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EVALUATING THE IMPACT OF HIGHER EDUCATION SYSTEMS ON ECONOMIC DEVELOPMENT OF TERRITORIES

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Problem description

Nowadays the higher education sector is considered to be an essential part of most national economies. According to the World Bank data for 2017[1], the average spending on higher education in the world was 4.1% of total government spending, in 30 countries of the world more than 80% of the younger generation are studying at universities. As noted in the expert report of the Higher School of Economics "12 Solutions for New Education"[2], the sphere of education and the sphere of higher education in particular can be viewed as an actively growing market, the export of education can reach tens of billions of dollars, as the examples of the most successful countries show. At the same time, universities are increasingly viewed as economic actors that can be included in the processes of socio-economic development of the territories in which they are located and, as a result, lead to higher rates of economic development [Belenzon and Schankerman, 2013; Pinheiro et al., 2012; Varga, 2001]. In this regard, additional financial investments in the expansion of the higher education system as well as in improving its quality can be considered as investments that allow obtaining positive economic benefits in the future [Hanushek, 2016].

In Russia, as in most other developed and developing countries, there has also been a significant expansion of the higher education sector: both the number of universities and the number of students have grown significantly. This growth mainly occurred in the period 1990-2010. According to the Ministry of Science and Higher Education of the Russian Federation[3], in the 1990/91 academic year there were 514 universities in the country, at the peak in the 2008/09 academic year the number of universities reached 1134. According to the same data, the total number of students increased from 2.6 million up to 7.3 million people over the same period. This expansion of the higher education system has led to the fact that to date Russia has accumulated a significant stock of human capital - according to the Global Human Capital report[4], in 2017 the country ranked 4th in the world in terms of the volume of

[1] https://data.worldbank.org/indicator/SE.XPD.TERT.ZS
[2] https://www.hse.ru/data/2018/04/06/1164671180/Doklad_obrazovanie_Web.pdf
[3] https://minobrnauki.gov.ru/ru/activity/stat/highed/
[4] https://www.weforum.org/reports/the-global-human-capital-report-2017

human potential, which is understood as the coverage of the population with various levels of education. However, the paradox is that this potential is not fully capitalized – according to the same report, Russia ranks only 42nd in the world in terms of the actual use of skills in labor and also 89th in the world in terms of the "availability of skilled workers" index. A similar situation is observed in terms of technology transfer and in terms of the interaction of universities with government authorities, local communities and industrial partners ("the third mission of universities"). Thus, the potential of the higher education system remains underutilized in terms of its contribution to economic development.

In this context, the issue of quantitative measurement of universities' contribution to economic development as well as the analysis of reforms and interventions which may affect the value of this contribution becomes relevant. Public policy in higher education can influence the magnitude of universities' contribution to economy and society development by influencing universities' performance indicators. Existing studies show that quality of educational outcomes of graduates, volume of applied research and development and publication activity of universities are positively associated with the pace of economic development [Agasisti and Bertoletti, 2020]. At the same time, given the limited resources faced by most national systems of higher education, including the Russian one, increasing the level of efficiency is one of the main opportunities to increase the level of performance. The concept of efficiency involves the relation of the achieved performance indicators and the amount of resources spent on their achievement. Thus, an efficient university can demonstrate relatively higher values of performance indicators (generate a greater contribution to economic development) having the same amount of resources. Efficiency of universities is one of the key determinants of performance and, as a result, the value of universities' contribution to economic development of territories – this fact determines the location of this dissertation at the junction of two areas of research: universities' contribution to economic development analysis as well as universities' efficiency measurement.

Brief literature review

The conceptual framework for the discussion regarding the role of education, higher education in particular, in the development of society is set by four main theories:

- social reproduction theory [Bourdieu et al., 1977], suggesting that the main function of education is to reproduce existing social structure;
- signaling theory [Spence, 1978], according to which education is considered as

a signal on the labor market based on which employers evaluate productivity of potential workers;

- institutional theory [North, 1981], which suggest that development level of institutions, including higher education, can be considered as a predictor of economic development;
- human capital theory [Schultz, 1961; Becker, 1964], according to which higher level of education is associated with greater productivity on the individual level and, consequently, with higher rates of economic development.

At the same time, the latter theory is dominant in studies that focus on the relationship between education and economic development [Lauder, 2015].

Human capital theory assumes the existence of non-negative individual and social returns to education. The private return to education implies the gain from education for an individual in the form of a higher salary [Mincer, 1974]; the concept of social returns to education suggests that universities are able to create positive externalities that can have a positive impact on society as a whole, in excess of the sum of all individual effects. The social return on education can be expressed in higher average labor productivity in the economy, greater tax collections, fewer people who need budget transfers [Bloom et al., 2007]. In addition, the social return from higher education can manifest itself in a number of social effects, including a decrease in crime rate, an increase in life expectancy, and formation of various mechanisms of civil society [Putnam, 2001]. At the same time, the social return to education is a connecting link that allows the theory of human capital to be used in research not only at the level of individuals but also at the level of individual territories and countries.

In the context of the described theoretical framework, there are a number of empirical studies that examine the relationship between the level of development of higher education systems and the pace of economic development. At the same time, the characteristics of the development level of the higher education system used in different studies can vary from the most general, e.g. the number of universities in the region [Valero and Van Reenen, 2019], to more specific ones reflecting individual performance indicators of universities, e.g. the number of graduates [Holland et al., 2014]; the volume of university research and development [Fritsch and Slavtchev, 2007]; the intensity of interactions between universities and local businesses [Mueller, 2006]. In addition, there are a number of studies that analyze the relationship between performance indicators of universities and the economic growth rates of regions in which they are located [Barra and Zotti, 2016; Agasisti et al., 2016].

Research of relationship between university performance and economic development rates involves integrating the academic debate on the efficiency measurement in the higher education sector into a line of research related to assessing the contribution of universities to economic development. Literature on higher education efficiency generally views universities as economic agents that transform a resource vector into an output vector in accordance with a specific production technology [De Witte and López-Torres, 2017]. The efficiency of universities is defined as an ability to achieve maximum possible outputs given fixed amount of resources. The indicators of university resources usually include university revenues [Agasisti and Perez-Esparrells, 2010], number of academic staff [Wolszczak-Derlacz and Parteka, 2011], average score of university entrance examinations [Johnes, 2006]. The scientific productivity of faculty members [Parteka and Wolszczak-Derlacz, 2013] and the number of graduates [Bonaccorsi et al., 2007] are usually used as indicators of outputs in the literature.

Parametric methods, such as the stochastic frontier analysis – SFA [Aigner et al., 1977], and nonparametric methods, such as data envelopment analysis – DEA [Farrell, 1957; Charnes et al., 1989] are commonly used for statistical analysis of organizational efficiency. These methods of efficiency analysis suggest constructing empirical producer possibility frontier. In this case the measure of "inefficiency" is defined as a distance from an organization to this empirical frontier. Higher education efficiency research began to develop rapidly in the 90s of the last century. The first studies were based on samples consisting of departments and other structural units of universities [Johnes, 1995]. Subsequent studies analyzed the efficiency of individual universities [Flegg et al., 2004] as well as higher education systems [Agasisti & Dal Bianco, 2006]. An important part of the research area related to the statistical analysis of higher education efficiency is the comparison of efficiency of universities located in different countries. Examples of such studies are [Agasisti & Perez-Esparrells, 2010], which compares the efficiency of Italian and Spanish universities, and [Agasisti & Johnes, 2009], where the authors use a similar methodological strategy to compare universities in Italy and the UK. Another part of this research area which has been actively developing in recent years is the analysis of exogenous factors. These factors cannot be classified neither as the resources of the organization nor as the results of its activities. Often such factors are out of control of an educational organization's management. However, their influence on efficiency of activities can be quite large. For example, in [Agasisti et al., 2019] such variables as student dropout after the first year of study; the amount of funds received in the form of a subsidy from the federal government; dummy variable reflecting the fact that the

university includes a medical faculty; the age of the university's technology transfer office were considered as exogenous factors. The above approach to analysis of universities' efficiency is dominant but it has a number of disadvantages including complexity of determining the resources and results of the organization's activities, the mechanistic nature and the difficulties in accounting for various exogenous factors affecting the production process within the university [Agasisti et al., 2019].

Despite the relevance of issues related to efficiency of universities and their contribution to economic development, there is an extremely limited number of Russian studies in the framework of the above two areas of research. Among Russian studies on the contribution of universities to socio-economic development, it is worth highlighting the papers [Klyachko, Semionova, 2018] and [Leshukov et al., 2017], in which the first attempts to statistically evaluate the contribution of Russian universities to the economic development of regions were made. Among Russian studies of universities' efficiency, only a few works can be noted. The study [Abankina et al., 2013] is one of the first studies in which the results of universities' efficiency assessment based on Russian data are presented. In [Abankina et al. 2016] an attempt to classify Russian universities based on efficiency estimates obtained using Data envelopment analysis (DEA) was made.

Thus, this dissertation research contributes to expansion of the existing scientific discussion regarding efficiency of universities and their contribution to economic development in two respects. First, the dissertation research links two scientific discussions that are related to universities' efficiency and universities' contribution to economic development analysis. Secondly, the study makes up for the lack of research in these areas using Russian statistical data and represents the first comprehensive attempt to assess the contribution of Russian universities to economic development of regions, to analyze universities' efficiency and to identify ways to improve efficiency through various instruments of public policy in higher education.

The aim of the research

The purpose of this dissertation research is to quantify universities' contribution to economic development of Russian regions as well as to determine ways to increase it through various instruments of public policy in higher education. This research goal can be decomposed into a number of **objectives**:

1. Analyze how the involvement of Russian universities in territories' socio-economic development has changed in the historical perspective, identify different types of incentives that ensured universities' contribution to socio-economic development and study how the combination of these types of

incentives has changed over time.

Within the framework of this objective, it is analyzed how Russian universities implemented their third mission during the Soviet and post-Soviet periods, as well as how the combination of "natural" and "externally induced" incentives that ensured universities' contribution to the territories' economic development changed.

2. Identify and describe the channels through which universities can generate contributions to economic development.

   At this stage, the main mechanisms through which universities can stimulate territories' economic development are identified and analyzed based on analysis of existing literature.
3. Conduct a statistical analysis of universities' contribution to territories' economic development in order to obtain a quantitative estimates of this contribution based on the econometric model of regional economic growth.

   This objective involves econometric modeling of the economic growth of Russian regions, identification of the model based on the sys-GMM methodology.
4. Conduct a statistical analysis of efficiency of Russian universities, obtain quantitative estimates of efficiency of Russian universities as one of the determinants of the value of their contribution to regional economic development in conditions of limited resources.

   At this stage, we assess the efficiency of Russian universities, as well as study the statistical relationship between the efficiency of regional higher education systems and the rate of regional economic growth.
5. Assess the impact of various public policy instruments in the field of higher education on efficiency of universities.

   Within the framework of this task, we study how reforms and policy interventions in higher education (mergers of universities, granting autonomous status, the allocation of separate cohorts of universities, etc.) can affect efficiency of universities and, as a result, their performance contribution to economic development.

Personal participation of the candidate for a scientific degree in obtaining the results set out in the dissertation

The personal contribution of the candidate consists in generalization and systematization of existing empirical and theoretical studies devoted to assessing universities' efficiency and their contribution to territories' economic development; preparation of the statistical database for the study (combining various databases,

searching for the necessary documents for analysis); development of statistical methods to answer the research questions posed in the dissertation; as well as obtaining the results presented in the dissertation research.

In particular, the personal contribution of the candidate in obtaining the results presented in the dissertation consists in:

- Formulation of theoretical framework which is a basis for hypothesis considered in the dissertation research;
- Identification and classification of incentives for the universities' third mission implementation, that suggests engagement of universities in social and economic development of regions of their localization;
- Quantitative analysis of universities' efficiency using different statistical techniques (data envelopment analysis, stochastic frontier analysis, etc.)
- Identification of econometric model that allows testing hypothesis about positive link between efficiency of regional higher education systems and regional economic short-term growth. In addition, this model allows estimating spillover effects, i.e. the effect of higher education systems' efficiency on economic development of neighboring regions;
- Classification of Russian universities based on the indicators reflecting efficiency and performance of their activities;
- Development of the methodological framework that allows estimating the effects of different public policies and interventions in higher education, including merger policy, on universities' efficiency.

Candidates' contribution by papers containing the results of dissertation research is presented in Table 1.

Table 1. Candidate's contribution by papers containing the results of dissertation research.

Paper	Candidate's contribution
Egorov, A., Leshukov, O., & Froumin, I. (2020). "Regional flagship" university model in Russia: searching for the third mission incentives. Tertiary	Writing following parts of the paper: «Understanding and managing university's third mission», «Soviet invention – Quasi-corporate higher

Education and Management, 26, 77-90.	education», «The advent of new regulatory incentives»; Data collection; Analysis of strategic plans of Russian universities; Work with reviews.
Agasisti, T., Egorov, A., Zinchenko, D., & Leshukov, O. (2021). Efficiency of regional higher education systems and regional economic short-run growth: empirical evidence from Russia. Industry and innovation, 28 (4), 507-534.	Writing following parts of the paper: «Literature review and hypotheses», «Methodology and data selection», «Discussion and concluding remarks»; Data collection and descriptive analysis; Formulation of regional economic growth model; Work with reviews.
Egorov A., University Efficiency Evaluation Based on Educational Production Functions (2020). University Management: Practice and Analysis, 24 (4), 87-99.	Paper without co-authors
Zinchenko D., Egorov A. (2019) Efficiency modelling of Russian universities. HSE economic journal, 23 (1), 143-172	Writing following parts of the paper: «Introduction», «Empirical analysis of universities' efficiency and its determinants», «Discussion and concluding remarks» Data collection and descriptive analysis; Efficiency analysis of Russian universities; Work with reviews.
Agasisti, T., Egorov, A., & Maximova, M. (2021). Do merger policies increase universities' efficiency? Evidence from a fuzzy regression discontinuity design. Applied Economics, 53(2), 185-204.	Writing following parts of the paper: «Introduction», «Received literature», «Evaluating the causal impact of merger on efficiency level», «Concluding remarks»; Elaboration of methodological framework; Work with reviews.

The candidate's contribution also consists in approbation of the obtained results

–preparation of scientific publications and expert-analytical reports, speeches at scientific conferences. In addition, the results obtained in the course of the study were tested in the course of the implementation of expert and analytical projects in the interests of state authorities at various levels as well as individual Russian universities.

Information base of research

The main source of data for the dissertation research is Monitoring of Performance of Higher Education Institutions Implemented by Russian Ministry of Science and Higher Education[5]. Monitoring is carried out annually and involves the collection of data on a wide range of indicators characterizing the volume of resources available to universities, as well as the performance of their activities. All public and a significant part of private universities take part in the Monitoring, data is available for the period 2013-2019. The Monitoring of performance data is supplemented by a number of other sources containing statistical data on Russian universities. In particular, the Monitoring of the employment of graduates of the Ministry of Science and Higher Education[6] (Monitoring of employment) is used in the study as a source of data on the number of university graduates, as well as the main characteristics of graduates in the labor market. Monitoring of the university admissions[7] of the Higher School of Economics (Admissions Monitoring) is used as a source of data on the average passing average state exam (USE) scores in universities. Some universities' financial performance indicators were obtained from the Analytical Component of the Integrated Financial Management System[8] (AC IFMS) of the Ministry of Science and Higher Education as well as from the Unified Information System of the Ministry of Science and Higher Education[9] (UIS). The report "Regions of Russia" by Rosstat was used as the main source of data on various characteristics of socio-economic development of the regions in which the universities are located.

The study also used various documents of the Ministry of Science and Higher Education of the Russian Federation, as well as strategic documents of individual universities (development strategies, road maps, etc.). Finally, in order to clarify the research questions of the dissertation research, interviews with experts in the field of higher education and representatives of universities management were conducted.

[5] https://monitoring.miccedu.ru/?m=vpo
[6] http://graduate.edu.ru/
[7] https://ege.hse.ru/
[8] https://www.cbias.ru/faq/01-analiticheskij-komponent-kompleksnoj-sistemy-upravlenija-finansami-ak-ksuf/
[9] http://eis.mon.gov.ru/education/

The structure and logic of the dissertation

In the first chapter of the dissertation research, which is presented by the article "Regional flagship university model in Russia: searching for the third mission incentives" published in Tertiary Education and Management journal, general approaches to analysis of universities' contribution of universities to development of economy and society are considered[10]. Using the example of the Russian system of higher education, we study incentives that ensure the involvement of universities in socio-economic development and the implementation of their "third mission". There are two types of such incentives - "natural", formed by the environment in which universities operate, and "externally induced", suggesting that implementation of the third mission is imputed to universities by the state regulator through various reforms and policy interventions. It is shown that the combination of "natural" and "externally induced" incentives is not constant over time and evolves with the economic, social and political development of society.

The second chapter, presented by the paper «Efficiency of regional higher education systems and short-run economic growth: empirical evidence from Russia» which is published in Industry and Innovation[11] journal, is devoted to the quantitative assessment of universities' contribution to economic development of Russian regions. We consider a model of regional economic growth, the specification of which was determined on the basis of the theory of endogenous economic growth. This model includes two key indicators of regional higher education systems activity among other factors – total number of university graduates in a region as well as an aggregate indicator of regional higher education systems efficiency. In addition, the model includes the spatial lag of gross regional product's growth rates as well as the spatial lag of regional higher education systems efficiency for statistical testing of the hypothesis of the spillover effects' existence. The model is identified on the basis of panel data, the source of which is the Monitoring of performance. The generalized method of moments, which allows partially solving the endogeneity problem and identifying the causal nature of the statistical relationship between the regional higher education systems' efficiency and the growth rate of gross regional product, is used.

The third chapter, presented by the paper "University Efficiency Evaluation Based on Educational Production Functions" published in University Management journal[12], is devoted to analysis of main approaches to universities efficiency

[10] Egorov, A., Leshukov, O., & Froumin, I. (2020). "Regional flagship" university model in Russia: searching for the third mission incentives. Tertiary Education and Management, 26, 77-90.

[11] Agasisti, T., Egorov, A., Zinchenko, D., & Leshukov, O. (2021). Efficiency of regional higher education systems and regional economic short-run growth: empirical evidence from Russia. Industry and innovation, 28(4), 507-534.

[12] Egorov A.A. University Efficiency Evaluation Based on Educational Production Functions. University

estimation. University efficiency in this chapter is considered as one of the main predictors of university contribution to regional economic development. In particular, the theory of production function is considered as a basis for assessing the universities' efficiency. The features of the two main methodological approaches to universities' efficiency assessment are discussed – data envelopment analysis and stochastic frontier analysis. The results of Russian universities' efficiency evaluation are presented, which are compared with the aggregate index of universities' performance. A classification of Russian universities according to the level of efficiency and performance of their activities is proposed on the basis of this comparison. Recommendations for public policy in the field of higher education are discussed, which can potentially increase the performance of the higher education system and, therefore, its contribution to the economic development of regions through the redistribution of available resources.

In the fourth chapter, presented by the paper "Efficiency modelling of Russian universities"[13] *published in HSE economic journal and the paper "Do merger policies increase universities' efficiency? Evidence from a fuzzy regression discontinuity design" published in Applied Economics journal*[14], different determinants of universities' efficiency are analyzed. In particular, the impact of university associations, departmental affiliation, whether an university has the status of an autonomous organization, whether an university belongs to the group of leading universities, which includes universities with a special status, federal universities, national research universities, as well as universities participating in the project "5-100" on efficiency is examined. This analysis of the determinants of efficiency is carried out on the basis of two separate models reflecting different types of activities of universities and characterized by different sets of resources and performance. In this chapter, using Russian data, two-step data envelopment analysis models were identified, which allow incorporating the influence of various exogenous factors into the efficiency analysis and obtaining unbiased efficiency estimates. To assess the impact of merger policies on the universities efficiency, a quasi-experimental study design is used, which involves the use of the regression discontinuity design. At the same time, the influence of the merger policy on the components of changes in efficiency over time, obtained based on the calculation of the Malmquist productivity index, is considered.

Management: Practice and Analysis. 2020;24(4):87-99. (In Russ.)

[13] Zinchenko D., Egorov A. Efficiency modelling of Russian universities// HSE economic journal. 2019. Vol.23, No 1, P. 143-172

[14] Agasisti T., Egorov A., Maximova M. Do merger policies increase universities' efficiency? Evidence from a fuzzy regression discontinuity design // Applied Economics. 2021. Vol. 53. No. 2. P. 185-204.

Research methodology

The analysis of the third mission of Russian universities and their contribution to the territories' socio-economic development in the historical perspective is based on the analysis of documents that include regulations of the Ministry of Science and Higher Education of the Russian Federation, as well as local documents of individual higher education organizations.

To obtain quantitative estimates of the contribution of regional higher education systems (their scale and level of efficiency) to economic development of Russian regions, econometric models of panel data were used, assessed using the generalized method of moments [Arellano, Bond, 1991; Arellano, Bover, 1995]. The dependent variable in these models is the growth rate of gross regional product. Among the key explanatory variables are total number of university graduates of a regional higher education system (graduates of bachelor's, specialist's and master's programs), an efficiency measure of regional higher education system, obtained using data envelopment analysis, as well as a spatial lag of higher education efficiency, which is necessary to test the hypothesis that universities' efficiency is associated not only with the rates of economic growth of the region in which these universities are located, but also with the rates of economic growth of neighboring regions (spillover effect). Also, the model includes additional control variables, including indicators of the regional economy's structure, a share of employees with higher education, etc. In particular, we consider model (1):

$$\Delta GRP_{j,t} = \alpha_0 + \alpha_1 \Delta GRP_{j,t-1} + \alpha_2 log(GRP_{j,t-1}) + \alpha_3 \Delta INV_{j,t} + \alpha_4 \Delta POP_{j,t} + \alpha_5 PSEC_{j,t} + \alpha_6 CME_{j,t} + \alpha_7 IND_{j,t} + \alpha_8 EMPHE_{j,t} + \alpha_9 GRAD_{j,t} + \alpha_{10} EFF_{j,t} + \alpha_{11} (EFF \times W)_{j,t} + \alpha_{12} (\Delta GRP \times W)_{j,t} + \mu_{j,t} + \tau_t + \varepsilon_{j,t} \quad (1)$$

where $\Delta GRP_{j,t}$– GRP growth rate; $log(GRP_{j,t-1})$ – log of GRP in the previous period; $\Delta INV_{j,t}$ – investment growth rate; $\Delta POP_{j,t}$ – population growth rate; $PSEC_{j,t}$ – share of public sector in GRP; $CME_{j,t}$ – share of commercial minerals extraction in GRP; $IND_{j,t}$ – share of industrial production in GRP; $EMPHE_{j,t}$ – share of employed population with higher education; $GRAD_{j,t}$ – total number of university graduates; $EFF_{j,t}$ – efficiency of regional higher education system measured through DEA methodology described below; $(EFF \times W)_{j,t}$ – efficiency spatial lag; $(\Delta GRP \times W)_{j,t}$ – GRP spatial lag; $\mu_{j,t}$ – individual (region-specific) effects; τ_t – time effects; $\varepsilon_{j,t}$ – random errors.

Methods of data envelopment analysis (DEA) and stochastic frontier analysis (SFA) were used to obtain statistical estimates of the efficiency of individual universities and regional systems of higher education [Farrell, 1957; Charnes et al., 1978; Kumbhakar and Lovell, 2003]. To obtain more reliable estimates of efficiency, various modifications of these methods were also used. In particular, data envelopment analysis with bootstrap and data envelopment analysis taking into account exogenous factors [Simar and Wilson, 2007] were implemented. In particular, we employ DEA model represented by the formula (2):

$$\max_{\theta_k, \lambda_i} \theta_k, s.t. \qquad (2)$$

$$\theta_k y_{sk} \leq \sum_{i=1}^{N} \lambda_i y_{si}, s = 1, \dots, S;\ S = \#\{outputs\}$$

$$x_{jk} \geq \sum_{i=1}^{N} \lambda_i x_{ij},\ j = 1, \dots, J;\ J = \#\{inputs\}$$

$$\sum_{i=1}^{N} \lambda_i = 1$$

where $X_k = (x_{1k}, \dots, x_{Jk}) \in R_+^J$ – input vector; $Y_k = (y_{1k}, \dots, y_{Jk}) \in R_+^S$ – output vector; K – number of the decision-making units in the sample (DMU); θ_k – efficiency of k-th DMU.

The production function of universities for evaluating these models was formulated on the basis of analysis of the literature on universities' resources as well as results of their activities. In terms of resources, the efficiency models include such indicators as an average USE score of incoming students (the quality of applicants), number and qualifications of research and teaching staff (the quality of an organization's human capital), amount of income (financial resources, available organizations). In terms of performance results, we used indicators reflecting educational activities of universities (the number of graduates employed within one year after completion of training), research activities (the number of publications in various scientific citation databases, as well as the level of citation of these publications), the third mission of universities, measured as the intensity of interactions with external customers (the volume of off-budget research and development). In addition, the models took into account various exogenous factors

that cannot be classified neither as the resources of universities, nor as the results of their activities.

Modifications of the data envelopment analysis model as well as quasi-experimental research designs were used to examine how various public policy instruments in higher education can affect universities' efficiency and, as a result, their performance and contribution to economic development. In particular, a two-step procedure data envelopment analysis with a bootstrap [Simar and Wilson, 2007] was used to analyze how policies such as granting universities an autonomous status, creating a group of "leading" universities, and subordination to various government agencies influenced the universities' efficiency. A quasi-experimental design (discontinuous regression method) was used to analyze the impact of merger policies on university efficiency.

The main findings

1. There are natural, induced by surrounding environment, and external, induced by government regulation, incentives that push universities to implement their third mission and generate a contribution to economic development, while the combination of these types of incentives has been constantly changing throughout the development of the Russian higher education system in the Soviet and post-Soviet periods;
2. The scale of the regional higher education system (in terms of the number of graduates), as well as its efficiency, have a positive effect on the growth rate of gross regional product. In this case, the general effect can be the result of the existence of three particular factors:

- output factor which assumes larger number of employed graduates, greater volume of research activities and other types of an university's output, which lead to a greater contribution to regional economic development;
- resource factor which assumes that the resources released due to more efficient universities' activities can be used alternatively in the regional economy;
- the reputation factor which assumes that a relatively more efficient educational organization has stronger collaborations with industrial partners for the transfer of knowledge and technology;

3. The efficiency of regional higher education system is one of the factors that negatively affect the rates of economic growth of neighboring regions. This effect occurs due to the fact that efficient universities pull resources (human and financial) from neighboring regions, which creates barriers to their economic development;
4. Factors of public policy in the field of higher education can have statistically

significant impact on efficiency of universities' activities. In particular, the connection between universities' efficiency and subordination type was found. Leading universities are on average less efficient, which can be explained both by the general underfunding of the higher education system (universities can achieve significant performance indicators with a small amount of available resources), and by the heterogeneity of the group of leading universities. Also no statistically significant relationship was found between the performance of universities and their autonomous status;

5. The universities which were part of university mergers policy, pursued in 2012-2015, in general, demonstrate higher rates of efficiency growth compared to non-participating peers. It is connected with such effects as returns on scale, returns on the diversity of activities, as well as improvement of management practices' quality at universities.

Contribution

The contribution of the dissertation research is as follows:

1. Within the framework of the dissertation research, a general approach to analysis of incentives that ensure the involvement of universities in the processes of socio-economic development of regions was proposed as well as the classification of these incentives;
2. The incentives of Russian universities that ensure implementation of their third mission were analyzed in a historical perspective. This distinguishes the study from previous research, which is based on a normative approach and implicitly assumes that universities should contribute to the territories' socio-economic development by default;
3. For the first time we empirically studied the statistical relationship between the efficiency of regional systems of higher education and the growth rate of the gross regional product on Russian data. In addition, we described the channels through which the efficiency of higher education systems can influence the GRP growth rates;
4. For the first time we evaluated the spillover effects in the activities of higher education institutions as well as their role in the economic development of Russian regions using Russian data;
5. Within the framework of the study, the first results of the analysis of the determinants of Russian universities' effectiveness were obtained;
6. A statistical analysis of various government policies and regulatory influences in the field of higher education was carried out in terms of their impact on the efficiency of universities and, as a result, on the value of their contribution to

the regions' economic development;

7. Based on the quasi-experimental design of the study, the influence of the merger policy of Russian universities on their activities' efficiency was studied. At the same time, an original methodology for analyzing the effects of a merger policy was proposed based on the peculiarities of the mechanism for implementing this policy.

Theoretical implication of the research

The dissertation is at the junction of two research areas in the economics of higher education: the area related to analysis of the universities' efficiency based on the production function and the area related to assessment of universities' contribution to economic development of countries and territories. In this regard, the theoretical significance of the work lies in the integration of these research areas and the description of new channels and mechanisms through which the regulator in the field of higher education can influence universities' efficiency and, as a result, their performance and contribution to economic development through various policies and interventions. In the dissertation research, methodological approaches to statistical analysis of efficiency and performance of universities' activities were proposed. Also methodological approaches to various policies' and regulatory influences' in the field of higher education impact assessment were proposed as well. In addition, the dissertation research also contributes to the debate regarding the functions of universities and their performance. In particular, the paper proposes a general approach to the analysis of the universities' incentives that ensure their contribution to economic development.

Practical implication of the research

The results of the dissertation research make it possible to formulate a number of conclusions and recommendations for public policy in higher education, which make it possible to maximize the contribution of universities to the economic development of regions:

1. Public policy in the field of higher education should focus not only on the accessibility and quality of higher education, but also on efficiency of its production, since efficiency of universities' activities is an important predictor of the performance of regional higher education systems and, as a result, the value of their contribution to economic development;
2. Despite the high level of centralization of the Russian system of higher education, the key stakeholders of their activities are regional, which makes it necessary to remove existing barriers to the participation of regional authorities

in universities' activities;

3. The negative spillover effects revealed in the study indicate that the further development of the network of higher education organizations should presuppose a more even geographical distribution of universities characterized by high values of efficiency and performance;
4. Partial redistribution of resources in favor of universities characterized by high efficiency of activities will increase the performance of the entire higher education system as well as create incentives for educational organizations to improve the overall quality of management;
5. The enlargement of universities through their mergers can contribute to the growth of their efficiency, performance and contribution to the territories' economic development. At the same time, the greatest positive effect arises in the case of the merger of relatively small universities, as well as universities characterized by a different structure of educational programs and a profile of scientific research.

List of publications that contain main findings of the dissertation research

Egorov, A., Leshukov, O., & Froumin, I. (2020). "Regional flagship" university model in Russia: searching for the third mission incentives. Tertiary Education and Management, 26, 77-90.

Agasisti, T., Egorov, A., Zinchenko, D., & Leshukov, O. (2021). Efficiency of regional higher education systems and regional economic short-run growth: empirical evidence from Russia. Industry and innovation, 28 (4), 507-534.

Egorov A., University Efficiency Evaluation Based on Educational Production Functions (2020). University Management: Practice and Analysis, 24 (4), 87-99.

Zinchenko D., Egorov A. (2019) Efficiency modelling of Russian universities. HSE economic journal, 23 (1), 143-172

Agasisti, T., Egorov, A., & Maximova, M. (2021). Do merger policies increase universities' efficiency? Evidence from a fuzzy regression discontinuity design. Applied Economics, 53(2), 185-204.

Other author's publications related to the topic of the dissertation research

Agasisti, T., Abalmasova, A., Shibanova, E., Egorov, A. (2021). The causal impact of performance-based funding on university performance: quasi-experimental evidence from a policy in Russian Higher Education. Oxford Economic Papers, 2021, in press

Sirotin V., Egorov A. (2018). Methodological Aspects of Career Trajectories

Analysis on Russian Labor Market. Voprosy statistiki, 25 (9), 37-47.

Archipova M., Egorov A., Sirotin V. (2017). Returns to schooling in Russian and Ukraine: comparative analysis. Applied Econometrics, 47, 100-122

Romanenko K., Shibanova E., Abalmasova E., Egorov A. (2018). Higher Education in Single-Industry Towns: Models, Practices, Challenges. University Management: Practice and Analysis, 22 (4), 110-125.

Approbation of the research results

The dissertation results were presented at the following conferences and seminars:

1. 6th International Workshop on "Efficiency in Education, Health and other Public Services" (Huddersfield, UK). Presentation: Higher education institutions efficiency and regional development, 2018;
2. The 31st conference of the Consortium of Higher Education Researchers (CHER) (Moscow, Russia). Presentation: Universities and regional economic growth in Russia, 2018;
3. XIX April International Academic Conference on Economic and Social Development (Moscow, Russia). Presentation: Does efficiency of higher education institutions matter for regional economic development? Evidence from Russia, 2018;
4. Conference "Higher education in modern ecosystems: efficiency, society and policies" (Augsburg, Germany). Presentation: Does efficiency of higher education institutions matter for regional economic development? Evidence from Russia, 2018;
5. LEER conference on Education Economics (Leuven, Belgium). Presentation: Do mergers policies increase universities' efficiency? Causal evidence from Russian higher education sector, 2019;
6. International Summer School on Higher Education Research (Saint-Petersburg, Russia). Presentation: Does efficiency of higher education institutions matter for regional economic development?, 2019;
7. European workshop on efficiency and productivity analysis - EWEPA 2019 (London, UK). Presentation: Do mergers policies increase universities' efficiency? Causal evidence from Russian higher education sector,2019;
8. International workshop on efficiency in education, health and other public services (Barcelona, Spain). Presentation: Do merger policies increase universities' efficiency? Evidence from a fuzzy regression discontinuity design;
9. GSOM 2019 Conference (Saint-Petersburg, Russia) Presentation: Merger

policies in Russian higher education sector, 2019;

10. AEFP 46th Annual Conference (Fort Worth, USA). Presentation: Do merger policies increase university efficiency? Evidence from a fuzzy regression discontinuity design, 2020;
11. Wisconsin Russia Project Young Scholars Conference (Madison, USA). Presentation: How do the characteristics of the environment influence university efficiency? Evidence from a conditional efficiency approach, 2020;
12. Conference of the Association of Program and Policy Evaluators (Moscow, Russia). Presentation: The impact of merger policies in the Russian higher education system on the efficiency of universities, 2021.

The results of the dissertation research were also discussed during 2 internships:

1. Politecnico di Milano School of Management (Milan, Italy), March-April 2019. Consultant – prof. Tommaso Agasisti;
2. University of Wisconsin-Madison (Madison, USA), January-June 2020. Consultant – prof. Paul Dower.

The main results of the dissertation research were included in the reports of the Laboratory for Development of Universities of the Institute of Education, National Research University - Higher School of Economics on research projects supported by the Program of Basic Research of the National Research University - Higher School of Economics: "Transformation of universities and their contribution to the development of the economy and society" (2018); "The contribution of universities to social, economic and cultural development and efficiency of their activities" (2019); “The role of universities in society and economy and factors of their productivity” (2020); "Differentiation of universities on the performance and efficiency of activities and the structure of their contribution to the public good" (2021). In addition, the results of the dissertation research formed the basis for the expert report "The Impact of Merger Policy in the Russian Higher Education System on the Efficiency of Universities Operations", issued with the support of a grant from the Center for Advanced Management Practices (2021), and were also used as reporting materials under the RFBR grant "Modern trends and socio-economic consequences of the development of digital technologies in Russia" (2018-2020). Some of the results of the dissertation research were used to implement the project “Preparing proposals for priority directions for the development of higher educational institutions for the development of urban agglomerations in the Russian Federation”, implemented by the Institute of Education, National Research University Higher School of

Economics, commissioned by the Center for Strategic Research Foundation. The materials of the dissertation research were used in the teaching activities of the candidate in the courses "Statistical modeling of social and economic processes" (Faculty of Economic Sciences, National Research University - Higher School of Economics); Methods of Applied Statistics (Faculty of Economic Sciences, National Research University Higher School of Economics); Research Project Seminar (Faculty of Economic Sciences, National Research University - Higher School of Economics); Comparative Analysis and Classification of Data (Faculty of Economic Sciences, National Research University - Higher School of Economics); Modeling of statistical dependencies (Faculty of Economic Sciences, National Research University - Higher School of Economics); Research Seminar (Institute of Education, National Research University Higher School of Economics); Economics of Education (Institute of Education, National Research University Higher School of Economics); Strategic Management in Education (Institute of Education, National Research University Higher School of Economics).

Four courseworks and three final qualification works were prepared at the Faculty of Economic Sciences and at the Institute of Education of the National Research University Higher School of Economics under the scientific supervision of the candidate.

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