

Does government support of leading universities affect the entire higher education system? Evidence from the Russian University Excellence Initiative^{1,2}

Andrey Lovakov^a, Anna Panova^a, Ivan Sterligov^b, Maria Yudkevich^a

^a Center for Institutional Studies, National Research University Higher School of Economics, Moscow

^b Scientometrics Centre, National Research University Higher School of Economics, Moscow

Many governments are attempting to improve the higher education system through competitive support of selected universities. To estimate the impact of targeted support for a small number of universities on the entire system, we estimate spillover effects of the recent Russian University Excellence Initiative (RUEI) in higher education. We examine the performance of universities that were not part of the RUEI in the last five years and were not directly supported by it. The indirect impact of the RUEI on the higher education sector at the regional level is estimated. Our findings suggest that various spillover effects do indeed take place. Proximity to a RUEI university has a significant positive effect on the quality of freshmen in neighboring universities. A positive effect on the level of publication activity has recently become apparent. However, there has been no effect on the share of young faculty and international collaboration in publications.

Keywords: University Excellence Initiative, regional effects, spillover effects, state intervention, world-class universities, policy evaluation, differences-in-differences approach

1. Introduction

The main characteristic of national and global academic systems over the past 50 years has been the increasing massification of higher education and research. This has led to stratification (Altbach et al., 2017; Clark, 1996, 2002; Hallonsten and Holmberg, 2013), and as a result, government policy becoming more targeted. In particular, there has been a shift from a system of proportional financing to selective support. One example of targeted government intervention is academic excellence initiatives. National governments want to turn national universities into global players on the international market in order to meet growing demand for education and research, and to increase their country's global academic stature (Liu et al., 2016; Kehm, 2013; Shin and Jang, 2013; Altbach, 2003; 2011). Such phenomena as academic excellence initiatives have taken place in several countries and Russia is no exception. The Russian University Excellence Initiative (also known as the 5-100 Project) was launched in 2013. Recent research show that since then, there has been a significant growth in research output, both in quantitative and qualitative terms (Turko et al., 2016; Poldin et al.,

¹ The article was prepared within the framework of the HSE University Basic Research Program and funded by the Russian Academic Excellence Project '5-100'.

² **Contact:** Anna Panova, apanova@hse.ru

2017, Guskov et al., 2018; Matveeva et al., 2019), and a significant improvement in the positions of Russian universities in international university rankings at both institutional and subject levels³.

At the same time, such programs themselves lead to greater stratification of national higher education systems (Altbach et al., 2017). Surprisingly little is known about the spillover effects of such programs on education systems in general. A large amount of public funds spent on a small number of universities in order to obtain a certain result inevitably affects other universities and changes the higher education landscape. However, this issue has not actually been investigated. Too much attention given to an elite group of universities could be at the expense of national goals (Altbach, 2003). Indeed, while improving the performance of a small, targeted group of universities is usually interpreted as the consequence of increasing efficiency, it might alternatively be explained by the redistribution effect (Teichler, 2008, Kehm, 2013). That is, the supported universities, which receive extra resources, also find themselves in a privileged position and are able to attract intellectual resources from other, less able institutions. The latter institutions, losing more able faculty, may consequently become less efficient, which in turn may lead to lower-quality student intakes, lower research performance, etc. Indeed, some voices claim that the improved performance of selected institutions may be due to local redistribution of talent among students and faculty (Salmi, 2016). The concentration of talented students in a small number of universities could not only be inefficient, but also harmful for equity in higher education (Cook, Frank, 1993; Salmi, 2016); the same is true for faculty. Thus, Sharma (2017) among others argues that in the case of China, there is a problem of local competition for talent, as faculty who are able to publish in good journals are “stolen” by institutions that receive extra-government support. The Chinese case also shows that inequality is growing in terms of the academic output between universities from two different Chinese support programs (Zong and Zhang, 2019). Yonezawa and Shimmi (2016) showed that in Japan, after the implementation of an excellence initiative the gap between top universities and the rest of the system widened.

Hence, the overall effect of a university excellence initiative may be less evident than it seems from a direct comparison of the universities supported by the initiative, and those with comparable characteristics but which are not part of the initiative. On the other hand, government regulations imposed on universities may affect both leading institutions and the rest of the system. Other potential spillovers (both positive and negative) should also be taken into consideration when the effect of an excellence initiative is examined. The empirical evidence is therefore limited, and our study fills an important gap in the literature. We investigate how the academic sector responds to the intervention, and we focus on spillover effects at a regional level. Our basic assumption is that if a university from the RUEI can affect another university, the effect should be limited to the same city or region. This

³ <https://www.topuniversities.com/university-rankings-articles/world-university-rankings/qs-world-university-rankings-2019-russia>

assumption is plausible, since we are dealing with an oligopolistic regional academic market. Leading universities are important for the academic sector in their home regions. Large financial injections into these selected universities, and greater attention on them, could lead to dramatic shifts in regional academic markets.

In order to estimate spillover effects, we examined the relative performance of higher education institutions that have not been part of the RUEI in the last five years and were not directly supported by this initiative in two types of regions: those that contain RUEI universities, and those that do not. Our analysis covers the period from 2012 to 2017. This allows us to study whether the performance of universities located near RUEI universities has significantly changed relative to other universities since the launch of the initiative.

Our paper makes contributions to two strands of literature: public economics and the economics of higher education. We go along with the contemporary idea in public economics that it is necessary to assess the indirect consequences of government interventions. Our results give new insights into the influence of one such intervention, the academic excellence initiative, on the regional academic market. We find a direct spillover effect from the RUEI in an increased number of collaborative papers. We also see that the presence of a supported university in a particular region leads to other universities in this region attracting more academically strong students compared to universities from other regions. A small positive effect on the level of publication activity has just started to become apparent. However, at least in the short term, the RUEI generates less spillover effect in research activities.

2. The Russian University Excellence Initiative in the context of other excellence initiatives

As Altbach and Salmi (2011) stated, it is important to take into account the environment of world-class universities. In this regard, Russia has plenty of features that distinguish it from other countries. While both private and public universities are represented in the academic market, about 90 percent⁴ of students study at public universities. An important feature of Russian private universities is that they are not involved in science. Public universities vary in the size of the student body and of the faculty body (from several dozen to several thousand people). The average size of an RUEI university is 17,600 students and around 1,300 faculty. Russia has 85 regions, which vary significantly in the quality of education and economic development. Each of these regions is under the supervision of the federal government, but they all have regional ministries of education. There were on average six public universities in each region in 2018. Thus, in the case of Russia we are dealing with oligopolistic local academic markets. All of these markets differ in the average grade obtained by prospective

⁴ Data of Ministry of Education and Science of Russia.

students in the unified state examinations (USE), with a range of more than 20 points out of 100 in mathematics and Russian language. Russian higher education institutions are mainly located in regional capitals. The diversity of regions' economic and educational development creates a variety of market prospects for young people. This leads to a migration of young people in search of better higher education to a limited number of regions (Kashnitskiy et al., 2016). Regions also vary in size and have their own infrastructure; sometimes, in order to travel to a neighboring region, one has to get a flight with a connection through a more distant region. Thus, there are certain economic and educational characteristics that distinguish Russia from other countries and make our analysis most interesting at the regional level.

The RUEI was launched in 2013, with the aim of supporting a group of leading universities with a strong international academic reputation, and to improve the global visibility of Russian universities. The RUEI is a government program with the stated goal of seeing at least five national universities placed in the top 100 in global university rankings by 2020. The government assumes that this initiative will also boost the performance of the public higher education sector as a whole (Salmi, 2016). The RUEI was launched as an open competition, targeted at public higher education institutions. Selection for the initiative was based on each university's development strategy, demonstrating how it would reach the goal, and its current academic performance. The main focus was research performance, collaboration, and integration into the global market. Universities would need to develop an infrastructure enabling them to attract the best talent among academic, students, and managers. Today, the RUEI includes 21 universities in 13 regions. Figure 1 shows the distribution of these regions, with RUEI universities across Russia. There were two waves of selection: 2013, when 15 universities were selected, and 2015 when a further six were chosen. Most of the selected universities were large. Annual funds are provided on a competitive basis, with permanent monitoring of short-term achievements. Since 2013, the government has spent 60 billion rubles on support (\$2.4 billion dollars in purchasing power parity), and in 2016 this support was accounted for, on average, 9% of each university's budget. There are a limited number of indicators that are monitored by the government: the number of peer-reviewed publications and citations per capita, the share of international students, the quality of student intakes, and R&D money.

In many ways the RUEI is similar to other programs. There have been more than 30 initiatives in the last decade (Salmi, 2016). Such programs are usually launched and financed by a state and administrated by a state body – in the case of Russia, by the Ministry of Education and Science. Programs mostly target public universities, with a few exceptions such as Japan, Taiwan, and Korea. Research excellence is a core issue of most programs, and as a result success is often measured by promotion in international rankings (Salmi, 2016).

It is very difficult to assess the impact of excellence initiatives, since it takes time for such programs to start yielding sustained results, and it is also difficult to prove that any changes occurred because of the programs (Salmi, 2016). Many scholars ask about the effect of such programs on the national system. Direct effects are most often measured (Zong and Zhang, 2019; Matveeva et al., 2019; Menter et al., 2018; Hou et al., 2012; Möller et al., 2016); for example, estimating whether or not national universities have progressed in international rankings or have become more visible on the global academic market. And, as we can see from the Russian data, such an effect really exists (Matveeva et al., 2019; Poldin et al., 2017; Turko et al., 2016). However, it is impossible to discard the questions of researchers and the academic community about what is happening to those higher education institutions outside of the RUEI. There is a lack of empirical studies about government intervention in the public sector, and in particular about the spillover effects of excellence initiatives. There are, however, researchers who refer to possible consequences (Kehm, 2013; Gaehtgens, 2015; Cremonini et al., 2013; Shin and Jang, 2012).

What is the potential effect on national systems? Expectations suggest that there is a substantial (and mixed) effect (Kehm, 2013; Gaehtgens, 2015). The focus on research and the global market leads to the fact that, as a result, only certain types of universities – those that can potentially advance in the global market – may enter such programs. These would include large universities, and universities where STEM disciplines play an important role (Salmi, 2016). Such a bias can be seen in various countries (Salmi, 2016). This means that universities that are small, teaching-oriented, or specialize in social sciences and humanities may suffer (Gaehtgens, 2015; Kehm, 2013; Cremonini et al., 2013), since they do not receive special attention or government support. In addition, there is a reorientation in public policy toward research excellence, which might affect other universities (Koenig et al., 2017) and also a reorientation from supporting specific researchers to supporting institutions (Gaehtgens, 2015). Cremonini et al. (2013) note that excellence initiatives can lead to segregation; instead of becoming drivers for the entire national system, world-class universities can provoke a redistribution of resources in their favor, in order to maintain their position in the global market. Cremonini et al. (2013) conclude that world-class universities alone do not lead to improvement in the entire university sector, as can be seen in France. One effect that has been evaluated at a regional level is the impact of excellence initiatives on changing the structure of university funding. In Germany, regions with large universities have benefited from the implementation of an excellence initiative. The amount of third-party, merit-based research funding for universities in those regions rose significantly compared with regions where small universities are more prevalent (Koenig, 2017).

These kinds of programs increase the mobility of resources between institutions as well as their interdependence, so one might expect some spillover effects. Such effects exist in other educational markets. For instance, scholars analyzed the effect on the school educational market from the

implementation of vouchers in the USA (Epple and Romano, 1998), from the appearance of charter schools in the USA (Ferreyra and Kosenok, 2018; Cordes, 2018; Rincke, 2007) and independent schools in Sweden (Wondratschek et al., 2013; Edmark, 2019).

3. Analytical framework

The aim of the Russian University Excellence Initiative is to have several Russian universities in the top world rankings, in order to improve the global visibility and competitiveness of the Russian higher education system. In other words, the initiative aims to create world-class universities. Salmi (2016) suggests that there are “three complementary sets of factors at play in top research universities: (a) a high concentration of talent (faculty members and students); (b) abundant resources to offer a rich learning environment and to conduct advanced research; and (c) favorable governance features that encourage leadership, strategic vision, innovation, and flexibility and that enable institutions to make decisions and manage resources without being encumbered by bureaucracy”.

While the third set of factors mostly refer to the inner structure of the institution, and are not much affected by the behavior and characteristics of other institutions, the first two are much more strategic and imply externalities between different institutions. At the same time, the second set of factors influences to a large extent the composition of the first: the ability of universities to attract top talents depends on all its resources, not just its financial strength.

In our paper, we mostly concentrate on the first factor – a high concentration of talent. Since leading Russian universities are not yet active players as employers at the global academic market (Kuskova and Yudkevich, 2016), and the primary source of human resources for them is the local academic market, one might expect that the increased ability of some selected universities to attract the best faculty would negatively affect other Russian institutions. The same is true of students.

In both cases (faculty and students), supply and demand work in a way that means the best talents should be concentrated in the best universities. Indeed, faculty may be attracted both by better salary prospects as well as a stronger academic environment. The prestige of a university, its intellectual environment, quality of colleagues, potential for intellectual exchange, and the possibility to work with high-quality students can all play an important role in faculties’ intentions to change jobs (Zhou and Volkwein, 2004; Brown, 1967; McGee and Ford, 1987). A university’s entry into an excellence initiative can be a signal of its high-quality academic environment. If we consider students, then the university’s reputation quality and financial support play important roles in choosing a university (Webb et al., 1997; Bhardwa, 2017; Ming and Kee, 2010). Students may be interested in studying in universities from the RUEI, since participation in the initiative is a signal of quality. Thus, prospective students of these universities may expect positive effects from the strong student and faculty bodies and better international prospects. At the same time, one of the key indicators of

university performance in the RUEI is the quality of student intake (measured by the minimum entry qualification for the educational program). For this reason, universities have extra incentives to aim for strong students. Research-oriented faculty are interested in good students as well. So, one might expect that high-ability students and faculty would migrate toward RUEI universities, especially when such universities exist in their home region. Thus, the Matthew effect can work when a university with a higher status attracts more and more high-quality resources.

At the same time, the selected university can positively influence the academic environment of its home region, making the region as a whole more attractive for faculty and students. Each university boosts the economic development of its home region (Astebro and Bazzazian, 2011; Koenig et al., 2017, Drucker and Goldstein, 2007), thereby making it attractive for talent. The university may be a signal that the region has a high-quality academic environment. Talented students, choosing this region, can apply to several universities; some will enroll in the RUEI university, others will go elsewhere. The dissemination of academic standards can occur both at the organization level and at the level of individual faculty. Selected universities can disseminate their standards through methods such as holding conferences and inviting world-famous professors, and holding refresher courses. The regional ministry may consider the selected universities as a benchmark and impose new requirements on the other universities; one might then talk about coercive isomorphism (DiMaggio and Powell, 1983; Croucher and Woelert, 2016). At the same time, mimetic isomorphism is also possible, when universities themselves are geared to, and implement, the best practices of the universities in the excellence initiative. Normative isomorphism is also possible, when these practices become the norm as a result of professional pressure. In turn, faculty at the selected university could, in order to achieve key publication performance indicators, collaborate with faculty from other universities.

Thus, one university in a region that succeeds in meeting the selection process for the excellence initiative can lead to different effects: either the redistribution of resources, or an improvement in the quality of resources. In order to assess the effect on the universities that are not part of the excellence initiative, we compare the quality of resources in universities in two types of regions: those that have universities in the RUEI, and those that do not. We examine the quality of incoming students, and also the quality of faculty by evaluating various aspects of their publication activity.

Data

Our database contains data from: Monitoring of the Effectiveness of Educational Institutions (<http://indicators.miccedu.ru/monitoring/?m=vpo>. This database is collected annually by the Ministry of Education and Science on the basis of universities' mandatory self-reporting); the Russian Index of Science Citation (RISC), a Russian national citation index, covering all Russian scientific journals (for

the overview see Moskaleva et al. 2018); and the Web of Science (WoS) database. Our database covers the period before and after the start of the Russian University Excellence Initiative, allowing us to study the effect of policy intervention.

We use different variables to measure university performance and its dynamics, including the quality of student intake (using freshers' scores from the Unified State Exam (USE), which all applicants pass in order to enter a university), the quantitative and qualitative characteristics of publication output, and other parameters. From the Monitoring database, we extracted two university performance indicators (UPIs) for each university for 2012–2016: 1) the average USE score among undergraduate students accepted onto state-funded places, and 2) the percentage of young academics (those up to 30 years of age without a degree, Candidates of Science (the Russia equivalent of a PhD) up to the age of 35, and Doctors of Science (a second-level academic degree in Russia, analogous to a Habilitation in Germany) up to 40 years of age). From the RISC database, we extracted two UPIs for each university for 2012–2016: 1) the number of publications in the RISC and 2) the number of publications included in the RISC Core, i.e., in journals indexed in the Web of Science Core Collection, Scopus, or selected for RSCI on the Web of Science platform (Moskaleva et al., 2018). The sample of publications included in the RISC Core is obviously smaller, but on average their quality should be higher, because only the strongest and most authoritative journals are in the core. In other words, an average paper from the RISC Core and a non-core paper may not be equal to each other in terms of quality, level or visibility. From the WoS database, we extracted six UPIs for each university for 2012–2017:

- the number of publications in the WoS Core Collection (including journals indexed in the Emerging Sources Citation Index (ESCI)),
- the number of publications in the WoS Core Collection (excluding journals indexed in ESCI),
- the number of publications in journals from Q1 by journal impact factor,
- the number of publications in journals from Q4 by journal impact factor,
- the number of publications in the WoS Core Collection (excluding journals indexed in ESCI) in international collaboration,
- the number of publications in WoS Core Collection in collaboration with universities included in the Russia University Excellence Initiative.

We considered the number of publications in the in WoS Core Collection, both including and excluding ESCI journals. There are a lot of Russian journals in the ESCI, and Russian universities may have publications in these journals, but the average level of ESCI journals is lower than that of journals from the 'senior' indexes (Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), and Arts & Humanities Citation Index (A&HCI)). So, one publication in a

journal included in the ESCI may be not be equal to a publication in a journal included in the ‘senior’ indexes. Therefore, the dynamics of the number of publications in these subsamples of journals may indicate different universities’ behavior and strategies. The separation of publications in journals from higher (Q1) and lower (Q4) quartiles was done according to the same logic.

We excluded several regions and institutions from our sample. Moscow and St. Petersburg were excluded since these regions are significantly more economically developed than others, and during the period under review the academic market in these regions underwent significant changes. Kaliningrad and Crimea were excluded since it is difficult to reach other regions from either of them. We also excluded those regions with institutions that joined the RUEI only during the second wave of selection in 2015, and those that differed significantly from the treatment group in terms of economic and educational quality before 2013 (notably, the regions below the 5th percentile for average USE scores in Russian and mathematics, or in the region’s socio-economic rating). Furthermore, several types of higher education institutions were excluded: private higher education institutions (since they cover a small percentage of the student body and focus mainly on teaching), branches of institutions (since they are not autonomous and are highly dependent on the head university) and sport and art institutions (since they are teaching oriented and their teaching methods are significantly different). The final sample included 399 universities.

4. Methodology

We used the Differences-in-Differences (DID) approach to test the effect of the RUEI on institutions that are not part of the initiative. For the treatment group, we considered institutions outside the RUEI from a city that has at least one institution *included* in the initiative. For the control group, we took institutions outside the RUEI from regions with institutions *not included* in the initiative. Figure 2 shows the distribution of regions and cities with universities from the treatment and control groups across Russia. The number of universities in each group is presented in Table 1. Such a choice is explained by the fact that potential spillovers from strong to weak institutions should be stronger within a region, not between regions. Since our data are observations of the performance indicators of the same universities for different years, the observations are not independent. To take this into account, we use a linear mixed-effects model via REML with random intercepts for universities for all indicators using the *lme4* package in R (Bates et al., 2015).

We used two specifications. In the first specification, we divided observations into two periods: 2012–2013 and after 2013. Since the RUEI was introduced in 2012, 2013 was the first full year following the intervention. However, to increase the number of observations in the period before the intervention, we attributed the 2013 observation to the pre-intervention period. Since the UPIs that we

analyzed are long-term and change only slowly, we did not expect the effect of the RUEI to appear on the following year's data.

Specification 1

$$Y_{it} = \beta_0 + \beta_1 \text{After_initiative}_{it} + \beta_2 \text{Treat}_i + \beta_3 \text{After_initiative}_{it} \cdot \text{Treat}_i + \beta_4 \text{SN}_i + u_i + e_{it} \quad (1)$$

Y_{it} – university performance indicators.

$\text{After_initiative}_{it}$ – dummy variables for the time period after the RUEI was introduced, coded 1 if the observation was in the time period after 2013 and 0 if the observation was in the period 2012–2013.

Treat_i – dummy variable for treatment group, coded 1 if the observation refers to the university from the treatment group, and 0 if it refers to the university from the control group.

$\text{After_initiative}_{it} \cdot \text{Treat}_i$ – dummy variable for the interaction; the coefficient for this variable captured the treatment effects of the RUEI.

SN_i – dummy variables for a strong neighboring region, coded 1 if the university was from a region that had a strong neighboring region (Moscow, St Petersburg, or regions with universities from the RUEI) and 0 if there was no strong region in the neighborhood.

u_i – university effect.

Specification 2

The second specification is similar to the first, but instead of the dummy variable dividing observations into periods before and after the intervention, we included a set of dummy variables for a specific year (2012 being the reference year). This specification allows us to identify the time when any effects of the intervention began to appear.

$$Y_{it} = \beta_0 + \beta_1 \text{Time}_{it} + \beta_2 \text{Treat}_i + \beta_3 \text{Time}_{it} \cdot \text{Treat}_i + \beta_4 \text{SN}_i + u_i + e_{it} \quad (2)$$

Y_{it} – university performance indicators.

Time_{it} – dummy variables for years (2012 is the reference).

Treat_i – dummy variable for treatment group, coded 1 if the observation refers to a university from the treatment group and 0 if it refers to a university from the control group.

$\text{Time}_{it} \cdot \text{Treat}_i$ – dummy variables for the interaction; coefficients for these variables capture the treatment effects of the RUEI in a specific year

SN_i – dummy variables for strong neighboring region (Moscow, St Petersburg, or regions with universities from the RUEI

u_i – university effect.

Table 1. Number of universities by groups

Total number of universities	399
In the RUEI	15
Outside the RUEI	384
Treatment (from a city where there is at least one RUEI university)	54
Control (from a region where there are no RUEI universities)	191
Other (from excluded regions)	139

5. Results

Figures 3–5 show the dynamics of the UPIs during the period analyzed in a group of universities included in the RUEI and among other universities, divided into treatment and control groups in our analysis. The first explicit conclusion that can be made is that universities included in the initiative are significantly ahead of other universities in all indicators, starting from the period before the introduction of the program. This group of universities also shows a more significant increase over time. This result is not surprising, because the RUEI includes stronger and more successful universities, including those on the UPIs we are considering. Figures 3–5 also show the dynamics of UPIs in the treatment and control groups. Since 2012, the gap in the mean USE scores between the treatment and control groups has been increasing. At the same time, the share of young academics is approximately the same in both groups and decreases over time. In 2012, i.e. before the RUEI was introduced, universities from the control group had, on average, more publications in the RSCI. Over time, the number of publications in the RSCI grows at universities in both groups, but the difference in the means between the groups persists throughout the period analyzed (see Figure 4). Figure 6 shows that the treatment group slightly outperforms the control group in the average number of WoS articles (both when the ESCI is included and when it is excluded) and in the average number of articles in the Q1 journals after 2014.

Next, we ran a series of regressions for our set of UPIs. Descriptive statistics for the UPIs, for both the whole sample and the treatment and control groups, are presented in Table 2. The results of the regression models for the first specification are presented in Table 3 (models 1-1 – 1-9), and those for the second specification in Table 4.

The results of the regression models for the first specification show that the DID estimator is statistically significant only for three indicators: mean USE ($b = 1.07$, $p = .021$, model 1-1), number of publications in WoS without ESCI ($b = 6.77$, $p = .026$, model 1-6), and number of publications in WoS Q1 journals ($b = 1.82$, $p = .044$, model 1-7). In all three cases, the treatment group has a higher value than the control group. The difference between the groups in the number of publications in the RISC and WoS (including ESCI), observed during a visual inspection of the figures, is not confirmed in the regression analysis.

The regression models for the second specification generally replicate the results of those for the first (see Table 4). The DID estimators are statistically significant only for the same three indicators: mean USE, number of publications in WoS without ESCI, and number of publications in WoS Q1 journals. However, the treatment effect began to appear at different intervals after the introduction of the 5–100 program. The DID estimator in the model for the mean USE score became statistically significant from 2014 ($b = 1.77$, $p = .004$, model 2-1). At the same time, the coefficient value for the DID estimator in 2016 was greater compared to 2014 (1.77 vs 1.92), which can be interpreted as an increase in the difference between the treatment and control groups, i.e. enhancing the effect of the RUEI. In the model of the number of WoS publications without ESCI, only the DID estimator for 2017 is statistically significant ($b = 12.77$, $p = .006$, model 2-6). In other words, the effect of the RUEI only began to manifest five years after its introduction. Finally, in the model of the number of articles in the WoS Q1 journals, the DID estimator is statistically significant only for 2016 ($b = 3.45$, $p = .016$, model 2-7), and not for 2017 ($b = 2.49$, $p = .082$). Thus, one cannot say that there is a stable RUEI effect on the number of articles in the WoS Q1 journals.

Figure 6 shows that the number of WoS articles written in collaboration with RUEI universities increases with time, in both the treatment and control groups. However, it grows faster in the treatment group. Regression analysis confirms this conclusion. In the first regression model specification, the DID estimator is statistically significant ($b = 7.92$, $p < .001$, model 1-10), i.e. the number of WoS articles in collaboration with RUEI universities grows faster in the treatment group than in the control group after the introduction of the initiative (Table 5). In the second specification model, the DID estimator begins to be statistically significant in 2014 and continues to be significant for all subsequent years (model 2-10), while the value of the coefficient for the DID estimator grows over the years (6.37 in 2014, 8.93 in 2015, 8.80 in 2016, and 11.53 in 2017). Thus, the difference in growth in the number of WoS articles in collaboration with RUEI universities between treatment and control groups arose in 2014 and remained in subsequent years, increasing in size.

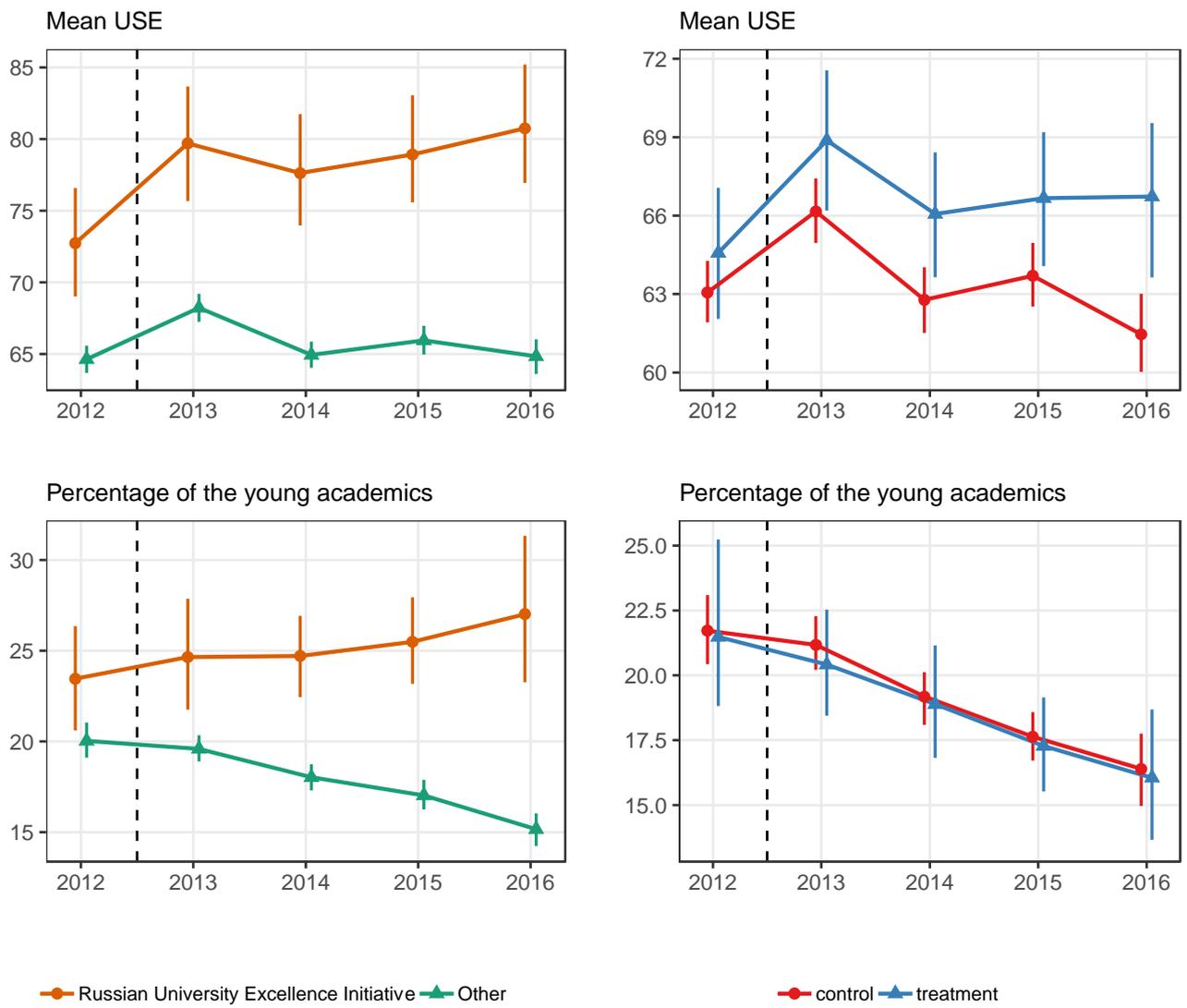


Figure 3. Means and 95% confidence intervals for mean USE and percentage of young academics in groups by years.

Russian University Excellence Initiative	15
Other: Outside the Russian University Excellence Initiative	384
Treatment (from a city where there is at least one university included in the Russian University Excellence Initiative)	54
Control (from a region where there are no universities included in the Russian University Excellence Initiative)	191

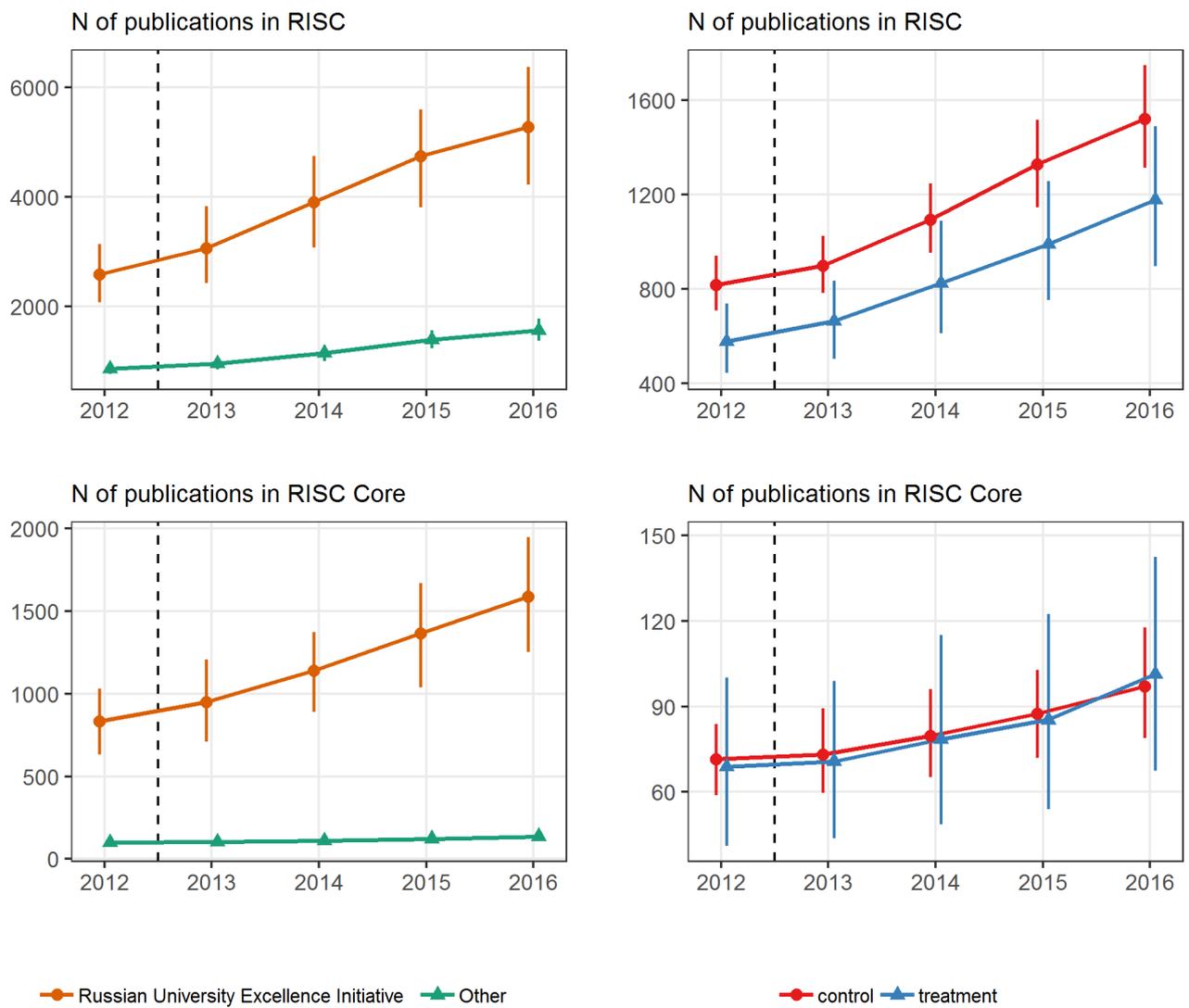


Figure 4. Means and 95% confidence intervals for number of publication indexed in RISC in groups by years.

Russian University Excellence Initiative	15
Other: Outside the Russian University Excellence Initiative	384
Treatment (from a city where there is at least one university included in the Russian University Excellence Initiative)	54
Control (from a region where there are no universities included in the Russian University Excellence Initiative)	191

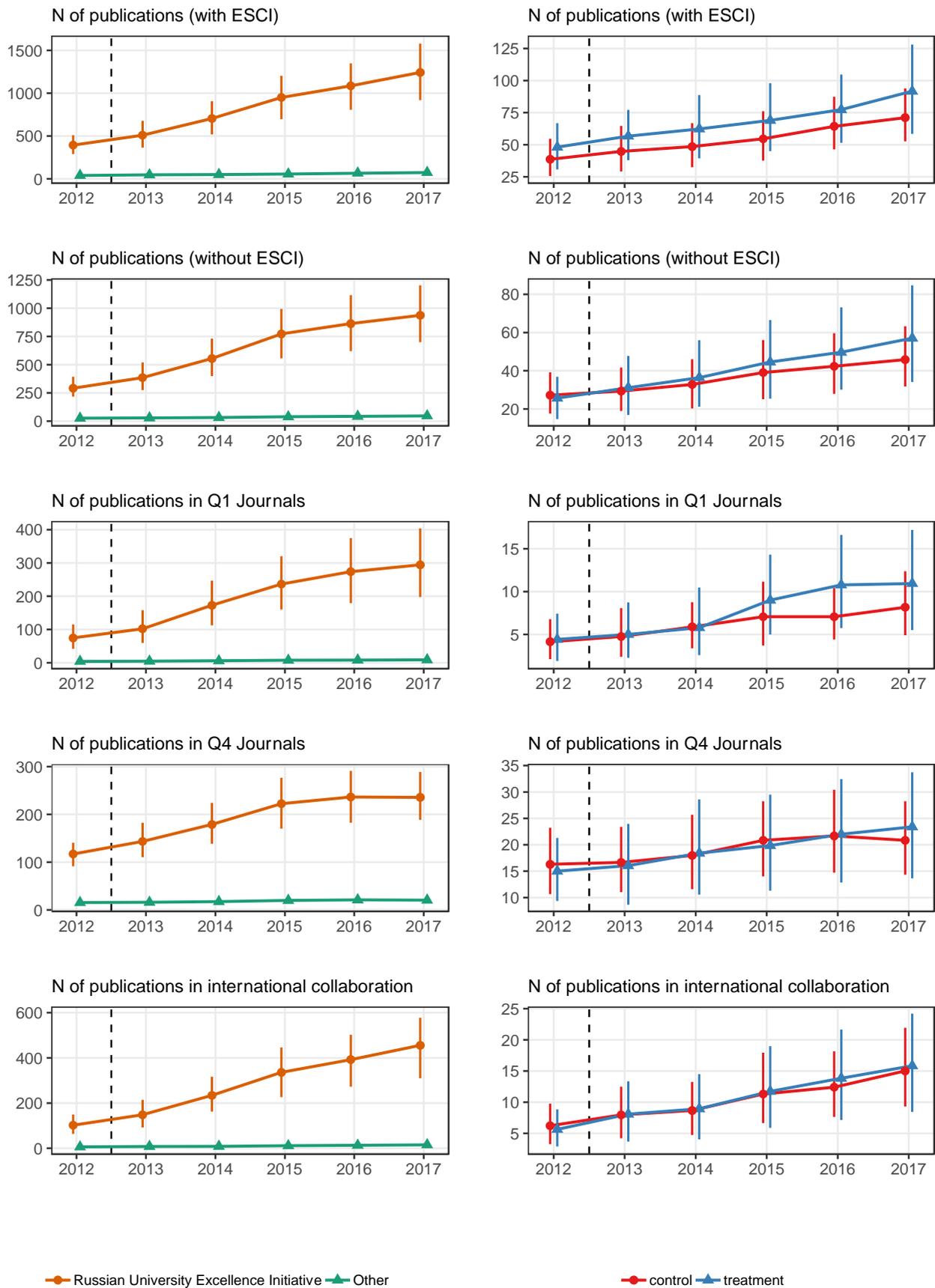


Figure 5. Means and 95% confidence intervals for number of publications indexed in the Web of Science in groups by years.

Russian University Excellence Initiative	15
Other: Outside the Russian University Excellence Initiative	384
Treatment (from a city where there is at least one university included in the Russian University Excellence Initiative)	54
Control (from a region where there are no universities included in the Russian University Excellence Initiative)	191

Table 2. Descriptive statistics of university performance indicators

Variable	Whole sample			Treatment group			Control group		
	Mean	<i>SD</i>	<i>N</i>	Mean	<i>SD</i>	<i>N</i>	Mean	<i>SD</i>	<i>N</i>
Mean USE	64.3	8.91	1098	66.56	9.57	242	63.66	8.62	856
% of young academics	19.45	8.1	1101	19.13	9.08	243	19.54	7.8	858
No. of publ. in RISC	1068.63	1113.51	1215	846.2	862.84	265	1130.67	1166.78	950
No. of publ. in RISC Core	81.65	113.91	1215	81.03	121.49	265	81.82	111.77	950
No. of publ. (with ESCI)	56.64	77.69	564	67.53	60.03	120	53.69	81.62	444
No. of publ. (without ESCI)	37.11	57.16	552	40.74	44.42	120	36.09	60.22	432
No. of publ. in Q1	6.53	12.26	480	7.66	10.44	114	6.18	12.77	366
No. of publ. in Q4	19.06	27.97	540	19.12	20.55	120	19.05	29.78	420
No. of publ. in international collaboration	10.37	19.31	498	10.69	14.25	120	10.27	20.67	378
No. of publ. in collaboration with Russian University Excellence Initiative universities	6.41	12.2	444	13.78	19.7	120	3.68	5.8	324

Note. Each observation is for a university year.

Table 3. Regression models of the all indicators

	Model 1-1 Mean USE	Model 1-2 % of young academics	Model 1-3 No. of publications in RISC	Model 1-4 No. of publications in RISC Core	Model 1-5 No. of publ. in WoS (with ESCI)	Model 1-6 No. of publ. in WoS (without ESCI)
(Intercept)	63.83*** (0.93)	21.79*** (0.73)	988.30*** (112.68)	74.46*** (12.22)	42.47*** (12.64)	29.98** (9.63)
After initiative	-1.20*** (0.22)	-3.40*** (0.37)	456.90*** (26.56)	15.73*** (1.67)	17.90*** (2.05)	11.75*** (1.42)
Treatment group	1.83 (1.36)	-0.37 (1.09)	-188.33 (165.74)	-1.76 (17.84)	11.08 (20.01)	1.04 (14.81)
Strong neighbor	1.31 (1.16)	-0.57 (0.87)	-221.55 (139.71)	-3.51 (15.26)	-1.32 (16.58)	-3.09 (12.46)
After initiative x Treatment group	1.07* (0.46)	0.13 (0.78)	-80.27 (56.87)	2.88 (3.57)	4.76 (4.45)	6.77* (3.05)
Observations	1098	1101	1215	1215	564	552
Marginal R ² / Conditional R ²	0.023/0.880	0.044/0.568	0.057/0.872	0.005/0.952	0.018/0.933	0.014/0.942

Note. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Treatment group: universities from a city where there is at least one university included in the Russian University Excellence Initiative.

Control group: universities from a region where there are no universities included in the Russian University Excellence Initiative.

Table 4. Regression models of the all indicators (with time as categorical variable, 2012 is reference year)

	Model 2-1 Mean USE	Model 2-2 % of young academics	Model 2-3 No. of publications in RISC	Model 2-4 No. of publications in RISC Core	Model 2-5 No. of publ. in WoS (with ESCI)	Model 2-6 No. of publ. in WoS (without ESCI)
(Intercept)	62.28*** (0.95)	22.05*** (0.77)	947.46*** (114.15)	73.61*** (12.28)	39.42** (12.73)	28.92** (9.68)
Year 2013	3.10*** (0.29)	-0.55 (0.54)	81.69* (38.32)	1.71 (2.50)	6.11* (3.07)	2.11 (2.18)
Year 2014	-0.28 (0.29)	-2.54*** (0.54)	277.22*** (38.32)	8.21** (2.50)	9.81** (3.07)	5.63** (2.18)
Year 2015	0.64* (0.29)	-4.09*** (0.54)	511.38*** (38.32)	16.00*** (2.50)	15.93*** (3.07)	11.82*** (2.18)

Year 2016	1.17** (0.37)	-5.30*** (0.69)	704.64*** (38.32)	25.55*** (2.50)	25.65*** (3.07)	15.14*** (2.18)
Year 2017	-	-	-	-	32.43*** (3.07)	18.63*** (2.18)
Treatment group	1.23 (1.40)	-0.12 (1.23)	-190.69 (170.29)	-1.88 (18.03)	9.81 (20.25)	-0.65 (14.98)
Strong neighbor	1.30 (1.16)	-0.56 (0.87)	-221.55 (139.71)	-3.51 (15.26)	-1.32 (16.58)	-3.09 (12.46)
Year 2013 x Treatment group	1.20 (0.62)	-0.52 (1.15)	4.71 (82.04)	0.24 (5.35)	2.54 (6.66)	3.39 (4.68)
Year 2014 x Treatment group	1.77** (0.62)	-0.05 (1.15)	-29.88 (82.04)	1.49 (5.35)	4.44 (6.66)	5.12 (4.68)
Year 2015 x Treatment group	1.45* (0.62)	-0.12 (1.15)	-98.83 (82.04)	0.47 (5.35)	4.92 (6.66)	7.08 (4.68)
Year 2016 x Treatment group	1.92* (0.80)	-0.29 (1.46)	-105.04 (82.04)	7.04 (5.35)	3.60 (6.66)	8.86 (4.68)
Year 2017 x Treatment group	-	-	-	-	11.17 (6.66)	12.77** (4.68)
Observations	1098	1101	1215	1215	564	552
Marginal R ² / Conditional R ²	0.041 / 0.904	0.055 / 0.580	0.071 / 0.889	0.008 / 0.955	0.028 / 0.944	0.020 / 0.949

Note. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Treatment group: universities from a city where there is at least one university included in the Russian University Excellence Initiative.

Control group: universities from a region where there are no universities included in the Russian University Excellence Initiative.

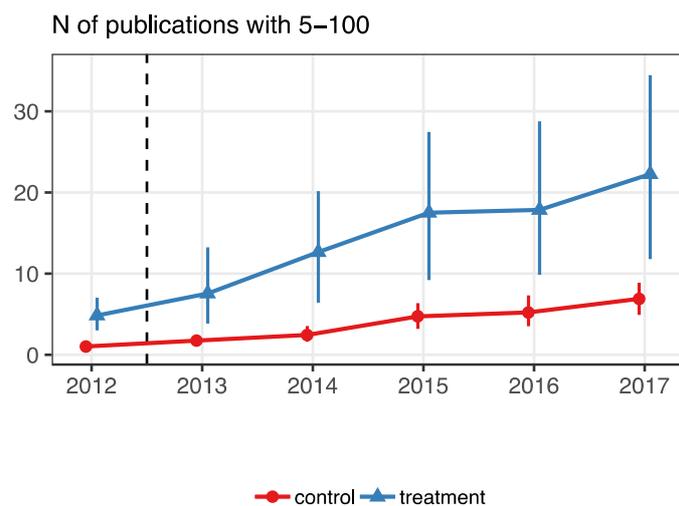


Figure 6. Means and 95% confidence intervals for number of publications in collaboration with Russian University Excellence Initiative universities indexed in the WoS in groups by years.

Treatment (from a city where there is at least one university included in the Russian University Excellence Initiative)	54
Control (from a region where there are no universities included in the Russian University Excellence Initiative)	191

Table 5. Regression models for number of publications indexed in the WoS, in collaboration with Russian University Excellence Initiative universities.

	Model 1-10 No. of publications in collaboration with Russian University Excellence Initiative universities	Model 2-10 No. of publications in collaboration with Russian University Excellence Initiative universities
(Intercept)	1.10 (2.03)	0.74 (2.11)

After initiative	3.44*** (0.72)	-
Treatment group	4.71 (2.73)	3.72 (2.92)
Strong neighbor	0.46 (2.44)	0.46 (2.44)
After initiative x Treatment group	7.92*** (1.39)	-
Year 2013	-	0.72 (1.12)
Year 2014	-	1.43 (1.12)
Year 2015	-	3.72*** (1.12)
Year 2016	-	4.20*** (1.12)
Year 2017	-	5.87*** (1.12)
Year 2013 x Treatment group	-	1.98 (2.16)
Year 2014 x Treatment group	-	6.37** (2.16)
Year 2015 x Treatment group	-	8.93*** (2.16)
Year 2016 x Treatment group	-	8.80*** (2.16)
Year 2017 x Treatment group	-	11.53*** (2.16)
Observations	444	444
Marginal R ² / Conditional R ²	0.196 / 0.754	0.218 / 0.778

Note. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Treatment group: universities from a city where there is at least one university included in the Russian University Excellence Initiative.

Control group: universities from a region where there are no universities included in the Russian University Excellence Initiative.

6. Discussion and Conclusions

Excellence initiatives do not exist in a vacuum and may potentially affect the entire national higher education system. Concern about the consequences of such targeted programs has been around for a long time. However, any possible positive and negative externalities are not yet taken into account in the development of such government interventions. In many countries, a significant gap between universities inside and outside excellence initiatives is visible, but what exactly happens to those outside is still unknown. The case of the Russian University Excellence Initiative has a number of advantages for research. There are many regions in Russia with universities from the initiative and also without such universities (see Figure 2), which has allowed us to see how a selected university affects other universities in its home region: i.e., whether or not it absorbs all resources. It is also important that other reforms in the higher education sector in this period affected all universities. Due to the specificities of Russia, we were able to evaluate these external effects at a regional level. In order to estimate the effects, we compared non-RUEI universities from

regions that had universities both in and outside the initiative between 2012 and 2017. An RUEI university, in the first place, can affect neighboring universities. We selected those indicators in which one can expect changes, though it is difficult to predict whether they will be positive or negative. The use of various model specifications allowed us to see both the overall effect during this period and also the year-by-year effect. We can argue that there is a positive effect on the quality of the student intake, and that this effect increases over the years. Thus, RUEI universities are able to attract more capable students for their home region. There is no spillover regional effect on the staff rejuvenation share, but the share of young academics in non-RUEI universities fell during this period. The cause of this phenomenon is that the academic profession is becoming less attractive for young people and only universities from the excellence initiative can attract and keep young faculty. There is a positive effect on the quality of publications. However, this effect has only recently appeared, which may be due to the fact that it takes a long time to develop an idea and take it through to a journal article. We also discovered an important effect associated with a statistically significant increase in collaboration in publications between RUEI universities and neighboring institutions. At the same time, there is no influence on international collaboration in publications. In general, it can be argued that the RUEI becomes a driver for regional academic markets.

Based on the results of this study on the external effects of the RUEI, several conclusions can be drawn. First, to the best of our knowledge, these results are one of the first empirical demonstrations of the impact of an excellence initiative on parts of the academic system that are not a direct part of that initiative. Our results demonstrate that the RUEI can influence neighboring universities that are not part of this program, i.e. not directly supported by the initiative. It reinforces the concerns of those researchers who raise questions about the impact of the initiative on the rest of the academic system (Gaehtgens, 2015; Kehm, 2013; Liu et al, 2016). This conclusion is important for policy, because it is empirical evidence suggesting that the potential impact of an excellence initiative on the rest of the academic system should be considered when developing its design and implementation.

Indeed, we have shown that spillover effects exist. Universities participating in the RUEI have created their own development strategies and are progressing well in accordance with those strategies. This development positively affects their neighboring environment, and there are several mechanisms through which they can make this influence felt. On the one hand, the RUEI and the media attention it has attracted has increased the visibility not just of the participating universities but also of the cities and regions in which they are located, forming an image of these cities and regions as scientific and educational centers of the country. On the other hand, the observed increase in the number of articles in international journals published in collaboration with RUEI universities suggests that participants in the initiative have a positive impact on the neighboring

environment. This impact is not only at an information level, but actually enriches the wider academic environment, involving academics from neighboring universities in joint research. The results of this study, taken together with those of previous studies that evaluated the direct effect of the RUEI on participating universities (Matveeva et al., 2019; Poldin et al., 2017; Turko et al., 2016), provide grounds for evaluating this initiative mostly as positive in its results, at least in the short run.

Based on evidence from the RUEI, one can initially conclude that such initiatives can be useful, not only for direct participants, but also for other parts of the academic system that do not receive direct support from the initiative. Of course, not all aspects of the functioning of universities that could be affected by the RUEI have yet been analyzed. However, the data obtained to date indicate a positive influence, and there is no empirical evidence for stating any detrimental effect of the RUEI on the academic system as a whole.

Our study has several limitations. Indeed, the set of indicators that we can use is limited, and to a great extent these represented the scientific activities of the university. Beyond that, not much time has passed since the start of the RUEI. It is still difficult to say how the influence of the program will manifest itself in the future. Another important issue is that we cannot predict what will happen at the regional level after the end of targeted support. This is important, as the RUEI is scheduled to be relaunched in 2021 and some universities could lose their place on the program.

References

- Astebro, T., and N. Bazzazian. 2011. "Universities, entrepreneurship and local economic development." In *Handbook of Research on Entrepreneurship and Regional Development: National and Regional Perspectives* edited by Fritsch M. Edward Elgar, Cheltenham.
- Altbach, P. 2003. "The costs and benefits of world-class universities." *International Higher Education* 33: 5-10.
- Altbach, P., ed. 2011. *Leadership for world-class universities: Challenges for developing countries*. London: Routledge.
- Altbach, P., and J. Salmi, eds. 2011. *The road to academic excellence: Emerging research universities in developing and transition countries*. Washington, DC: The World Bank.
- Altbach, P., L. Reisberg, and H. de Wit, eds. 2017. *Responding to massification: Differentiation in postsecondary education worldwide*. Springer.
- Bates, D., M. Mächler, B. Bolker, and S. Walker. 2015. "Fitting Linear Mixed-Effects Models Using lme4." *Journal of Statistical Software* 67(1): 1–48. <https://doi.org/10.18637/jss.v067.i01>
- Bhadwa, S. 2017. "Why do students go to university and how do they choose which one." *Times Higher Education* . <https://www.timeshighereducation.com/student/news/why-do-students-go-university-and-how-do-they-choose-which-one>
- Brown, D. G. 1967. *The mobile professors*. American Council on Education.
- Clark, B. R. 1996. "Substantive growth and innovative organization: New categories for higher education research." *Higher education* 32(4): 417-430.
- Clark, B. R. 2002. "University transformation: Primary pathways to university autonomy and achievement." In *The future of the city of intellect: The changing American university* edited by S. Brint, 322-342. Stanford University Press
- Cremonini, L., P. Benneworth, H. Dauncey, and D. Westerheijden. 2013. "Reconciling republican 'Egalite' and global excellence values in French higher education." In *Institutionalization of world-class university in global competition* edited by Shin, J. and B. Kehm 99-123. Springer, Dordrecht.
- Cook, P. and R. Frank. 1993. 'The growing concentration of top students at elite schools', in: *Studies and Demand in Higher Education*, edited by Clotfelter, C. and M. Rothschild 121-144. Chicago: University of Chicago Press.
- Cordes, S. A. 2018. "In pursuit of the common good: The spillover effects of charter schools on public school students in New York City." *Education Finance and Policy* 13(4): 484-512.

- Croucher, G. and P. Woelert. 2016. "Institutional isomorphism and the creation of the unified national system of higher education in Australia: an empirical analysis." *Higher Education* 71(4): 439-453
- DiMaggio, P. J. and W. W. Powell. 1983. "The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields." *American Sociological Review* 48(2): 147–160.
- Drucker, J. and H. Goldstein. 2007. "Assessing the regional economic development impacts of universities: A review of current approaches." *International regional science review* 30(1): 20-46.
- Edmark, K. 2019. "Location choices of Swedish independent schools." *The Annals of Regional Science* 63(1): 219-239.
- Epple, D. and R. E. Romano. 1998. "Competition between private and public schools, vouchers, and peer-group effects." *American Economic Review* 88(1): 33-62.
- Ferreira, M. M. and G. Kosenok. 2018. "Charter school entry and school choice: The case of Washington, DC." *Journal of Public Economics* 159: 160-182.
- Gaetgens, C. 2015. "Does Size Matter?—The Example of the "Excellence Initiative" and its Impact on Smaller Universities in Germany." In *Diversity and Excellence in Higher Education* edited by Pritchard R., M. Klumpp and U. Teichler 19-30. Sense Publishers, Rotterdam.
- Guskov, A. E., D. V. Kosyakov and I. V. Selivanova. 2018. "Boosting research productivity in top Russian universities: the circumstances of breakthrough". *Scientometrics* 117(2): 1053-1080.
- Hallonsten, O. and D. Holmberg. 2013. "Analyzing structural stratification in the Swedish higher education system: Data contextualization with policy-history analysis." *Journal of the American Society for information Science and Technology* 64(3): 574-586.
- Hou, A. Y. C., M. Ince, and C. L. Chiang. 2012. "A reassessment of Asian pacific excellence programs in higher education: the Taiwan experience." *Scientometrics* 92(1): 23-42.
- Kashnitsky I., N. Mkrtchyan and O. Leshukov. 2016. "Mezhregional'naya migratsiya molodezhi v Rossii: kompleksnyy analiz demograficheskoy statistiki" [Interregional Migration of Youths in Russia: A Comprehensive Analysis of Demographic Statistics]. *Voprosy obrazovaniya / Educational Studies Moscow* 3: 169-203.
- Kehm, B. 2013. "To be or not to be? The impacts of the excellence initiative on the German system of higher education." In *Institutionalization of world-class university in global competition* edited by Shin, J. and B. Kehm, 81-97. Springer, Dordrecht.
- Koenig, J., T. Brenner, and G. Buenstorf. 2017. "Regional effects of university funding: Excellence at the cost of regional disparity?" *Review of Regional Research* 37(2): 111-133.
- Kuskova, V. and M. Yudkevich. 2016. "International Academic Recruitment in a Turbulent Environment: The Case of the Higher School of Economics in Russia." In *International*

- Faculty in Higher Education* edited by Altbach, P, M. Yudkevich and L.E. Rumbley 206-229 . Routledge.
- Liu, N. C., Y. Cheng and Q. Wang. 2016. “Matching Visibility and Performance: A Standing Challenge for World-Class Universities.” In *Matching Visibility and Performance* edited by Liu, N.C, Y. Cheng and Q. Wang 1-11. SensePublishers, Rotterdam.
- McGee, G. W. and R. C. Ford. 1987. “Faculty research productivity and intention to change positions.” *The Review of Higher Education* 11(1): 1-16.
- Matveeva, N., I. Sterligov and M. Yudkevich. 2019. “The Russian University Excellence Initiative: Is It Really Excellence that Is Promoted?” Higher School of Economics Research Paper No. WP BRP, 49.
- Menter, M., E. E. Lehmann and T. Klarl. 2018.” In search of excellence: a case study of the first excellence initiative of Germany.” *Journal of Business Economics* 88(9): 1105-1132.
- Ming, J. K. S. 2010. “Institutional Factors Influencing Students’ College Choice Decision in Malaysia: A Conceptual Framework.” *International Journal of Business and Social Science* 1(3): 53-58.
- Moskaleva, O., V. Pislyakov, I. Sterligov, M. Akoev, and S. Shabanova. 2018. “Russian index of science citation: Overview and review.” *Scientometrics* 116(1): 449–462. <https://doi.org/10.1007/s11192-018-2758-y>
- Möller, T., M.Schmidt and S. Hornbostel. 2016. “Assessing the effects of the German Excellence Initiative with bibliometric methods.” *Scientometrics* 109(3): 2217-2239
- Poldin O., N. Matveeva, I. Sterligov and M. Yudkevich. 2017. “Publikatsionnaya aktivnost' vuzov: effekt proekta «5–100»” [Publication Activities of Russian Universities: The Effects of Project 5–100]. *Voprosy obrazovaniya / Educational Studies Moscow* 2: 10-35. (in Russian).
- Rincke, J. 2007. “Policy diffusion in space and time: The case of charter schools in California school districts.” *Regional Science and Urban Economics* 37(5): 526-541.
- Salmi, J. 2016. “Excellence strategies and the creation of world-class universities.” In *Matching Visibility and Performance* edited by Liu, N.C, Y. Cheng and Q. Wang 13-48. SensePublishers, Rotterdam.
- Sharma, Y. 2017. “World-class universities policy fuels talent poaching.” *University World News*, March 16, Issue No: 451. <http://www.universityworldnews.com/article.php?story=20170316143426976>
- Shin, J. C. and Y. S. Jang. 2013. “World-class university in Korea: Proactive government, responsive university, and procrastinating academics.” In *Institutionalization of world-class university in global competition* edited by by Shin, J. and B. Kehm 147-163. Springer, Dordrecht.

- Teichler, U. 2008. "Exzellenz und Differenzierung: Auf der Suche nach einer neuen Systemlogik." *iFQ*, 13.
- Turko, T., G. Bakhturin, V. Bagan, S. Poloskov, and D. Gudym. 2016. "Influence of the program "5-top 100" on the publication activity of Russian universities." *Scientometrics* 109(2): 769-782.
- Webb, M. S., R. L. Coccari, and L. C. Allen. 1997) "Doctoral programs: What factors attract students." *Journal of Marketing for Higher Education* 7(4): 73-85.
- Wondratschek, V., K. Edmark, and M. Frölich. 2013. "The short-and long-term effects of school choice on student outcomes—evidence from a school choice reform in Sweden." *Annals of Economics and Statistics/ANNALES D'ÉCONOMIE ET DE STATISTIQUE* 111: 71-101.
- Yonezawa, A. and Y. Shimmi. 2016. "Transformation of university governance through internationalization." In *Matching Visibility and Performance* edited by Liu, N.C, Y. Cheng and Q. Wang 103-118. SensePublishers, Rotterdam.
- Zhou, Y. and J. F. Volkwein. 2004. "Examining the influences on faculty departure intentions: A comparison of tenured versus nontenured faculty at research universities using NSOPF-99." *Research in higher education* 45(2): 139-176.
- Zong, X. and W. Zhang. 2019. "Establishing world-class universities in China: deploying a quasi-experimental design to evaluate the net effects of Project 985." *Studies in Higher Education* 44(3): 417-431.



Figure 1. Distribution of regions and cities with universities from the Russian University Excellence Initiative across Russia.

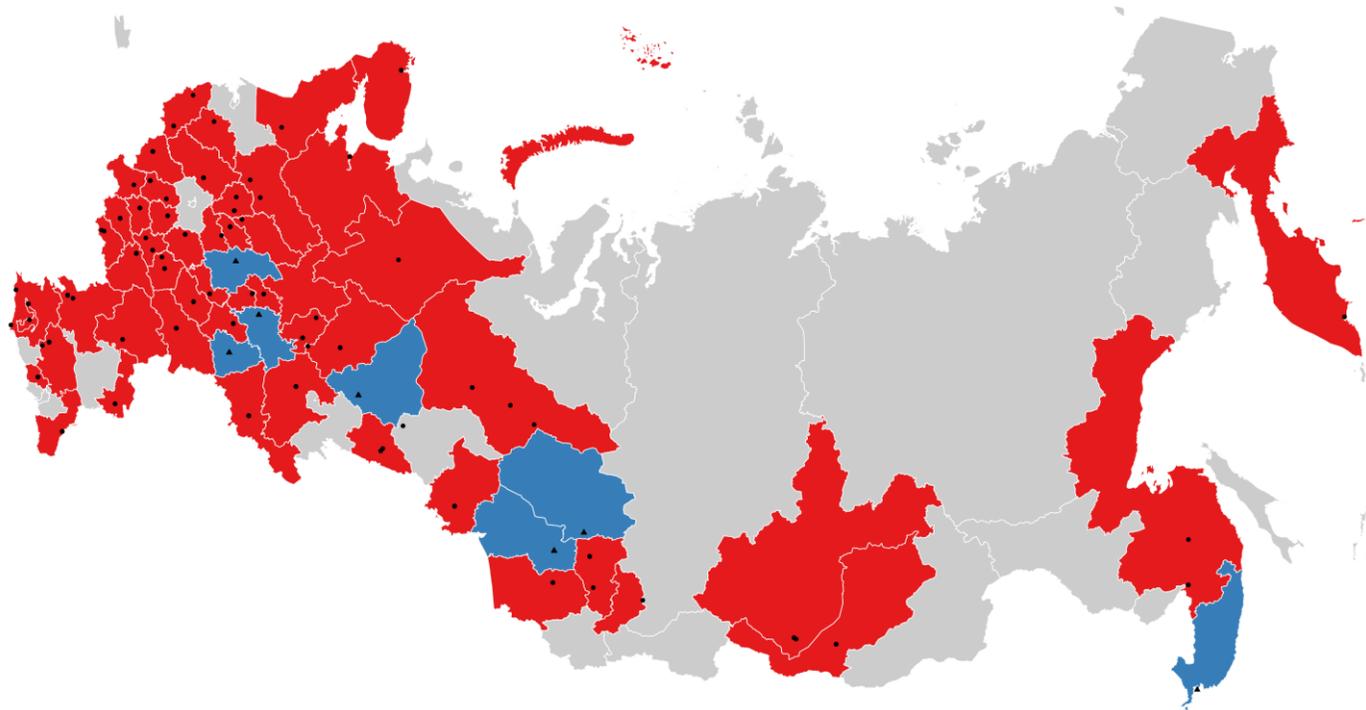


Figure 2. Distribution of regions and cities with universities from the treatment (blue) and control (red) groups.

Treatment group: universities from a city where there is at least one university included in the Russian University Excellence Initiative.
Control group: universities from a region where there are no universities included in the Russian University Excellence Initiative.