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EDUCATIONAL AND CAREER TRAJECTORIES AND SCIENTIFIC PRODUCTIVITY OF RUSSIAN RESEARCHERS IN THE FIELD OF MATHEMATICS AND NATURAL SCIENCES

THESIS SUMMARY

for the purpose of obtaining academic degree

Doctor of Philosophy in Education

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Content

Key concepts of the study and list of abbreviations 3
Introduction 7
Relevance and degree of development of the problem 7
Research questions 12
Aim and objectives of the study 12
Scientific novelty of the study 14
Theoretical significance of the study 15
Practical significance of the study 17
Provisions for defense 19
Approbation of the results of the study 21
Theoretical basis of the study 22
Methodology 26
Results 29
Career trajectories of researchers 29
Factors of academic inbreeding 30
Impact of academic inbreeding on scientific productivity 32
Conclusion 37
References 40

Key concepts of the study and list of abbreviations

The educational and career trajectories of scientific and pedagogical workers are the change of states in education and on the labour market, in this study associated with the transition from the period of preparation and successful defence of a PhD thesis to further work in the academic labour market and beyond.

Academic career/career trajectory – employment of a scientific and pedagogical worker in academic sector organisations (institutions of science and higher education).

Academic inbreeding – at the institutional level, this is the practice of science and higher education organisations hiring their graduates; at the individual level, this is a feature of the career trajectory when an academic researcher works in the same organisation where he/she studied.

Academic organisations – institutions of science and higher education (universities, academies, scientific institutes, including those subordinate to the Russian Academy of Sciences).

Inbreed – a scientific and pedagogical worker who works in the same organisation where he/she received one of the levels of higher education. In the empirical analysis of dissertation work, an inbreed is a researcher who works in the same organisation where he/she prepared the dissertation.

Temporary inbreed is a researcher who, after defending the thesis, worked in the same organisation where he/she prepared the thesis for at least one year, after which he/she moved to another organisation in the academic sector.

Silver-corded – an academic staff member who, after defence, worked in an organisation other than the one where he/she prepared the thesis and then returned to his/her alma mater.

Adherent – a scientific-pedagogical worker who, after defending his/her thesis, moved to another organisation and did not change his/her place of work.

A mobile researcher is an academic researcher who moved to another organisation after defending the thesis and then changed jobs at least once. In the empirical analysis of the thesis work, when using the inbreed/mobile dichotomy,

the category of mobile researchers includes all researchers who changed their place of work at least once after defending the thesis, i.e. the category of mobile then includes the categories of temporary inbreed, 'returnee' and committed.

The alma mater is the organisation where the researcher received one of the levels of higher education. In the empirical analysis of the thesis, alma mater refers to the organisation where the researcher prepared the thesis.

Scientific productivity is a set of bibliometric metrics characterising the volume and quality of publication activity.

Metropolitan cities and regions – the cities of Moscow and St. Petersburg, as well as the adjacent Moscow and Leningrad Oblasts.

Regions with a saturated/large academic labour market / large regions – regions with the largest number of science and higher education institutions (total number of public higher education institutions in general and scientific institutes for each branch of science), except for metropolitan regions[1]. A detailed description of the methodology of categorisation of regions is presented in Section 2.1.3.3.

Regions with an unsaturated/small academic labour market / medium and small regions – regions with the average and/or the smallest number of science and higher education institutions (total number of public higher education institutions in general and scientific institutes for each branch of science)[2]. A detailed description of the methodology for categorisation of regions is presented in Section 2.1.3.3.

Research sector – Research organisations outside the structures of higher education institutions: institutes of the Russian Academy of Sciences, research institutes within the Ministry of Science and Higher Education, research institutes within state corporations.

[1] The boundaries between large regions and regions with a smaller academic labour market were determined for each field of sciences using cluster analysis. For chemical and physical-mathematical sciences, regions with more than 9 institutions of science and higher education are considered large, for biological sciences - more than 16.

[2] For physical and mathematical sciences, regions with more than 4 to 10 institutions of science and higher education are considered average, and regions with up to 3 institutions are considered small. For the chemical sciences, regions with more than 4 to 8 institutions of science and higher education and up to 3 institutions are considered medium-sized. For biological sciences, regions with more than 8 to 15 institutions of science and higher education, and up to 7 institutions are considered medium-sized.

University sector – organisations of higher professional education.

Leading universities – federal universities, national research universities, universities participating in the 5-100 project (both waves), Moscow State University, St. Petersburg State University.

Higher education institutions without special status – other higher education institutions that do not have the status of federal, national research and did not participate in the project '5-100'.

Involvement in the academic profession – active research activity expressed in scientific publications, work in an organisation of the academic sector (university or research organisation).

Young scientists / early career researchers / PhD graduates[3] **–** PhD candidates in the first eight years after defence of the thesis, and whose first publication was published not earlier than ten years before defence of the thesis (publications in Scopus-indexed publications are taken into account).

Active researchers – scientific and pedagogical staff with at least one publication in Scopus-indexed publications six to eight years after defence of the thesis, in 2018-2020.

Invisible researchers – scientific and pedagogical workers who defended their PhD thesis, who do not have profiles in bibliometric databases (Elibrary, Scopus) and who do not have information about their work in open access on the Internet.

Researcher's human capital is a person's skills, knowledge and abilities, the result of the application of which is the production of some useful product. In this paper, the researcher's human capital is operationalised through the volume and quality of his/her publication activity. A researcher with human capital of high quality is a researcher who publishes the results of his/her scientific activity in publications indexed by international scientific databases.

[3] This study investigates the careers of young scientists in the first eight years after defending a thesis. It is assumed that the majority of young scientists observed in the paper graduated from postgraduate schools or acted as co-researchers at Russian universities and research institutes; therefore, the paper uses 'postgraduate graduates' as an equivalent to young scientists, PhDs, and early career researchers.

Multiple employment is the fact of indicating more than one affiliation in the publication.

Institutional Collaboration publication is a publication whose authors work in the same organisation.

Publication made in a national collaboration – a publication whose authors work in different organisations of the same country.

International collaborative publication – a publication whose authors work in organisations in different countries.

Introduction

Relevance and degree of development of the problem

The phenomenon of academic inbreeding at the individual level represents a specific career trajectory of a scientific and pedagogical worker when he/she works in the same organisation where he/she mastered one of the levels of higher education [1]. Such a trajectory may reduce the quality of researchers' human and social capital due to less diversity of professional experience [2-4]. As a consequence, academic inbreeding may pose risks to the quality of scientific knowledge production through its impact on the human and social capital of academic researchers.

The production of scientific knowledge is an important component of the second, research, mission of universities, while helping to ensure the fulfilment of educational and social missions. [5, 6]. On the one hand, the research activity of university employees allows to fulfil the first, educational mission qualitatively through the implementation of research-based pedagogical activities and by involving students in the production of advanced scientific results, thus allowing to train competitive specialists [7, 8]. In Russia, the interrelation of scientific and educational missions of universities is enshrined, among other things, at the legislative level. Article 72 of the Federal Law ‘On Education in the Russian Federation’ is devoted to the integration of educational and scientific (research) activities in higher education [9]. On the other hand, the results of research activities represent the basis for the fulfilment of the public mission, strengthening ties with business structures and being an object spread to the external environment of the HEI for the benefit of society [10-12]. As a result, the research mission as such and the importance of the task of scientific knowledge production can hardly be overestimated, so all the factors involved in the process of this production become especially important.

The factors of scientific knowledge production in the university environment certainly include human capital, social capital, technical infrastructure, financial and information resources, etc. [13-18]. The key factor is usually recognized as

human capital, which ensures the effective use of all the others. An important characteristic of human capital is the professional experience of its holders, which is created, among other things, due to mobility [19, 20]. In the academic environment, a relatively frequent change of employer (academic mobility), is usually associated with higher scientific productivity both in theory [21] and in practice [22-26], as it broadens the researcher's horizons and ensures an active circulation of knowledge and ideas. However, in many national systems of science and higher education, the opposite phenomenon of academic mobility is widespread, which is associated with a complete absence of job change starting from the period of higher education - academic inbreeding [27]. The phenomenon of academic inbreeding is a peculiarity of career trajectory, when a scientific and pedagogical worker works in the same organization where he/she studied [1]. The low level of academic mobility and widespread inbreeding are natural for academic systems at the initial stage of development at a small number of institutions of science and higher education [28, 29]. However, in more developed systems, academic inbreeding is perceived rather negatively, as it can potentially create obstacles to the generation of scientific knowledge and reduce the productivity of researchers due to limited information exchange [2, 30-33]. Among the few positive effects of inbreeding are the reduction of risks in recruitment (at the organizational level) [34] and the absence of an adaptation period (at the individual level), which usually reduces the productivity of researchers in the short term [35, 36]. The ambiguity of academic inbreeding and its importance as a characteristic of human capital necessitate additional study of the phenomenon.

In the scientific literature there are contradictory results of assessing the relationship between academic inbreeding and academic productivity. A number of studies find a negative correlation between academic inbreeding and productivity [31, 37, 38]; others find a positive correlation [36, 39, 40], while others find no statistically significant correlation at all [41-43]. Differences in the results of empirical studies can be explained by differences in research design (specifics of inbreeding status determination; career stage; field of science whose scientists are

the focus of the work, etc.) and differences in the institutional characteristics of the countries on whose data the studies were conducted. This indicates that the relationship between academic inbreeding practices and scientific productivity is obviously highly dependent on the external context, hence the need to study the impact of academic inbreeding under the influence of different external conditions. The thesis will attempt to identify how certain features of the external environment influence the nature of the relationship between academic inbreeding and individual academic productivity.

The Russian academic system is quite mature with a large number of universities and scientific institutes, but academic inbreeding remains its inherent feature: almost every second scientific and pedagogical worker builds his/her career in the same organisation where he/she studied [44]. There is no consensus in the few papers on the relationship between academic inbreeding and scientific productivity among Russian employees of the science and education system [44-47]. At the same time, the Russian system of science and higher education is of particular interest for studying the phenomenon of academic inbreeding and scientific productivity for two main reasons. Firstly, historically, the academic system is divided into two sectors: university and research, each of which is focused to a different extent on the fulfilment of the first and second missions [48]. Organisations of the Russian Academy of Sciences perform mainly scientific tasks, while universities perform training tasks. However, the university sector is heterogeneous, and the leading universities in their turn, in addition to teaching, are involved in the production of scientific knowledge almost on a par with research organisations [49]. The differences between sectors and the heterogeneity of the university sector have not previously been taken into account in studies of academic inbreeding in Russian data, although the research sector produces almost one third of PhDs [50]. Secondly, Russia has a very high concentration of academic organisations in metropolitan regions (Moscow, St. Petersburg and adjacent regions) and some other large cities and a relatively low concentration in other Russian regions [50, 51]. As a result, within one institutional environment

there are several locations with different infrastructural arrangements, potentially influencing the level of academic inbreeding and its effects. Thus, the peculiarities of the Russian academic system (division into sectors and differences in the concentration of academic organisations) can be used as key moderators for an in-depth study of the impact of academic inbreeding on scientific productivity.

Academic inbreeding has not been studied among those working in the research sector, although one third of all PhDs in science are prepared in organisations in this sector [50]. In addition, the vast majority of organisations in the research sector are engaged in research in natural sciences and mathematics. In the total number of Russian publications, three quarters are made in these branches of science [115]. More than a quarter of all scientists in Russia work in these fields, and it is these branches of science that receive the largest share of funding compared to others [109]. Natural sciences and mathematics make the main contribution to the scientific and technological development of the country. For these reasons, the dissertation study was carried out on the basis of data on early career scientists from physical, mathematical, chemical and biological sciences.

A methodological gap in most studies is that they assess the correlation between academic inbreeding and academic productivity, but do not test the existence of a causal relationship. There are only a few studies that have addressed the issues of assessing the causal relationship between the opposite phenomenon to inbreeding, academic mobility, and academic productivity [21, 24, 52]. At the same time, there are no works on the effect of academic inbreeding on academic productivity. A number of factors hinder the assessment of the causal relationship between inbreeding and productivity. Firstly, both career trajectory choice and academic productivity are influenced by many processes, and not all of them can be captured and used in the empirical evaluation of the inbreeding effect (the problem of unobserved variables). Second, the problem of endogeneity of variables significantly impedes the causal interpretation of the estimates of inbreeding. Empirical design also requires special attention. The elimination of such obstacles

in the study of causality is possible through the use of accurate data and special econometric tools.

Finally, there are few papers in the scientific literature on the relationship between academic inbreeding and researchers‘ scientific performance that focus on the different stages of scientists’ careers. The early career stage has only been studied on American, Spanish data [37, 41] and on a small sample of ecologists [53]. In particular, the initial stage of an academic career is of particular importance, largely determining the later success of researchers [54, 55]. For the purposes of inbreeding studies, this period is of particular importance as researchers tend to change location more frequently at a younger age, when they have not yet established a family [56] and when they are in search of the most suitable job [57]. In addition, it is worth noting that the early career stage is particularly interesting for studying the phenomenon of academic inbreeding, as it allows us to illuminate the immediate moment of entry into the academic labour market and to identify the initial factors that contribute to the retention of young researchers at their alma mater. Therefore, it is extremely relevant to focus on the first years of an academic career, the full-fledged beginning of which, as a rule, is the completion of an academic degree.

The lack of consensus in research findings on the relationship between academic inbreeding and scientific productivity, the absence of causality assessment, and the lack of attention to the early career stage make it relevant to analyse the impact of academic inbreeding on the scientific productivity of researchers in general. The high level of academic inbreeding in the Russian academic system, weak study of inbreeding issues on Russian data, unaccounted heterogeneity of the landscape of science and higher education institutions and the goals of increasing the visibility of Russian scientists' results among the international academic community justify the importance of studying the phenomenon of inbreeding in Russia.

Research questions

1. What factors determine the involvement of postgraduate graduates in the academic profession in the fields of science and mathematics?

2. What is the impact of academic inbreeding on the individual scientific productivity of Russian science and mathematics academics at the initial stage of their career?

3. How does the effect of academic inbreeding on the individual scientific productivity of Russian science and mathematics educators at the beginning of their careers differ in regional academic labour markets of different sizes, in organisations of different sectors, and in different fields of science?

Aim and objectives of the study

The main objective of the study is to analyse the impact of academic inbreeding on individual scientific productivity of PhD graduates from the fields of natural sciences and mathematics at the initial stage of their career.

Academic inbreeding is essentially a peculiarity of the academic career trajectory associated with the complete absence of inter-organisational mobility of a scientific and pedagogical worker, starting from the place of his/her education. At the same time, the phenomenon of inbreeding represents the opposite of academic mobility, and scientific and pedagogical workers with a mobile career trajectory in the academic environment act as a control group. Accordingly, an important first step in analysing the impact of academic inbreeding on academic productivity is a general description of the landscape of career trajectories. The first task is to analyse the main career trajectories and patterns of academic mobility of young Russian scientific-pedagogical workers from the fields of natural sciences and mathematics in order to clarify the peculiarities of the structure of the academic labour market in Russia.

The assessment of the causal relationship between academic inbreeding and academic productivity requires solving the problem of self-selection, which is possible by identifying the factors of academic inbreeding. In addition, clarifying the factors of inter-organisational mobility trajectories is necessary to update the

practical recommendations of the analysis. The second objective is to identify the factors of inter-organisational mobility trajectories of young academic staff from the fields of science and mathematics.

The third task of the thesis is based on the results of the two previous tasks and consists in assessing the causal relationship between academic inbreeding and individual scientific productivity of Russian science and mathematics educators at the initial stage of their careers.

Finally, given the ambiguity of the estimates of the relationship between inbreeding and academic productivity obtained in previous studies, the fourth objective is to analyse the differences in the nature of the impact of academic inbreeding on the individual academic productivity of early career academic staff depending on the field of science, the sector of the graduating academic organisation and the saturation of the academic labour market with science and higher education institutions.

An illustration of the design of the empirical part is given in Figure 1. The paper sequentially assesses the factors of academic inbreeding (relationship 1 in Figure 1), the causal relationship between academic inbreeding and scientific productivity of early career scientists within the Russian institutional context (relationship 2), then shows the role of moderating effects in the relationship between inbreeding and productivity (effects 3-5), and finally assesses the relationship between different trajectories of inbreeding and mobility and scientific productivity.

Thus, the thesis provides a general description of the careers of young PhD candidates from science and mathematics, followed by a comprehensive analysis of the effect of academic inbreeding on academic productivity, including an analysis of the causal relationship between inbreeding and productivity, and an analysis of the conditions affecting the effect of academic inbreeding.

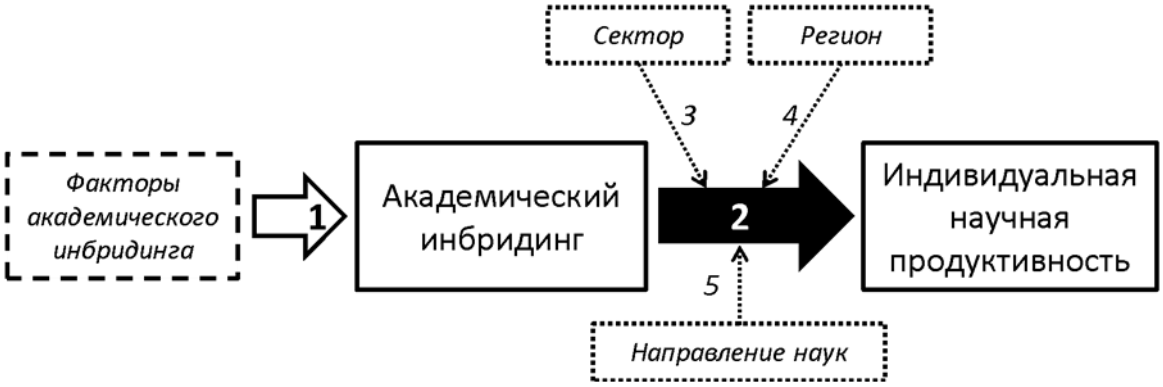

Figure 1 – Illustration of the design of the key empirical part of the thesis

Source: compiled by the author

Scientific novelty of the study

1. The thesis is the first to assess the causal relationship between academic inbreeding and individual academic productivity by testing two methods: the Instrumental Variables Method and the Inverse Probability Treatment Weighting method. Thus, the paper contributes to the development of methodological aspects of analysing the effects of academic inbreeding.

2. The thesis evaluates the influence of the fields of science, the sector of organisation and the size of the academic labour market on the nature of the relationship between academic inbreeding and individual academic productivity, which makes a significant contribution to the development of the scientific debate on the effects of academic inbreeding by clarifying the conditions under which the phenomenon has a particular impact on individual academic productivity.

3. This paper identifies and describes for the first time a career trajectory with delayed entry into the external academic labour market - ‘temporary inbreds’. This allows for a broader understanding of academic career trajectories.

4. For the first time, the association of a PhD student's involvement in joint publication activity with an academic supervisor with the likelihood of a PhD student entering the external academic labour market after obtaining a PhD degree is assessed. Accordingly, the study contributes to the discussion on the role of social ties in determining the career trajectory of young scientific and pedagogical workers.

5. This thesis study is the first to analyze the level of engagement in the academic profession, and to assess the level of academic inbreeding and its effect on individual academic productivity, comparing it with the results of a similar analysis on a sample of university sector postgraduates. This closes a gap in academic knowledge about academic career trajectories in the research sector.

Theoretical significance of the study

The dissertation research has theoretical significance, as it is the first to apply human capital theory to explain differences in the effect of academic inbreeding on individual scientific productivity, as well as to apply the matching theory to explain differences in the effect of inbreeding on the scientific productivity of scientists in regions with different levels of saturation of the academic labour market. The paper contributes to the academic debate on the relationship between academic inbreeding and individual scientific productivity by clarifying the conditions under which the relationship may be of one nature or another. Three moderators are used for this purpose: sectors of academic organisations with different organisational arrangements, regions with different infrastructural arrangements and fields of science. The analysis of the impact of academic inbreeding on scientific productivity is carried out taking into account the factors affecting the prevalence of the phenomenon among scientific and pedagogical staff.

Analyses on a full sample of young scientists working in the academic sector showed that continuing a career at an alma mater is associated with a lower probability of publishing scientific papers in international peer-reviewed publications and a lower volume of publication activity. This effect is observed among graduates from non-specialised HEIs, but is absent among academics from the research sector. Inbreds from leading HEIs are just as likely as their counterparts from HEIs without special status to publish in international journals, but those who do publish are almost identical in the number of papers to mobile researchers. Thus, graduates of universities without special status do not have sufficient human capital and, while remaining in the same environment, continue

to reproduce academic standards of low quality. In turn, the high quality of human capital provided by organisations with greater resources and higher academic standards (leading HEIs and research organisations) can offset the negative effect of academic inbreeding.

The situation is somewhat different among young researchers with a high level of human capital: academic inbreeding does not have a negative impact on scientific productivity. Moreover, the phenomenon has a positive effect on the performance of highly productive scientists in leading universities and in regions with a small number of employers in the academic environment. This indicates the importance of qualitative characteristics of human capital: if they are high, academic inbreeding does not create risks for the individual productivity of scientists at the initial stage of their career.

With a wide choice of employers in the regional academic labour market, it is much easier for researchers to find the most suitable job. Accordingly, continuing their career at their alma mater often becomes disadvantageous for young scientists, as they miss opportunities to find a job that would best fulfil their potential. As a result, inbreed scientists lose out in terms of publication activity to their mobile colleagues in regions with a saturated academic labour market.

The role of social factors of academic inbreeding is confirmed: it was found that collaboration with a supervisor during the preparation of a dissertation research increases the probability of subsequent career development at the alma mater among young scientists from peripheral regions. In central regions and in organisations with a greater focus on research activities (research sector organisations and leading universities), postgraduate graduates with higher quality human capital remain at their alma mater. In HEIs without special status, more productive researchers enter the external academic labour market. The paper also identified a new category of researchers in relation to their mobility trajectory - ‘temporary inbreds’; it is shown that the trajectory of gradual entry into the external academic labour market (the trajectory of ‘temporary inbreds’) does not

correlate with researchers' academic productivity, while the trajectory of “adherents” is associated with a lower level of productivity than that of inbreds.

Thus, the dissertation research claims to fill three significant gaps in the scientific knowledge of academic inbreeding, as well as to add to it in a fundamentally new way. Firstly, it addresses the issue of the causal relationship between academic inbreeding and academic productivity. Second, it clarifies the conditions affecting the relationship between academic inbreeding and academic productivity, thereby eliminating the problem of ambiguity in the effect of inbreeding on individual academic productivity. Third, the paper identifies the role of academic supervisor in career trajectory choice. Finally, a new type of career trajectory associated with academic inbreeding - the trajectory of temporary inbreeding - is proposed.

Practical significance of the study

The key value of this study in terms of practical application of its results is to clarify the conditions under which academic inbreeding affects the academic productivity of young researchers in one way or another. Accordingly, based on the results of the work, it is possible to develop differentiated measures to regulate academic careers.

The study has shown that, given the overall low mobility in the Russian academic labour market, academic inbreeding reduces the probability that a researcher will publish in publications indexed by international bibliometric databases. Young inbreeding scientists from universities without special status, as well as inbreeding scientists from metropolitan regions show on average a lower volume of publication activity than their mobile colleagues. At the same time, the publication activity of scientists who regularly publish in international editions does not differ much depending on the specifics of their academic career trajectory. Moreover, highly productive inbreds from leading universities, as well as inbreds from medium and small regions even surpass mobile researchers in terms of publication activity. Thus, under current conditions, young researchers from universities without special status and from organisations in metropolitan regions

should be encouraged to plan their careers outside their alma mater. Highly productive early career researchers from leading HEIs and from regions with a small number of employers in the academic environment should follow a career trajectory associated with academic inbreeding.

The observed negative effect of academic inbreeding on research productivity in HEIs without special status points to the need for a deeper study of HEIs in this category and the development of measures to curb the reproduction of low quality standards in them. Universities in this group need to strengthen staff circulation, including attracting productive researchers from more prestigious organisations to ensure an influx of good research practices. One of the reasons for problems in human resource management at universities without special status may be insufficient funding, as state initiatives in the 2010s covered primarily leading universities. Consequently, the state should pay attention to mass universities and develop measures to support research activities and regulate human resources policy in them. The Priority-2030 programme implemented in the 2020s develops competition between universities without special status, which presumably can have a positive impact on the quality of the environment of organisations in this category, but this requires further study.

Academic inbreeding reduces the scientific productivity of researchers from metropolitan regions. This result has implications not so much for the regulator as for the scientists themselves, indicating that in the context of high availability of switching from one employer to another, a mobile strategy is more favourable for scientific productivity, as it allows finding the most suitable employer.

While academic inbreeding has a positive impact on the scientific productivity of young researchers regularly publishing in international journals in the case of leading HEIs and in the case of small and medium-sized regions, mobile researchers perform more poorly and need additional support. Consequently, there is a need to strengthen the research training of PhD students and to expand programmes to support their academic mobility so that they are more prepared for mobility to other organisations later in their careers. In addition,

measures to support mobile scientists need to be developed, including the introduction of various tools for the adaptation of new employees in Russian institutions of science and higher education.

The results of the study showed that academic inbreeding is more characteristic of regions with a low concentration of science and higher education institutions. The high concentration of scientific organisations and high transport accessibility in the European part of Russia and the remoteness of a number of major scientific centres outside the Urals provide young scientists from different parts of the country with unequal opportunities for developing their scientific careers. This is confirmed both by the different levels of mobility and the difference in the size of co-author networks in the central and peripheral regions[4]. Given the significant differences in the accessibility of mobility for researchers from different parts of the country, it is advisable to develop tools that would increase the accessibility of the transition between academic organisations regardless of their geographical location. Such instruments could include programmes to support academic mobility between science and higher education organisations, including providing hostels or subsidising rental costs for mobile researchers and their families, subsidising transport costs for mobile researchers (e.g. for holiday travel) or supporting short-term academic mobility.

Provisions for defense

1. A characteristic feature of the academic labour market in Russia is the orientation towards internal recruitment. The level of academic inbreeding is lower in regions with a more developed labour market and higher among graduates of postgraduate programmes of research organisations and leading universities.

2. The quality of a researcher's human capital, expressed by the volume and quality of publication activity in the period before the thesis defence, is a significant predictor of academic inbreeding in the central regions. Involvement in

[4] In this study, the central regions are defined as Moscow and the Moscow Region, St. Petersburg and the Leningrad Region, as the regions with the most developed infrastructure and the highest concentration of scientific and higher education institutions. The peripheral regions are all other regions of the Russian Federation.

co-authorship with a supervisor is a significant predictor of academic inbreeding in peripheral regions.

3. Academic inbreeding in general does not affect the individual scientific productivity of young Russian researchers of natural science profile who regularly publish in international journals. The effect of academic inbreeding becomes positive in conditions of relatively small size of the local academic labour market.

4 The nature of the relationship between academic inbreeding and individual scientific productivity depends on the size of the local academic labour market and the level of prestige of the organisation. The larger the size of the academic labour market, the greater the negative effect of academic inbreeding. Graduates of more prestigious organisations are less susceptible to the negative effect of academic inbreeding.

5. The level of involvement in the academic profession and the quality of publication activity of PhD graduates varies by sector of organisation and field of science. Two thirds (68%) of defending PhD graduates and postgraduates are involved in research activities, of which nine out of ten young scientists have published at least one paper in international publications. Researchers from the research sector and from leading universities are more likely to stay in academia (78 and 67% respectively) and more likely to publish in peer-reviewed international journals if they remain in academia (83 and 79% respectively) than those whose alma mater belongs to the group of universities without special status (55% remain in academia and of these only 58% publish in international journals). Regarding fields of science, young PhDs in biological sciences remain in academia less often than degree holders in chemistry, mathematics or physics (67% vs. 82, 76 and 80% respectively). Of those who remain in academia, the highest proportion of researchers who publish internationally is among physicists (76%) than among biological, chemical or mathematical scientists (67, 67 and 63% respectively).

Approbation of the results of the study

The list of publications of the author, where the basic results of the thesis are represented	1. Kryachko V. Otsenka akademichesloy mobilnosti issledovateley: vozmozhnosti i ogranicheniya sushchestvuyushchikh podkhodov [Academic Mobility Assessment: the Strengths and Limitations of Different Approaches] // *Universitetskoe upravlenie: praktika i analiz / University management: Practice and Analysis*. 2020. T. 24. №4. P. 130-145. https://doi.org/10.15826/umpa.2020.04.040
	2. Slepykh V., Lovakov A., Yudkevich M. Research career after defence: case of four fields of study in Russia *// Educational Studies Moscow,* 2022. № 4, С. 260-297
	3. Nefedova A.I., Chefanova E.I., Slepykh V.I., Ivashchenko A.D. (2024) Effects of Participation in Domestics Mobility for Young Researchers and Lecturers. Voprosy obrazovaniya / Educational Studies Moscow, no 2, pp. 203–225 (In Russian).
The list of scientific conferences, where results of the thesis were presented	1. 46th EAIR Cork forum, University College Cork, Cork, Ireland, 21-23 августа 2024. Report: The relationship between academic inbreeding and publication activity in academic profession
	2. 35th annual CHER Conference, Vienna University of Economics and Business, Vienna, 31 August - 1 September 2023. Report: The impact of academic inbreeding on individual researchers' productivity: the case of Russian early-career researchers in natural sciences and Mathematics
	3. XXIV Yasin (April) international academic conference on economic and social development, HSE, Moscow, 4-14 April, 2023. Report: Academic inbreeding and social capital of Russian early-career researchers
	4. XVI All-Russian Scientific Conference "Exhibition of Achievements of Scientific Economy", The European University at Saint-Petersburg, 25 March, 2023. Report: Academic career in Russia: trajectories after theses defence
	5. XII International Russian conference on Higher education, HSE, Moscow, 26-28 October, 2022. Report: The impact of academic inbreeding on researchers' productivity
	6. XXIII Yasin (April) international academic conference on economic and social development, HSE, Moscow, 5-22 April, 2022. Report: Academic career pathways of Russian researchers
	7. XII International Russian conference on Higher education, HSE, Moscow, 14-16 October, 2021. Report: Academic Mobility Assessment: the Strengths and Limitations of Different Approaches

Theoretical basis of the study

The theoretical framework of the study is based on human capital and labour market matching theory. The former is used to explain differences in the effect of academic inbreeding on research productivity in science and higher education organisations in different sectors. The second theory is used to explain differences in the effect of academic inbreeding on academic productivity in regions with different sizes of academic labour market. The following section discusses each of the theories as they apply to the effects of academic inbreeding.

Human capital is a person's skills, knowledge and abilities, the result of the application of which is the production of some useful product [86]. The basic factor of human capital is education, along with this and other factors, the acquisition of skills knowledge and skills can occur through various experiences [20]. Academic inbreeding is a characteristic of a career trajectory in which a researcher realises his/her human capital in the same environment where he/she acquired it. As a consequence, the researcher's knowledge, skills, and research practices are not complemented and developed through integration into a new environment, and the professional experience of the inbred researcher is limited [32, 37, 42, 87]. At a high level of inbreeding in a team, significant stagnation of the researcher's human capital development is possible [38], if other ways of improving the quality of human capital are not implemented (e.g., short-term mobility, additional education, collaborations with other teams, etc.) [88-90]. In addition, academic inbreeding can be associated with the ‘nurturing’ of personnel with specific human capital relevant to the alma mater's environment [91]. At the same time, the owner of such capital may be successful at his/her alma mater, but may also face the loss of relevance of the acquired human capital when moving to another environment [34, 69]. As a result, mobility may require the researcher to make additional efforts to acquire new skills and knowledge [21, 35].

The effect of academic inbreeding on a researcher's human capital may differ depending on the organisational characteristics of the alma mater [67, 110]. In prestigious organisations that provide their graduates with the best quality of

human capital [23, 92, 111, 112] there is often a high level of academic inbreeding. This is attributed to the fact that very few external candidates can apply for positions at prestigious HEIs, and graduates of such institutions do not have much choice of alternative HEIs with equally high quality environments in the academic labour market [1, 23, 28, 92]. Given the high quality of the environment and human capital of prestigious universities, academic inbreeding does not usually have a negative effect on the productivity of their researchers [37, 40]. Thus, academic inbreeding may affect the quality of human capital differently depending on the characteristics of the organisational environment. Those coming from prestigious organisations may be as competitive in the case of mobile careers as they are in continuing their careers at alma maters, at least in the early stages of their careers. In addition, the environments of prestigious universities are well resourced, which can have a positive impact on the diversity of experience of alumni who remain working at their alma mater. Whereas graduates from universities without special status acquire lower quality human capital and, while remaining at their alma mater, continue to reproduce academic standards of low quality. However, by entering the external academic labour market, especially by moving to an organisation with an environment of higher quality than their alma mater, researchers from non-selective organisations may have the chance to increase their academic productivity through new experiences.

The application of human capital theory to the question of the effect of academic inbreeding on scientific productivity allowed us to formulate the first hypothesis:

H1: The sector of the academic organisation (in terms of prestige) moderates the relationship between inbreeding and the productivity of young scientists in such a way that the negative effect of academic inbreeding is mitigated in more prestigious organisations.

Different conditions at the institutional level may have different effects on the relationship between academic inbreeding. In studies by McGee (1960) and Tavares et al. (2017), academic inbreeding was shown to have a positive

relationship with researcher productivity in remote regions with academic labour markets of low size [40, 93]. Differences in the relationship between inbreeding and productivity depending on the size of the academic labour market can be explained by the matching theory, in other words, matching the employee to the job.

At the individual level, one of the models explaining mobility in the labour market is the 'reward-resource' model [57, 94], according to which workers tend to look for a job that best compensates them for the resources spent on acquiring knowledge and skills. Alternatively, mobility may be stimulated by the desire to find a job where a specialist can best realise his or her potential and get the maximum return on his or her human capital [95]. According to this approach, in a perfectly competitive labour market, the career trajectory associated with academic inbreeding would signal that the alma mater is indeed the best place for a particular professional to work and his or her potential is best realised there. In an imperfect labour market, on the contrary, academic inbreeding may represent a missed opportunity, whereby academics who remain at their alma mater may have lower productivity than those who have entered the external labour market in search of a more suitable job.

In the case of an imperfect labour market, academic inbreeding may appear to be a forced career trajectory as all others are unavailable to the researcher. The inaccessibility of other positions may be due to the inability to move to other organisations in other cities for family reasons or lack of money to move/unprofitable to move. Another reason for 'forced' inbreeding may be the peculiarities of an internally oriented organisational culture, where the practice of building a career at the alma mater is perceived as the only true one [85, 113] and mobility is interpreted in the rhetoric of 'betrayal' [73]. [73]. Accordingly, such an organisational culture is hardly ready to accept external candidates, hindering the free circulation of human capital. The most extreme form of recruitment that hinders the adequate distribution of human capital is nepotism and disregard for meritocratic principles, when 'own' people are hired for one purpose or another,

and their knowledge and skills are not taken into account [114]. In such circumstances, both mobile researchers cannot be recruited to an organisation that might be a good fit for them and inbreds potentially lose opportunities to find an employer with more suitable conditions except in the case of elite academic institutions. For researchers from elite organisations, there may simply be no decent alternatives in the labour market, so the trajectory of ‘forced’ inbreeding for them leads to higher academic productivity or the same as their mobile colleagues [1, 23, 37]. Thus, imperfections of the academic labour market and external environment, prejudices of the organisational culture can form conditions for inefficient allocation of human capital.

In the case of a labour market saturated with academic organisations, the researcher has a wide choice of employers, accordingly, they are almost free to seek the most suitable post-degree employment. By entering the external academic labour market, researchers can acquire advantages by finding the most suitable job and fully realise their human capital. On the contrary, if there are few employers in the labour market, researchers' choices are limited, which can potentially offset the negative effect of academic inbreeding on academic productivity. Accordingly, the second hypothesis of the thesis research is as follows:

H2: The number of science and higher education organisations in a region moderates the relationship between academic inbreeding and the scientific productivity of early career researchers such that the negative effect of inbreeding is stronger in regions with more organisations.

Methodology

Data.

The sample consisted of 2102 researchers who defended PhD theses in 2012 in biological, chemical, and physical and mathematical sciences in Russian dissertation councils. Two data sources were used. The abstracts of all defended researchers in the above sciences were downloaded from the website of the Higher Attestation Commission (HAC). The sample is considered to be representative, as announcements of theses defences are published on the HAC website on a mandatory basis. The second source was the international bibliometric database Scopus, from which the metadata of all publications of the researchers in the sample were downloaded. For scientists who did not have publications in Scopus-indexed sources, data on their careers were searched on the Internet and in the Russian Science Citation Index (RSCI) database without downloading publications. In the total number of Russian publications, three quarters were made just in these branches of science [105-108]. More than a quarter of all scientists in Russia work in these fields, and these branches of science receive the largest share of funding compared to others [109]. And it is natural sciences and mathematics that make the main contribution to the scientific and technological development of the country.

Variables.

The paper uses the following operationalisation of the main constructs. Inbreed is defined as a researcher who works in the same organisation where he/she prepared the thesis. Individual scientific productivity is measured by such indicators as the total number of publications in sources indexed by Scopus, their citations, Hirsch index, area-weighted citation index, number of publications in first quartile journals.

Methods.

Several statistical and econometric methods were used in this paper. The non-parametric Pearson's chi-square test was used to test the significance of differences between groups of researchers in describing their career trajectories.

In order to assess the impact of academic inbreeding on the individual scientific productivity of researchers, two methods were tested: the method of instrumental variables and Inverse Probability Treatment Weighting (IPTW). As instruments, an attempt was made to use, firstly, the physical distance from the alma mater to the nearest organisation with a similar research activity to that of the young scientist, and secondly, an adapted Herfindahl-Hirschman index characterising the size of the network of organisations engaged in the same research activity. The IPTW method is an improved version of the propensity score matching method. The essence of IPTW is to eliminate the self-selection problem by comparing the productivity of individuals from the group of mobile researchers and from the group of inbreds with the most similar characteristics, and to eliminate the endogeneity problem by inverse weighting the weights. However, instrumental variables were weak and valid results were obtained using the IPTW method.

Logit regression and multinomial logit regression were used to identify factors of academic inbreeding and mobility. The moderating effects and estimation of different academic trajectories on academic productivity were assessed using the negative binomial regression method.

Limitations of the study.

Firstly, absolutely all publications of researchers are not included in the analysis, as the Scopus database covers only a part of the publishers with the highest quality standards, while many publications in local journals remain out of focus. Secondly, bibliometric data do not have a high accuracy of identifying the moment of transfer to another organisation, as it is impossible to reliably identify the organisation where the researcher worked in a year when no publications of the researcher are observed. Third, researchers‘ productivity was assessed through scientometric indicators, which allow comparing a large number of researchers among themselves, but cannot fully reflect the substantive quality, value and usefulness of researchers’ work. Fourthly, the use of open data sources does not provide data on the personal characteristics of researchers and the characteristics of

their workplaces. Finally, the paper uses data on early career researchers from the three fields of natural sciences and mathematics, which does not allow us to extrapolate the results to researchers from other fields, especially the humanities and social sciences, as the latter have a completely different organisation of research activities.

Results

Career trajectories of researchers

Overall, the university sector produces more PhDs than the research sector (63% and 37% respectively). Almost half of PhD graduates from universities without special status (45%) do not choose a research-related academic career, and conversely, the majority of PhD graduates from leading universities (67%) and research sector organisations (78%) pursue an academic career and are actively involved in research-related academic activities. At the same time, researchers from universities without special status are much less likely to publish in international journals than their colleagues from leading universities and research organisations (32%, 53% and 65%, respectively). Researchers from research sector organisations are more likely to stay at their alma mater for the first eight years of their academic career compared to researchers from universities (57% and 48%, respectively).

Summarising, we can say that the majority (68%) of scientists who defended their PhD thesis in Russian dissertation councils remained in the academic environment, three quarters of them publish their work in international journals, and the rest publish articles in local journals. Every tenth scientist found a job outside academia. A further 22% either continued to work in the academic sector, but their activities are not related to research, or moved to the non-academic labour market.

Geographical mobility of scientists is at a low level, which corresponds to the generally low mobility of the Russian population. Only 106 researchers (10.7% of all "active" scientists) moved to an organisation in a city different from the one where they prepared their dissertation, and 98 scientists (9.9%) moved to a new place of work abroad, almost 20% of whom subsequently returned to Russia. Half (52.9%) of all dissertations were written in organisations located in just four Russian cities - Moscow, St. Petersburg, Novosibirsk and Kazan Thus, the uneven distribution of PhD training organisations across Russia is evident.

Academic inbreeding is a very common phenomenon among Russian academics. Almost half of the researchers in the sample continue their careers in the same organisation where they studied: the data obtained show an inbreeding level of 52%. Another 17% of degree holders worked at their alma mater for an average of 4-5 years after defence and then changed employers. One in ten researchers moved to another organisation but did not change employers once after the defence (adherents), and 18% of researchers left their alma mater immediately after the defence and then changed employers at least once.

Factors of academic inbreeding

The field of science is a significant predictor of the level of academic inbreeding. Among researchers in the natural sciences, researchers are more likely to stay at their alma mater (50% among biologists, 61% among chemists and 58% among physicists), while among mathematicians the level of inbreeding is 29%. A higher concentration of academic organisations in central regions is associated with lower levels of academic inbreeding than in peripheral regions (49% and 58%, respectively). Other significant factors of academic inbreeding include higher productivity in the pre-dissertation period, expressed in the number of publications in international publications, and having co-authored publications with a supervisor in the pre-dissertation period. However, these results vary by sector and region of the alma mater.

Female researchers are somewhat more likely to remain in organisations in the central regions, as well as those who defended their dissertations where they prepared them. The presence of multiple affiliations increases the likelihood of entering the external academic labour market. At the same time, more productive researchers are more likely to stay at their alma mater. All other variables were statistically insignificant for researchers from central regions. For researchers from peripheral regions, factors such as the larger size of the organisation and close interaction with the supervisor were consistent predictors of academic inbreeding. Researchers from universities without special status leave their alma mater more often than their colleagues from organisations in other sectors. Thus, while in

central regions the probability of academic inbreeding is determined by the lack of links with other organisations and higher publication activity, in peripheral regions the involvement in the alma mater team plays a significant role.

Young scientists who have completed their theses in research sector organisations are more likely to leave their alma mater if it is located in large cities. The probability of a career associated with academic inbreeding is higher for more productive researchers and for researchers who have published all their work in co-authorship with a supervisor. For researchers from the university sector, all factors considered were statistically insignificant. Thus: researchers of all characteristics have a better chance of staying at their alma mater.

The level of publication activity in the period before the thesis defence has a small, but still statistically significant, positive effect on the probability of academic inbreeding. Mobile researchers have an average number of publications before thesis defence of 3.48, while inbred researchers have an average number of publications before thesis defence of 4.55. Thus, more productive researchers remain at their alma mater. However, in a more detailed analysis it was noted that this conclusion is only true for researchers from leading HEIs and from research sector organisations. In universities without special status, on the contrary, less productive researchers continue their careers after defending their thesis, while their more productive colleagues enter the external academic labour market. The research sector and leading HEIs train more productive researchers. The higher level of inbreeding in organisations in this sector and the fact that the most productive young researchers stay at their alma mater is quite natural if we consider them as elite organisations in the academic labour market. In other words, it is disadvantageous for researchers from these sectors to move to less well-off HEIs without special status, and it is unlikely that they will move to other research sector organisations or leading HEIs, perhaps because of the small number of organisations with a suitable specialisation.

Impact of academic inbreeding on scientific productivity

Estimation of causality

No statistically significant effect of academic inbreeding on the majority of productivity indicators of young Russian researchers from natural sciences was found in the sample of researchers regularly publishing in international journals (Table 1). Nevertheless, in regions with medium and small size of the academic labour market, a positive effect of academic inbreeding on the quality and volume of publication activity of young researchers was observed. Inbreeding researchers in leading universities publish a slightly higher number of papers, inbreeding researchers from large regions have lower values of the field-weighted.

Table 1 - Mean effect of the influence of academic inbreeding on the academic productivity of researchers from different groups

		Publications	Normalised by year and discipline number of citations	Hirsh-index	FWCI	Q1 publications	N
Total sample	ATE	1.055	-3.86	-0.21	-0.04	-0.89	870
	Average	18.82	31.05	6.07	0.60	5.61	
Metropolitan cities and their regions	ATE	0.55	-0.55	-0.68	-0.00	-1.03	408
	Average	19.91	32.90	7.08	0.63	6.13	
Large regions	ATE	1.52	-6.41	0.03	**-0.16****	-0.95	271
	Average	18.09	32.34	5.96	**0.65**	5.39	
Medium and small regions	ATE	**6.01****	2.53	**0.85***	0.08	**2.31****	192
	Average	**13.09**	15.99	**3.77**	0.43	**2.07**	
Research sector	ATE	1.37	-5.39	-0.54	-0.15	-0.94	420
	Average	18.7	34.21	6.95	0.70	5.80	
Institutions of higher education without special status	ATE	-1.12	-2.03	-0.18	0.12	-0.07	186
	Average	14.31	18.50	3.85	0.41	2.67	
Leading universities	ATE	**7.48*****	7.01	0.73	0.00	1.17	265
	Average	**15.94**	23.83	5.51	0.59	4.50	

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

Source: compiled by the author

Thus, academic inbreeding does not generally affect the intensity and quality of labour of researchers who regularly publish in Scopus-indexed publications, with the exception of regions with a relatively small academic labour market and leading universities.

Estimation of moderating effects on the relationship between inbreeding and scientific productivity

Regression analysis of the relationship between academic inbreeding and researcher productivity on the full sample of academics working in academic organisations showed that academic inbreeding is a negative rather than positive practice. Inbreds are less likely to publish in international journals than their mobile counterparts (Table 2). This result is robust when using a count regression controlling only for research area.

Table 2 - Results of negative binomial regression estimation of the association between academic inbreeding and publication activity after defence (odds ratios for the null part and incidence rates for the count part)

	Full list of variables		**Short list of variables**	
	Zero part	Count part	Zero part	Count part
Inbred	0.388*** (0.081)	0.845*** (0.051)	0.93*** (0.193)	0.918 (0.06)
Field of study (biology – basic)				
Chemistry	3.892*** (1.442)	1.314*** (0.103)	2.064*** (0.342)	1.651*** (0.137)
Mathematics	1.258 (0.464)	0.589*** (0.084)	0.123 (0.335)	0.668*** (0.101)
Physics	1.642* (0.417)	1.412*** (0.108)	1.111*** (0.21)	2.124*** (0.159)
Alma-mater's sector (research sector – basic)				
Universities without special status	0.434*** (0.104)	0.721*** (0.057)		
Leading universities	0.714 (0.189)	0.998 (0.07)		
Region (metropolitan regions – basic)				
Large regions	0.753 (0.192)	0.993 (0.068)		
Medium and small regions	0.722 (0.177)	1.177** (0.091)		
Male	1.151 (0.233)	1.378*** (0.086)		
Publications before defence	1.621*** (0.115)	1.083*** (0.008)		
Log-likelihood	-0.352 (0.048)		-0.14 (0.046)	
AIC	6894.921		7119.804	
N	1132		1132	

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

A coefficient value >1 means a positive relationship, <1 means a negative relationship

Source: compiled by the author

In assessing the moderating effects on the relationship between academic inbreeding and scientific productivity, the following results were obtained (Table 3).

There is no difference in the level of publication activity between inbred and mobile researchers if they prepared their dissertations in research sector organisations. Inbreed researchers from top universities are slightly less likely to publish in journals indexed by Scopus. At the same time, academic inbreeding is negatively correlated with both the probability of publication in international journals and the volume of publication activity of researchers if they are graduates of universities without special status.

Academic inbreeding is strongly correlated with a lower probability of publication in international journals regardless of the location of the alma mater. However, the size of the regional academic labour market has a different effect on the effect of academic inbreeding on the scientific productivity of young academic staff. Namely, the number of publications is significantly lower for inbreds from metropolitan cities and regions compared to mobile researchers, and about the same for inbreds and mobile researchers from other regions.

Academic inbreeding is negatively associated with both the likelihood of publishing indexed papers and the level of publication activity of early career researchers from the biological, physical sciences and mathematics fields. Chemical researchers who continue their career at their alma mater after defending their thesis are expected to have lower publication activity than their mobile counterparts, but the probability of publishing in an international journal is comparable to that of mobile researchers.

Table 3 - Results of negative binomial regressions estimating the association between academic inbreeding and post-defence publication activity, taking into account moderating effects[5]

		The dependent variable is the probability of publishing a paper in an international peer-reviewed journal (odds ratios).	Calculated part: dependent variable - number of publications in Scopus (incidence rate ratios)
Alma-mater sector	Inbreds versus mobile scientists: only the research sector	0.565 (0.201)	0.887 (0.076)
	Inbreds versus mobile scientists: only HEIs without special status	**0.258*** (0.086)**	**0.584*** (0.072)**
	Inbreds from leading HEIs vs. mobile scientists: only leading HEIs	**0.462* (0.189)**	1.047 (0.114)
Region by saturation of the academic labour market	Inbreds versus mobile scientists: metropolitan cities and surrounding regions only	**0.274*** (0.11)**	**0.805** (0.071)**
	Inbreds versus mobile scientists: only large regions	**0.379** (0.147)**	0.88 (0.094)
	Inbreds versus mobile scientists: medium and small regions only	**0.498** (0.158)**	0.879 (0.106)
Field of study	Inbreds versus mobile scientists: only biology	**0.566** (0.142)**	**0.662*** (0.071)**
	Inbreds versus mobile scientists: only chemistry	0.783 (0.57)	**0.772* (0.119)**
	Inbreds versus mobile scientists: only maths	**0.129** (0.11)**	**0.405*** (0.123)**
	Inbreds versus mobile scientists: only physics	**0.122*** (0.077)**	**0.815* (0.101)**

**** p<0.01, ** p<0.05, * p<0.1*
Standard errors in brackets
A coefficient value >1 means a positive relationship, <1 means a negative relationship
Source: compiled by the author

[5] The table shows the coefficients of only the key variables from three different regressions: 1) a regression of academic inbreeding with the moderating effect of alma mater sector on scientific productivity; 2) a regression of academic inbreeding with the moderating effect of region on scientific productivity; and 3) a regression of academic inbreeding with the moderating effect of branches of science on scientific productivity. Full tables with control variables are provided in Appendix 2 of the thesis.

Differences in the scientific productivity of researchers depending on the trajectory of inter-organisational mobility

Full inbreds do not differ practically in their level of scientific productivity with researchers with other career trajectories, with the exception of adherents - researchers who moved to an organisation other than their alma mater almost immediately after defending their thesis and did not change jobs again during the observed first eight years of their career in academia. The trajectory of adherents is associated with lower scientific productivity compared to full inbreds in most indicators: total number of publications in Scopus, Hirsch index, and number of publications in first quartile publications.

Conclusion

The tasks set in the framework of the study have been fulfilled. The career trajectories of Russian early career researchers from the fields of natural sciences and mathematics were analysed, and the factors of their trajectories of inter-organisational mobility were identified. The influence of academic inbreeding on individual scientific productivity of young Russian scientists in four fields of sciences was assessed. The conditions influencing the relationship between inbreeding and productivity were specified.

Obtaining a PhD in biological, chemical or physical-mathematical sciences in Russia is primarily for the purpose of pursuing an academic career. Almost half of PhD graduates, after receiving their degrees, remain employed in the same organisation where they prepared their dissertations: the overall level of academic inbreeding exceeds 50%. At the same time, young inbreeding researchers remain invisible to the international academic community more often than their mobile colleagues.

So, the effect of academic inbreeding is ambiguous. This thesis reveals the conditions under which academic inbreeding affects individual academic productivity in one way or another. By taking into account the characteristics of the organisational environment, we conclude that academic inbreeding is neutral for the quality of human capital in more prestigious organisations and potentially harmful for less prestigious academic organisations. Inbreeding has no effect on the productivity of young academics from the research sector: they remain equally productive in their alma mater or in another organisation. In the university sector, academic inbreeding is negatively associated with the visibility of early career academics internationally. However, in top HEIs, academic inbreeding does not have as negative an effect on individual productivity as it does in HEIs without special status. Consequently, in more prestigious organisations (in terms of research orientation) inbreeding does not pose a threat to the quality of researchers' human capital at the beginning of their careers. The same cannot be said about mass segment HEIs, where researchers who remain at their alma mater are less

productive than those who have entered the external academic labour market. Thus, the high quality of human capital provided by the educational environment during the training of highly qualified specialists can offset the negative effect of academic inbreeding.

The size of the academic labour market affects the relationship between inbreeding and individual scientific productivity. In the context of a very wide choice of employers in metropolitan regions, academic inbreeding is negatively related to the intensity of publication activity of young scientists, which may indirectly indicate an inefficient distribution of human capital. However, in peripheral regions, regardless of the size of the academic labour market, inbreeding does not pose a threat to the productivity of early career academics. Moreover, inbreeding scientists from regions with medium or small size of academic organisations who regularly publish in international journals have even higher indicators of the volume and quality of publication activity. Accordingly, territories with different size of the academic labour market need different measures for regulating academic careers.

Based on the results obtained, the following recommendations can be formulated.

A characteristic feature of the academic labour market in Russia is the orientation towards internal recruitment: the level of academic inbreeding is lower in the central regions of Russia, where there is a high concentration of science and higher education organisations and higher transport accessibility. Consequently, scientists from more remote regions and regions with lower transport accessibility need additional support for academic mobility and the development of other activities aimed at intensifying interaction between scientists from different academic organisations.

The interaction of a young researcher with a supervisor is a significant predictor of academic inbreeding. This can potentially create risks for the observance of meritocratic principles in the recruitment of scientific and pedagogical staff and reduce the efficiency of human resource allocation in the

academic labour market. In this situation, in addition to various material and organisational measures to support the circulation of academic staff, it is important to increase the willingness and interest of heads of departments to attract external candidates and to encourage their graduate students and subordinates to gain diverse professional experience outside their alma mater.

Depending on the environment, there are differences in the relationship between the quality of a young researcher's human capital and his or her subsequent career trajectory. In particular, in organisations that are more research-oriented (leading HEIs and research organisations), researchers with higher quality human capital are more likely to stay at their alma mater. In HEIs without special status, the opposite situation is observed, when researchers with lower productivity become inbred. Thus, it can be assumed that HEIs without a special status may create risks of reducing the quality of human capital and the quality of fulfilment of research and educational functions. Most initiatives to reform the higher education system are aimed at the strongest HEIs. However, HEIs without special status, which train one third of highly qualified specialists, remain unsupported. Therefore, it is crucial to study in-depth the peculiarities of research activities in the group of these HEIs and then develop measures aimed at supporting and developing research activities in HEIs without special status.

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