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INBREDS AND NON-INBREDS AMONG RUSSIAN ACADEMICS: SHORT-TERM SIMILARITY AND LONG-TERM DIFFERENCES IN PRODUCTIVITY[5,6]

This paper studies the publication productivity of inbreds and non-inbreds among Russian academics. The literature provides ambiguous results on the relationship between inbred status and productivity. This may be explained by the focus on different segments of academia as well as by using different indicators for measuring publication productivity. We exploit data from 3 datasets covering different segments of the academic population and included different indicators of the publication productivity to see whether inbreds and non-inbreds differ in their productivity. We did not find any difference in current publication productivity between s and non-inbreds. We found, however, a difference between inbreds and non-inbreds in whole career publication productivity; non-inbreds are more productive on an individual level. While focusing on Russian data, an analysis of the 3 datasets suggests an explanation for the contradictory existing results on the relationship between academic inbreeding and productivity in general.

JEL Classification: I21, I23
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Keywords: academic profession, academic inbreeding, academic productivity, publication activity, Russia.

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1. Introduction

Academic inbreeding – the practice of hiring a university's own graduates – has been widespread in most academic systems for centuries. However, it began receiving attention only at the beginning of the 20th century. Since that time academic inbreeding has been regarded as an important problem and has been widely discussed both by academics themselves and policymakers and university practitioners administration (Eells & Cleveland, 1935a, 1935b; McGee, 1960; Musselin, 2004; Soler, 2001; Yudkevich, Altbach, & Rumbley, 2015). The practice of inbreeding is very widespread among Russian scholarsacademics. Perceiving low mobility as the norm, the majority of Russian academics are employed in the same university over their entire career. According to Horta and Yudkevich (2016) only 10% have been employed in two or more institutions since gaining a higher degree, only 5% have been employed by two or more institutions among junior academics, and among senior academics 53% have worked at a single institution their entire academic career. According to a survey of a representative sample of Russian university faculty conducted in 2016, 45% of them studied at the university where they started their career and now work. Inbreeding is considered to underlie the importance of seniority over research proficiency, since younger academics are required to maintain good relationships with their seniors and avoid scientific independence for career progression, while mobility can be considered as a sort of betrayal.

Inbreeding is commonly regarded as a negative practice, which leads to knowledge stagnation and prevents the circulation of scientific ideas (Berelson, 1960; Horta, 2013; Pelz & Andrews, 1966). Numerous empirical studies examine the effects of inbreeding on an individual level and explore the link between inbreeding and publication productivity – the most easily measured academic scientific output. While inbreeding is usually considered harmful practice for academic systems, the literature reports ambiguous results on this link: some papers show that inbred faculty (those academics who work in the university of graduation) are less productive than their colleagues hired from outside (Dutton, 1980; Eells & Cleveland, 1935b; Eisenberg & Wells, 2000; Hargens & Farr, 1973; Horta, 2013; Horta, Veloso, & Grediaga, 2010; Inanc & Tuncer, 2011), while others demonstrate that inbreds are more productive researchers (Klemenčič & Zgaga, 2015; McGee, 1960; Wyer & Conrad, 1984). Some other papers do not find any statistically significant differences in productivity of inbred and non-inbred faculty (Cruz-Castro & Sanz-Menéndez, 2010; Roleda, Bombongan, Tan, Roleda, & Culaba, 2014; Smyth & Mishra, 2014; Sologub & Coupé, 2015).

This ambiguity in results may be explained by the fact that different papers look at different segments of the academic sector and use different indicators for measuring publication productivity. Our study analyses the relationship between academic inbreeding and publication productivity on data from different segments of the academic system using different indicators of publication productivity. To do so we compare the results for three subsamples of Russian academia – 2 samples that represent

Russian faculty in general (under different policy regimes and with different operationalizations of inbreeding) and a sample of those who are the most productive and are recognized by their academic peers. We use output indicators vs. impact indicators, and indicators of current publication productivity vs. indicators of career publication productivity.

The literature examining the relationship between academic inbreeding and research productivity shows great diversity in the samples and research productivity indicators used. Some studies are based on general representative samples which cover the whole national academic system (Cruz-Castro & Sanz-Menéndez, 2010; Horta, 2013; Horta et al., 2010; Sologub & Coupé, 2015); others examine individual universities (McGee, 1960; Morichika & Shibayama, 2015; Roleda et al., 2014) or disciplines (Dutton, 1980; Hargens & Farr, 1973; Sivak & Yudkevich, 2009; Smyth & Mishra, 2014). Some studies use the number of publications as the measure of research productivity (Cruz-Castro & Sanz-Menéndez, 2010; Horta, 2013; Horta, Sato, & Yonezawa, 2011; Horta et al., 2010; Klemenčič & Zgaga, 2015; McGee, 1960; Morichika & Shibayama, 2015; Sivak & Yudkevich, 2009; Sologub & Coupé, 2015; Wyer & Conrad, 1984); others use citations or the h-index (Eisenberg & Wells, 2000; Hargens & Farr, 1973; Inanc & Tuncer, 2011; Smyth & Mishra, 2014).

There are a number of studies which show that the segments of academic system the and publication productivity indicators can be important for understanding the relationship between academic inbreeding and publication productivity. Hargens and Farr (1973) studied the relationship between inbreeding and productivity in US universities among leading mathematicians, biologists, physicists and chemists, using data from 'American Men in Science' and 'Science Citation Index'. They found that inbreds (those who had worked in their PhD department since graduation) and silver-corded (those who work in the PhD department they graduated from after being employed elsewhere for a period of time) have fewer publications and citations than non-inbreds. However, these results do not hold for leading departments in the field. Dutton (1980) studied American physicists, economists, sociologists and earth scientists on a sub-sample from a national general-purpose survey of faculty. The results show a negative effect of inbreeding for pure inbreds, but not for silver-corded ones. Despite inbreds publish more books, they publish fewer articles and have fewer citations. Horta (2013) found a negative association for inbreds in Portuguese academics on a sample representing the whole academic sector. Pure inbreds produce 20% fewer articles in international journals than non-inbreds, but they have higher internal productivity. Wyer and Conrad (1984), focusing on American faculty with doctoral degrees, did not find a difference in total productivity but found that inbreds produce more scholarly papers of different types per time unit. Klemenčič and Zgaga (2015), based on a sample representing the whole academic sector, demonstrated that inbreds produce more books and articles, and edit and prepare more scientific reports compared to non-inbreds, but edit fewer international scientific books. Sivak and Yudkevich (2009) also revealed a null relationship for

Russian economists in quantitative terms, but the quality of inbreds' publications may be perceived as lower since they on average target lower quality journals than their non-inbred colleagues. Inbreds have fewer publications in national Russian journals and more in the journals of their own university (and in journals of worse quality in general). Non-inbreds are more productive in national journals.

Summing up, although inbreeding is considered harmful from a theoretical perspective, empirical studies show ambiguous results. There are several possible explanations for this contradiction. The first is the specifics of the segment of the academia taken for analysis – the consequences of inbreeding for the general and elite segment of the academic sector may be different. The second concerns the indicators for measuring publication productivity. As described above, total productivity may not differ, whereas the quality of productivity (citations, quality of journals, impact) may differ.

2. Study design and data

For the empirical analysis we use three datasets: The first two datasets (CAP-2012 and MEMO-2016) contain self-reported survey data, the third (Experts Corpus) contains bibliometric data supplemented with the personal characteristics of academics. These datasets represent different segments of the academic sector in Russia. The CAP-2012 data cover faculty from 9 Russian regions (representing the largest share of students). The MEMO-2016 data are the most representative and cover faculty from different types of higher education institutions, covering a large proportion of Russian regions. Finally, the Experts Corpus data cover only the Russian academic elite in mathematics – those mathematicians who that are the most productive and who are recognized by the disciplinary academic community. Each of these three datasets contains data about education, work experience and publication productivity. Together these three datasets cover different segments of academia and contain different types of the publication productivity indicators. A summary of the three datasets is given in Table 1. Below, we provide a more detailed description of each dataset.

Table 1. Summary of the three datasets

	CAP-2012	**MEMO-2016**	**Experts Corpus**
Source	Survey / Self-reported data	Survey / Self-reported data	Web of Science, Russian Index of Science Citation, and CVs
Sample	University faculty	University faculty	Academics that are the most productive and recognized by the academic society
Field	Mixed	Mixed	Mathematics
Current vs whole career publication productivity	Current (3 years) productivity	Current (1 year) productivity	Current (3 years) and whole career productivity
Output vs impact indicators of the publication productivity	Output	Output	Mixed
N	1007	708	279

2.1 Description of the datasets

CAP-2012 data

The CAP-2012 data from the survey ‘The dynamics of the academic profession’, conducted in 2012 in Russia using the methodology of the international comparative study ‘Changing Academic Profession’ (CAP) (Yudkevich, Kozmina, Sivak, Bain, & Davydova, 2013). The CAP questionnaire, translated into Russian, was used. The total sample size was 1623 respondents, teaching different disciplines in Russian public universities subordinated to the Russian Ministry of Education and Science. The sample includes 25 Russian universities in the 9 regions with the highest proportion of students. The sample was multistage and its formation was in accordance with CAP sample methodology (Cummings & Bracht, 2006). At the first stage, the 9 regions with the highest proportion of students in Russia were selected. In each region at least one university with special status (national research university or federal university) and at least one university without special status were selected proportionally to the total number of higher educational institutions of each type in the region. From each of these universities, academics were randomly selected. We excluded from the sample those respondents who did not have a PhD (the Russian equivalent of a PhD is a Candidate of Sciences degree) at the time of the survey and respondents who had at least one missing answer in the publication variables and inbreeding variable. The final sample size consists of 1007 respondents.

MEMO-2016 data

The MEMO-2016 data are from the ‘Monitoring of educational markets and organizations’ survey (https://memo.hse.ru/en/) conducted in 2016. This survey has been conducted annually since 2002 by the Higher School of Economics with the support of the Ministry of Education and Science to collect generalized information on all levels of education from pre-school to tertiary. The data contain information on 1559 respondents from 100 higher education institutions from 34 regions. 15–20 respondents are surveyed in each institution. For our analysis we excluded from the sample respondents from higher education institutions of cultural, theatre and dance, and respondents who teach physical culture and civil defence as they are not required to research and publish. Faculty from private universities were also excluded from the sample as there are no private PhD granting universities in Russia and we studied only PhD holders. We also excluded from the final sample non-permanent workers and those academics who have less than three years of experience in academia. The final sample size is 708 respondents. The MEMO-2016 dataset is the most representative for Russian university faculty. It has already been used for analysing the relationship between academic inbreeding and publication activity. Alipova and Lovakov (2018) compared publishing productivity of inbreds, non-inbreds and silver-corded Russian faculty and did not find substantial and robust differences. Here we reuse the MEMO-2016 dataset combining it, however, with the other datasets.

Experts Corpus data

The Experts Corpus data represent the elite of Russian academics, as the sample includes highly cited academics and also those recommended by them as experts in their disciplines. The sample consists of 956 prominent Russian mathematics researchers. To collect the data, a list of mathematicians, 'selected on the basis of the recommendations of scholars with high citation indices in international scientific journals' (Experts Corpus website[7]) by the project 'Corpus of Experts' was used. The data contain names and several indicators of their career publication productivity (e.g. total number of publications, h-index). We also gathered information about age, alma mater and the institutions where academics obtained their PhD, Doctor of Sciences degree (a second level academic degree in Russia, an analogue of a Habilitation in Germany) and places of work from their CVs and other open sources. This information was found for only 279 academics from the sample. We also supplemented this data with information from the Russian Index of Science Citation (RISC), a Russian national citation index (for overview see: Moskaleva et al, 2018). From author profiles of each academics, we extracted several indicators of recent publication productivity (2014–2016).

2.2 The operationalization of inbreeding

While all three datasets contain information about academic inbreeding, their operationalization is slightly different. However in all three datasets three categories of academics are identified: inbreds, non-inbreds, and silver-corded. These three categories differ from each other in terms of experience in one or more universities as a student and as faculty. Berelson (1960) argued that it is necessary to separate the inbreds who are hired immediately following graduation and inbreds who took positions elsewhere after graduating, but returned to their alma mater, and recent research supports this idea empirically (Horta, 2013; Morichika & Shibayama, 2015). Table 2 summarizes operationalization of inbreeding in the three datasets.

Table 2. Operationalization of inbreeding in three datasets

Dataset	Inbreds	Non-inbreds	Silver-corded
CAP-2012	Have a PhD from the university where they work and started their career in this university	Don't work at the university where they received their PhD	Have a PhD from the university where they work but started their academic career elsewhere
MEMO-2016	Studied (Bachelor's or Master's Degrees or Russian Specialist's degree) at the university	Did not study (Bachelor's or Master's Degrees or Russian Specialist's degree) at the university where they now	Studied (Bachelor's or Master's Degrees or Russian Specialist's degree) at the university

[7] "Corpus expertov", http://expertcorps.ru (in Russian). Accessed 28 May 2018.

Dataset	Inbreds	Non-inbreds	Silver-corded
	where they now work and started their career in this university	work	where they now work, but started their academic career in different university
Experts corpus	Got doctoral education in the same university where they work	Never studied (neither graduate education nor doctoral education) at the university where they work and change their place of work at least once	Work at the same university where they got doctoral education, but their first job institution differs

The operationalization of inbreeding in CAP-2012 data is based on the information where respondents received their PhD and where they started their career. Respondents who do not have a PhD were excluded because according this operationalization they may be defined as non-inbreds but in reality they could just have been graduate students working in a university but who had not yet received this degree. There are three groups of faculty divided into groups based on different combination of these information: 1) inbreds – faculty who have a PhD from the university where they work and started their career in this university, 2) silver-corded – faculty who have a PhD from the university where they work but started their academic career elsewhere, 3) non-inbreds – faculty who work and obtained their PhD at different universities.

The operationalization of inbreeding in MEMO-2016 data is based on the information where respondents got their education and where they started their career. Due to this operationalization non-permanent workers and academics with less than three years of experience in academia were excluded from analysis. There are three groups of faculty divided into groups based on different combination of this information: 1) inbreds – faculty who studied (Bachelor's or Master's Degrees or Russian Specialist's degree) at the university where they now work and who started their career in this university, 2) silver-corded – faculty who studied at the university where they now work, but started their academic career in different university, 3) non-inbreds – faculty who did not study at the university where they now work.

The operationalization of inbreeding in Experts Corpus data is based on the information about the educational and professional background of academics collected from open sources. There are also three groups of faculty divided into groups based on different combination of these information: 1) inbreds – academics who got doctoral education (the program of the doctoral education in Russia is aspirantura) in the same university where they work, 2) silver-corded – academics who work at the same university where they got doctoral education, but their first job institution differs, 3) non-inbreds – academics who never studied (neither graduate education nor doctoral education) at the university where they work and change their place of work at least once.

Despite the differences, these operationalizations of inbreeding are comparable. A previous study of the differences in productivity between inbreds and non-inbreds showed the results are robust with respect to different operationalizations. Gorelova and Lovakov (2016) showed that inbreds defined by having a postgraduate degree, all degrees, and postgraduate degree plus first position do not differ from non-inbreds in the probability of having articles and books or in the number of articles and books. It is widespread in Russia, when the PhD students of a university have an undergraduate degree from the same university. This is another reason to consider the operationalizations of inbreeding, based on degrees of different levels, as comparable. Table 3 shows the percentage of inbred, non-inbred, and silver-corded academics in each datasets.

Table 3. Percentage of academics in different groups

Dataset	**Inbreds**	**Non-inbreds**	**Silver-corded**
CAP-2012	38.3	55.6	6.1
MEMO-2016	44.9	37.7	16.4
Experts corpus	22.6	43.4	34.1

2.3 The operationalization of publication productivity

CAP-2012 and MEMO-2016 contain self-reported data about current publication productivity. The CAP-2012 data contain two relevant variables: the number of articles in journals or books and the number of books. The MEMO-2016 data contains three relevant variables: the number of articles in Russian journals, the number of articles in journals published by the university where the faculty work and the number of articles in foreign journals. In CAP-2012, respondents report publications in the last three years, in MEMO-2016 it is only for the last year. We do not consider this difference substantial since faculty mostly publish in journals where the production cycle (including submission, review and processing) does not take long. We believe that if there are any differences in the results between these samples, they should not be attributed to the differences in proxies for productivity. Experts Corpus contains data about publication productivity extracted from WoS and RISC databases. Four indicators relate to the career of the academics:

1) h-index,

2) the number of papers indexed in WoS (M_ref),

3) the number of papers found by Cited Reference Search (M_all),

4) citations per paper (the ratio between the total number of citations and the number of papers found by Cited Reference Search CItot / M_all).

Two indicators represent current publication productivity: the number of articles in RISC (core), published from 2014 to 2016, and the number of articles in WoS and/or Scopus, published 2014–2016. Table 4 shows the descriptive statistics of the publication productivity indicators across three datasets.

Table 4. Mean (SD) of the publication productivity indicators in different groups

	Whole sample	Inbreds	Non-inbreds	Silver-corded
CAP-2012				
Articles in journals or books	5.18 (6.80)	5.75 (7.54)	4.88 (6.39)	4.31 (5.13)
Books	0.66 (1.21)	0.70 (1.32)	0.65 (1.15)	0.57 (0.97)
MEMO-2016				
Articles in Russian journals	2.34 (4.57)	2.26 (4.28)	2.47 (5.36)	2.09 (2.87)
Articles in university journals	1.20 (1.84)	1.35 (1.97)	1.00 (1.47)	1.16 (2.15)
Articles in foreign journals	0.25 (0.69)	0.22 (0.61)	0.30 (0.81)	0.20 (0.55)
Experts corpus				
h-index	13.87 (10.71)	11.71 (8.31)	16.42 (11.74)	12.05 (10.12)
M_ref	55.66 (48.96)	61.58 (59.57)	56.97 (43.14)	50.04 (48.05)
M_all	209.52 (228.93)	184.66 (196.27)	259.61 (280.79)	162.54 (152.54)
Citations per paper	5.02 (4.36)	4.27 (3.65)	5.82 (4.63)	4.49 (4.30)
Articles in RISC (2014-2016)	10.30 (10.91)	12.44 (14.14)	8.80 (8.12)	10.40 (10.77)
Articles in WoS/Scopus (2014-2016)	7.82 (7.88)	8.67 (9.16)	6.84 (6.39)	8.28 (8.33)

3. Results

Figures 1 and 2 show that from the CAP-2012 and MEMO-2016 data all three groups of faculty have about the same percentage of publications with at least one and a very similar distribution of the number of publications among those who have at least one publication.

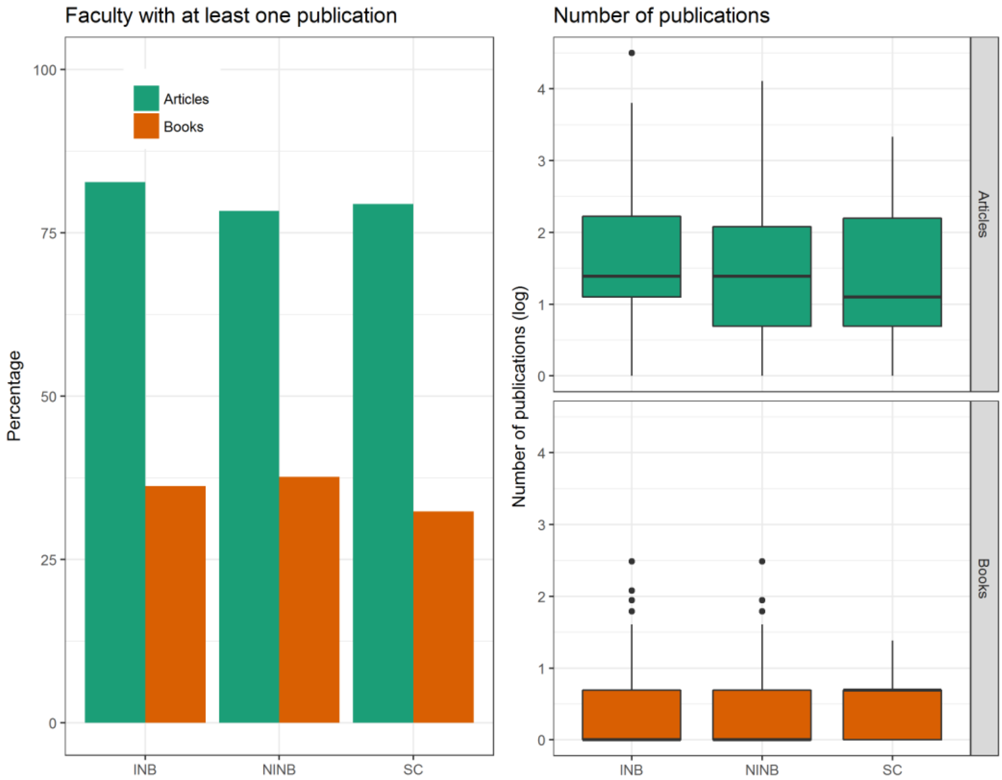

Figure 1. Percentage of faculty with at least one paper (left panel) and number (logarithm) of papers among faculty with at least one paper (right panel) (CAP-2012). INB – inbreds, NINB – non-inbreds, SC – silver-corded faculty.

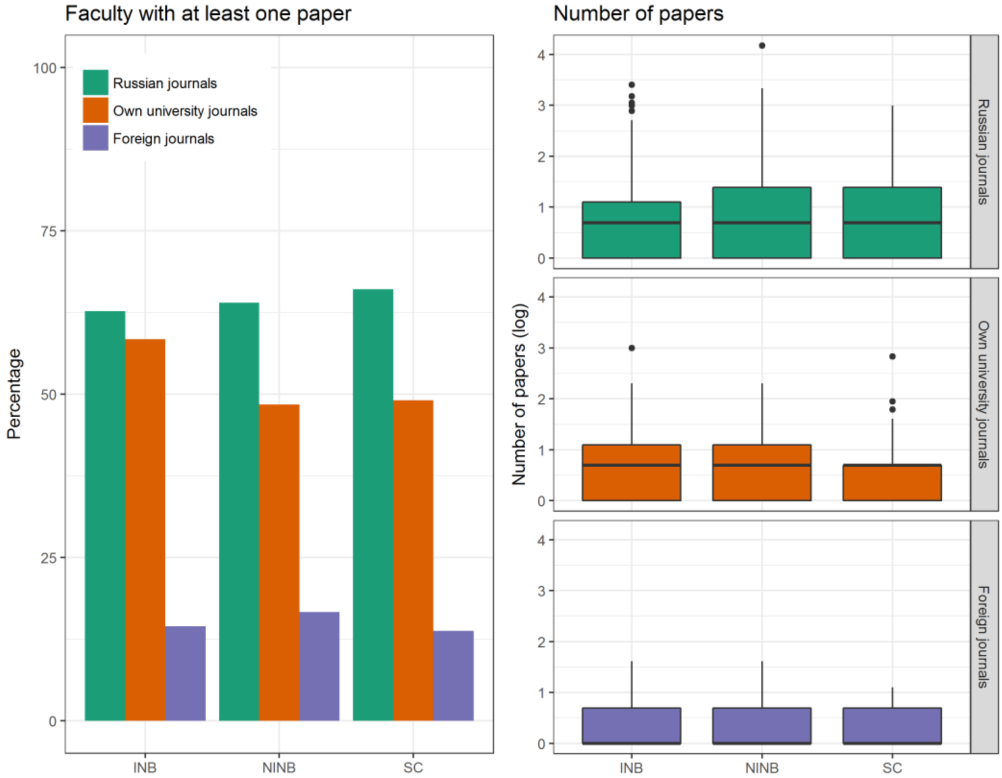

Figure 2. Percentage of faculty with at least one paper (left panel) and number (logarithm) of papers among faculty with at least one paper (right panel) (MEMO-2016). INB – inbreds, NINB – non-inbreds, SC – silver-corded faculty.

For the analysis of the CAP-2012 and MEMO-2016 data we use a negative binomial logit hurdle (NBLH) regression model, specifically suited for the analysis of count data with a lot of zeros. These models are mixture models in which the complete distribution of the dependent variable is split into two separate components. The zero part represents the probability of zero values and the count part represents the non-zero counts. For a simpler interpretation regression coefficients are exponentiated and transformed into odds ratios (OR) in the zero parts and rate ratios (RR) in the count parts. In percentages ($100*(e^{B}–1)$) OR reflects the percentage decrease (OR < 1) or increase (OR > 1) in the odds of having at least one publication, whereas RR reflects the percentage decrease (RR < 1) or increase (RR > 1) in the expected number of publications for each unit increase in the independent variable, controlling for other predictors. All calculations are performed in R (R Core Team, 2016). To fit these models the *hurdle* function from the *pscl* package (Zeileis, Kleiber, & Jackman, 2008) is used. Separate regression models were run for each type of publication. Gender, age, and disciplinary field are used in regressions as standard controls. Table 5 shows the exponentiated regression coefficients from the NBLH models for articles in journals or books and for books from the CAP-2012 data. The results demonstrate no significant differences between inbreds and the two other types of faculty. Neither the probability of having at least one article in a journal or a book nor the number of these types of publications differ between inbreds and non-inbreds or silver-corded faculty. Table 6 shows the exponentiated regression coefficients from the NBLH models for articles in Russian journals, in journals published by the university where the faculty work, and in foreign journals from the MEMO-2016 data. The results also demonstrate no significant differences between inbred and the two other types of faculty. Neither non-inbreds nor silver-corded faculty have a greater probability of having at least one article or several articles in any type of journal.

If we constrain our samples from the CAP-2012 and MEMO-2016 databases to only those faculty members that belong to the upper tier of the productivity distribution, the results also hold and there are no substantial quantitative differences between inbreds and non-inbreds in the high-productivity segment of the samples.

Table 5. Summary of the NBLH models comparing inbreds, silver-corded and non-inbreds (CAP-2012)

Variables	**Articles in journals or books**				**Books**			
	Zero part		*Count part*		*Zero part*		*Count part*	
	OR	*95% CI*	*RR*	*95% CI*	*OR*	*95% CI*	*RR*	*95% CI*
Non-inbred	0.76	0.53-1.09	0.89	0.75-1.05	0.85	0.64-1.15	0.74	0.49-1.12
Silver-corded	0.76	0.38-1.50	0.76	0.54-1.06	0.75	0.42-1.34	0.72	0.31-1.70
Gender (1 = male)	1.46*	1.05-2.05	1.31**	1.11-1.55	1.31	0.99-1.73	1.34	0.87-2.06
Age	0.98***	0.96-0.99	1.00	1.00-1.01	1.02***	1.01-1.03	1.01	0.99-1.02
Humanities	0.86	0.18-4.03	2.28*	1.17-4.44	0.70	0.24-2.04	1.04	0.28-3.90
Natural sciences	0.94	0.20-4.35	2.14*	1.11-4.12	0.40	0.14-1.15	0.93	0.25-3.45
Social sciences	0.60	0.13-2.81	2.58**	1.32-5.02	0.83	0.28-2.43	1.33	0.36-4.96
Technology	0.59	0.13-2.68	2.09*	1.08-4.01	0.40	0.14-1.16	0.98	0.27-3.61
N	1007				1007			

Note. Exponentiated regression coefficients (odds ratios in zero part, rate ratios in count part) are shown in Table. Category 'Inbred' was reference category for non-inbred and silver-corded dummies. Category 'Other fields' was reference category for fields' dummies. * – $p < .05$, ** – $p < .01$, *** – $p < .001$.

Table 6. Summary of the NBLH models comparing inbreds, silver-corded and non-inbreds (MEMO-2016)

Variables	**Articles in Russian journals**				**Articles in university journals**				**Articles in foreign journals**			
	Zero part		*Count part*		*Zero part*		*Count part*		*Zero part*		*Count part*	
	OR	*95% CI*	*RR*	*95% CI*	*OR*	*95% CI*	*RR*	*95% CI*	*OR*	*95% CI*	*RR*	*95% CI*
Non-inbred	1.10	0.77-1.59	1.05	0.69-1.60	0.74	0.52-1.04	0.81	0.56-1.17	1.21	0.75-1.93	1.63	0.91-2.92
Silver-corded	1.22	0.76-1.96	0.79	0.48-1.32	0.71	0.45-1.11	0.99	0.62-1.57	0.98	0.52-1.82	0.88	0.37-2.10
Gender (1 = male)	0.94	0.66-1.32	1.12	0.74-1.69	0.92	0.66-1.28	1.18	0.84-1.68	1.12	0.72-1.74	0.95	0.51-1.78
Age	0.99	0.98-1.01	1.01	0.99-1.02	0.99	0.97-1.00	0.99	0.98-1.01	0.99	0.97-1.01	1.02	0.99-1.04
Humanities	0.64	0.32-1.25	2.06	0.94-4.52	0.81	0.42-1.57	1.46	0.73-2.93	1.72	0.55-5.45	2.69	0.34-21.55
Math & CS	0.64	0.30-1.37	1.54	0.62-3.86	0.95	0.45-1.99	0.81	0.36-1.80	3.11	0.95-10.17	2.71	0.33-22.15
Natural sciences	0.78	0.38-1.61	1.15	0.50-2.65	1.18	0.58-2.40	1.02	0.49-2.12	2.36	0.72-7.68	3.55	0.45-28.02
Social sciences	1.42	0.74-2.72	1.38	0.68-2.79	0.94	0.50-1.75	1.02	0.53-1.95	2.43	0.82-7.21	2.17	0.28-16.66
Technology	1.20	0.61-2.35	1.57	0.75-3.32	1.38	0.72-2.66	1.04	0.53-2.05	1.81	0.58-5.63	3.77	0.47-30.51
N	654				658				690			

Note. Exponentiated regression coefficients (odds ratios in zero part, rate ratios in count part) are shown in Table. Category 'Inbred' was reference category for non-inbred and silver-corded dummies. Category 'Other fields' was reference category for fields' dummies. * – $p < .05$, ** – $p < .01$, *** – $p < .001$.

The specificity of the Experts Corpus data is that they contain portfolio indicators that cover career publication productivity. Therefore age or career length may be crucial for the analysis and interpretation because the higher the age or the longer the career length, the higher the indicators of career publication productivity. Table 7 shows the number and percentage of academics from different age cohorts in each group (inbreds, non-inbreds, and silver-corded). An analysis of standardized residuals demonstrates that the observed frequency outweighs the expected in the inbreds born in the 1940s. There is also a deviation downward from the expected frequencies in the s born in the 1950s and in the silver-corded of the 1940s. It is important that there is no bias in the direction of getting the young into the group of inbreds, as this would mean that young employees have not had time to change jobs. In general, age cohort observations are distributed into the three groups, approximately equally.

Table 7. The percentage of academics in each group by age cohorts (Experts Corpus)

Age cohort	**Inbreds**	**Non-inbreds**	**Silver-corded**	**Total**
1922-1930	2 (3.2)	5 (4.1)	1 (1.1)	8
1931-1940	10 (15.9)	13 (10.7)	8 (8.4)	31
1941-1950	21 (33.3)	22 (18.2)	13 (13.7)	56
1951-1960	6 (9.5)	25 (20.7)	22 (23.2)	53
1961-1970	11 (17.5)	24 (19.8)	22 (23.2)	57
1971-1980	8 (12.7)	21 (17.4)	18 (18.9)	47
1981-1990	5 (7.9)	11 (9.1)	11 (11.6)	27
Total	63 (100)	121 (100)	95 (100)	279

For the analysis of Experts Corpus data we use a negative binomial regression model, specifically suited for the analysis of count data with skewed distribution. For a simpler interpretation regression coefficients are also exponentiated and transformed into rate ratios (RR). In percentages ($100*(e^{B}–1)$), RR reflects the percentage decrease (RR < 1) or increase (RR > 1) in the expected scores for indicators of the publication productivity for each unit increase in the independent variable, controlling for other predictors. To fit these models the *glm.nb* function from the *MASS* package (Venables & Ripley, 2002) is used. Separate regression models were run for each indicator of publication productivity. Age (on a scale from 1 to 7 for the generations) is used in regressions as a control. Table 8 shows the exponentiated regression coefficients from the negative binomial models for the h-index, the number of papers indexed in WoS, the number of papers found by Cited Reference Search, and citations per paper from the Experts Corpus data. The results demonstrate that non-inbreds have a 53% higher h-index ([95% CI = 25%–87%], $p < .001$), 67% more papers found by Cited Reference Search (M_all) ([95% CI = 27%–116%], $p < .001$), and 42% more citations per paper ([95% CI = 13%–78%], $p = .002$) compared to inbreds. There are no differences between inbred and silver-corded. Figure 3 compares the distribution of the indicators in each group. Although the regressions showed differences between inbreds and non-inbreds, they are not very large in terms of the absolute values of the indicators.

Table 8. Summary of the negative binomial models comparing inbreds, silver-corded and non-inbreds (Experts Corpus)

Variables	**h-index**		**M_ref**		**M_all**		**CItot / M_all**		**N of papers in RISC**		**N of papers in WoS/Scopus**	
	RR	*95% CI*	*RR*	*95% CI*	*RR*	*95% CI*	*RR*	*95% CI*	*RR*	*95% CI*	*RR*	*95% CI*
Non-inbred	1.53***	1.25-1.87	1.07	0.84-1.36	1.67***	1.27-2.16	1.42**	1.13-1.78	0.75	0.54-1.03	0.81	0.59-1.12
Silver-corded	1.18	0.95-1.46	0.96	0.75-1.24	1.12	0.85-1.47	1.16	0.91-1.48	0.89	0.64-1.23	0.99	0.72-1.36
Age	1.23***	1.17-1.30	1.29***	1.21-1.38	1.45***	1.35-1.56	1.12***	1.06-1.18	1.10	1.01-1.19	1.05	0.97-1.14
N	277		273		273		271		249		249	

Note. Exponentiated regression coefficients (rate ratios) are shown in Table. Category ‘Inbred’ was reference category for non-inbred and silver-corded dummies. * – p < .05, ** – p < .01, *** – p < .001.

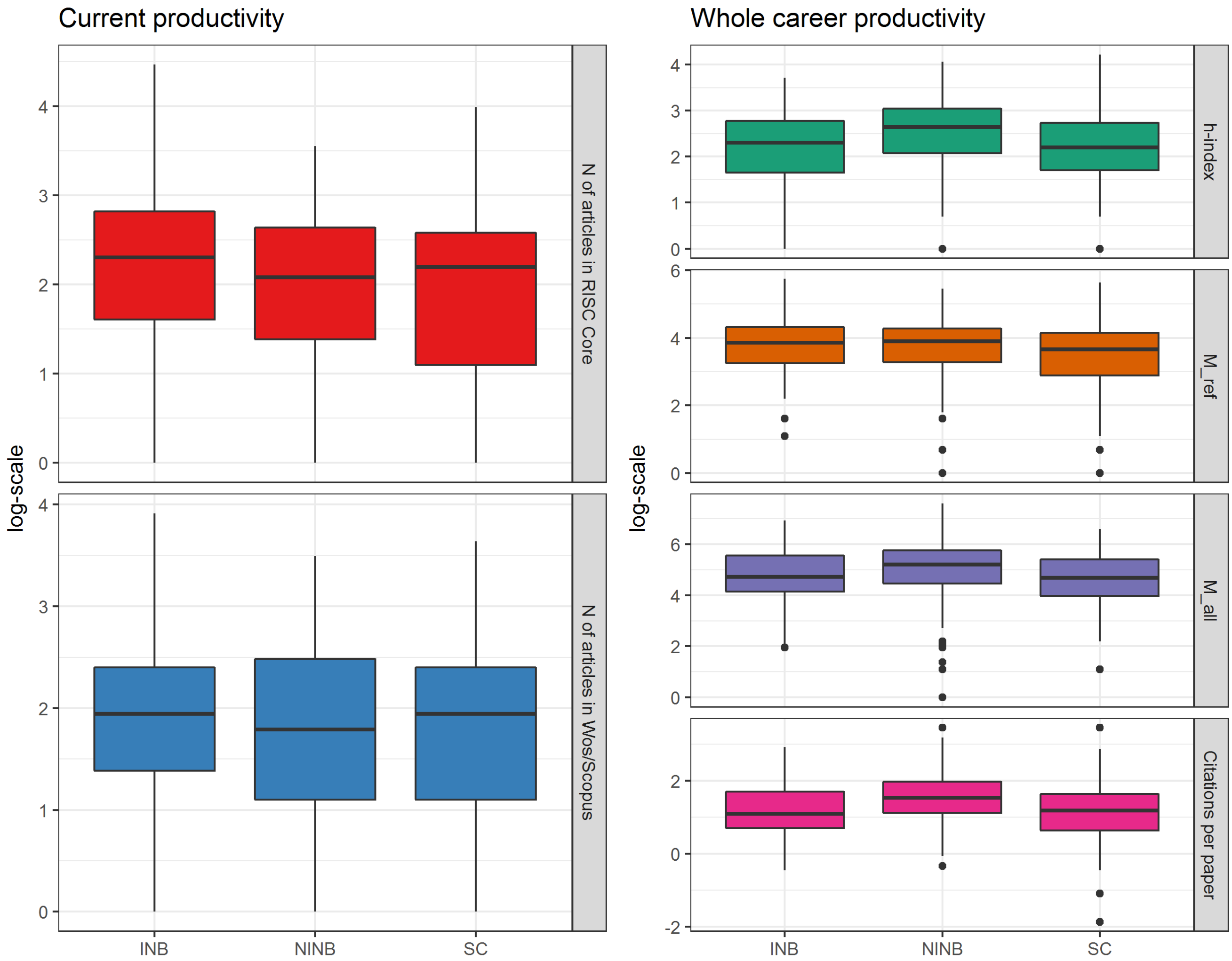

Figure 3. Distribution of the indicatiors of the whole career (left panel) ad current (right panel) publication productivity (log-scale) among academics in Experts Corpus. INB – inbreds, NINB – non-inbreds, SC – silver-corded faculty.

4. Conclusions

Our analysis of three datasets revealed no substantial differences in current publication productivity of inbred and non-inbred Russian academics. These results are robust to the operationalization of inbreeding and hold both for the average and highly-productive segments of the academic population. Under the same institutional rules both inbreds and non-inbreds seem to demonstrate the same publishing performance suggesting that there is no systematic bias toward inbreeding at the expense of productivity as university administration might see it. However, we find a difference between inbreds and non-inbreds in career publication productivity. We are inclined to conclude that the inbreeding effect can accumulate and affect productivity negatively in the long run.

Such a long-term effect may arise due to academic mobility since more mobile non-inbreds are interested in moving toward better universities with therefore higher productivity standards.

These differences appear both in output and impact indicators of publication productivity. Non-inbred faculty seem to produce more impact. While both groups are characterized by the same quantitative indicators of current performance (such as the number of publications) the research of non-inbreds is better cited in the long run and has more visibility. This result is in line with the fact that non-inbreds have more academic connections with peers in different institutions, have a broader view of research agendas and are better embedded in the broader academic community. However, one should be aware that the Expert Corpus database covers the segment of high-quality researchers so any extrapolations to the Russian academic profession as a whole should be made with caution. We think that for the average-quality segment the results might be weaker since in that segment academics care more about meeting the formal requirements of their academic employers.

Focusing on Russian data, the analysis of three datasets allows us to suggest a potential explanation for the controversy of existing results on the relationship between academic inbreeding and productivity in general. Further research, taking into account the segment of the academic profession and exploring qualitative indicators of research productivity, may shed light on the role of inbreeding in individual productivity.

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