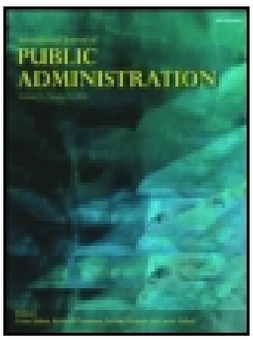

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Actual Autonomy, Efficiency and Performance of Universities: Insights from the Russian Case

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ABSTRACT

This paper studies the relationship between university institutional autonomy (both formal and informal) and their performance and efficiency using multi-stage empirical methodology. First, we measure an "autonomy-in-use" index, and then we employ Data Envelopment Analysis in order to evaluate institutional efficiency. Lastly, we use a panel fixed effect regression to provide robust evidence for the relationship between institutional autonomy, performance and efficiency. We find that formal status of autonomy does not predict higher publication activity or efficiency. However, the findings also reveal that informal autonomy is positively associated with efficiency scores, and advanced practices in staff management can contribute to increases in publication activity and overall institutional efficiency.

KEYWORDS

Autonomy; higher education management; composite indicator; efficiency analysis

Introduction

The Russian higher education (HE) system is composed of numerous heterogeneous institutions, despite the high level of governmental regulation of the sector. The central government determines rules for public financing, lower price boundaries for private universities, and develops standard costs for HE. However, Russian universities – like other non-profit organizations in the country – can obtain (or not) different degrees of autonomy. According to the classification adopted in the federal legislation, universities can be labelled as (i) autonomous, (ii) budgetary autonomous or (iii) completely state-owned (the latter defined as "kazennoe"). Autonomous universities develop their own charters, create internal governance bodies, develop their own rules for enrollment, salaries, and financial plans. The other two groups enjoy limited freedoms in those management areas.

In the academic literature, scholars have always paid particular attention to the relationship between universities and the government-as-regulator. Berdahl (1990) defines HEI's "institutional" autonomy and separates it from academic freedom. He argues that institutional autonomy includes a sustainable and a procedural aspect. The first reflects an institution's right to determine its own goals and programs (the "what" dimension), the second reflects the power to determine the means and mechanisms by which these goals will be achieved (the "how" dimension). In this paper, the three keys aspect of autonomy described by Berdahl are considered as coherent with those set by the Russian government, namely the freedom of (i) selecting staff, (ii) determining the curriculum and (iii) reallocating funds.

When considering the hypotheses about the economic and managerial mechanisms that can be activated by a higher degree of institutional autonomy, the main assumption is that relatively more autonomous universities tend to be more efficient and productive (see Verhoest, 2005). Aghion et al. (2010) explicitly test the hypothesis that universities are more productive when they are more autonomous and face more competition, arguing that European universities could benefit from a combination of both greater autonomy and accountability. This topic deserves more empirical validation in the context of the Russian HE sector. The only recent study in this area, conducted by Zinchenko and Egorov (2019), finds that autonomy is not a statistically significant predictor of university efficiency. A potential explanation for this is that formal autonomous status does not necessarily expand a university's freedom and flexibility in practice (i.e. the autonomy is limited to unimportant practices). Alternatively, it can be the case that university management does not use the whole spectrum of available powers, determining a gap between "formal" and "actual" autonomy.

In this paper we deal with the relationship between autonomy and performance in the HE industry, using Russia as the reference case. Specifically, this paper answers the following two research questions: (i) *to*

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what extent do Russian universities differ in their autonomy, formally and practically? (ii) *is there a robust statistical association between university autonomy (both formal and actual), and their efficiency and performance*?

To answer these questions, we use a multi-step methodology. We first propose a definition of university autonomy, operationalized into three components, based on the freedom to (i) allocate funds, (ii) deploy specific staff policy and (iii) determine curriculum content. Then, we construct a composite synthetic indicator of autonomy, using the Benefit-of-the-Doubt methodology (Cherchye et al., 2007). Once the indicator of autonomy is derived, we measure the relationship between formal autonomy (i.e. the autonomy that is regulated by the legislation and is fixed in the legal status of a university) and the actually used autonomy. Then, we statistically explore the relationship between the autonomy of universities and their efficiency and performance. In so doing, we argue that our composite indicator is a more robust evaluation of university autonomy than the corresponding formal definition. The specific focus on the relationship between the autonomy and performance of universities can be interesting for the international reader, given the broad debate in the academic and institutional arenas (Enders, De Boer and Weyer, 2013).

The paper is organized as follows. Section 2 presents a review of the literature on the autonomy of universities and its potential effect on efficiency. Section 3 describes the Russian HE system's context. In Section 4, a conceptual framework is derived to develop the hypotheses about the effects of autonomy on performance. Section 5 presents our data and the methodological strategy for the empirical analysis. Section 6 reports the results, while the policy and managerial implications are discussed in Section 7.

Literature review

There are several stream of the academic literature which are useful for setting the stage of the present research: (i) the notion of autonomy in public sector organizations, (ii) the autonomy of universities, (iii) the relationship between autonomy and performance in the public organizations and (iv) the impact of autonomy on the performance and efficiency of HEIs.

The key for defining public organizations' autonomy is the neoliberal logic of new public management (NPM) in the public sector. Within NPM, pursuing the objectives of efficiency, legitimacy and participation (Christensen & Lægreid, 2008) requires that public organizations and their managers can make decentralized (autonomous) decisions. Verhoest et al. (2004) define organizational autonomy as the freedom in making decisions without restrictions by upper-level managers, authorities and organizations. From the neo-institutional perspective, granting autonomy might be beneficial as the reconfiguration of centralized monolithic organizations into specialized ones involves an adjustment in their performance and efficiency.

In the specific area of Higher Education, university autonomy can be opposed to governmental regulation defining the organization's capacity to govern itself without external control (McLendon, 2003) i.e. public accountability. Starting from Ashby and Anderson (1966) and Ashby (1966), the notion of universities' autonomy has been decomposed into a range of conceptual elements. De Groof et al. (1998) highlight three components of autonomy: substantive, procedural and organic. More operationally, Durham (1989) defines autonomy as having four elements: autonomy in research, teaching, financial expenditure and administration. Whatever are the elements of autonomy, it is relevant to differentiate between formal and informal autonomy, or autonomy-in-use (de Boer & Enders, 2017). This distinction is particularly important, as we claim in this paper that formal and informal autonomy can operate very differently in the case studied. Formal autonomy is legally determined, but the formal regulation of required and prohibited actions might not be implemented in reality and do not necessarily predict university practical actions.

Empirical research on whether autonomy has an impact on the performance of public organizations has not reached a definitive conclusion. Two sectors are a good example to be recalled here – namely, healthcare and secondary education. Ali et al. (2019) studies UK hospitals and find that the organizations with a higher level of managerial autonomy are characterized by lower values of productivity. Ferreira and Marques (2015) studies the Portuguese partial corporatization of public hospitals using non-parametric measures of efficiency and productivity and they conclude that higher autonomy is associated with lower productivity (nevertheless, more autonomous hospitals outperformed traditionally managed ones in terms of efficiency). Zhang et al. (2018) study Japanese healthcare and found local reform resulted in a temporary increase in efficiency and productivity, positively related to the degree of decentralization. Studies on autonomy in secondary education provide more promising and unambiguous evidence of a positive relationship between operational management features and performance (Hashim et al., 2019).

An increase in HEI performance and efficiency due to autonomy might be expected because of mechanisms of resource allocation, a better ability to compete for scarce

resources and flexible human resource management. Knott and Payne (2004) identified that universities under a weaker governmental control perform better in terms of research funding and in the number of publications. De Boer et al. (2010) found that autonomy improves university research productivity and educational attainment through flexible operational management (staffing) and funding independence. Aghion et al. (2010) show that a higher degree of autonomy is an essential driver of university performance; more autonomous universities have more capacity to respond to market competition and to convert revenues into performance outcomes. McCormack et al. (2014) prove that managerialism matters in universities as a more flexible management style generates a better research and teaching performance. They underline the importance of operational management in key activities and the general institutional setting. Quiroga-Martinez et al. (2018) studied the factors explaining efficiency scores of Argentinian universities. They find that distinctive management characteristics such as a higher proportion of highly qualified faculty members and a higher number of hours taught by full-time position holders is positively related to efficiency.

Summarizing these streams of the literature, the majority of studies on the autonomy of public organizations provide a comprehensive explanation of this complex construct. However, the empirical research linking it to the performance and efficiency goals of NPM reforms is limited. We contribute to fill this gap in the HE sector by accounting for the multi-component logic of university autonomy.

Background: autonomy of Russian HEIs

Since the collapse of the Soviet Union, the Russian HE system has experienced a considerable number of structural and institutional reforms. Although the government implemented a range of measures (e.g., the unified federal monitoring of university performance) to control the quality of the rapidly growing HE sector, the system is still vast and highly differentiated. Today the HE system in Russia comprises 1,417 universities in total, 766 of which are state universities, and one third of these are branches (i.e. subsidiaries of main campuses).

Specific programs of additional funding were gradually introduced in order to increase the quality of teaching and research activities of Russian HEI in a differentiated manner. The first were created in the late 2000s: Federal Universities and National Research Universities (the first large-scale project to stimulate a limited number of competitively chosen universities to develop strategic plans and enhance research productivity). Another group was formed under the aegis of Project 5–100, which granted 21 universities a subsidy and managerial support to internationalize, produce research and most importantly – enter the world university rankings. The last group of the 33 Flagship universities were granted special support in order to provide regional economic development and stimulate business and community interaction.

In the context of a highly regulated HE system, it is challenging to analyze (i) the degree of autonomy that different universities experience, and (ii) how the use of this autonomy results in different levels of performance and efficiency. A federal law in 2006 was the first one to structure institutions in the public sector into the three groups ("kazennoe", budgetary and the autonomous). Nowadays, "kazennoe" universities are subordinated to military governmental authorities, budgetary universities compose the majority of the system, and 48 head state universities are autonomous (10% of the total).

The disparities between different groups of universities are summarized in Table 1. The most crucial features that distinguish autonomous universities from the other two groups are:

(a) The presence of a supervisory board responsible for the approval of financial plans. The board can be composed of both internal staff (e.g., professors) and external persons (e.g., ministers). This board approves financial plans, public procurement and commercial deals, opening bank accounts and investments. In budgetary universities these activities shall be approved by the supervisory ministry, while in kazennoe HEIs these activities are not possible at all;
(b) Autonomous universities can use privately raised money according to their needs and do not need to approve the redistribution of their financial assets through governmental authorities. Budgetary universities can do so only in exceptional cases and with the approval of the external governing body.

When considering educational activities, Federal Law №237 obliges all HEI to comply with federal educational standards. However, some universities, mainly the leading ones, have the right to develop advanced curricula on the basis of the universal ones.

Conceptual framework

In our study, we use two major theoretical approaches that provide arguments in favor of enhancing organizational autonomy in order to increase institutional performance: managerialism (Deem & Brehony, 2005) and neo-

Table 1. The autonomy of different types of Russian HEIs.

Kazennoe	Budgetary	Autonomous
	public funding scheme	
Are financed through strictly regulated state subsidy, estimated with a normative budget scheme.	Educational activities are financed through performance-based funding scheme (since 2015). research activities are financed through subsidies.	The same regulation as for budgetary HEIs is applied.
Unspent public funding		
Cannot voluntarily transfer financial resources from one activity to another. all unspent balance must be transferred to the founder's (supervising ministry) budget.	Formally, all unspent income from public sources can be redistributed 1) after the founder's agreement and 2) if the state task is fulfilled. HEIs are not interested in saving, because they will not receive as much financing in the next year.	The same regulation as for budgetary HEIs.
	Private income	
Income-generating activities are possible if fixed in the institution's constituent document.	Such activities must comply with the main goals of the HEI, set in the constituent documents and can be led upon supervisory ministry approval.	The same regulation as for budgetary HEIs.
	Use of private income	
All income generated is transferred to the budget of the founding governmental structure (ministry).	All income generated remains in HEI's disposal but can be used only upon approval of the supervisory ministry.	All non-state income can be redistributed to the next period and reinvested into financial assets upon supervisory board approval.
	Commercial deals and procurement	
Major deals and procurement of amount higher than 50 thousand rubles (≈$700) can be settled after the founding ministry's consent only.	The same regulation as for kazenoe HEIs is applied.	Major deals can be settled under supervisory board's consent only. the limit of public procurement deal that does not need consent is extended.
	Property	
Does not possess and cannot acquire any property.	Can manage its property, but real estate and valuable movable property can be managed with the consent of the founder only.	The same regulation as for budgetary HEIs.
	Special governing bodies	
Not applicable	Not applicable	A supervisory board regulates financial plans, deals, procurement, opening of bank accounts, and property; approves the rector.

institutionalism (Jensen & Meckling, 1976; Pratt & Zeckhauser, 1985).

Managerialism embodies the principle of "letting managers manage": if bureaucratic regulation (typical of the public domain) is removed, public managers will behave like ones from the private sector and adopt advanced tools and techniques in order to stimulate an organization's performance. Internal performance regulation procedures will be established because managers have a rational incentive to benefit from an organization's increased performance (Osborne & Gaebler, 1992). Under managerialism, we suppose that the innovative managerial tools used in an autonomous university will increase its efficiency through target setting, performance evaluation adoption, and resource reallocation (Schubert, 2009).

Under *neo-institutionalism*, and more specifically, addressing the principal-agent model, we can regard a public organization as an agent and the government authority as the principal. The agent provides public services on behalf of the principal, but they may have differing interests, and while information is asymmetric, agents may act independently and not in accordance with the principal's will. To overcome this problem, the government can grant a public institution autonomy in decision-making in exchange for monitoring and control mechanisms, and an increase in public managers' self-regulation is accompanied by increased accountability (Enders et al., 2013). The stimulus to overcome rigid managerial practices creates a favorable institutional setting to implement new practices, techniques and products (Wynen et al., 2014). Higher-level managers will transmit the goals and priorities to lower-level managers, and thus will need internal performance control tools (Wynen & Verhoest, 2016). An increase in efficiency can be expected because the monolithic structure of a public organization will atomize into structures under rule of autonomous managers, free to deregulate the use of inputs and stimulated to maximize outputs.

In this research, we use our theoretical arguments and suppose that some management practices are more relevant than others for the link between autonomy and performance/efficiency. First, we follow the previous research on autonomy (Christensen, 2011; de Boer and Enders, 2017) and distinguish between formal institutional autonomy, i.e. that stated in the legislation, and informal autonomy (Fumasoli et al., 2014). Secondly, we consider the multi-component logic of autonomy, inherent in the definition of autonomy in different types of public organizations. We propose a distinction between *financial, staffing* and *academic* autonomy, which seems reasonable in the Russian context. On average, Russian universities depend significantly on government funding, which necessarily obliges extensive accountability. However, if a university is capable of raising private funds, it can invest in various activities ranging from student support to capital expenditure. Regarding staff policy, each university must follow the general regulations on the staff/student ratio and salaries that cannot be lower than the average level in the region. Certain universities can invest more in human resources, e.g., hiring international researchers and rewarding highly productive employees. Finally, academic freedom directly influences two key university activities, teaching and research. In Russia, when developing curricula, all universities have to adhere to general educational standards, but some universities can make advancements in their courses or pay more attention to post-graduate studies in order to enhance research activity.

Data and methodology

The methodology follows three steps. First, we build a composite synthetic indicator of autonomy, based on Benefit-of-the-Doubt (BoD) methodology (see Section 5.1). Second, we calculate the efficiency of universities (5.2). Third, we combine information about the efficiency and autonomy of universities (5.3) and provide descriptive analysis (5.4).

Measuring the autonomy of Russian universities

In order to evaluate informal autonomy, or the Autonomy-in-Use (AiU) index, we build a continuous measure through a composite index technique based on BoD methodology. The BoD composite indicator method (OECD, 2008) is based on non-parametric Data Envelopment Analysis (DEA) (Charnes et al., 1978) both operationally and conceptually. As DEA assumes that the production function of the observed units is not known, BoD helps to deal with the problem of when a measure should be multi-dimensional but the weight loadings for each component of the index are unknown (Cherchye et al., 2007), and extracts the relative measures using benchmarking. BoD is used widely, including in general education (Stumbriene et al., 2020; De Witte & Schiltz, 2018), and HE in particular (De Witte & Rogge, 2011).

The core idea behind the BoD-based index is in the comparison of the actual level of a certain indicator to the ideal, benchmark one. The benchmark can be either exogenously set or determined within the sample by maximizing problem solving, as suggest Cherchye et al. (2007).

The AiU index is calculated in two steps. We first measure the autonomy sub-components, and then use these to evaluate the final index. In order to measure the informal autonomy of a university, we suppose that the overall AiU is composed of three subscales: financial, staffing and academic. The descriptive statistics for the

variables which depict each dimension of the AiU, as well as our rationalization of using each of the variables, are presented in Table 2.

Evaluating the efficiency of Russian universities

To measure the efficiency of universities, we use the non-parametric method of DEA which is widely used in the public sector in general (Agasisti et al., 2016) and educational studies particularly (Johnes, 2006; Thanassoulis et al., 2011). The main advantage of this method is that it allows measuring efficiency without knowing the exact functional form of the production function and does not require any assumptions about data distribution.

In this research, we use the output-oriented model as we are interested in how well universities are capable of allocating scarce resources in order to produce more. We also use the variable return to scale assumption based on previous studies on the production function of Russian universities (Abankina et al., 2013; Agasisti et al., 2020). The linear programming model we address is reported in Johnes (2006), see Section 2 in the TA for more details.

One of the most debated issues in measuring the efficiency and production function of such complex organization as universities is the selection of variables (De Witte & López-Torres, 2017). We use a simplistic model that depicts a university's ability to transfer income and human resources in enrollments and research. We use two inputs: the total financial resources available to a university (including salary expenditure), and the average unified entrance exam score to measure the students' ability. The first variable is often used in efficiency measurements as a universal indicator of an educational organization's capacity to invest and allocate money (Agasisti & Pérez-Esparrells, 2010). Students' ability might be a resource available for a university as well (Johnes, 2013). We use the total number of students as one of the outputs representing teaching activity instead of the more widely used number of graduates or graduation rate (Agasisti & Johnes, 2015), because in Russia most enrolled students (about 80%, Gorbunova, 2018) successfully finish their studies. The total number of publications is the research output used to measure scientific productivity (Wolszczak-Derlacz, 2017).

Estimating the robust relationship between university autonomy, performance and efficiency

To empirically analyze the effect of both formal autonomy and the AiU, we employ a fixed-effects regression in order to respect the panel structure of our data. The between variation is exogenous, and in order to solve the problem of unobserved heterogeneity due to universities' individual characteristics, we apply within variation in the efficiency estimation and infer a causal effect of autonomy from it (Best & Wolf, 2014). We use the number of publications indexed in Web of Science/Scopus per academic staff member as a measure of performance, and the DEA-estimated score as a measure of university efficiency as the dependent variable and the following predictors and control variables, presented in the Methodological Annex along with the model itself.

Data sources and descriptive statistics

The main data source we use in this research comes from the monitoring of HEIs' performance (MoP), a self-reported administrative survey on finance, internationalization, teaching, research, human resources, capital and infrastructure. This survey is conducted by MHES and is mandatory for all public universities. Due to data availability our dataset covers from the 2014/2015 to the 2017/2018 academic years and illustrates the activity of 385 head public universities, including 42 formally autonomous (as of 2017/2018). We excluded branch, private, sports and culture universities due to their differing production functions and the non-

Table 2. Variables used for the AiU index.

sub-index	variables	rationalization
Academic freedom	Share of master and PHD students	Illustrates a university's capacity to provide advanced postgraduate programs.
	Right to determine educational standards	Certain universities can develop higher standards of enrollment procedures and advanced study plans.
	Numbers of dissertation (thesis) committees	Indicates university's capacity to grant doctoral degrees independently from external organizations, e.g., from the higher attestation commission
Financial independence	Share of private income in income from educational activities	Formally, all universities may undertake income-generating activities, but the more private resources which do not require strict reporting, a university has, the more freedom it has to reinvest.
	Share of private income in income from research activities	
Operational staff management	Average research and teaching staff salary	Demonstrates a university's capacity to invest in its staff and surpass normative salary rates.
	Share of international staff	Illustrates a university's desire to internationalize and invest in staff who are more productive in international research.
	Share of staff with advanced degrees	General human capital proxy.

uniformity of data collection methodology. Descriptive statistics for the variables used in building the AiU index, measuring efficiency and estimating the robust relationship between autonomy and performance/efficiency are presented in Tables 3–5.

The descriptive analysis of variables employed in estimating the AiU index and the efficiency analysis provides a preliminary comparison between the mean values of the formally autonomous and non-autonomous universities. In our sample, the share of formally autonomous universities is no more than 11%. On average, formally autonomous universities are much wealthier in terms of total income and accumulate more staff and student human resources, accumulate students with higher entrance exam scores and are more likely to be research-oriented universities.

Results

The autonomy of Russian universities

The AiU index is a robust measure of the organizational informal autonomy of universities.[1] We applied minimal weight restrictions in order to include all of the sub-indices in the final index evaluation, 20% minimal weights preserved the maximum observations. University financial independence remained the key component of informal autonomy, weighting 42% in 2014/2015 and 44% in 2017/2018. Staff management average weighting in informal autonomy decreased over time (from 34% to 25%), while academic freedom average weights remained stable (24% and 26% respectively). The descriptive statistics of the AiU index by formal autonomy status (Table 6) illustrates that formally non-autonomous universities tend to be slightly more autonomous also from an informal viewpoint.

The efficiency of Russian universities

The descriptive analysis of the variables used for the efficiency estimation reveals that the universities in our sample received the same average amount of total funding at current prices and lost their funding at constant prices. They also managed to considerably increase research productivity in terms of the number of publications. On average, formally autonomous universities outperformed non-autonomous ones in terms of financing, students enrolled and the number of publications. This balance of resources might indicate that the group of formally autonomous universities is likely to include a large proportion of leading research-intense universities which attract a large proportion of the student body. In addition, descriptive statistics for the group of formally non-autonomous universities shows some of them can be wealthier than the best resourced formally autonomous institutions.

DEA estimations of university efficiency resulted in normally distributed efficiency scores. The descriptive analysis of DEA scores does not demonstrate any significant the discrepancies between formally autonomous and non-autonomous universities (Table 6). This results can indicate that (i) formally autonomous universities are diverse and gained this legal status under varying circumstances or that (ii) a large sub-group of formally autonomous universities are leading institutions that operate on larger scales. It is important to notice that as formally non-autonomous universities demonstrated higher maximum values for resources and outputs, the same holds for the efficiency analysis, which shows that formally autonomous universities are a less heterogeneous group.

Estimating the robust relationship between university autonomy and efficiency

The effects on publication activity

The empirical analysis shows that informal autonomy is negatively associated with publication performance, while the formal autonomy effect is absent. This might corroborate our assumption on the heterogeneity of formally autonomous universities which brings together universities that vary drastically in their size, financial resources and mission. The academic freedom sub-index is a negative and significant predictor of publication activity, but in case of interaction with the formal autonomy or leading status, the effect disappears. This might happen because the academic freedom sub-index is not a valid predictor of having more capacity, financial or managerial, to transfer their educational activity into publications. However, a higher quality of enrollees is a powerful predictor of higher academic institutional performance (Models 2–1, 2–2, 2–3 and 2–4, Table 7). The financial independence sub-index demonstrates the same absence of the effect. Although financial independence can be the general source of investment in higher performance, it might be the case that relative financial independence does not guarantee the capacity to invest in higher publication performance.

The staff management sub-index is the only positive and statistically significant predictor of higher publication performance (the effect size varies from 7.06 to 10.73, Table 7). This might indicate that better human capital together with greater investment in rewarding academic staff leads to an average increase in total staff productivity. However, together with formal autonomy, this index predicts a negative change in publication

Table 3. Variables used for measuring universities' autonomy: descriptive statistics and descriptive statistics by formal autonomy status, 2014/15-2017/18.

		All universities					Formally autonomous universities					Formally non-autonomous universities				
Year	Variables	n	mean	std. dev.	min	max	n	mean	std. dev.	min	max	n	mean	std. dev.	min	max
2014/15	(1)Share of master and phd students, %	385	7.874	7.116	0	74.94	37	13.00	7.64	0.36	36.31	348	7.33	6.85	0.00	74.94
	(2)Numbers of dissertation (thesis) committees		4.19	7.321	0	104		8.41	7.98	0.00	27.00	348	3.74	7.11	0.00	104.00
	(3)Research and teaching staff salary, thousand rubles		46.81	20.89	0	154.7		61.50	28.69	0.00	154.74	348	45.25	19.29	12.86	145.48
	(4)Share of private income in income from educational activities, %		58.49	28.52	0	100		47.73	25.53	1.21	100.00	348	59.64	28.61	0.00	100.00
	(5)Share of private income in income from research activities, %		30.65	15.93	1.54	89.68		30.62	19.24	5.99	89.68	348	30.66	15.57	1.54	89.62
	(6)Share of international staff, %		0.522	1.159	0	14.46		0.86	1.02	0.00	5.59	348	0.49	1.17	0.00	14.46
	(7)Share of staff with advanced degrees, %		72.42	9.123	24.43	98.52		70.48	7.71	56.65	93.37	348	72.63	9.25	24.43	98.52
2017/18	(1)		14.01	7.542	0	47.62	42	20.13	10.19	0.00	47.62	343	13.26	6.80	0.00	47.09
	(2)		3.699	6.226	0	85		9.02	8.46	0.00	30.00	343	3.05	5.57	0.00	85.00
	(3)		62	26.23	23.26	156.7		80.07	32.31	33.87	140.16	343	59.79	24.55	23.26	156.67
	(4)		33.62	16.17	2.81	81.84		32.74	17.91	6.46	77.69	343	33.73	15.97	2.81	81.84
	(5)		63.89	30.49	0	100		51.38	29.17	0.22	100.00	343	65.42	30.34	0.00	100.00
	(6)		0.645	1.437	0	13.15		1.91	2.44	0.00	13.15	343	0.49	1.18	0.00	13.04
	(7)		76.14	8.88	44.68	99.5		72.07	8.91	47.95	99.50	343	76.64	8.76	44.68	96.88

Source: Authors' calculations based on the MoP

Table 4. Variables used for measuring universities' efficiency: descriptive statistics and descriptive statistics by formal autonomy status, 2014/15-2017/18.

		All universities					Formally autonomous universities					Formally non-autonomous universities				
Year	Variables	n	mean	std. dev.	min	max	n	mean	std. dev.	min	max	n	mean	std. dev.	min	max
2014/15	(1)Total income, million rubles	385	1,509.00	2,104.00	0.076	21,780.00	37	3,598.76	2,792.73	0.076	11,100.00	348	1,286.50	1,890.98	100.43	21,800.00
	(2)Total number of bachelor, specialist, masters students		5,467	4,160	146.00	28,713		9,351.28	6,762.81	512.55	24,004.05		5,054.14	3,552.91	146.00	28,713.15
	(3) Number of publications indexed in scopus or web of science or rsci		1,364	1,609	56.01	10,472		2,488.10	2,375.72	97.95	9,555.72		1,244.52	1,459.07	56.01	10,472.19
2017/18	(1)		1,652.00	2,432.00	0.072	25,420.00	42	3,933.10	3,360.33	0.72	14,800.	343	1,372.54	2,137,88	0,09	25,400.
	(2)		549.30	640.40	35.30	8,818		9,722.30	7,218.98	503.90	26,197.90		4,995.42	3,969.74	284.00	33,241.70
	(3)		5,511	4,667	284.00	33,242		5,049.59	4,932.38	77.00	21,801.78		2,032.33	2,607.56	31.00	25,172.23

Source: Authors' calculations based on MoP

Table 5. Variables used for regression analysis: descriptive statistics.

Variables	n	mean	std. dev.	min	max
Leading status	1540	0.107	0.309	0	1
Formal autonomy		0.103	0.304	0	1
AiU, %		50.38	22.2	0	100
dea scores, %		58.98	18.5	3.107	97.41
Number of publications per staff capita		334.82	1386.69	0.00	20600.20
Academic freedom, %		27.5	15.49	20	60
Financial independence, %		42.46	19.53	20	60
Staff management, %		30.04	16.91	20	60
Average unified state exam score		66.70	10.26	44.81	100
Share of r&d income, %		9.381	8.636	0	57.88
Share of full-time students, %		62.62	16.2	19.97	100
Total number of staff		1,817	3,165	35.3	31,585
Total number of students		4,208	4,319	37.8	33,242
Number of id	384	384	384	384	384

Source: Authors' calculations based on MoP

activity. The same holds for the interaction term between leading status and informal autonomy, which is counterintuitive and might indicate the presence of inefficient staff expenditure or an oversaturation of formally advanced staff in leading universities.

The relationship between university autonomy and efficiency

The AiU index is a positive, statistically significant predictor of efficiency; a 1-point increase in informal autonomy is associated with a 5% gain in efficiency (Table 8). Academic freedom alone can result in an 8% rise in institutional efficiency, while financial independence has a positive but not statistically significant effect. We suppose that academic freedom can be a strong predictor of market power in accumulating more high-performing students, institutional prestige and better performance. Universities with high degree of academic freedom might have certain organizational features allowing them to manage their activity in a more efficient way, e.g., sophisticated contracting schemes or specific rules of relations between scientific and teaching departments. Again, higher values of entrance exam scores predict higher efficiency. The staff management sub-index contributes to higher efficiency as well (the effect is 0.42–0.45): a higher quality of teaching and research staff, more rewards and greater internationalization in leading universities contributes to more the efficient conversion of total funds into teaching and research outputs.

Discussion and policy implications

In this research, we studied two main research issues relating to HE organizations in Russia: (i) HE institutional differentiation in terms of formal and informal autonomy; (ii) the presence of a statistical relationship between institutional autonomy (both formal and informal), university efficiency and publication performance. We first made a distinction between formal autonomy (regulated by Russian legislation) and the level of autonomy actually used by university management. The indicator for autonomy relies on three sub-dimensions of institutional autonomy that are the most relevant for the Russian context, according to the literature: (i) academic freedom, (ii) financial independence and (iii) staff management.

The main results of our analysis can be summarized in four core messages. First, the descriptive analysis of the AiU index and the efficiency evaluation results demonstrate that formal autonomous status does not necessarily imply the subsequent, actual use of autonomy, nor it is associated with higher levels of performance or efficiency. Second, AiU and its academic freedom subindex are negatively associated with the publication activity. A likely explanation for this is that the right to relative self-determination in teaching and research activities does not imply the availability of sufficient resources and managerial capacity to invest in publications. Third, autonomy in staff management is positively associated with publication performance: highly rewarded, skilled and internationalized staff are more productive. Fourth, contrary to performance, actual autonomy is positively associated with institutional efficiency, the same holds for the AiU sub-indices of academic freedom and staff management. We cannot demonstrate that this link is causal; nevertheless, we believe that

Table 6. Descriptive statistics of universities' AiU index and dea efficiency scores by formal autonomy status, 2014/15-2017/18.

		Formally autonomous universities					Formally non-autonomous universities				
Variable	Year	n	mean	std. dev.	min	max	n	mean	std. dev.	min	max
aiu	2014/15	37	0.61	0.26	0.02	0.92	348	0.34	0.19	0.00	1.00
	2015/16	39	0.60	0.24	0.00	0.93	346	0.46	0.17	0.00	1.00
	2016/17	41	0.71	0.20	0.00	1.00	344	0.64	0.22	0.00	1.00
	2017/18	42	0.63	0.24	0.00	0.98	343	0.51	0.16	0.00	1.00
Efficiency, %	2014/15	37	49.37	19.74	7.53	87.91	348	57.37	18.07	4.38	98.15
	2015/16	39	41.33	20.53	10.00	80.00	346	33.30	17.79	2.00	93.00
	2016/17	41	51.22	18.25	16.00	82.00	344	59.31	18.10	6.00	97.00
	2017/18	42	51.71	18.57	20.00	83.00	343	60.13	17.69	5.00	97.00

Source: Authors' calculations based on MoP

Table 7. Regression analysis results: publication activity explained through the formal autonomy and the AiU index and its sub-indexes.

	Autonomy = AiU					Autonomy = Academic freedom				Autonomy = Financial independence				Autonomy = Staff management			
variables	model 1_1	model 1_2	model 1_3	model 1_4	model 1_5	model 2_1	model 2_2	model 2_3	model 2_4	model 3_1	model 3_2	model 3_3	model 3_4	model 4_1	model 4_2	model 4_3	model 4_4
Formal autonomy		−3.409	70.46	70.46			−25.96	−203.1	−29.03		−48.5	−106.1	−51.11		−5.356	1,450 *	−193.5
		−480.9	−597.5	−597.5			−484.7	−557.2	−484.9		−495.4	−802.8	−495.8		−495.5	−766.9	−497.6
Autonomy	−9.487 ***		−9.359 ***	−9.359 ***	−9.112 ***	−8.960 ***	−8.970 ***	−9.162 ***	−8.968 ***	−0.763	−0.789	−0.817	−0.686	7.096 *	7.06	10.44 **	10.73 **
	−1.761		−1.818	−1.818	−1.787	−1.247	−1.249	−1.284	−1.249	−1.967	−1.97	−1.994	−2.026	−4.302	−4.312	−4.513	−4.463
Formal autonomy##autonomy			−1.801	−1.801				2.728				0.869				−28.76 **	
			−6.1	−6.1				−4.229				−9.524				−11.59	
Leading status					1,424		325.8	342.3	678.7		263.8	255.7	398.6		214.5	500.4	3,657 ***
					(1,044)		−669.1	−669.8	(1,114)		−684.3	−690.3	−920.1		−683.5	−691.7	(1,322)
Leading status##autonomy					−14.43				−5.634				−1.783				−43.97 ***
					−10.75				−14.22				−8.133				−14.47
Constant	−1,275	−1,443 *	−1,268	−1,268	−1,249	−1,384 *	−1,409 *	−1,426 *	−1,394 *	−1,416 *	−1,434 *	−1,426	−1,450 *	−1,976 **	−1,991 **	−2,230 **	−2,291 **
	−846.8	−857.1	−848.1	−848.1	−849.4	−838.3	−840.7	−841.3	−841.9	−859.7	−862	−866.7	−865.2	−914.9	−917.2	−920.2	−919.2
Observations									1,540								
r-squared	0.37	0.354	0.37	0.37	0.371	0.382	0.382	0.382	0.382	0.354	0.355	0.355	0.355	0.356	0.356	0.359	0.361
Number of id									385								

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: authors' calculations based on MoP

Table 8. Regression analysis results: institutional efficiency explained through the formal autonomy and the AiU index and its sub-indexes.

	autonomy = aiu				autonomy = academic freedom					autonomy = financial independence				autonomy = staff management			
variables	model 5_1	model 5_2	model 5_3	model 5_4	model 5_5	model 6_1	model 6_2	model 6_3	model 6_4	model 7_1	model 7_2	model 7_3	model 7_4	model 8_1	model 8_2	model 8_3	model 8_4
Formal autonomy		−1.937	−2.339	−2.339			−1.509	−0.665	−1.59		−1.258	−0.037	−1.305		1.187	11.24	−0.355
		−7.663	−9.622	−9.622			−7.84	−9.015	−7.843		−7.891	−12.79	−7.896		−7.773	−12.06	−7.829
Autonomy	0.059 **		0.059 **	0.0589 **	0.062 **	0.081 ***	0.081 ***	0.082 ***	0.081 ***	0.034	0.034	0.035	0.036	0.423 ***	0.424 ***	0.448 ***	0.454 ***
	−0.028		−0.029	−0.029	−0.029	−0.020	−0.020	−0.021	−0.020	−0.031	−0.031	−0.032	−0.032	−0.068	−0.068	−0.071	−0.0702
Formal autonomy## autonomy			0.0103	0.0103				−0.013				−0.018				−0.199	
			−0.098	−0.098				−0.068				−0.152				−0.182	
Leading status					1.485		−4.236	−4.315	4.998		−4.004	−3.833	−1.55		−5.975	−4	22.24
					−16.83		−10.82	−10.84	−18.03		−10.9	−10.99	−14.66		−10.72	−10.87	−20.8
Leading status## autonomy					−0.081				−0.147				−0.033				−0.36
					−0.173				−0.23				−0.13				−0.228
Constant	9.356	10.49	9.397	9.397	10.02	9.873	10.28	10.36	10.69	9.216	9.581	9.413	9.301	−21.38	−21.05	−22.7	−23.51
	−13.64	−13.66	−13.66	−13.66	−13.69	−13.56	−13.6	−13.61	−13.62	−13.69	−13.73	−13.8	−13.78	−14.35	−14.39	−14.47	−14.46
Observations									1,540								
r-squared	0.068	0.065	0.068	0.068	0.069	0.078	0.078	0.078	0.078	0.066	0.066	0.066	0.066	0.096	0.096	0.097	0.098
Number of id									385								

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Authors' calculations based on MoP

higher levels of exhibited autonomy are inherent in universities that apply innovative management practices which lead to an increase in the efficiency of resource management.

The high heterogeneity of formally autonomous universities might indicate the involution of criteria according to which universities were selected to be granted autonomy privileges. A lack of legislative updates makes this status archaic and might inhibit institutional development in HE. Financial independence, as BoD weights depicted, was considered to be the main component of informal autonomy. Nevertheless, this dimension was not associated with higher publication performance or higher efficiency. Such a lack of correlation might arise because universities, enjoying formal autonomy or not, are subject to strict accountability, even with regard to how privately acquired resources are redistributed. As a consequence, universities interested in raising their efficiency and performance should search for more opportunities in operations (staff and academic activities) than finance.

A final note is about the limitations of the study, which pave the way to further research in this area. Firstly, we operate with limited data, as we study a short period of time that is remote from both waves of granting formal autonomy. This could be a reason for the instrumental variable approach failing and the lack of division between formally autonomous and non-autonomous universities. Another limitation is the lack of in-depth information on management practices, which would be relevant for actually used autonomy. This specific issue could be subject to future studies in the field of operational management in HE.

Note

1. We use an alternative method of constructing the composite indicator, the mazziotta-pareto index (Mazziotta & Pareto, 2013). When calculating the final index, we apply the minimal weight restrictions (20%) to provide more robustness. The variables used at the stage of sub-index calculation and the sub-indices used for the final index evaluation are normalized (see Agasisti & Shibanova, 2020).

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Appendix. Methodological Annex of the paper "Actual autonomy, efficiency and performance of universities: insights from the Russian case"

The multi-dimensional structure of AiU allows us to suppose that some sub-indices may lead to higher levels of efficiency, because some managerial practices are more effective than the others. Thus, in our analysis we use the following specification of regression model:

$$y_{it} = x_{it}\beta + \alpha_i + \in_{it} \quad (1)$$

where y_{it} is the observed outcome of university i at time t, x_{it} is the $(1 \times K)$ vector of covariates of this university, and β is the corresponding $(K \times 1)$ vectors of coefficients to be estimated.α_i are stable university-specific unobserved characteristics which capture time-constant individual heterogeneity. $\in_{it}$ is the error term that varies across universities and over time.

Under we consider the number of publications indexed in Web of Science/Scopus per academic staff member and the DEA-estimated score. The x_{it} is represented by the following variables:

- *Formal autonomy* – a binary variable that indicates whether a university possessed autonomous status in a certain year;
- *AiU* – an index that depicts informal, de-facto autonomy and its subcomponents: financial autonomy, operational (staff) management and academic freedom;
- *Leading status* – a binary variable that illustrates whether a university is a leading university, which includes the excellence initiative participants, national research and federal universities, Moscow and Saint Petersburg State universities;
- *Leading status##AiU/Sub-indices* – an interaction term between leading status that presupposes universities having advanced managerial practices and the informal autonomy or its subcomponents;
- *Formal autonomy##AiU/Sub-indices* – an interaction term between formal autonomy and informal autonomy or its subcomponents, which illustrates whether a formally autonomous university is actually using its rights;
- *Unified state exam score, the share of full-time students* – control variables for the human capital quality of students enrolled;
- *The total number of teaching and research staff; Total number of students* – size control variables;
- *The share of research and development income* – a control variable that illustrates the extent to which a university is oriented towards research rather than teaching.