

# Higher Education Funding Models and Institutional Effectiveness: Empirical Research of European Experience and Russian Trends

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**Abstract.** World Bank data shows that education accounts for, on average, 13% of government expenditure in the world, effective spending being a priority. Position in international academic rankings has been a universally accepted, yet criticized, criterion of institutional effectiveness. No consistent positive correlation was revealed during research on how the size of government subsidies affected university ranking. Assessment methodology is adjusted to study the influence of public funding mechanisms on

university ranking. Three mechanisms are investigated: formula-based funding, outcome-based funding, and negotiated funding. The sample includes 107 European universities from 27 countries. For each of them, information on the funding model (or a combination of models), total annual revenue, proportion of public subsidies, ranking and ranking movements over the last decade is collected. Analysis results are used to group universities into two major categories: low-ranking universities (ranked in the top 200–500), which are mostly funded using formal mechanisms (formula- and outcomes-based funding), and high-rankings universities (the top 100), which largely use the negotiated funding model (either alone or combined with formal models). This confirms previous research findings that the size of government subsidies has no impact on university ranking. A qualitative analysis of higher education funding patterns in Russia is performed. Formalization of all sources of university funding has become a major trend, yet this empirical study demonstrates that prioritization of formal criteria may be ineffective if Russian universities want to reach their ambitious goals of making it to the top 100 in international rankings.

**Keywords:** institutional effectiveness, university funding models, formula-based funding, outcomes-based funding, negotiated funding, cluster analysis.

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Education, with its ever-growing importance, is undeniably a key resource of economic and social development in today's world. The reason behind this is that education systems, primarily those of universities, make up a part of national innovation systems. Efficient investments in education give rise to new innovative companies that establish the foundations of innovative national economies [Hazelkorn 2015; Salmi, Froumin 2007]. This is why a number of countries have intensified their efforts in designing programs and roadmaps for university development [Satsik 2014].

Russia's higher education system has also been undergoing a modernization recently [Salmi, Froumin 2013]. Presidential Decree No. 599 'On Measures for the Implementation of the National Policy in Education and Science' of May 7, 2012, which set the goal to dramatically enhance the competitive power of leading Russian universities, can be regarded as the pivotal document regulating the vector of reform policies. As soon as the position in world university rankings had been accepted as one of the key criteria of competitive strength, an objective in line with said goal was defined: to propel at least five Russian universities into the top 100 of the major world rankings by 2020. The government is ready to invest sizeable amounts in the development of national education and science, yet spending efficiency remains a great concern, as the fundamental university governance policies have not changed for over 20 years so far.

The existing university rankings are numerous, diverse and based on various methodologies, yet none of them have been immune to criticism by the academic community. The major points of criticism include the structure and weight of ranking criteria as well as the dependence of final values on the size of institution, specific education majors and areas of research [Bongioanni et al. 2014]. Even though individual indicators of university performance cannot be compared directly based on rankings, the latter have become an unavoidable reality of higher education, playing an ever more prominent role for development strategies and funding-related decisions [Amsler, Bolsmann 2012; Goglio 2016]. The Shanghai Academic Ranking of World Universities (ARWU) along with the British Times Higher Education (THE) and Quacquarelli Symonds (QS) World University Rankings, known jointly as THE-QS in 2004–2009, are the most powerful and influential international rankings today. They are used in this article to assess how performance and competitive power of universities change in the present-day market of educational services and academic research.

Formal methodologies of the world university rankings use two major groups of indicators: those related to previous academic merits and those related to current performance. These indicators are expected to illustrate the quality of university governance as a whole, its research and teaching activities, governance mechanisms and structural organization, as well as reflect the institutional aspects of univer-

sity performance, the scope of funding, and the degree of internationalization in research and teaching [Hazelkorn 2015; Aguillo et al. 2010]. All these factors are important for university performance to a varying degree, and management's crucial goal consists in setting priorities, i. e. choosing areas to focus on in order to make the university as effective as possible.

Identifying the critical aspects of university performance is a challenge that has been addressed in many publications [Salmi 2009; Yang, Welch 2012]. Major difficulties that researchers stumble upon include the lack of publicly available information on university activities and the problems arising from comparing available data in an attempt to determine statistically significant correlations (e. g. between the governance system and university ranking). Singularity of each individual university is another factor that hinders drawing conclusions and making inferences [Saisana, d'Hombres, Saltelli 2011].

Differences in funding models are the most relevant factor of diversity when it comes to Russian universities. Back in the Soviet era of a planned and closed national economy, institutions of higher education were primarily financed by the state. The activities of some of them were regulated solely by the Ministry of Education, while others were supervised by both the Ministry of Education and the industry-specific ministry. It was not on a competitive basis but according to a plan that funds were allocated among institutions (or projects within an institution), so spending efficiency was often disregarded when making managerial decisions at various levels [Platonova 2015].

Bearing in mind that a dedicated study [Auranen, Nieminen 2010] found no direct relationship between the size of university funding and its position in a specific ranking, it seems appropriate to focus on ontological analysis of the existing mechanisms and sources of funding. A modern university is able to attract private-sector investments along with governmental subsidies for its development. However, the proportion of public funding is either about the same size as that of independently raised funds or much larger than that (over 90% in some universities). It is important for the state to understand the volume, methods and conditions of funding to make a particular university as effective as possible [Bolli, Somogyi 2011]. Therefore, this study revolves around the mechanisms of public funding for universities.

In particular, the study seeks to test empirically the correlation between the mechanisms of public funding and university performance expressed as a position in world university rankings.

The article is structured as follows: Chapter 1 describes the sources and models of university funding; Chapter 2 investigates the relationship between university ranking and funding models; Chapter 3 provides an analysis of university funding in Russia; and, finally, Chapter 4 gives a summary of all the findings to draw some conclusions.

## **1. Models and sources of university funding**

These days, university funding models are not just sets of tools to allocate funds among donors and beneficiaries (who may include the government, students or research and teaching staff). They also represent sets of mechanisms to achieve specific goals and maximize outcomes with the existing resource limitations. Where public universities dominate the education and research market (which is true for the majority of countries including Russia), a funding model is the key element of the overall university governance strategy, which traditionally consists of the following:

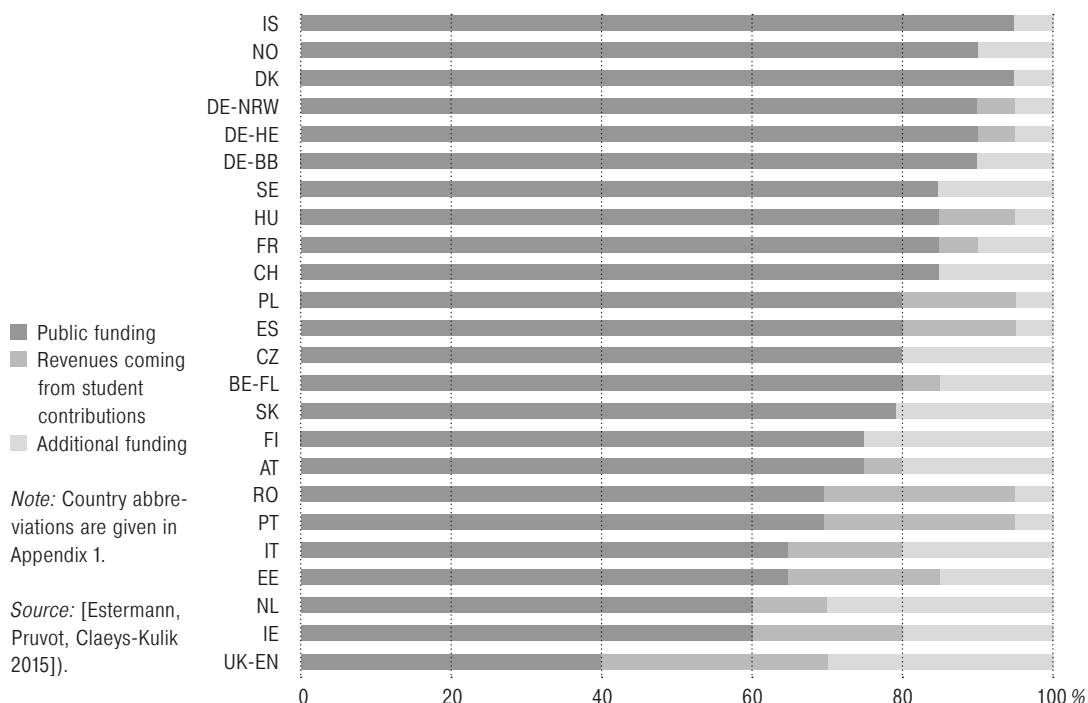
1. Legal regulation
2. Funding model
3. Public production
4. Communication strategy [Jongbloed 2004]

Some major trends can be identified within the higher education funding reforms that are being implemented today in Europe, Asia and America [Auranen, Nieminen 2010; Nagy, Kováts, Németh 2014]:

- Transforming the ways public funds are allocated in the education system. In order to increase the sensitivity of educational institutions to consumer needs, part of the funds is allocated directly to students and companies as government-subsidized loans or tax incentives. In addition, changes are made to the direct institutional support mechanisms (discrimination is made between funding of teaching and research; formula-based funding is getting more widespread; spending efficiency becomes an increasingly important factor of fund allocation).
- Actively introducing new open e-learning technologies efficient in reducing teaching-related expenses. This strategy can bring about an essentially new university model in the long term.
- Diversifying the sources of funding and establishing a partnership with the business community, research centers and NGOs. A direct correlation is thus formed between university performance and the amount of private funds attracted. Co-funding gives more financial management autonomy to institutions and improves the quality of public fund spending due to double auditing procedures. Once granted autonomy, universities can attract external funds from business communities in financial markets, render supplementary and business education services, and customize contracts for individual teachers and researchers.

Hence, educational activities are financed today from the following sources:

1. Government subsidies (allocated by federal and municipal governments);

Figure 1. **The structure of university funding in Europe**

2. Tuition and proceeds from education-related services (sale of study guides, accommodation services, etc.);
3. Funds received from businesses: payments for advanced training programs and individual trainings for current and prospective employees; scholarships for students that may imply a student's obligation to work for the company for some time after graduation; etc.;
4. Donations, sponsor support, endowed professorship, and other types of nonrefundable investment in education by companies and individuals;
5. System of vouchers and other governmental mechanisms of student finance (examples in Russia include maternity allowance and tax credits);
6. Other external sources of finance, such as grants from nonprofit organizations or loans;
7. Self-funding (revenues from non-core activities, such as publishing, telecommunication services, etc.);
8. Student loans.

Public grants constitute the major part of university funding in most European countries (Fig.1).

All sources of university funding except government subsidies have their own institutional mechanisms to control the efficiency of fund allocation, which often do not need to be formalized. It is public funding mechanisms whose efficiency has yet to be assessed.

Studies conducted by Thomas Estermann and Terhi Nokkala [Estermann, Nokkala 2009; Estermann, Nokkala, Steinel 2011] as well as the DEFINE Project [Estermann, Pruvot, Claeys-Kulik 2015] identify the following mechanisms of public fund allocation:

9. Public grants:
  - performance-based funding;
  - formula-based funding (input- and output-based models);
  - Negotiation (amount determined on a historical basis).
10. Project-based funding
11. Funding for excellence
12. Other types of direct and targeted funding

This study investigates the mechanisms of public funding.

Funding formula is understood as an algorithm to calculate the size of university funding using a mathematical formula. Formula variables include student population, publication performance, and other indicators. Variables are based on retrospective data (e. g. for the last year). The mechanism seeks to ensure transparency in funding justification and to bind the size of funding with measurable indicators. This funding model allows for taking into account temporal changes, such as those in the size of faculty or in the student or graduate population.

Performance contracts between a university and a public authority specify target performance indicators that the university undertakes to achieve by receiving the required amount of funding. This funding mechanism allows for structuring the dialogue between universities and public authorities, thus increasing funding transparency, as well as helping to design the strategy for university development. Unlike funding formula, the performance-based model uses prospective indicators, thus guiding universities into predetermined lines of development.

Goals to be achieved by universities under performance contracts may either be specific to the institution and consistent with its strategy to a greater or lesser extent, or result from more generalized goals of higher education and national research policies. Target indicators can be described as outcomes that should be achieved while leaving the university free to choose any specific measures to be taken within the agreed period of time. Goals may be either qualitative (e. g. promote equal access of men and women to leading academic positions) or quantitative (e. g. increase the proportion of female professors), very much like indicators in formula-based funding. Performance assessment procedures differ depending on the type of goals and objectives

and may imply either discussion between the government and university or, at other times, the collection of relevant statistics.

Negotiated funding suggests that the amount of funding has been determined historically and embraces all kinds of informal negotiation mechanisms that are used to obtain funding. On the one hand, this funding mechanism is the most obscure of all; on the other hand, allowance can be made for nearly all university characteristics, in particular university reputation, which is hard to quantify and thus cannot be included in the other two models.

The mechanisms described above can be applied to funding of both teaching and research activities. The funding models may be used separately or in combination, where one is primary and the other is secondary.

Further on, this study will dwell on the funding models and types of their combinations used in European universities, as well as on the relationship between using those mechanisms and university ranking.

## **2. Relationship between funding model and university position in world rankings**

### **2.1. Research data**

The following data was used to test empirically the hypothesis on the relationship between models and sources of university funding, on the one hand, and university ranking, on the other:

1. Results of the DEFINE (Designing Strategies for Efficient Funding of Universities in Europe) Project, run by the European University Association. The survey involved European countries and produced an extensive overview of funding models used in universities of each participant country as well as recommendations for university management.
2. Academic Ranking of World Universities (ARWU) 2003–2014. Unlike the other two rankings (THE and QS), this one uses objective indicators calculated based on data from official sources. As this study aims to assess the impact of specific funding mechanisms on university ranking, dynamic data on university ranking was used instead of last year's static indicators. The study is premised on the assumption that higher education funding mechanisms underwent no significant change between 2003 and 2014. Feasibility of this assumption is confirmed by the fact that results of the DEFINE Project, launched in 2007, were not published until 2015.
3. Statistics on university activities: total funding, proportion of public grants (separately for teaching and research, where applicable), student population, faculty size, etc.

The sample is restricted to universities of the European Union and Russia. More reliable findings will require including countries of North and South America, Australia, Middle and Far East, too. However, a larger-scale research is currently impossible due to the absence of systematized information on the models and mechanisms of higher education funding used in those countries.



**2.2. Research design** The study is built around analyzing how funding model and other university operation parameters correlate with university ranking. Research is based on the DEFINE Project, which analyzes the existing mechanisms of university funding in Europe as well as possible ways of increasing their efficiency [Pruvot, Claeys-Kulik, Estermann 2015]. The project was prompted by the crisis of 2008–2009. Back then, public grants—the main source of higher education funding—reduced in many European countries, putting steady university development under threat and introducing the need to seek out new sources of revenue and increase spending efficiency. Therefore, enhancing the finance policies in higher education became the paramount goal of the DEFINE Project.

The DEFINE Project involved 28 European countries and individual regions (*Appendix 1*). This study only uses DEFINE data on the countries that were ranked in the ARWU Ranking between 2003 and 2014, meaning that at least one university in the country was part of the ranking throughout the specified period or became as such within that period and was still in the ranking in 2014. As a result, the initial sample included 205 universities (*see Appendix 2 for the complete list*) from Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, and Great Britain.

Because the DEFINE survey did not include all the EU countries and some of the countries were represented by their autonomous regions (Spain by Catalonia, Germany by North Rhine-Westphalia, Hesse and Brandenburg, and Great Britain by England only), some ARWU-ranked European universities were also excluded from the analysis. The final sample consisted of 157 European universities and two Russian ones (not included in the first study phase).

The following information was collected for each of the 157 European universities in the sample:

- Total funding
- Proportion of public grants
- Size of grants for teaching and research
- Amount of third-party research funding
- Tuition
- Student population
- Faculty size and proportion of research staff
- Availability of excellence centers and excellence initiatives

Information was obtained from materials posted on universities' official websites over the last year (mostly 2013/14, but some universities only provided data on the academic year 2011/12). In cases where some of the required data (e. g. financial records) was unavailable, the relevant university was excluded from the analysis. The sample shrank to 107 universities after the data collection phase.



The data obtained was unified to ensure comparability: financial indicators were converted from national currencies (for Czech Republic, Denmark, Sweden, Norway, Switzerland and England) into euros based on the European Central Bank's reference rates<sup>1</sup> over the relevant financial year. The resulting data was used to calculate some basic university funding indicators: total funding; total funding per student; total funding per faculty member; proportion of public grants in total funding; proportion of research grants in total public funding; proportion of teaching grants in total public funding; proportion of third-party research grants in total funding; and proportion of tuition revenues in total funding.

The DEFINE Project associated each university with a specific national (or regional) model of teaching and research funding, which was described by six variables: funding formula for teaching; performance contracts for teaching; negotiations for teaching; funding formula for research; performance contracts for research; and negotiations for research.

Each university was assigned an index according to its ARWU ranking: "1" for the top 100, "2" for positions 101–200, "3" for positions 201–300, etc. Additional variable showed university ranking movements between 2003 and 2015: "1" for moving up, "0" for retaining the position, and "–1" for moving down the ranking.

As a result, three sets of data were provided for each university:

1. University funding models are contingent on the country and described by the following variables:
  - a. Funding formula for teaching (FFT)
  - b. Performance contracts for teaching (PCT)
  - c. Negotiations for teaching (NT)
  - d. Funding formula for research (FFR)
  - e. Performance contracts for research (PCR)
  - f. Negotiations for research (NR)
2. The size of university funding is described by the following variables:
  - a. Total funding per student (mln euros)
  - b. Total funding per faculty member (mln euros)
  - c. Total funding (mln euros)
  - d. Proportion of public grants in total funding
  - e. Proportion of research grants in total public funding
  - f. Proportion of teaching grants in total public funding
  - g. Proportion of third-party research grants in total funding
  - h. Proportion of tuition revenues in total funding
3. University ranking is described by the following variables:

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<sup>1</sup> <https://www.ecb.europa.eu/stats/exchange/eurofxref/html/index.en.html>

Table 1. **Description of the specifications tested during cluster analysis**

Specification #	Variables involved	Observations used
1	Proportion of public grants (Gov_share), university funding model (FFT, PCT, NT, FFR, PCR, NR), and university ranking (Rat_fin_year)	All / w/o Great Britain
2	University funding model (FFT, PCT, NT, FFR, PCR, NR) and university ranking (Rat_fin_year)	
3	Proportion of public grants (Gov_share), research funding model (FFR, PCR, NR), and university ranking (Rat_fin_year)	
4	Teaching funding model (FFR, PCR, NR) and university ranking (Rat_fin_year)	

- a. University ranking during the financial year
- b. University ranking movements

The universities were divided into groups based on the funding models they used and the proportion of public grants in order to test the relationship between the size and mechanism of public funding and university ranking. Various modifications of cluster analysis procedures were used. Data was analyzed using the IBM SPSS Statistics 20.0 tool. The base specification included variables describing funding models for both teaching and research as well as university ranking. Additional variables described the size of university funding. The variables describing university funding models were reduced to research funding models: the ARWU Ranking does not assess teaching quality, so teaching funding models may be irrelevant to university ranking.

Examples of the abovementioned specifications are given in Table 1, where the size of university funding is represented by the proportion of public grants. Specifications with other funding variables were also tested.

### 2.3. Empirical findings

In general, correlations between funding model and university ranking were revealed as various specifications were tested. Specifications that assessed the size of university funding in one form or another were inferior to those that only analyzed university ranking positions and funding models. The analysis produced three clusters, which are described in Tables 2 and 3.

The first cluster mostly consists of the top 100 universities. It also includes some universities with other indexes, but their proportions are considerably lower. Institutions in this category normally use negotiations for research as their primary funding mechanism, whereas funding formula for research is mostly used as the secondary model and performance contracts are not used at all. Teaching in this cat-

Table 2. **Clustering criteria**

Variable		Cluster 1	Cluster 2	Cluster 3
Observations in the cluster		43	36	28
Teaching funding	Funding formula	1 (2)	1	1
	Performance contracts	0	2	2
	Negotiations	0 (1)	0 (1;2)	0
Research funding	Funding formula	2(1)	1	1
	Performance contracts	0	2	2
	Negotiations	1 (0)	2 (0)	0
University ranking	Top 100	47%	11%	0%
	101–200	19%	64%	0%
	201–300	21%	17%	29%
	301–400	14%	8%	21%
	401–500	0%	0%	50%

Note: 1 indicates that the funding mechanism is used as primary; 2 indicates that the funding mechanism is used as secondary; 0 indicates that the funding mechanism is not used. Digits in round brackets indicate that some universities within the cluster (a minor part) use the funding mechanism differently.

Table 3. **Descriptive characteristics of the clusters**

Indicator	Value	Cluster 1	Cluster 2	Cluster 3
Centers of excellence (%)	No	44	56	39
	Yes	56	44	61
Ranking movements (%)	Down	7	11	29
	None	74	53	50
	Up	19	36	21
Amount of funding (mln euros)	Total funding per student	0.03	0.02	0.018
	Total funding per faculty member	0.18	0.21	0.20
	Total funding	704.7	540.7	317.6
	Public funding per student	0.02	0.01	0.009
Proportions of selected sources in total funding (%)	Public grants in total funding	60	49	49
	Public grants for research in total public funding	55	48	50
	Public grants for teaching in total public funding	45	52	50
	Third-party research grants in total funding	33	24	20
	Tuition revenues in total funding	24	28	36

egory is mainly subject to formula-based funding and partly funded through negotiations. The second cluster mostly includes universities ranked 101–200, which largely use formalized funding mechanisms, namely funding formula as the primary mechanism and performance contracts as the secondary one. They either use negotiations as their secondary mechanism or do not use them at all. The third cluster consists of universities ranked 201–500. These never use negotiations and rely heavily on formal funding models. The specified differences between the clusters are statistically significant, the results being tested using Pearson's chi-squared test. The test results, the breakdown of observations by clusters and their description are given in Appendices 4 and 5.

No firm conclusion can be drawn based on cluster analysis by such parameters as university ranking movements or availability of centers of excellence as to whether these indicators correlate somehow with funding mechanisms. Although the clusters differ statistically significantly in the size of funding, no relationship is revealed between the amount of public grants and university ranking. The mechanisms of public funding proper are thus what appears to be a more important factor.

These results allow for a conclusion that universities using negotiations in addition to formal funding procedures are ranked higher by ARWU.

### **3. Characteristics of university funding in Russia**

Global trends of information integration that have intensified greatly over the last decade following the telecommunications boom require Russian authorities to focus on improving the international competitiveness of Russian education. Enhancement of education finance systems is the key prerequisite for such improvement. Educational institutions are largely heterogeneous both in their administrative organization and availability of materials and resources, so promoting internal competition in conditions of publicity, transparency and objectivity was expected to produce maximum positive effects.

A competitive academic environment in Russia is created by introducing normative per capita funding, which suggests that universities are granted public funds proportionally to the population of government-funded students. The latter is estimated using admission quotas in compliance with stipulated standard costs of education. Admission quotas are distributed on a competitive basis in accordance with the Ministry of Education and Science, which implies comparing requests from educational institutions. Such requests contain indicators of university potential in specific domains or majors (or categories of domains or majors) that are assessed during selection. The overall amount of admission quotas is agreed upon in advance by supervising authorities (ministries and associations), which design policies for every domain or major and suggest solutions on the structure

of admission quotas for every subject of the Russian Federation. The standard cost of an educational service is estimated by applying region- and industry-specific correction coefficients of individual institutions to the unified base standard cost of this service. The approved list of coefficients and their values predetermines quite a vast range of normative price deviations for the same educational service between universities. Greater relative public support is enjoyed by universities that perform better in the indicators assessed: the average USE (Unified State Examination) score of students admitted to the major or department; the amount of revenues from research and development per faculty member; the number of publications in journals indexed in Web of Science and Scopus per 100 faculty members; etc.

As a result of the budget reform (transition to program-based budgeting), public funding of Russian universities is essentially based on indirect formalization of the results of bidding procedures under the national 'Education Development for 2013–2020' program in the form of individual subprograms and initiatives segmented by different types of activities. Bidding results are recorded in quarterly budget breakdowns. Apart from targeting expenditures, assigning fixed responsibilities and verifying congruence of goals, objectives and indicators, the structure of such breakdowns, together with the Ministry of Education and Science's recommended practices for determining standard costs associated with education program implementation, is designed both to extend the analytical potential of supervising ministries and to ensure system responsiveness to changes in the strategic vector of national policies (by adjusting priority schemes, public funding mechanisms, etc.).

An increase in the analytical potential naturally leads to comparing individual indicators of university performance with a view to identifying institutions below threshold values and applying organizational and administrative measures to them. This phase of the education reform is formalized in the national monitoring of public educational institutions, the results of which serve as the basis for possible reorganization. Despite criticism from NGOs and the expert community—mostly regarding the lack of unbiased decisions—systematic monitoring has amplified the control of university management over certain university sectors and inspired many of the innovative solutions.

Unfortunately, the improvements in governance efficiency achieved at the level of individual universities have not been fully extended to the national Education Development 2013–2020 program as a whole. System responsiveness is obstructed by bureaucratic processes, mostly delays in the approval of amendments to national programs (including the initiative funding chapter) by the Ministry of Economic Development and the Ministry of Finance and in the publication of relevant governmental acts and regulations. As a result, the implementation lag takes about a year, which is unacceptable in the unstable macroeconomic conditions.

Figure 2. **Changes in the rough structure of university funding between 2012 and 2015.**



The dramatic decrease in public funding became the main macroeconomic factor to directly affect the financial standing of universities. Spending in such vital areas as overhaul, student allowances and investments has been cut following the two rounds of 10% sequestration carried out by the Russian government over the last two years. Furthermore, funding for education programs was reduced too, as public grants for universities were revised using the standard cost methodology.

Cuts in public funding are accompanied by a decreasing effective demand from Russian consumers for educational services, caused by the drop in their purchasing power as well as by the “demographic trough” of the 1990s and its anticipated effects. The reduction in funding for university research—this expenditure item was forced out by the costs of daily needs—does not allow for covering the cash deficit at the expense of income-generating activities. This is proved by universities’ financial results (Fig. 2) indicated in their business plans. In this situation, Russian universities have to raise prices for their educational services, switching from competitive pricing (maximizing enrolment rates) to the prohibitive policy (maximizing costs). Given the global reach of the impact factors, such response is virtually ubiquitous, putting prospective students in a situation identical to price fixing.

These circumstances generate a sharp rise in the competition between universities for students from far-abroad countries, whose purchasing power has skyrocketed with the slump of ruble.

In order to keep to the schedule of getting Russian universities into the top 100 of the world rankings—stipulated by Section V of the Action Plan “Changes in Social Industries Designed to Increase Efficiency in Education and Science”<sup>2</sup>—the Ministry of Education and Science included resource concentration into the concept of normative per capita funding, meaning that relative volumes of funding are increased for universities that are likely to get into or move up the world rankings. With this in mind, activity characteristics of such universities were made a priority when devising multiplying factors to apply to the base funding rates.

<sup>2</sup> Approved by the Resolution of the Government of the Russian Federation No. 2620-p of December 30, 2012.

As a result of these reforms, public grants allocated under government contracts with the universities included in major rankings increased by more than 20% from 2013<sup>3</sup> to 2016. Besides, the most promising universities are offered additional government funding under Project 5–100 implemented in compliance with the Order of the Government of the Russian Federation No. 2006-p of October 29, 2012. These are targeted subsidies granted to winners of the university development program tender carried out under the auspices of the Council on Competitiveness Enhancement of Leading Russian Universities among Global Research and Education Centers. The size of subsidies is revised annually depending on the outcomes achieved.

Resource concentration was expected to promote qualitative transformation of the existing performance standards followed by selected universities into a local equivalent of the most advanced foreign models, which would boost their rise up the rankings. Unfortunately, not all the financial incentives had a positive effect. The movements of Russian universities in the QS Rankings (see Appendix 3)<sup>4</sup> in 2013–2016 (seven rose, six fell, and eight retained their positions) do not go beyond statistical deviations. There is almost no correlation between intensified funding in the form of targeted government subsidies and university ranking. For instance, Kazan (Volga Region) Federal University rose from the 601–650 category up to 551–600 despite the 358 mln ruble cut in subsidies, whereas Ural Federal University, named after the first President of Russia B. N. Yeltsin, slipped down from 501–550 to 601–650 even though it had been granted an additional 227 mln rubles. Thus, a considerable increase in funding did not entail better ranking positions for a number of universities, including the National Research University Higher School of Economics (HSE) and Southern Federal University.

Between 2013 and 2015, only 13 Russian universities improved their positions in the QSBRICS Ranking (see Appendix 4), where Russian universities are represented better than in the QS Rankings (58 positions as compared to 21), while 25 institutions moved down and 20 remained where they were. Such a degradation of the situation, not least induced by exogenous political and economic factors, discredits somewhat the concept of normative funding for universities, given that no other significant institutional transformations affected the education system during that period. Apparently, the normative approach to higher education funding is not the best option at the time of global social transformations.

The effects of additional competitive grants look more reassuring. According to the most recent report of the Ministry of Education and

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<sup>3</sup> The year of completing the transition to normative per capita funding of universities beyond governmental jurisdiction.

<sup>4</sup> <http://studyinrussia.ru/why-russia/world-university-rankings/qs/>



Science<sup>5</sup>, the number of Russian universities in the QS World University Rankings increased over the last few years (up to 24 in 2017) due to the increase in the number of Project 5–100 participants that received competitive targeted grants (from 9 in 2012 to 15 in 2017). Putting aside qualitative analysis of the changes in technical indicators (faculty-student ratio first of all) responsible for this growth, it can be safely stated that direct competitive funding algorithms based on the performance of specific goals look more preferable than normative funding models.

There is certain conceptual congruence between the key university funding models in Russia and abroad. For example, subsidies under government contracts bear the hallmarks of formula-based funding, while targeted grants for the implementation of development programs (implying achievement of predetermined indicator values) can be interpreted as an equivalent of performance contracts. Meanwhile, the proportion of negotiations when allocating targeted grants is higher in Russia due to the absence of intermediate decision-making elements that distort original arrangements as they are put into practice.

Given the high volatility in all spheres of state life (including business and law), negotiated funding appears to be the most viable model. This algorithm suggests that the size of university funding for a planning period is determined based on thorough and comprehensive assessment of all aspects of university life and subsequent comparison to the respective indicators of other applicants, using budget data of the previous period as a reference. The rigid formula-based system that underlies the existing concept of normative per capita funding will only be able to provide a similar level of flexibility and responsiveness if there is a powerful statistical framework and an elaborated methodology of determining the key indicative criteria, which amount to dozens. Unfortunately, procedures necessary to gather and process the required amount of data are only being introduced in Russia. An important step in this direction was made as the Ministry of Education and Science systematized universities' analytical reporting processes and designed new single-entry templates.

#### **4. Conclusion and avenues for further research**

States are ready to invest sizeable amounts into universities. However, it is important to monitor efficiency of university activities in general and spending in particular. University ranking has been universally accepted as a metric of university performance. Meanwhile, empirical research reveals no consistent positive correlation between the size of funding and university ranking. This study attempts to probe the relationship between university ranking movements and the funding mechanism, not the amount of funding. Cluster analysis reveals that

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<sup>5</sup> <http://5top100.ru/news/58610/>

universities funded through negotiations, in addition to formal models (funding formula and performance contracts), show better performance in the rankings. Nonetheless, no correlation is found between the size of public grants and university ranking; the mechanism of public funding appears to be a more important factor.

Characteristics of public funding for Russian universities have been analyzed in the context of global experience findings using the example of institutions that see improving their world ranking positions as a strategic priority. Combinations of formula- and performance-based mechanisms have been found to prevail in public funding of universities, which echoes the policies pursued by universities from the second cluster in the international part of the study.

In the light of the data obtained on the sample of European universities—indicating that universities using negotiated funding mechanisms along with formal models are ranked higher (first cluster)—hopeful prospects for Russian institutions are offered by the promotion of new formats and types of funding that imply extended use of negotiations. Advisability of negotiated funding is confirmed by the specific conditions in which Russian universities exist, having to achieve extremely ambitious goals while facing severe resource limitations. Under these circumstances, it would be unwise to rely on clichéd patterns to establish a well-functioning, long-lasting system of cross-institution interaction.

In summary, the overarching goal faced by Russian higher education today consists in creating an innovative conception of public funding for leading universities that will be premised on the negotiations approach and not restricted to mechanically reallocating the resource potential in favor of individual educational institutions under the presence of growth point generation. A separate study is proposed to design the methodological framework for this conception.

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**Appendix 1.**  
The list of countries involved in cluster analysis

AT — Austria	HU — Hungary
BE-FL — Flanders in Belgium	IE — Ireland
BE-FR — French speaking community in Belgium	IS — Iceland
CH — Switzerland	IT — Italy
CZ — Czech Republic	LT — Lithuania
DE-BB — Brandenburg in Germany	LV — Latvia
DE-HE — Hesse in Germany	NL — Netherlands
DE-NRW — North Rhine—Westphalia in Germany	NO — Norway
DK — Denmark	PL — Poland
EE — Estonia	PT — Portugal
ES-CA — Catalonia in Spain	RO — Romania
FI — Finland	SE — Sweden
FR — France	SK — Slovakia
	TR — Turkey
	UK-EN — England in United Kingdom

**Appendix 2.**  
The list of universities included in and excluded from the analysis

#	University	Country	DEFINE country code	Included in the analysis
1	University of Vienna	Austria	AT	+
2	Medical University of Vienna			+
3	University of Innsbruck			+
4	Medical University of Graz			+
5	University of Graz			+
6	Vienna University of Technology			+
7	Ghent University	Belgium	BE-FL	+
8	Catholic University of Leuven			+
9	University Libre Bruxelles		BE-FR	+
10	Catholic University of Louvain			+
11	Vrije University Brussel		BE-FL	+
12	University of Liege		BE-FR	+

#	University	Country	DEFINE country code	Included in the analysis
13	University of Antwerp	Belgium	BE-FL	+
14	Charles University in Prague	Czech	CZ	+
15	University of Copenhagen	Denmark	DK	+
16	Aarhus University			+
17	Technical University of Denmark			+
18	University of Southern Denmark			+
19	Aalborg University			+
20	University of Helsinki	Finland	FI	+
21	University of Oulu			+
22	University of Turku			+
23	Aalto University			+
24	University of Eastern Finland			+
25	University of Jyvaskyla			+
26	Pierre and Marie Curie University—Paris 6	France	FR	+
27	University of Paris Sud (Paris 11)			+
28	Ecole Normale Supérieure—Paris			+
29	University of Strasbourg			+
30	University of the Mediterranean (Aix-Marseille 2)			+
31	University of Paris Diderot (Paris 7)			+
32	Joseph Fourier University (Grenoble 1)			+
33	University of Paris Descartes (Paris 5)			+
34	Claude Bernard University Lyon 1			+
35	Ecole Normale Supérieure—Lyon			+
36	Paul Sabatier University (Toulouse 3)			+
37	University of Bordeaux 1			+
38	University of Lorraine			+
39	University of Montpellier 2			+
40	Ecole Polytechnique			+
41	ESPCI ParisTech			+
42	University of Paris Dauphine (Paris 9)			+
43	MINES ParisTech			+
44	University of Auvergne			+
45	University of Nice Sophia Antipolis	+		

#	University	Country	DEFINE country code	Included in the analysis
46	University of Rennes 1	France	FR	+
47	University of Heidelberg	Germany	DE	-
48	Technical University Munich		-	
49	University of Munich		-	
50	University of Bonn		DE-NRW	+
51	University of Frankfurt		DE-HE	+
52	University of Freiburg		DE	-
53	University of Göttingen		DE	-
54	University of Münster		DE-NRW	+
55	University of Hamburg		DE	-
56	University of Kiel		DE	-
57	University of Koeln		DE-NRW	+
58	University of Tübingen		DE	-
59	University of Würzburg			-
60	University of Karlsruhe			-
61	RWTH Aachen University		DE-NRW	+
62	Dresden University of Technology		DE	-
63	University of Erlangen-Nuremberg			-
64	University of Leipzig			-
65	University of Mainz			-
66	University of Marburg		DE-HE	+
67	University of Stuttgart		DE	-
68	Hannover Medical School		-	
69	Technical University of Berlin		-	
70	University of Bochum	DE-NRW	+	
71	University of Düsseldorf	DE	-	
72	University of Duisburg-Essen	DE-NRW	+	
73	University of Giessen	DE-HE	+	
74	University of Ulm	DE	-	
75	University of Bielefeld	DE-NRW	+	
76	Technical University Darmstadt	DE-HE	+	
77	Technical University of Braunschweig	DE	-	
78	University of Bayreuth		-	
79	University of Bremen		-	

#	University	Country	DEFINE country code	Included in the analysis
80	University of Halle-Wittenberg	Germany	DE	-
81	University of Hannover			-
82	University of Jena			-
83	University of Konstanz			-
84	University of Regensburg			-
85	University of Rostock			-
86	National and Kapodistrian University of Athens	Greece	GR	+
87	Aristotle University of Thessaloniki			+
88	Eotvos Lorand University	Hungary	HU	+
89	University of Szeged			+
90	Trinity College Dublin	Ireland	IE	+
91	University College Dublin			+
92	University College Cork			+
93	University of Roma—La Sapienza	Italy	IT	+
94	University of Milan			+
95	University of Padua			+
96	University of Pisa			+
97	University of Turin			+
98	Polytechnic Institute of Milan			+
99	University of Bologna			+
100	University of Florence			+
101	Scuola Normale Superiore—Pisa			+
102	University of Naples Federico II			+
103	Catholic University of the Sacred Heart			+
104	University of Ferrara			+
105	University of Genoa	+		
106	University of Milan—Bicocca	+		
107	University of Palermo	+		
108	University of Parma	+		
109	University of Pavia	+		
110	University of Perugia	+		
111	University of Roma—Tor Vergata	+		
112	University of Trieste	+		



#	University	Country	DEFINE country code	Included in the analysis
113	Utrecht University	Netherlands	NL	+
114	University of Groningen			+
115	Leiden University			+
116	VU University Amsterdam			+
117	Radboud University Nijmegen			+
118	University of Amsterdam			+
119	University of Wageningen			+
120	Erasmus University			+
121	Delft University of Technology			+
122	University of Maastricht			+
123	Eindhoven University of Technology			+
124	University of Twente			+
125	University of Oslo			Norway
126	Norwegian University of Science and Technology	+		
127	University of Bergen	+		
128	Jagiellonian University	Poland	PL	+
129	University of Warsaw			+
130	University of Lisbon	Portugal	PT	+
131	University of Porto			+
132	University of Coimbra			+
133	Moscow State University	Russia	—	Не на всех этапах
134	Saint Petersburg State University			
135	University of Belgrade	Serbia	—	—
136	University of Ljubljana	Slovenia	—	—
137	University of Barcelona	Spain	ES-CA	+
138	Autonomous University of Barcelona			+
139	Autonomous University of Madrid		ES	—
140	Complutense University of Madrid			—
141	University of Pompeu Fabra		ES-CA	+
142	Polytechnic University of Valencia		ES	—
143	University of Granada			—
144	University of Valencia			—

#	University	Country	DEFINE country code	Included in the analysis	
145	Polytechnic University of Catalonia	Spain	ES-CA	+	
146	University of Santiago Compostela		ES	-	
147	University of Seville		-		
148	University of the Basque Country		-		
149	University of Zaragoza		-		
150	Karolinska Institute	Sweden	SE	+	
151	Uppsala University			+	
152	Stockholm University			+	
153	Lund University			+	
154	University of Gothenburg			+	
155	Royal Institute of Technology			+	
156	Swedish University of Agricultural Sciences	Sweden	SE	+	
157	Chalmers University of Technology			+	
158	Linkoping University			+	
159	Umea University			+	
160	Stockholm School of Economics			+	
161	Swiss Federal Institute of Technology Zurich			Switzerland	CH
162	University of Zurich	+			
163	University of Geneva	+			
164	University of Basel	+			
165	Swiss Federal Institute of Technology of Lausanne	+			
166	University of Bern	+			
167	University of Lausanne	+			
168	Istanbul University	Turkey	TR	+	
169	University of Cambridge	UK	UK-EN	+	
170	University of Oxford			+	
171	University College London			+	
172	The Imperial College of Science, Technology and Medicine			+	
173	The University of Manchester			+	
174	The University of Edinburgh			UK	-
175	King's College London			UK-EN	+

#	University	Country	DEFINE country code	Included in the analysis
176	University of Bristol	UK		+
177	University of Warwick			+
178	London School of Economics and Political Science			+
179	The University of Glasgow		UK	-
180	The University of Sheffield		UK-EN	+
181	University of Birmingham			+
182	University of Leeds			+
183	University of Liverpool			+
184	University of Nottingham			+
185	University of Southampton			+
186	Cardiff University		UK-EN	+
187	Queen Mary, University of London			+
188	University of Exeter			+
189	University of Sussex			+
190	Newcastle University			+
191	The University of Dundee		UK	-
192	University of Aberdeen			-
193	University of East Anglia		UK-EN	+
194	University of Leicester			+
195	University of York			+
196	Lancaster University			+
197	London School of Hygiene and Tropical Medicine			+
198	Queen's University Belfast		UK	-
199	The University of Reading		UK-EN	+
200	University of St Andrews	UK	-	
201	Brunel University	UK-EN	+	
202	University of Bath		+	
203	University of Essex		+	
204	University of Surrey		+	

**Appendix 3. Russian universities in the QS World University Rankings and sources of their funding**

#	University	Period				Government contracts		Other sources of funding		Proportion of public grants	
		2012/2013	2013/2014	2014/2015	2015/2016	2013	2015	2013	2015	2013	2015
1	Lomonosov Moscow State University	116	120	114	108	9,633,204,100	10,767,125,300	9,377,234,910	13,412,680,983	50.7	44.5%
2	Saint Petersburg State University	253	240	233	256	6,893,830,600	5,953,167,300	5,787,655,931	4,831,998,317	54.4	44.5%
3	Bauman Moscow State Technical University	352	334	322	338	5,176,404,900	6,100,029,900	7,675,403,072	6,214,721,248	40.3	55.2%
4	Novosibirsk State University	371	352	328	317	870,851,800	1,301,321,356	3,507,962,988	3,038,763,150	19.9	49.5%
5	Moscow State Institute of International Relations (University) run by the Ministry of Foreign Affairs of Russia	367	386	399	397	708,585,400	744,633,500	1,759,363,600	2,311,949,499	28.7	30.0%
6	Moscow Institute of Physics and Technology	—	441–450	411–420	431–440	996,848,900	2,554,528,900	2,850,320,942	3,263,685,796	25.9	24.4%
7	Peoples' Friendship University of Russia	501–550	491–500	471–480	601–650	1,850,449,200	1,702,519,900	3,835,681,068	6,096,668,042	32.5	43.9%
8	National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)	—	—	481–190	501–550	2,754,966,500	3,526,147,400	5,971,333,820	4,536,167,944	31.6	21.8%
9	Peter the Great St. Petersburg Polytechnic University	—	451–460	481–490	471–480	2,632,643,100	3,303,313,700	4,818,382,300	4,484,481,691	35.3	43.7%
10	National Research Tomsk State University	551–600	551–600	491–500	481–490	1,665,981,500	2,700,990,900	2,758,751,366	2,871,126,124	37.7	42.4%
11	National Research University Higher School of Economics	501–550	501–550	501–550	501–550	5,522,833,900	6,611,898,300	10,139,126,642	11,701,853,600	35.3	48.5%
12	Tomsk Polytechnic University	601+	551–600	501–550	481–490	3,156,467,601	3,831,017,400	4,037,704,022	4,819,075,097	43.9	36.1%
13	Kazan (Volga Region) Federal University	601+	601–650	551–600	551–600	3,982,437,900	3,623,989,100	4,087,323,830	4,668,284,478	49.4	44.3%
14	Ural Federal University named after the first President of Russia B. N. Yeltsin	451–500	501–550	551–600	601–650	3,409,739,400	3,636,428,900	5,064,912,752	4,923,086,592	40.2	43.7%
15	Saratov State University	—	—	601–650	601–650	975,850,900	1,136,674,200	844,521,819	952,731,267	53.6	42.5%
16	Southern Federal University	—	601–650	601–650	601–650	2,297,270,100	2,875,601,200	3,004,536,889	2,926,342,175	43.3	54.4%
17	Far Eastern Federal University	601+	701+	701+	651–700	5,257,960,700	6,559,616,100	3,636,026,985	4,808,476,321	59.1	49.6%
18	Lobachevsky State University of Nizhni Novgorod (Lobachevsky University)	601+	701+	701+	701+	1,119,985,800	1,654,131,900	3,289,176,069	3,353,197,687	25.4	57.7%
19	National University of Science and Technology "MISiS"	—	—	701+	701+	772,380,200	3,752,798,700	3,401,992,389	3,401,271,093	18.5	33.0%
20	Plekhanov Russian University of Economics	601+	701+	701+	701+	н/д	126,161,077	н/д	326,272,099	—	52.5%
21	Voronezh State University	—	701+	701+	701+	н/д	н/д	н/д	н/д	—	27.9%

#### Appendix 4. Russian universities in the QS BRICS Rankings

#	University	Period			
		2012/2013	2013/2014	2014/2015	2015/2016
1	Lomonosov Moscow State University	3	3	4	7
2	Saint Petersburg State University	14	12	15	20
3	Bauman Moscow State Technical University	33	36	35	38
4	Novosibirsk State University	22	18	19	20
5	Moscow State Institute of International Relations (University) run by the Ministry of Foreign Affairs of Russia	37	35	39	44
6	Moscow Institute of Physics and Technology	55	52	45	48
7	Peoples' Friendship University of Russia	86	82	84	99
8	National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)	65	57	51	50
9	Peter the Great St. Petersburg Polytechnic University	47	47	60	61
10	National Research Tomsk State University	58	47	44	43
11	National Research University Higher School of Economics	50	58	63	62
12	National Research Tomsk Polytechnic University	71	67	64	64
13	Kazan (Volga Region) Federal University	79	69	72	74
14	Ural Federal University named after the first President of Russia B. N. Yeltsin	84	80	77	78
15	Saratov State University	—	121–130	121–130	151–200
16	Southern Federal University	89	85	81	85
17	Far Eastern Federal University	99	100	98	94
18	Lobachevsky State University of Nizhni Novgorod (Lobachevsky University)	74	72	86	76
19	National University of Science and Technology "MISIS"	—	98	89	87
20	Plekhanov Russian University of Economics	—	100	91	90
21	Voronezh State University	91	90	111–120	111–120
22	Moscow Power Engineering Institute	97	101–110	121–130	111–120
23	ITMO University	—	111–120	99	101–110
24	Perm State University	—	111–120	111–120	131–140
25	Tomsk State University of Control Systems and Radioelectronics	—	111–120	121–130	141–150
26	Gubkin Russian State University of Oil and Gas	—	121–130	121–130	151–200
27	Mendeleev University of Chemical Technology of Russia	—	121–130	121–130	141–150
28	Saint Petersburg Electrotechnical University "LETI"	—	121–130	101–110	121–130
29	Herzen State Pedagogical University of Russia	—	131–140	121–130	141–150
30	Moscow Aviation Institute (National Research University)	—	131–140	121–130	131–140
31	Moscow State Linguistic University	—	131–140	121–130	141–150

#	University	Period			
		2012/2013	2013/2014	2014/2015	2015/2016
32	Moscow State University of Civil Engineering	—	131–140	131–140	141–150
33	Saint Petersburg Mining University	—	131–140	101–110	121–130
34	Novosibirsk State Technical University	—	131–140	111–120	101–110
35	Belgorod State Technological University named after V.G.Shukhov	—	141–150	151–200	151–200
36	Irkutsk State University	—	141–150	131–140	151–200
37	Russian Presidential Academy of National Economy and Public Administration under the President of the Russian Federation (RANEPA)	—	141–150	131–140	121–130
38	Altai State University	—	151–200	141–150	131–140
39	Belgorod State University	—	151–200	151–200	151–200
40	Financial University under the Government of the Russian Federation	—	151–200	151–200	151–200
41	Kaliningrad State Technical University	—	151–200	151–200	151–200
42	Kazan National Research Technical University named after A.N.Tupolev	—	151–200	151–200	151–200
43	Kazan National Research Technological University	—	151–200	141–150	151–200
44	Ammosov North-Eastern Federal University	—	151–200	151–200	151–200
45	Northern (Arctic) Federal University named after M.V. Lomonosov	—	151–200	—	201–250
46	Petrozavodsk State University	—	151–200	151–200	151–200
47	Russian State University for the Humanities	—	151–200	151–200	151–200
48	Saint-Petersburg University of Economics	—	151–200	—	—
49	Samara State Aerospace University	—	151–200	151–200	151–200
50	Samara State University	—	151–200	151–200	—
51	Siberian Federal University	—	151–200	151–200	151–200
52	South Ural State University	—	151–200	151–200	151–200
53	Volgograd State University	—	151–200	151–200	151–200
54	Immanuel Kant Baltic Federal University	—	—	151–200	131–140
55	N. P. Ogarev's Mordovia State University	—	—	151–200	—
56	National Research University of Electronic Technology "MIET"	—	—	—	201–250
57	Moscow Technical University of Communications and Informatics	—	—	—	201–250
58	Perm National Research Polytechnic University	—	—	—	201–250

## Appendix 5. Quantitative results of cluster analysis

Table A5.1. Cluster characteristics by the variables included in cluster analysis

### Funding formula for teaching

	Chi-square test results
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
Not used	3,373
2	4
0	0,497
2	Likelihood Ratio
Primary	4,553
27	4
26	0,336
20	Linear-by-Linear Association
Secondary	1,054
14	1
10	0,305
6	N of Valid Cases
Total observations	107
43	
36	
28	

### Performance contracts for teaching

	Chi-square test results
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
Not used	58,25
33	4
2	0
3	Likelihood Ratio
Primary	64,663
2	4
0	0
2	Linear-by-Linear Association
Secondary	38,068
8	1
34	0
23	N of Valid Cases
Total observations	107
43	
36	
28	

### Negotiations for teaching

	Chi-square test results
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
Not used	36,653
29	4
10	0
21	Likelihood Ratio
Primary	39,577
14	4
10	0
6	Linear-by-Linear Association
Secondary	0,228
0	1
16	0,633
1	N of Valid Cases
Total observations	107
43	
36	
28	

### Funding formula for research

	Chi-square test results
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
Not used	21,896
3	4
4	0
3	Likelihood Ratio
Primary	22,334
13	4
26	0
19	Linear-by-Linear Association
Secondary	10,725
27	1
6	0,001
6	N of Valid Cases
Total observations	107
43	
36	
28	



Performance contracts for research

Chi-square test results	
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
Not used	58,25
33	4
2	0
3	Likelihood Ratio
Primary	64,663
2	4
0	0
2	Linear-by-Linear Association
Secondary	38,068
8	1
34	0
23	N of Valid Cases
Total observations	107
43	
36	
28	

Negotiations for research

Chi-square test results	
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
Not used	1,862
15	2
14	0,394
21	Likelihood Ratio
Primary	1,866
28	2
6	0,393
6	Linear-by-Linear Association
Secondary	0,057
0	1
16	0,812
1	N of Valid Cases
Total observations	107
43	
36	
28	

Ranking position

Chi-square test results	
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
1-100	86,787
20	8
4	0
0	Likelihood Ratio
101-200	93,317
8	8
23	0
0	Linear-by-Linear Association
201-300	41,668
9	1
6	0
8	N of Valid Cases
301-400	107
6	
3	
6	
401-500	
0	
0	
14	
Total observations	
43	
36	
28	

Ranking movement

Chi-square test results	
Cluster	Value
1	df
2	Asymp. Sig. (2-sided)
3	Pearson Chi-Square
Down	10,797
3	4
4	0,029
8	Likelihood Ratio
No change	10,022
32	4
19	0,04
14	Linear-by-Linear Association
Up	1,07
8	1
13	0,301
6	N of Valid Cases
Total observations	107
43	
36	
28	

Table A5.2. **Descriptive cluster characteristics by the variables excluded from cluster analysis**

	Average amount of funding						Kruskal-Wallis test results		
	Cluster 1		Cluster 2		Cluster 3		$\chi^2$	df	Asymp. Sig.
	Mean	Observations	Mean	Observations	Mean	Observations			
Amount of funding (mln euros)									
Total funding per student	0,03**	43	0,02**	36	0,018**	28	5,80	2	0,06
Total funding per faculty member	0,18	33	0,21	25	0,20	19	1,90	2	0,39
Total funding	704,7***	43	540,7***	36	317,6***	28	37,63	2	0,00
Public funding per student	0,02***	38	0,01***	27	0,009***	23	15,34	2	0,00
Proportions of selected sources in total funding (%)									
Public grants in total funding	60,0***	38	48,8***	27	48,7***	23	7,93	2	0,02
Public grants for research in total public funding	55	16	48	12	50	15	1,79	2	0,41
Public grants for teaching in total public funding	45	16	52	12	50	15	1,79	2	0,41
Third-party research grants in total funding	33	33	24	14	20	7	4,42	2	0,11
Tuition revenues in total funding	24	10	28	20	36	17	3,78	2	0,15

\*\*\*  $p < 1\%$ , \*\*  $p < 5\%$ .

## Appendix 6

Table A6.1. **University distribution by country**

(the table indicates the number of universities from a specific country in the relevant cluster)

Country	Cluster		
	1	2	3
AT	2		2
BE-FL	4		
BE-FR	1		
CZ	1		
DK	4		1
FI	1		5
FR		6	4
DE-NRW	6		1
DE-HE		2	

Country	Cluster		
	1	2	3
IE		1	1
IT		4	1
NL		12	
NO	2		
ES-CA		2	1
SE	9		
CH	6		
UK-EN	7	9	12

Table A6.2. **ARWU Ranking positions of universities in 2014 (analyzed year):  
breakdown by clusters**

Universities	ARWU 2014 ranking
CLUSTER 1	
Aarhus University	74
Catholic University of Leuven	96
Chalmers University of Technology	301
Charles University in Prague	201
Ghent University	70
King's College London	59
Linköping University	301
Lund University	102
Norwegian University of Science and Technology	201
Royal Institute of Technology	201
RWTH Aachen University	201
Stockholm University	78
Swedish University of Agricultural Sciences	201
Swiss Federal Institute of Technology of Lausanne	96
Swiss Federal Institute of Technology Zurich	19
Technical University of Denmark	102
The Imperial College of Science, Technology and Medicine	22
The University of Manchester	38
Umeå University	201
University College London	20
University of Antwerp	301
University of Basel	90
University of Bern	152
University of Bochum	201
University of Bonn	94
University of Bristol	63
University of Cambridge	5
University of Copenhagen	39
University of Duisburg-Essen	301
University of Gothenburg	152
University of Helsinki	73

Universities	ARWU 2014 ranking
University of Innsbruck	201
University of Koeln	152
University of Lausanne	152
University of Liege	201
University of Muenster	152
University of Oslo	69
University of Oxford	9
University of Southern Denmark	301
University of Vienna	152
University of Zurich	56
Uppsala University	60
Vrije University Brussel	301
<b>CLUSTER 2</b>	
Aix-Marseille University	102
Autonomous University of Barcelona	201
Cardiff University	102
Claude Bernard University Lyon 1	201
Delft University of Technology	201
Eindhoven University of Technology	301
Erasmus University	152
Leiden University	77
London School of Economics and Political Science	102
Radboud University Nijmegen	102
Technical University Darmstadt	401
The University of Sheffield	102
Trinity College Dublin	152
University of Amsterdam	102
University of Barcelona	152
University of Bologna	152
University of Bordeaux 1	201
University of Frankfurt	102
University of Groningen	82
University of Leeds	102

Universities	ARWU 2014 ranking
University of Liverpool	102
University of Lorraine	201
University of Maastricht	201
University of Milan	152
University of Nottingham	102
University of Padua	152
University of Paris Descartes (Paris 5)	152
University of Paris Sud (Paris 11)	42
University of Roma — La Sapienza	152
University of Southampton	102
University of Sussex	152
University of Twente	301
University of Wageningen	102
University of Warwick	152
Utrecht University	57
VU University Amsterdam	100
<b>CLUSTER 3</b>	
Aalborg University	401
Aalto University	401
Brunel University	401
Ecole Polytechnique	301
Lancaster University	301
Newcastle University	201
Polytechnic Institute of Milan	201
Polytechnic University of Catalonia	401
Queen Mary, University of London	201
The University of Reading	301
University College Dublin	201
University of Bath	401
University of Bielefeld	401
University of East Anglia	152
University of Eastern Finland	401
University of Essex	401

Universities	ARWU 2014 ranking
University of Exeter	201
University of Graz	401
University of Leicester	201
University of Nice Sophia Antipolis	401
University of Oulu	301
University of Paris Dauphine (Paris 9)	301
University of Rennes 1	401
University of Surrey	401
University of Turku	301
University of York	201
Vienna University of Technology	401