externality.

Moreover, we implement also a panel model with clustered errors:

$Y_{it} = X_{it}\boldsymbol{\beta} + u_i + e_{it}$ (9)

where $i$ = universities and $t$ = 2015 and 2016

$t$ index could represent any arbitrary index for observations grouped along two dimensions. The usual assumption is that $e_{it}$ is independently and identically distributed, iid, but this is clearly violated in many cases. For this reason, we may assume "clustered errors", i.e. observations within group $i$ are correlated in some unknown way, inducing correlation in $e_{it}$ within $i$, but that groups $i$ and $j$ do not get correlated errors (Wooldridge, 2002).

**Table 4. Panel data Model results**

| Variable | Coeff | s.e.[a] |
|---|---|---|
| logColl | 0.79* | (0.481) |
| logPub | 0.29** | (0.139) |
| logSize | -0.25 | (0.441) |
| logPhd | -0.03 | (0.069) |
| logPost | 0.01 | (0.001) |
| logFunds | -0.42*** | (0.152) |
| Log_Age_staff | 0.04** | (0.018) |
| Log_Age | 0.09 | (0.245) |
| Log_staff | 0.01** | (0.001) |
| $R^2$ | 0.57 | |

a: *** Coefficient significant at the 1%, ** Coefficient significant at the 5%, * Coefficient significant at the 10%.
b: Scientific dummies are included in the estimation procedure. Chemical sciences is the reference country.
c: standard errors are corrected for heteroscedasticity.

The causal interpretation of the parameters could be questionable because scientific performance and collaborations are affected by authors' ability. This aspect may lead to an omitted variable or joint causation matter. In order to avoid this bias, we consider two instruments for collaborations variable (Coll) in an instrumental variable (IV) model: the number of students towards Russian Universities (MOBILITYIN) and the number of Russian students towards other universities (MOBILITYOUT). There is no reason to expect correlation with the error term, since even if more students were involved in international exchange programs, this event does not lead to better scientific performance of the research units.

**Table 5. IV Model results**

| Variable | Coeff | s.e.[a] |
|---|---|---|
| logColl | 2.81** | (1.293) |
| logPub | 0.60*** | (0.180) |
| logSize | 0.11 | (0.386) |
| logPhd | -0.03 | (0.082) |
| logPost | 0.01 | (0.001) |
| logFunds | -0.46** | (0.233) |
| Log_Age_staff | 0.04 | (0.024) |
| Log_Age | -0.05 | (0.253) |
| Log_staff | 0.01 | (0.001) |
| Sargan overid.test | 0.145179 (p = 0.7032) | |

a: *** Coefficient significant at the 1%, ** Coefficient significant at the 5%.
b: Scientific dummies are included in the estimation procedure. Chemical sciences is the reference country.
c: standard errors are corrected for heteroscedasticity .

As we may observe from IV results, we find confirmation of the importance of external collaborations on Russian universities performance. The values of the Sargan overidentification test provide support for the null of valid orthogonal instrumental variables in the estimated model.

## 7. Policy implications and conclusions.

The main objective of this paper is that of investigating the effects of external scientific collaborations on the Russian Universities performance, measured by the number of citations towards the publications.

This topic has become important in any debate on policies to foster productivity in different countries. We approach this issue both theoretically and empirically. In particular, the rational behind the model is that the scientific publications in collaboration produce positive externalities to all Universities involved in the economic process.

Moreover, we estimate different econometric models to evidence the impact of external collaborations on the universities performance. The data refer to top 50 Russian Universities according to National Ranking of Universities 2016 prepared by Interfax specialized in 10 disciplines, observed for two years 2015 and 2016. The findings of all models evidence the importance of collaborations for the academic performance. Furthermore, we show that the knowledge flows that arise among researchers from different Universities are relevant to enhance the quality research. Indeed, we use the mobility of students as instruments for endogeneity of collaborations variable.

The results of our work have relevant implications for science policy. The knowledge exchange with researchers is crucial to obtain the highest research quality.

However, further research is necessary. The weaknesses of the analysis consist in the limited number of Universities and years observed in the sample. Hence, it should be opportune to replicate the economic exploration with a sample based on better statistical features. Additionally, it should be very interesting to compare our results to those stemming from the analysis based on more developed countries.

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**References**

Acemoglu D. A. (1996). Microfoundation for social increasing returns in human capital accumulation. *The Quarterly Journal Economics*, *111*(3), 779-804.

Adams J.D., Black G.C., Clemmons J.R., and Stephan P.E. (2005), Scientific teams and institutional collaborations: Evidence from U.S. universities, 1981-1999. Research Policy; 34; 259-285.

Aldieri L. and Vinci C. P. (2016). Technological Spillovers through a Patent Citation Analysis. *International Journal Innovation Management,* 20(2), 1650028.

Beaver D. (2001), Reflections on Scientific Collaboration (and its study): Past, Present, and Future. Feature Report. *Scientometrics*; 52; 365-377.

Bonaccorsi, A. and Daraio C. (2005), Exploring size and agglomeration effects on public research productivity. *Scientometrics*; 63; 87-120.

Cameron, AC and PK Trivedi (2013). Regression Analysis of Count Data, 2nd Edition. Cambridge: Cambridge University Press.

Carillo M R., Papagni E. and Sapio A. (2013). Do collaborations enhance the high-quality output of scientific institutions? Evidence from the Italian Research Assessment Exercise, *Journal of Behavioral and Experimental Economics (formerly The Journal of Socio-Economics)*, 47(C), 25-36.

Chakravarty, R., Chakravarty, R., Madaan, D., & Madaan, D. (2016). SCOPUS reflected study of selected research and higher education institutions (HEIs) of Chandigarh: a city of education and research. *Library Hi Tech News*, *33*(2), 12-14.

Chuang, K. Y., & Ho, Y. S. (2015). An evaluation based on highly cited publications in Taiwan. *Current Science*, *108*(5), 933-941.

Elhorst, J. P., & Zigova, K. (2014). Competition in research activity among economic departments: Evidence by negative spatial autocorrelation. *Geographical Analysis*, *46*(2), 104-125.

Fu, J. Y., Zhang, X., Zhao, Y. H., Tong, H. F., Chen, D. Z., & Huang, M. H. (2012). Scientific production and citation impact: a bibliometric analysis in acupuncture over three decades. *Scientometrics*, *93*(3), 1061-1079.

Geracitano, L. A., Chaves, I. S., & Monserrat, J. M. (2009). Scientometric analysis of Latin American environmental studies. *International Journal of Environment and Health*, *3*(4), 427-437.

Goyal S., Van der Leij M.J., and Moraga J. (2006), Economics: An emerging small world?. *Journal of Political Economy*; 114; 403-412.

Graue, M., Iversen, M. M., Sigurdardottir, Á. K., Zoffmann, V., Smide, B., & Leksell, J. (2013). Diabetes research reported by nurses in Nordic countries. *European Diabetes Nursing*, *10*(2), 46-51.

Greene, W. R. (1994). Accounting for excess zeros and sample selection in poisson and binomial regression models. Working paper 94–10, New York University.

Isiordia-Lachica, P., Rodríguez-Carvajal, R., Angulo, G., Chávez, K., & Barboza-Flores, M. (2015, August). Measurement of scientific research performance at the Universidad De Sonora, México. In *2015 Portland International Conference on Management of Engineering and Technology (PICMET)* (pp. 204-210). IEEE.

Katz S. J., and Martin B. R. (1997), What is research collaboration?. Research Policy; 26; 1-18.

O'Leary, J. D., Crawford, M. W., Jurczyk, E., & Buchan, A. (2015). Benchmarking bibliometrics in biomedical research: research performance of the University of Toronto's Faculty of Medicine, 2008–2012. *Scientometrics*, *105*(1), 311-321.

Riahi, A., Siamian, H., Zareh, A., Navaei, R. A., & Haghshenas, M. R. (2014). Quantitative Evaluation of Scientific Productions in Iran in Immunology and Microbiology Indexed in Scopus Database (2000-2012). *Journal of Mazandaran University of Medical Sciences (JMUMS)*, *24*(118).

Rosenblat T. S., and Mobius, M. M. (2004), Getting closer or drifting apart?. Quarterly Journal of Economics; 119; 971-1009.

Stein, D.J., Daniels, W., Emsley, R., Harvey, B., Blackburn, J., Carey, P., Ellis, G., Illing, N., Flisher, A., Moolman-Smook, H. and Mwaba, K., 2006. A brain-behaviour initiative for South Africa: the time is right. Metabolic brain disease, 21(2-3), pp.266-271.

Sweileh, W. M., Shraim, N. Y., Sa'ed, H. Z., & Al-Jabi, S. W. (2016). Worldwide research productivity on tramadol: a bibliometric analysis. *Springerplus*, *5*(1), 1-8.

Zdravkovic, M., Chiwona-Karltun, L., & Zink, E. (2016). Experiences and perceptions of South–South and North–South scientific collaboration of mathematicians, physicists and chemists from five southern African universities. *Scientometrics*, 1-27.

Zucker, L. G., & Darby, M. R. (2001). Capturing technological opportunity via Japan's star scientists: Evidence from Japanese firms' biotech patents and products. *The journal of Technology transfer*, *26*(1-2), 37-58.

Winkelmann, R. and Zimmermann K. (1995). Recent developments in count data modeling: Theory and application. *Journal of Economic Surveys*, 9(1), 1–24.

Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data. Cambridge, MA: MIT Press.

Appendix.

**Table A.1. List of variables used in the model.**

| Short name | Cluster of variable | Description |
|---|---|---|
| age | no cluster-basic info | Year of establishment of University |
| year | no cluster-basic info | Year of analysis |
| PhDS | students | Number of PhD students per 100 students |
| CIT | Research activity | Number of citations on publications published in the past 5 years, indexed in the Russian Science Citation Index per 100 persons of teaching and research staff |
| PUB | Research activity | Number of the publications indexed in Russian Science Citation Index, per 100 persons of teaching and research staff |
| Grants | Research activity | Number of grants received during the reporting year, per 100 persons of teaching and research staff |
| ForeignS1 | Internationalisation | Share of foreign students (bachelors, masters, specialists) except the Commonwealth of Independent States countries in total number of students (bachelors, masters, specialists) (all types of education) |
| ForeignS2 | Internationalisation | Share of students (bachelors, masters, specialists) from Commonwealth of Independent States (CIS) countries in total number of students (bachelors, masters, specialists) (all types of education) |
| ForeignS3 | Internationalisation | Share of foreign alumni (bachelors, masters, specialists) CIS countries all other countries in total number of students (bachelors, masters, specialists) (all types of education) |
| ForeignS4 | Internationalisation | Share of foreign alumni (bachelors, masters, specialists) except the CIS countries in total number of students (bachelors, masters, specialists) (all types of education) |
| ForeignS5 | Internationalisation | Share of alumni (bachelors, masters, specialists) from Commonwealth of Independent States countries in total number of students (bachelors, masters, specialists) (all types of education) |
| MobilityOut | Collaboration | Share of students (bachelors, masters, specialists) enrolled in full-time, studied abroad for at least a semester (trimester), in total number of students (bachelors, masters, specialists) enrolled in full-time education |
| MobilityIn | Collaboration | Share of students (bachelors, masters, specialists) from foreign universities studied full-time in a given Russian university at least a semester (trimester) per 100 students (bachelors, masters, specialists) enrolled in full-time education |
| ForeignR | Collaboration | Number of foreign leading professors, teachers and researchers working in a given Russian university for at least one semester |
| PostS1 | Internationalisation | Share of foreign postgraduate students (excluding the CIS countries) in total number of postgraduate students |
| PostS2 | Internationalisation | Share of foreign postgraduate students from CIS countries in total number of postgraduate students |
| Infra | infrastructure | Total square of teaching and laboratory space per student (the reduced contingent), including: |
| Computer | infrastructure | Number of personal computers per one student |
| Machinery | infrastructure | Share of the value of machinery and equipment not older than 5 years old in the total value of machinery and equipment |
| Size | students | Total number of students (bachelors, specialists, masters) |
| Funds1 | Revenues and Finance | The total amount of funds received (for the year) on the implementation of R & D performed in-house |
| Funds2 | Revenues and Finance | The total amount of funds received (for the year) of works and services related to scientific, scientific-technical, creative and development services performed in-house |
| PostNumber | students | Number of postgraduate students |
| employees | Personnel | Total number of employees of university (without external part-time workers and personnel working under contracts of a civil law character) |
| teachers | Personnel | Total number of teaching staff (without external part-time workers and personnel working under contracts of a civil law character) |
| researchers | Personnel | Total number of research staff (without external part-time workers and personnel working under contracts of a civil law character) |
| teach65 | Personnel | Share of teaching staff younger than 65 years |

| Short name | Cluster of variable | Description |
|---|---|---|
| teach40 | Personnel | Share of teaching staff younger than 40 years |
| fields | no cluster-basic info | Key field of science (according to Russian Science citation Index) |
| Coll | Collaboration | Number of articles in collaboration with foreign organizations |
| coll2 | Collaboration | Share of publications in collaboration with other organizations (Russian Science Citation Index database) (for 2011 - 2015) |
| coll3 | collaboration | Share of publications in collaboration with foreign co-authors (Russian Science Citation Index database) (for 2011 - 2015) |

**Table A.2. Some key variables for the 50 studied Russian universities analysed in the model.**

| name | year | **year** | **PUB** | **Grants** | **Size** | **Funds1** | **PostNumber** | **employees** | **coll2** |
|---|---|---|---|---|---|---|---|---|---|
| Lomonosov Moscow State University | 1755 | 2016 | 151.98 | 17.33 | 30 313 | 6 287 054.20 | 3 923 | 19 021 | 33.1 |
| Lomonosov Moscow State University | 1755 | 2015 | 86.93 | 13.98 | 30 822 | 5 657 091.20 | 3 786 | 19 065 | 33.1 |
| National Research Nuclear University MEPhI (Moscow Engineering Physics Institute) | 1942 | 2016 | 425.99 | 12.02 | 7 398 | 1 958 940.10 | 582 | 2 799 | 34.9 |
| National Research Nuclear University MEPhI (Moscow Engineering Physics Institute) | 1942 | 2015 | 185.26 | 16.38 | 8 093 | 2 025 584.40 | 489 | 2 731 | 34.9 |
| Novosibirsk State University | 1959 | 2016 | 317.47 | 8.02 | 6 413 | 565 805.90 | 327 | 1 721 | 74.6 |
| Novosibirsk State University | 1959 | 2015 | 148.16 | 7.97 | 6 485 | 527 715.10 | 275 | 1 672 | 74.6 |
| Moscow Institute of Physics and Technology | 1951 | 2016 | 113.32 | 6.35 | 5 878 | 1 516 753.40 | 789 | 1 922 | 69.9 |
| Moscow Institute of Physics and Technology | 1951 | 2015 | 94.77 | 7.93 | 5 611 | 1 748 659.60 | 655 | 1 794 | 69.9 |
| Saint-Petersburg State University | 1724 | 2016 | 152.34 | 6 | 19 395 | 1 625 152.50 | 2 251 | 10 739 | 33.1 |
| Saint-Petersburg State University | 1724 | 2015 | 99.62 | 6.21 | 19 944 | 1 050 194.40 | 2 003 | 11 121 | 33.1 |
| National Research University Higher School of Economics | 1992 | 2016 | 199.87 | 4.49 | 19 680 | 2 489 007.40 | 679 | 5 440 | 20 |
| National Research University Higher School of Economics | 1992 | 2015 | 154.4 | 4.22 | 17 760 | 2 484 401.40 | 663 | 5 392 | 20 |
| Bauman Moscow State Technical University | 1830 | 2016 | 206.09 | 3.63 | 18 557 | 2 759 860.70 | 946 | 6 914 | 29.8 |
| Bauman Moscow State Technical University | 1830 | 2015 | 116.76 | 0 | 17 138 | 3 295 811.10 | 910 | 6 881 | 29.8 |
| Peoples' Friendship University of Russia | 1960 | 2016 | 281.81 | 3.45 | 21 484 | 323 670.80 | 2 926 | 4 786 | 21.1 |
| Peoples' Friendship University of Russia | 1960 | 2015 | 116.76 | 0 | 17 138 | 3 295 811.10 | 910 | 6 881 | 21.1 |
| National Research Tomsk State University | 1878 | 2016 | 251.62 | 19.65 | 13 940 | 1 827 700.00 | 687 | 4 318 | 41.6 |
| National Research **Tomsk State University** | 1878 | 2015 | 229.83 | 20.38 | 13 952 | 1 400 801.40 | 663 | 4 245 | 41.6 |
| National Research Tomsk Polytechnic University | 1896 | 2016 | 191.63 | 12.34 | 16 841 | 1 908 691.90 | 867 | 5 234 | 22.6 |
| National Research Tomsk Polytechnic University | 1896 | 2015 | 178.48 | 13.29 | 18 196 | 1 859 027.40 | 888 | 5 290 | 22.6 |
| Kazan (Volga region) Federal University | 1804 | 2016 | 253.14 | 10.74 | 29 491 | 1 107 791.20 | 1 034 | 6 054 | 20.7 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kazan (Volga region) Federal University | 1804 | 2015 | 194.88 | 13.48 | 28 964 | 978 334.10 | 989 | 5 859 | 20.7 |
| ITMO University (Saint Petersburg National Research University of Information Technologies, Mechanics and Optics) | 1900 | 2016 | 222.26 | 20.87 | 12 139 | 1 927 920.50 | 826 | 2 778 | 33.2 |
| ITMO University (Saint Petersburg National Research University of Information Technologies, Mechanics and Optics) | 1900 | 2015 | 87.54 | 19.79 | 13 391 | 1 694 590.00 | 771 | 2 777 | 33.2 |
| Peter the Great St.Petersburg Polytechnic University | 1899 | 2016 | 157.66 | 2.71 | 29 367 | 1 365 117.40 | 828 | 6 352 | 28 |
| Peter the Great St.Petersburg Polytechnic University | 1899 | 2015 | 106.13 | 3.67 | 24 461 | 1 554 056.40 | 711 | 6 003 | 28 |
| National University of Science and Technology "MISIS" (Moscow Institute for steels and alloys) | 1930 | 2016 | 111.1 | 9.23 | 8 241 | 1 261 360.00 | 461 | 2 853 | 28.9 |
| National University of Science and Technology "MISIS" (Moscow Institute for steels and alloys) | 1930 | 2015 | 84.85 | 0 | 9 532 | 1 499 869.20 | 483 | 2 908 | 28.9 |
| Ural Federal University | 1920 | 2016 | 198.86 | 5.42 | 32 720 | 1 427 041.80 | 1 031 | 6 995 | 37.2 |
| Ural Federal University | 1920 | 2015 | 96.74 | 6.34 | 34 326 | 826 807.70 | 929 | 6 967 | 37.2 |
| The Russian Presidential Academy of National Economy and Public Administration (The Presidential Academy, RANEPA) | 1977 | 2016 | 503.47 | 1.77 | 17 412 | 1 087 050.70 | 703 | 3 778 | 28.8 |
| The Russian Presidential Academy of National Economy and Public Administration (The Presidential Academy, RANEPA) | 1977 | 2015 | 387.95 | 3.32 | 15 400 | 1 018 265.80 | 805 | 3 590 | 28.8 |
| Southern Federal University | 1915 | 2016 | 298.37 | 23.66 | 26 772 | 1 300 270.20 | 1 006 | 7 163 | 17.6 |
| Southern Federal University | 1915 | 2015 | 137.34 | 24.58 | 30 365 | 1 134 804.30 | 1 086 | 7 662 | 17.6 |
| Siberian Federal University | 1930 | 2016 | 88.96 | 0 | 29 819 | 487 036.70 | 829 | 6 130 | 38.7 |
| Siberian Federal University | 1930 | 2015 | 84.8 | 0 | 31 573 | 474 030.80 | 769 | 6 397 | 38.7 |
| Belgorod National Research University | 1876 | 2016 | 167.16 | 12.92 | 17 461 | 957 150.00 | 1 093 | 2 749 | 14.7 |
| Belgorod National Research University | 1876 | 2015 | 177.24 | 11.5 | 19 105 | 838 158.80 | 680 | 2 793 | 14.7 |
| Lobachevsky State University of Nizhni Novgorod - National Research University | 1916 | 2016 | 205.26 | 4.97 | 18 705 | 988 316.80 | 812 | 3 908 | 20.4 |
| Lobachevsky State University of Nizhni Novgorod - National Research University | 1916 | 2015 | 166.75 | 9.05 | 18 404 | 948 648.80 | 752 | 3 837 | 20.4 |
| Samara State University | 1942 | 2016 | 90.92 | 6.52 | 15 106 | 868 188.00 | 525 | 3 334 | 22.7 |
| Samara State University | 1942 | 2015 | 83.87 | 5.48 | 8 308 | 797 428.80 | 299 | 2 067 | 22.7 |
| Saint Petersburg Electrotechnical University 'LETI' | 1886 | 2016 | 93.35 | 4.36 | 7 782 | 565 820.00 | 334 | 2 460 | 28.2 |
| Saint Petersburg Electrotechnical University 'LETI' | 1886 | 2015 | 83.44 | 6.32 | 7 377 | 653 998.90 | 298 | 1 967 | 28.2 |
| Far Eastern Federal University | 1899 | 2016 | 131.25 | 8.38 | 19 954 | 983 935.60 | 516 | 5 724 | 23.4 |
| Far Eastern Federal University | 1899 | 2015 | 113.83 | 11.53 | 22 176 | 646 434.10 | 593 | 5 998 | 23.4 |
| Gubkin Russian State University of Oil and Gas (National Research University) | 1930 | 2016 | 92.22 | 2.55 | 8 539 | 913 814.80 | 413 | 2 179 | 26.1 |
| Gubkin Russian State University of Oil and Gas (National Research University) | 1930 | 2015 | 77.66 | 2.21 | 8 741 | 726 390.40 | 436 | 2 197 | 26.1 |

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|---|---|---|---|---|---|---|---|---|---|
| National Research University of Electronic Technology (MIET) | 1965 | 2016 | 109.98 | 5.67 | 4 259 | 962 066.60 | 236 | 1 682 | 19.4 |
| National Research University of Electronic Technology (MIET) | 1965 | 2015 | 58.01 | 4.74 | 4 494 | 848 270.10 | 235 | 1 672 | 19.4 |
| Kazan National Research Technological University (KNRTU) | 1890 | 2016 | 149.99 | 2.3 | 20 219 | 708 484.10 | 591 | 3 877 | 25.5 |
| Kazan National Research Technological University (KNRTU) | 1890 | 2015 | 195.1 | 1.51 | 19 729 | 946 220.10 | 593 | 3 297 | 25.5 |
| Voronezh State University | 1802 | 2016 | 354.83 | 7.92 | 16 845 | 340 082.20 | 733 | 3 428 | 15.3 |
| Voronezh State University | 1802 | 2015 | 221.08 | 5.45 | 18 384 | 372 729.00 | 652 | 3 492 | 15.3 |
| Financial University under the Government of the Russian Federation | 1919 | 2016 | 1 110.77 | 2.14 | 19 201 | 265 237.70 | 598 | 2 999 | 27 |
| Financial University under the Government of the Russian Federation | 1919 | 2015 | 658.03 | 1.03 | 20 390 | 286 710.40 | 669 | 3 348 | 27 |
| Moscow Aviation Institute | 1930 | 2016 | 54.6 | 5.38 | 19 556 | 1 306 597.20 | 590 | 4 352 | 20.7 |
| Moscow Aviation Institute | 1930 | 2015 | 5.29 | 6.87 | 14 341 | 865 897.80 | 459 | 3 598 | 20.7 |
| Irkutsk National Research Technical University | 1930 | 2016 | 176.89 | 4.54 | 15 824 | 230 470.80 | 444 | 3 071 | 27.9 |
| Irkutsk National Research Technical University | 1930 | 2015 | 111.81 | 3.39 | 16 673 | 328 350.20 | 473 | 3 355 | 27.9 |
| Petrozavodsk State University | 1940 | 2016 | 100.91 | 14.37 | 9 607 | 258 117.70 | 347 | 2 297 | 14.7 |
| Petrozavodsk State University | 1940 | 2015 | 79.87 | 12.48 | 10 361 | 308 888.10 | 144 | 2 417 | 14.7 |
| Saint Petersburg Mining University | 1773 | 2016 | 205.63 | 20.22 | 7 627 | 1 089 350.50 | 423 | 2 013 | 13 |
| Saint Petersburg Mining University | 1773 | 2015 | 119.8 | 22.39 | 10 073 | 866 832.30 | 407 | 2 001 | 13 |
| Saratov State University named after N.G. Chernyshevsky | 1909 | 2016 | 227.32 | 7.64 | 17 183 | 277 520.90 | 536 | 3 019 | 17.2 |
| Saratov State University named after N.G. Chernyshevsky | 1909 | 2015 | 150.69 | 7.93 | 17 535 | 226 149.20 | 500 | 3 178 | 17.2 |
| North-Eastern Federal University (NEFU) | 1934 | 2016 | 200.78 | 1.85 | 13 113 | 197 221.00 | 581 | 3 631 | 11.6 |
| North-Eastern Federal University (NEFU) | 1934 | 2015 | 138.45 | 18.04 | 14 680 | 410 755.50 | 327 | 3 842 | 11.6 |
| Moscow Technological University | 1947 | 2016 | 41.25 | 2.08 | 16 221 | 538 619.10 | 529 | 2 542 | 28.6 |
| Moscow Technological University | 1947 | 2015 | 439.17 | 0 | 18 011 | 32 416.80 | 0 | 163 | 28.6 |
| Tomsk State University of Control Systems and Radioelectronics (TUSUR University) | 1962 | 2016 | 92.32 | 4.61 | 10 488 | 566 181.80 | 212 | 1 838 | 21.4 |
| Tomsk State University of Control Systems and Radioelectronics (TUSUR University) | 1962 | 2015 | 53.38 | 4.45 | 10 775 | 438 232.80 | 246 | 1 891 | 21.4 |
| I.M. Sechenov First Moscow State Medical University | 1758 | 2016 | 207.78 | 1.79 | 15 624 | 562 555.50 | 2 644 | 3 431 | 49.5 |
| I.M. Sechenov First Moscow State Medical University | 1758 | 2015 | 133.23 | 0.78 | 15 253 | 622 985.60 | 721 | 3 483 | 49.5 |
| South Ural State University | 1943 | 2016 | 284.77 | 3 | 26 722 | 373 613.50 | 563 | 4 601 | 10.4 |
| South Ural State University | 1943 | 2015 | 219.49 | 1.64 | 28 682 | 548 690.60 | 518 | 4 643 | 10.4 |
| Perm State University | 1916 | 2016 | 143.78 | 10.01 | 10 930 | 351 845.20 | 235 | 1 910 | 17.8 |
| Perm State University | 1916 | 2015 | 141.38 | 10.89 | 10 871 | 401 225.30 | 239 | 1 888 | 17.8 |
| Novosibirsk State Technical University | 1950 | 2016 | 118.6 | 3.75 | 13 631 | 261 554.40 | 413 | 2 753 | 31 |
| Novosibirsk State Technical University | 1950 | 2015 | 98.74 | 3.05 | 14 293 | 229 933.30 | 385 | 2 843 | 31 |
| Moscow State University of Civil Engineerin | 1921 | 2016 | 169.14 | 0.86 | 11 502 | 487 943.60 | 464 | 2 528 | 18.6 |
| Moscow State University of Civil Engineerin | 1921 | 2015 | 147.34 | 0.44 | 14 491 | 503 980.80 | 482 | 2 691 | 18.6 |
| Altai State University | 1973 | 2016 | 259.24 | 8.06 | 10 600 | 141 767.80 | 260 | 1 589 | 11.4 |

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|---|---|---|---|---|---|---|---|---|---|
| Altai State University | 1973 | 2015 | 231.13 | 7.56 | 10 866 | 161 130.10 | 269 | 1 804 | 11.4 |
| Perm National Research Polytechnic University | 1953 | 2016 | 217.91 | 6.46 | 15 921 | 1 047 352.80 | 589 | 2 773 | 16.4 |
| Perm National Research Polytechnic University | 1953 | 2015 | 233.59 | 6.64 | 18 556 | 540 427.50 | 583 | 2 809 | 16.4 |
| Moscow Power Engineering Institute (MPEI) | 1930 | 2016 | 271.63 | 11.34 | 12 761 | 823 887.70 | 651 | 3 412 | 18.7 |
| Moscow Power Engineering Institute (MPEI) | 1930 | 2015 | 74.51 | 8.71 | 12 270 | 834 789.50 | 610 | 3 509 | 18.7 |
| Dmitry Mendeleev University of Chemical Technology of Russia | 1898 | 2016 | 142.75 | 4.04 | 5 007 | 521 160.30 | 360 | 1 667 | 26 |
| Dmitry Mendeleev University of Chemical Technology of Russia | 1898 | 2015 | 164.57 | 9.84 | 5 099 | 415 023.70 | 275 | 1 723 | 26 |
| N.P.Ogarev Mordovia State University | 1931 | 2016 | 129.21 | 2.5 | 15 637 | 295 951.40 | 880 | 3 251 | 10.7 |
| N.P.Ogarev Mordovia State University | 1931 | 2015 | 104.51 | 3.59 | 16 528 | 339 342.50 | 568 | 3 463 | 10.7 |
| Plekhanov Russian University of Economics | 1903 | 2016 | 428.61 | 3.26 | 22 881 | 170 087.10 | 595 | 3 250 | 20.5 |
| Plekhanov Russian University of Economics | 1903 | 2015 | 275.19 | 1.98 | 19 581 | 171 697.00 | 470 | 2 665 | 20.5 |
| North Caucasian Federal University | 1930 | 2016 | 487.56 | 1.96 | 17 264 | 148 367.60 | 563 | 2 759 | 14 |
| North Caucasian Federal University | 1930 | 2015 | 281 | 1.48 | 18 276 | 192 201.80 | 624 | 2 976 | 14 |
| Kazan National Research Technical University named after A.N.Tupolev - KAI (KNRTU-KAI) | 1932 | 2016 | 259.67 | 3.12 | 9 583 | 451 049.80 | 453 | 2 268 | 15.1 |
| Kazan National Research Technical University named after A.N.Tupolev - KAI (KNRTU-KAI) | 1932 | 2015 | 137.95 | 2.86 | 9 804 | 485 147.70 | 462 | 2 551 | 15.1 |
| Pirogov Russian National Research Medical University | 1906 | 2016 | 97.17 | 1.19 | 8 480 | 396 616.10 | 1 980 | 3 263 | 39.1 |
| Pirogov Russian National Research Medical University | 1906 | 2015 | 64.33 | 1.16 | 8 719 | 326 163.50 | 397 | 3 518 | 39.1 |