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Publishing Patterns of Polish Authors in Domestic and Foreign Economic Journals[1]

Introduction

The 'publish or perish' threat currently seems to be a driving force behind scientists' performance. No working scientist can establish his/her position without publications. Furthermore, scholars' promotion in Poland is since decade based mostly on publishing articles in reputable journals with high citation indexes, which is in accordance with a trend observed all over the world. Research funding systems have gradually become more selective and competitive, a process that has affected individual employees' evaluations by their universities. In line with the new incentives, Polish scientists must develop strategies to increase their presence in top journals.

As noted in other studies, research in Central and Eastern European countries (CEECs) has faced many problems resulting in poor scientific performance, especially during the communist regime years and thereafter. Because of the isolation of CEECs from Western countries in communist times, even nowadays, researchers from these countries routinely publish in domestic journals that are not indexed in the Web of Science and in Scopus, and the number of papers published in international journals is accordingly rather small (Ciaian and Pokrivcak 2005). Radosevic and Yoruk (2014) compared the science and social science capabilities of the countries of Central and Eastern Europe with those of the long-established

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members of the European Union. Authors explore the extent to which CEE has converged in disciplinary profiles to the EU15, and the extent to which it has diverged from the science systems of the former USSR. They show that, at an aggregate level, science systems operate with high inertia and in areas of their historically inherited advantages and disadvantages.

However, different paths have been seen in the last decades in the region. Schlemmer et al. (as cited in Teorodescu and Andrei 2011) found that while the publication strategy in Hungary significantly changed from publication in national journals to international ones, Slovenian scientists still preferred publishing in national journals. Our analysis may provide some further insights about the evolution of domestic and international productivity.

Furthermore, we attempt to identify the patterns of publication performance when institutional incentives could have strongly affected the motivation of researchers to collaborate in order to meet the increased quality expectations. Clearly, an especially promising catch-up strategy here is foreign co-authorship, especially with scientists from Western universities. We focus in this paper on the field of economics, as an example of science where collaboration is an alternative and not the only option like in some laboratory sciences. In economics there is a choice between solitary and collaborative strategy. Concurrently, with an increasing role of quantitative and interdisciplinary works, diversity of skills of co-authors is gaining in importance, which is observed in economics worldwide. Yet economists from CEECs face additional challenges, as research in social sciences, including economics, was politically restricted during Communism (Kozak et al. 2015).

Surprisingly, analyses of scientific publications and their determinants (both in economics and in other domains) are very rare and limited in transition countries (Ciaian and Pokrivcak 2005; Fiala and Willett 2015). Therefore, uncovering the kinds of regularities that characterize the publishing process in economics in countries after a system transition is interesting. We reference rich international literature on the topic (Acedo et al. 2006; Fafchamps et al. 2006; Goyal et al. 2006; Hamermesh 2013; Laband and Tollison 2000) to consider if there are universal strategies that may be applied in CEECs. The results may be useful for development of a more effective and incentive based support for researchers and universities in those countries, as well as for a more systematic approach to encouraging openness of scientific institutions for cooperation, both domestic and foreign.

In this study, we attempt to explain the determinants of quantity of scientific productivity for Polish researchers publishing in two types of economics journals. We base our analyses on articles published by Polish authors between 1999 and 2012 in foreign journals listed in Scopus and in Web of Science as well as those published in five leading Polish economic journals (*Argumenta Oeconomica*, *Bank i Kredyt*, *Ekonomista*, *Gospodarka Narodowa*, and *Polityka Społeczna*). Furthermore, we apply multilevel modeling to simultaneously analyze various factors correlating with productivity while both controlling and exploring embeddedness of individuals in organizations (Hox 2002; Snijders and Bosker 1999). This allows

us to show that both individual and institutional determinants matter for individual-level outcomes, and it is important to track the influence of research units (e.g., university departments) that employ scientists and can be a source of various resources. Additionally, we consider a meso-level analysis by introducing interactions between authors and affiliation-level variables. We show to what extent the impacts of various factors differ between different types of journals (domestic and foreign). We pose following hypotheses:

1. *Collaboration is more frequent for articles published in foreign journals than for those published in Polish ones. However, in case of scientists publishing in both Polish and foreign journals, choice of collaborative publishing strategy and the content of collaboration networks tend to be stable between those two types of journals.*
2. *There is a positive relationship between co-authorship and research productivity in case of foreign journals, but not in case of domestic journals.*
3. *Choosing foreign contributors is positively correlated with quantity of papers published both in foreign and domestic journals.*
4. *Choosing contributors from the same affiliation is positively correlated with the quantity of papers published in domestic journals but not in foreign ones.*
5. *The research potential of the university department is positively correlated with the quantity of articles both in foreign and domestic journals.*

The remainder of this paper is organized as follows. The next section develops the argumentation supporting our hypotheses based on a literature review. After describing the data used in this study, we present and discuss the results of our empirical study. Finally, we conclude.

1. The role of collaboration and institutional surroundings in publication performance

Authors attempting to explain research productivity often consider a range of factors regarding individual researcher characteristics, such as gender (Leahey 2006; Lee and Bozeman 2005), age (Aksnes 2011; Costas et al. 2010), and title (Abramo et al. 2011; Puuska 2010). Moreover, studies have explored determinants connected to the academic environment, such as those linked to promotion (Lissoni 2011). Others have reviewed the role of institutional determinants, such as the organization size (Bonaccorsi et al. 2006), assessment criteria (Moed 2008), types of funding (Jacob and Lefgren 2011; Kelchtermans and Veugelers 2011), and teaching load (Porter and Umbach 2001). More recently, special focus has been placed on the role of collaboration patterns (Abbasi et al. 2012; De Stefano et al. 2013; Li et al. 2013; McCarty et al. 2013). Nevertheless, few studies have simultaneously considered various levels of determinants in their analytical models of research performance (Porter and Umbach 2001; Shin and Cummings 2010). In our study, we follow this multilevel approach, paying spe-

cial attention to factors regarding co-authorship behavior and the effects of the research institution.

Collaboration plays an important role in enhancing productivity both by sustaining the process of knowledge creation and through the division of tasks that enables economies of scale for research activities (Adams et al. 2005). Indeed, collaborative articles are, on average, more highly cited than sole-authored articles, which may be treated as an indicator of their higher quality (Levitt and Thelwall 2010). However, research collaboration may not always lead to better or higher research output. Collaboration also entails various costs, including the costs of finding and assessing research partners and the costs of coordination among the collaborating scientists. Time must be spent clarifying roles and responsibilities and continuously updating them as the collaborative research project evolves (Katz and Martin 1997). We suspect that those costs stifle collaboration when scientists are able to succeed on their own, which is the case of domestic journals. However, in order to meet the challenge of getting approved in international journals, scholars should seek co-authorship strategy.

Some studies investigate the characteristics of co-authors by considering the country of origin with the assumption that a special advantage exists in creating relations with foreign researchers (e.g., Lissoni et al. 2011). Furthermore, there is substantial evidence that international collaboration increases the citation rates far above those of domestic collaboration (Sooryamoorthy 2009). Gómez et al. (1999) argued that international collaboration increases the visibility of research papers more than national collaboration does because papers with international co-authors are published in journals of greater impact. Schmoch and Schubert (2008) suggest that internationally co-authored papers are more highly cited because their potential scientist community is larger and more people know of these studies. This type of collaboration seems to give access to diverse resources by connecting researchers with different backgrounds, knowledge, skills, and experience and therefore should facilitate the generation of new ideas (Burt 2005). It should be especially essential in case of transition countries, which have to break through to publish in recognized international journals (Teodorescu and Andrei 2011). CEECs have lower degrees of material and intellectual resources, and constraints exist for building domestic human and financial resources for science. Considering transition country specificity, we suppose that international collaboration is one of the most important aspects of cooperation when seeking to improve research performance by publishing both in foreign and top Polish journals.

However, even considering a lot of opportunities open for Polish scientists due to the fact of European integration, foreign collaboration may be difficult both to launch and sustain and it may involve high transaction costs. Furthermore, accessing diverse and excellent but remote coauthors may be problematic for the transfer and development of complex, tacit knowledge which needs strong ties and regular interactions (Krackhardt 1992; Moran 2005). Therefore we also consider the role of in-house collaboration, in which case all coauthors are of the same affiliation and therefore communication is simplified. Simultaneously, it must be

taken into consideration that people from similar backgrounds have similar ideas and skills and the probability of generating innovation is therefore small. This may even stifle creativity and flexibility, as it reinforces the status quo (Gargiulo and Benassi 2000). Therefore we expect that in-house collaboration should be more suitable for publishing in domestic than international journals.

We expect that the extent of collaboration varies and plays different roles for domestic and foreign journals. Particularly now, research and knowledge production thrives on cross-communication, inter-linkages, networks, and collaboration. The integration of research teams into national and especially international networks appears to be a key determinant of performance, especially when catching-up strategies are needed to publish in the recognized journals. In the case of Polish scientists, the challenge is to reach foreign journals, especially those with a high IF. This is in line with the universal finding of Lancho-Barrantes et al. (2012), who analyzed the 20 countries with the greatest scientific production using the SCImago Journal & Country Rank and Scopus. They confirmed that the number of citations for collaborative papers is considerably greater than those for non-collaborative papers, and they found that the difference originates mainly in non-domestic papers.

However we can presume that as long as scientists managed to have built their networks of collaboration and got used to see benefits from co-authorship, they will use similar collaborative strategy within both foreign and Polish journals. This can have some important consequences, as may lead to an increase of quality of papers in national journals and also enable to share expertise, obtained while publishing in recognized international journals, in scientific discussion of more domestic scope.

Furthermore, potential influence of collaboration and peer-effects can be assessed not only by looking at the co-authorship structure but also by examining authors' affiliations, which are connected with access to resources available at the research institution level. Including organizational variables to explain publication performance (following Hesli and Lee 2011; Kelchtermans and Veugelers 2011; McFadyen and Cannella 2004), we maintain that their effects are partially generated through the possibility for informal interactions and exposure to ideas within the group of scientists (Laband and Tollison 2000). Concurrently, researchers compete at their faculty for position and resources. Thus, being in an environment with good scientists is an incentive to exert greater effort. Scientific research is simultaneously motivated by co-operation and by the race to be the first. Turner and Mairesse (2005) show that publishing by colleagues increases individual productivity, finding that a 10-percent increase in laboratory production induces 0.6 more published papers per researcher (per year).

However, the effects of environmental factors are not limited to this connection with organizational social capital. Resources available to scientists and their motivation are strictly dependent on their institutional environment and on characteristics that describe the research unit. Studies have shown that scientific productivity depends on the research potential of the organization, which is often connected

with its size. Furthermore, the relationship between research potential and productivity is positive (Bonaccorsi et al. 2006; Seglen and Aksnes 2000), and authors underline the necessity of achieving the 'critical mass' required to compete for research grants. Thus, departments pool both finances and intellectual resources.

Furthermore, competitive financing mechanisms (Abramo et al. 2009b) and assessment criteria (Moed 2008) affect scientists' performance. Moed (2008) examined how British academics tend to orient their activities according to assessment guidelines. In 1992, the assessment system of the Research Assessment Exercise (RAE) emphasized the quantitative aspect of scientific production, resulting in an increase in the number of publications. However, when the attention shifted to quality in 1996, it increased the tendency to publish in journals with higher IFs. In Polish economics, although the funds for research are relatively low (dominated by funds for teaching), competitive funding has started to increase in importance. Furthermore, several types of control mechanisms have been introduced in academic organizations that incentivize researcher behavior. Thus, in both recruitment and promotion policies, universities have increasingly evaluated performance through bibliometric indicators with a special focus on publications in foreign journals with an IF (as most of Polish journals do not have this indicator). Furthermore, for assessment connected with possible promotion, good articles prepared in co-authorship are becoming to be appreciated as part of significant individual contribution to economics. Together it should pose the incentive for Polish economists to try to publish in recognized international journals and choose to write in co-authorship as long as this collaborative strategy is evaluated as potentially successful.

2. Data sources, methods and variables

The analysis is based on data covering articles from the period 1999–2012 published both in Polish journals[2] (limited to five leading Polish economic journals: *Argumenta Oeconomica*, *Bank i Kredyt*, *Ekonomista*, *Gospodarka Narodowa*, and *Polityka Społeczna*), written in both Polish and English) as well as in foreign economic journals (articles in English with at least one Polish affiliation and available in Scopus or in Web of Science).[3] Articles in the database are limited to those in which at least one author was identified as a Polish author.

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[2] Choosing these five Polish journals was dictated by three important considerations. First, we chose journals that have been in publication since 1999 or before to consider their established reputation. Second, we focused on general-interest journals rather than on field-specific ones, assuming that most influential papers in Polish economics are published in the general-interest journals. Lastly, we considered journals that most frequently received the best evaluations by the Polish Ministry of Science over the period 1999–2012, which we used to indicate the journals' quality and prestige.

[3] Articles with seven co-authors and more were excluded, as we expected them to exhibit different collaboration processes than the majority of those in the database (i.e., with reasonably few authors). The num-

Data on Polish journals were obtained from BazEkon, and missing articles were added based on journal archives. For foreign journals, it was important to determine whether the journal was an economic one (even if it was classified as such in Scopus and Web of Science). The verification was done based on the Econlit database, which includes the American Economic Association's list of economic journals.

In order to combine articles from different databases, we had to exclude duplicate records. Therefore, article titles, author names, affiliations, and journal titles were compared. This led to the detection and correction of differences in spelling within and between databases. Affiliations were obtained directly from the bodies of the articles. Polish journals often had to be obtained as hard copies from libraries because online access was not possible. Nevertheless, there were many missing entries, especially for earlier years. In addition, for all journals, the affiliations sometimes differed between articles by authors with the same first name and surname.

Therefore, Polish authors[4] were identified using external data sources, Nauka Polska, POL-on, and Internet searches. This enabled the confirmation or establishment of their main[5] affiliation and allowed us to gather additional information about their scientific titles and dates of promotion. Furthermore, this approach helped trace and distinguish between different scientists with the same surnames and first initials (in foreign journals) or the same surnames and names (in Polish journals). Using this approach also helped avoid (at least to some extent) treating authors with surname changes (e.g., women after marriage) as different authors. This method of managing data cleansing helped solve several problems reported by researchers using co-authorship data (De Stefano et al. 2013; McCarty et al. 2013). A final list of authors' main affiliations was established at the university department level. Additional data were also collected at that level: information on the number and value of national grants gained by all scholars from the faculty (available from OPI – The National Information Processing Institute) and data on 2013 formal faculty evaluations provided by the Ministry of Science and Higher Education. Journal quality was assessed based on their IFs, which were obtained from Thomson Reuters *Journal Citation Reports*.

The whole database consists of 2,849 scholars who authored a total of 4,146 articles, including 1,142 co-authored articles. Among the researchers, there were 1,266 Polish collaborating authors (having at least one co-author in case of at least one article), 1,130 Polish solitary authors, 430 foreign co-authors, and 23 co-authors who were not identified. For the final publication performance modelling,

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ber of such articles, which we treated as outliers, was a negligible 18 for the entire database of over 4,000 articles. We have chosen only articles in English, assuming that they are directed to the international audience.

[4] Authors were treated as Polish if they were found to have Polish affiliation.

[5] In some cases, choosing the main affiliation was based on comparing different pieces of information from different databases. Data from *Nauka Polska* as well as the information provided in most of the scientist's articles were considered to be most important.

1647 Polish scholars from 171 affiliations (including 892 collaborating authors) were used due to availability of data needed to build the chosen set of variables.

In order to measure scientific performance and compare it between Polish and foreign journals, in our econometric modelling we decided to use only indicators of quantity, that is a count of articles in the database (with the distinction between articles published in Polish journals and those published in foreign ones). We also considered using measurements based on IFs from Thomson Reuters *Journal Citation Reports*, following other studies in economics that assess paper quality using the journals' average number of cited articles published in a particular period (Combes and Linnemer 2003; Kalaitzidakis et al. 2011). The use of such indicators is relatively widespread despite being somewhat controversial, because they do not measure the impact of the actual article or researcher but deliver a qualitative statement about the paper. This is because it is assumed that the standards of a journal with a high IF are superior: it is more difficult to be accepted to such a journal for publication (Diem et al. 2011). However, most of Polish economic journals are not listed in Web of Science and do not have IFs, therefore we cannot compare the quality of articles in Polish and foreign journals based on this approach. Obviously, we could not either use a direct measure of article quality, which are article citations as there are no credible data, especially for the period covered, to count citations for articles in Polish journals and to compare them with those in foreign ones.

The explanatory variables used are individual attributes, indicators of collaboration and university department (faculty) characteristics. Variables considered at the scholar level are gender (binary variable taking a value of 1 for males), publication year of first article (an indicator of 'publication tenure' as a proxy of the scientist's research experience and age), and academic title in 2012 (a set of dummy variables incorporating the academic hierarchy in Poland, with the reference category being masters of sciences – *mgr* in Polish – and authors with no title identified who are most likely masters of sciences). The titles considered are: doctors/PhD (Polish *dr*), assistant professor/associate professor (*dr hab.*), and full professor (*prof. dr hab.*). Additionally, a binary variable indicating promotion to *dr hab.* during the period 2000–2013 was included (following the arguments of Lissoni 2011)[6], because there was an incentive for scientists to increase the quantity of articles published in the best Polish journals and in foreign journals to be considered for this promotion.[7]

Several considered variables reflected collaboration and were established for both collaborative and solo authors: whether the author was collaborative (binary variable), share of articles written through collaboration (equals 1 for scientists

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[6] Unfortunately, it was not possible to establish this variable for all scientists owing to missing promotion dates for various different titles. The inclusion of this data reduced the sample size by 206 scientists (both *dr hab.* and *prof. dr hab.* scientists when the date of the *dr hab.* promotion was not available).

[7] Articles in good journals are not critical considerations of productivity for the two remaining promotions in the Polish scientist's career (for the title *dr*, the thesis is the most important; to be promoted to *prof dr hab.*, there are many other important factors considered, including monographs and reports).

who co-authored all their articles), average number of authors per paper (for a given Polish author), foreign collaboration (binary variable equaling 1 for scientists with at least one foreign co-author, assuming that foreign co-authors' resources are distinctive and attractive to Polish collaborators), and share of papers in-house collaboration (share of articles in collaboration written only by authors from the same affiliation). In final modelling we have chosen to use 'average number of authors per paper' as a general measure of co-authorship (following Harzing and Alakangas 2016) over other considered options, e.g., share of articles written in collaboration and whether the author was collaborative. We evaluated both of them to be more biased than the alternative by natural dependency on the article count, especially in the situation where most of authors in our sample published only one article in the whole analyzed period. For the 'share of articles written through collaboration' values zero and one naturally dominated in case of those single-paper authors and, in a result, the best fit in all considered models was a nonlinear, reversed U-shape relation with all dependent variables.[8] For the binary variable 'collaborative author', the chances to get a value one naturally increased with higher article count and this might affect the results in favorable way. In the case of foreign co-authors, we assumed that it is reasonable to use a binary variable, as most of the Polish authors did not have a single foreign collaborator, no matter the article count. Another variable considered under this point was additional foreign affiliations for the Polish author, which is another indicator of access to colleagues from foreign universities and other foreign research institutions.

Variables at the organizational level included number of authors from the faculty (sum of scholars in the database from the same main affiliation), number and value of grants (obtained from all employees of a faculty and not only authors in the database during the period 1999–2012; because of the availability of data, only national grants obtained from the National Science Centre were counted[9]), the 2013 Ministry evaluation of faculties (a continuous variable reflecting the final assessment based on points for research potential, publications, and the popularization of science),[10] and maximum journal IF, which refers to the highest-quality paper present in our database published within the faculty of the affiliate organization (indicating the existence of at least one excellent researcher who can be approached for expertise and advice within the affiliated organization). These variables were all strongly inter-correlated and were assumed to be imperfect indicators of the same latent trait, namely research potential of the affiliation (how 'good' it is). Therefore, factor analysis was used to create an aggregated measure of this latent variable, taking into consideration 171 observations at the

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[8] However, replacing variable 'average number of authors per paper' by 'share of articles in collaboration' did not affect the main results of modelling.

[9] This is a clear limitation; for example, large European grants were not covered.

[10] Data on grants and Ministry evaluations were not available for all affiliated organizations in the database. Therefore, the inclusion of these variables in the model is connected with the limited sample of organizations that can be considered 'research units'.

level of affiliation[11] (Bartholomew et al. 2002).[12] Whether an institution only performs research and does not teach was also considered (research institutes versus university faculties, which is a proxy for a lack of teaching load). However, this variable was not significant in any analyses and was therefore abandoned.

To analyze the determinants of scientific performance, we applied random-intercept hierarchical nonlinear models (Hox 2002; Rabe-Hesketh and Skrondal 2008; Snijders and Bosker 1999). These models are suitable for analyses of organizations for which there is only one observation in the sample; however, the number of such groups should be limited. Because this condition is not met in our case, we limited our research to departments from which at least two authors are present in the database.

Additional limitations to our study exist that must be listed. Indeed, this research shows only correlation and not causal relationships. For example, we may expect that collaboration patterns are both determinants and results of high publishing performance, as researchers may seek to co-write with prolific authors. Similarly, promotions were treated as an incentive for scientists working toward this promotion, but promotions are also a consequence of high research performance. A possible solution here may be to use panels that include time effects. However, this approach was not possible in our sample, as the panel would be severely unbalanced owing to a small average number of articles per scholar in the whole 14-year period. The skewed distribution of our dependent variables poses another problem. The common practice in such a situation is to use logarithmic or square root transformations (Hesli and Lee 2011); however, in our models, this tactic did not improve the distribution of residuals.

To address the problem, we took in consideration the nature of variables and used appropriate nonlinear models for quants, namely multilevel negative binomial models. Those models were estimated according to the following equation (for a given level-two group):

$$E(y_{ij}|X_{ij}, Z_j, \delta_j) = \exp\{\beta_{00} + \ln(\delta_j) + \beta_{10}X_{ij} + \beta_{01}Z_j\}, \tag{1}$$

where:
$E(y_{ij}|X_{ij}, Z_j, \delta_j)$ is a conditional expectation of the count,
$\ln(\delta_j)$ is a group-specific intercept.

The conditional variance is:

$$\mathrm{Var}(y_{ij}|X_{ij}, Z_j, \delta_j) = E(y_{ij}|X_{ij}, Z_j, \delta_j)(1 + \delta_j), \tag{2}$$

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[11] The sample of 171 affiliation included only affiliations of more than one employee in the database and only those with available data on Ministry evaluation (i. e., those being evaluated as research units).

[12] The factor analysis performed was based on the maximum likelihood method, which enables a test of a choice of a number of factors (in our case, one factor). The variables used in the analysis were number of authors from the faculty in the database, number of grants, the 2013 Ministry evaluation of faculties, and maximum journal IF. However, the aggregate indicator based on this analysis also strongly correlates with the value of grants.

where:
$(1+ \delta_j)$ is a group-specific overdispersion factor (meaning constant dispersion within group equal to $1+ \delta_j$), and $1/(1+ \delta_j)$ has a beta distribution.

Parameter δ_j determines the level-one overdispersion factor and the group-specific intercept.

3. Descriptive analysis of differences between Polish and foreign journals

The following descriptive analysis aims to verify if the extent of collaboration in foreign journals is higher than that in Polish journals. It is also aimed to investigate to what extent scientists transfer a co-authorship strategy between different types of journals and to what extent they use the same network of co-authors both in foreign and Polish journals. Additionally, it considers the differences between publishing outcomes in four groups of research units distinguished on the basis of the level of their research potential.

Table 1

Number of articles in different types of journals

	Journal Impact Factor					
	0	(0,0.5)	<0.5,1)	<1,2)	<2,5.605>	Total
Polish journals						
1 author	2 505	78	0	0	0	2 583
2 authors	455	21	0	0	0	476
3 authors	81	5	0	0	0	86
4 authors	13	0	0	0	0	13
5 authors	2	1	0	0	0	3
6 authors	1	0	0	0	0	1
share of co-authored papers	*18%*	*26%*	*–*	*–*	*–*	*18%*
Foreign journals						
1 author	169	120	66	52	14	421
2 authors	118	83	80	48	23	352
3 authors	35	26	37	28	11	137
4 authors	9	8	8	12	4	41
5 authors	4	5	4	1	5	19
6 authors	1	4	2	5	2	14
share of co-authored papers	*50%*	*51%*	*66%*	*64%*	*76%*	*57%*
Total	3 393	351	197	146	59	4 146

Source: own elaboration.

Table 1 indicates that co-authorship is especially extensive in foreign journals and for high-quality articles (with a higher IF). Obviously, the IF of Polish journals is lower than that of foreign ones. The prevalent articles in our data are single-authored, low-impact, and published in Polish journals.[13]

Table 2

Comparison of collaboration extent in Polish and foreign journals

	All journals in total	Polish journals	Foreign journals
Time period	1999–2012	1999–2012	1999–2012
No of journals	288	5	283
No of articles	4 146	3 162	984
No of authors	2 849 (incl. 2 396 Polish authors)	1 841 (incl. 1 785 Polish authors)	1 198 (incl. 790 Polish authors)
No of collaborating authors	1 719 (incl. 1 266 Polish authors)	814 (incl. 758 Polish authors)	1 008 (incl. 600 Polish authors)
Percentage of Polish collaborating authors among all Polish authors	53%	42%	76%
Percentage of Polish authors with at least one foreign co-author	22%	5%	40%
Average no of articles per author	2.02 (2.16 per Polish author)	2.1 (2.13 per Polish author)	1.57 (1.73 per Polish author)
Average no of authors per paper	1.39	1.22	1.91
Rate of co-authored papers	28%	18%	57%
Rate of co-authored papers in international collaboration	31%	7%	55%
Rate of co-authored papers in pure in-house collaboration	37%	51%	23%

Source: own elaboration.

Table 2 shows that collaboration is generally more widespread in foreign journals than in domestic ones. First, 76 percent of Polish scholars co-author papers in foreign journals while only 42 percent chose collaborative strategy in case of Polish journals. Second, the rate of co-authored papers is around three times lower in Polish journals than in foreign ones. Third, the average number of authors

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[13] This does not necessary mean that publications in Polish journals have lower quality than those in foreign ones. It has to be taken in consideration that articles in Polish journals are often written in Polish and are focused on Polish economic context, which negatively influences the possibility of them being cited abroad.

per paper for foreign journals is 1.91, whereas that for Polish journals is 1.22. Furthermore, foreign collaboration (as a share of collaboration in total) is more frequent in case of foreign journals. Concurrently, in-house collaboration is more present in Polish journals.

Table 3

Co-authorship strategy in Polish and foreign journals

| Polish authors	Collaborating in Polish journals	Solicitors in Polish journals	Not publishing in Polish journals	Total
Collaborating in foreign journals	92	45	463	600
Solicitors in foreign journals	14	28	148	190
Not publishing in foreign journals	652	954	–	1 606
Total	758	1 027	611	2 396

Source: own elaboration.

Table 3 depicts how many Polish scientists collaborate both in case of Polish and foreign journals, how many do not collaborate in any journals, and how many chose to collaborate in one type and publish sole in the other. As it can be seen, only a small fraction (179 authors – a sum of bolded numbers in Table 3.) of Polish economists publish both in Polish and foreign journals and therefore can be directly compared. We can also notice that for this group of authors, the biggest part (92 authors, that is 51% out of 179 authors) collaborates both in Polish and foreign journals, and the smallest share (14 scientists, that is 8% out of 179 authors) collaborates in Polish and does not collaborate in foreign journals. Interestingly, among Polish authors who publish only in Polish journals solitary publishing strategy prevails (in case of 954 scientists, that is 59% out of 1606 authors). At the same time, for Polish journals, in case of Polish authors who also publish in foreign journals, co-authorship is preferred rather than solitary approach (is chosen by 106 scientists, or 59% out of 179 authors). Furthermore, for foreign journals (no matter if the Polish authors also publish in five chosen Polish journals or not) collaborative strategy dominates (is chosen by 600 scientists, or 76% out of 790 authors). Taking it all in consideration, we may make a cautious conclusion that collaborative strategy seems to be transferred from foreign into Polish journals.

In order to see to what extent the content of co-authors' network is transferred between the types of journals we have calculated QAP correlation between dichotomized Polish-journal and foreign-journal co-authorship networks of Polish collaborating authors who publish both in Polish and foreign journals. This procedure is appropriate to correlate matrices and is based on permutation tests of significance (Borgatti et al. 2013). We have obtained a significant Pear-

son correlation of 0.11 with *p*-value 0.0002. This result enables us to conclude that if a scientist collaborates with one co-author in case of foreign journals there is a significant probability that they will also co-author an article in Polish journals.

Figure 1 shows to observe differences in scientific performance between different groups of university departments, established based on their research potential. The variable used (namely research potential, described in the previous section) is the outcome of factor analysis and therefore is a continuous variable. We divided all research units in four groups, characterised by the research potential of level from I to IV, where I is the lowest and IV is the highest. We aimed to obtain possibly equal numbers of scholars belonging to each of the groups, so we used quartiles for the division. The total number of Polish scientists covered here is 1852, including only records for which research potential was calculated. As it can be noticed, all types of average article counts (total, in Polish journals, and in foreign journals) rise with the increasing level of the affiliation research potential.

Figure 1

**Performance in Polish and foreign journals
in case of faculties
with different levels of research potential**
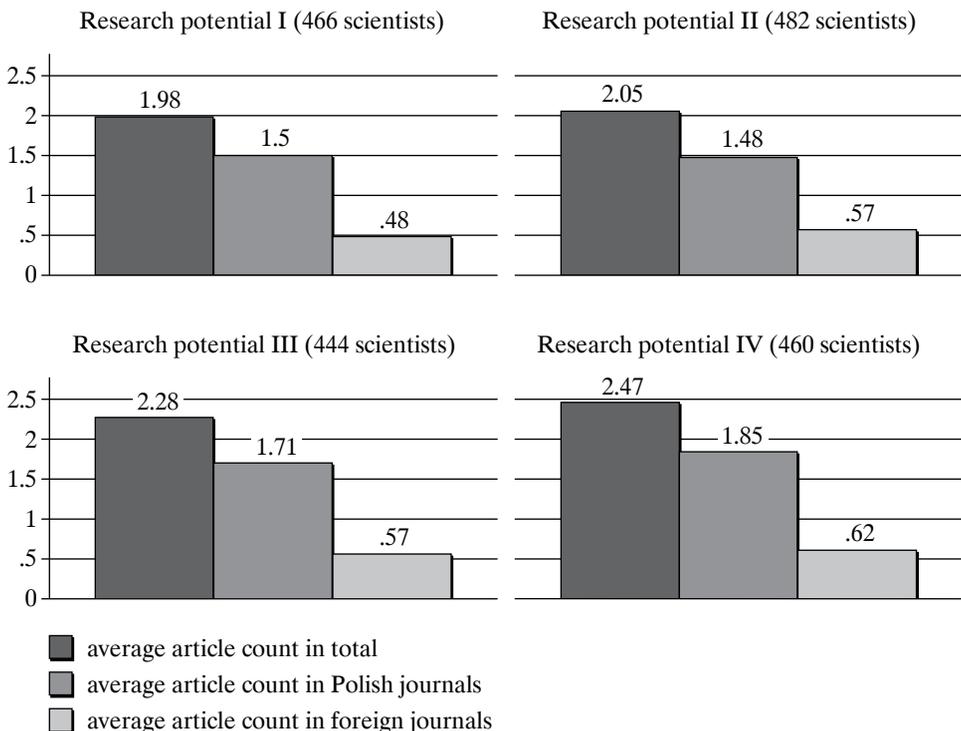
Source: own elaboration.

4. Multilevel analysis – results and discussion

The results of econometric modeling are presented in Table 4. There are 6 models, 2 for each of the dependent variables measuring the article count for each Polish scientist: total number of articles published, those published in Polish journals (only for 1199 observations having records in Polish journals), and those published in foreign ones (only for 602 observations having records in foreign journals). The first model for each explained variable includes only one variable connected with collaboration, namely, average number of authors per article. The second model explores collaboration type, by including two additional variables regarding collaboration: foreign collaboration and share of articles in in-house collaboration (among co-authored articles). In models for article counts in Polish and foreign journals, all those variables are calculated taking into consideration only articles in a given type of journals – Polish or foreign, respectively. To enable comparisons, all models additionally cover the same determinants of performance on an individual level and one aggregated performance factor indicator on an institutional level, namely, the research potential of an affiliation. In order to better understand the relations between publishing in Polish and in foreign journals, in models exploring total quantity in both types of journal together, whether the author has published in Polish journals was controlled for. In model 5, a cross-level interaction between research potential and date of first article in the database was included[14], regarding better chances of younger scientists from better affiliations. Models 1 and 2 (for the total article count) are presented only for reference. Our main interest is to compare publishing patterns in Polish and foreign journals.

The results on collaboration partly support our theses. Generally, writing in co-authorship matters for articles in foreign journals, whereas it is not significant for Polish journals. All variables regarding co-authorship were insignificant (with $p < 0.05$) in all models for article counts in Polish journals. For article count in foreign journals and in all journals in total, the outcome is less clear, as measures of collaboration become significant when included in a set, indicating, that this is the type of collaboration that matters. When potentially beneficial collaborative strategies are controlled for (e.g., foreign collaboration enabling access to diverse resources and in-house collaboration ensuring better understanding and trust), average number of authors per an article starts to be negatively correlated with article count in models 2 and 6.

As expected, foreign collaboration correlates positively with article count in foreign journals and in all journals in total, however it is insignificant (with $p < 0.05$) for Polish journals. Having additional foreign affiliations has a similar but smaller effect, as it is significant (with $p < 0.05$) in models 1 and 5. Surprisingly, the measure of in-house collaboration turned out to be a significant (with $p < 0.05$) and positive correlative of article count in total and in foreign journals. At the same time this share of in-house collaboration was not significant in case

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[14] This interaction was included only in models where it was significant with $p < 0.05$.

of Polish journals, which is in contrary to the proposed hypothesis. It seems that in case of Polish journals none of the considered types of collaboration matters, while Polish authors find some benefits in strong ties within their own affiliation for catching-up in order to publish in foreign journals.

Among individual-level characteristics, it is important when an author started to publish in journals included in our database. Scientists who entered the database earlier, who are those with longer tenure, have been able to publish more articles in the period considered (both total publications and those in a given type of journals). Additionally, in case of foreign journals (in model 5), there is a significant interaction between the date of first article in the database and research potential, meaning that in case of better affiliations, positive relation between longer publishing tenure and higher publishing output is less evident. It is expected that scientists who started earlier had more chances to publish articles, but it turns out that younger scientists have probably more skills and incentives to publish in foreign journals. Costas et al. (2010) indicate that young scientists are the leading ones. Junior researchers acquire the most current skills conducive to higher quality of work, allowing them to publish in the best journals. This seems to be especially convincing for transition countries, where scientists have to catch up not only with technological changes but also with significant institutional and cultural changes.

Controlling for minimum year in the database, scientific titles are not significant in any models. Many studies show that the number of publications increases when a person advances in the academic hierarchy (Aksnes et al. 2011). However, the relationship between scholars' position or their scientific titles and productivity of research may be endogenous, as publication performance is the main criterion for promotion at the university (Gonzalez-Brambila and Veleso 2007; Puuska 2010). We have partly controlled this effect by introducing a variable for promotion to assistant professor, and this variable positively correlates with article count in total and article count in Polish journals, indicating that in Polish economics, during the analyzed period, this promotion is not on average related to successes in international journals. The result may change if we could include a longer time horizon, as since 2011 it is possible in Poland to base this promotion exclusively on achievements in form of articles in journals.

Additionally, males turn out to have higher article counts in all models. This is in accordance with literature, as several authors since long have indicated performance gaps between male and female researchers, with men on average publishing more papers, and receiving more citations than female researchers (Prpic 2002; Taylor et al. 2006; Ledin et al. 2007; Abramo et al. 2009a).

Interestingly, research potential of the institution positively correlates with scientific performance when we consider all articles in total and articles only in Polish journals. It is also significant (with $p < 0.05$) in model 5 (for article count in foreign journals), but only after including across-level interaction with publishing tenure, indicating that it works mostly for younger scientists. For Allison and Long (1990), two complementary mechanisms can explain this result.

Table 4

Estimates of multilevel negative binomial models for article counts in total and in different types of journals (Polish and foreign) – coefficients' values (standard errors in parentheses)

Variables	Model 1 sum of articles in total (minus 1)	Model 2 sum of articles (minus 1)	Model 3 sum of articles in Polish journals (minus 1)	Model 4 sum of articles in Polish journals (minus 1)	Model 5 sum of articles in foreign journals (minus 1)	Model 6 sum of articles in foreign journals (minus 1)
Publishing in Polish journals	0.504*** (0.109)	0.643*** (0.111)				
Males	0.198** (0.071)	0.192** (0.07)	0.195** (0.082)	0.187** (0.082)	0.328** (0.156)	0.322** (0.151)
Doctors	0.219 (0.293)	0.163 (0.288)	0.389 (0.451)	0.398 (0.451)	0.157 (0.396)	-0.208 (0.39)
Ass. professors	0.0491 (0.313)	-0.076 (0.309)	0.223 (0.469)	0.209 (0.47)	0.205 (0.446)	-0.351 (0.448)
Professors	0.573* (0.3)	0.46 (0.296)	0.745 (0.458)	0.754 (0.458)	0.294 (0.424)	-0.169 (0.421)
Promotion to ass. professor	0.569*** (0.109)	0.551*** (0.107)	0.586*** (0.128)	0.575*** (0.128)	0.153 (0.205)	0.225 (0.198)
Date of first article	-0.114*** (0.01)	-0.104*** (0.01)	-0.145*** (0.012)	-0.142*** (0.012)	-0.111*** (0.021)	-0.0544*** (0.016)
Additional foreign affiliation	0.663*** (0.185)	0.0948 (0.189)	-0.818* (0.493)	-0.820* (0.494)	1.036*** (0.203)	0.27 (0.208)
Average no of authors per article	0.044 (0.046)	-0.171** (0.059)				
Average no of authors per in Polish journals article			0.0138 (0.065)	-0.0633 (0.083)		
Average no of authors per article in foreign journals					-0.0503 (0.067)	-0.457*** (0.093)
Foreign collaboration		0.969*** (0.111)				

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign collaboration in Polish journals				0.361* (0.196)		
Foreign collaboration in foreign journals						1.589*** (0.195)
Share of articles in in-house collaboration		0.245** (0.112)				
Share of articles in in-house collaboration in Polish journals				0.169 (0.147)		
Share of articles in in-house collaboration in foreign journals						0.476** (0.202)
Research potential of affiliation	0.143** (0.063)	0.129** (0.064)	0.149** (0.075)	0.146* (0.075)	−90.57** (36.37)	0.131 (0.101)
Research potential x date of first article					0.0452** (0.018)	
Constant	227.939*** (19.332)	207.118*** (19.36)	288.517*** (24.5)	283.917*** (24.7)	220.729*** (42.27)	108.697*** (32.559)
r	6.121 (1.414)	7.047 (1.719)	5.172 (1.259)	5.296 (1.31)	14.148 (10.87)	50.363 (101.859)
s	8.28 (2.33)	9.192 (2.687)	6.872 (2.025)	7.085 (2.114)	18.071 (16.846)	55.056 (121.182)
Observations	1 647	1 647	1 199	1 199	602	602
Number of groups (affiliations)	171	171	133	133	119	119
Log-likelihood	−2 313.426	−2 281.414	−1 702.001	−1 700.04	−652.393	−624.561

*** $p < 0.001$, ** $p < 0.05$, * $p < 0.1$; r and s are estimated parameters of beta distribution.

Source: own elaboration.

First, more prestigious institutions attract more publishing researchers. This selection creates cumulative advantages for the best researchers (the so-called Matthew effect). Second, in these departments, research conditions are more advantageous because of access to more funding. There have been several assessments of the benefits of working in high-potential departments, which are suggested to have higher cross-fertilization of ideas and increased intellectual stimuli. However, it is interesting to note that in case of Polish scientists, working in an university with higher research potential seemed to be more a support in case of Polish than foreign journals. It can indicate that attempts to reach the second are more based on individual efforts and connections and are not facilitated by research units. Furthermore, in addition to the significance of the organization-level variable in most of the models, 5 of 6 models (with exception of model 6[15]) were found to be a better fit than relevant one-level regressions, so the assumption concerning the multilevel structure of the data was generally confirmed.

Finally, it should be noticed that publishing in Polish journals was positively correlated with total number of articles published by a scientist. This is connected with the fact that most of the analyzed articles were published in Polish journals (even if we regarded only 5 Polish economic journals and 283 foreign economic journals).

Conclusion

Several factors, many of which have been shown here, can explain the systematic differences in scientific productivity between researchers. In this study, we developed a multilevel model and tested the correlation of several factors (individual characteristics, collaboration patterns and institutional factors) with individual research performance in domestic and foreign journals. Interestingly, the results differ for those two types of journals. Generally co-authorship plays a more important role for publishing articles in foreign than in Polish journals. However, it is not collaboration itself, but the choice of proper collaboration strategy that matters for reaching foreign journals. For Polish journals, collaboration is insignificant, no matter the collaboration strategy taken. As expected, it is also more extensive for articles in foreign journals in comparison to Polish ones. Interestingly, authors publishing both in Polish and foreign journals seem to transfer publishing patterns form foreign journals to Polish journals, both regarding the decision to collaborate rather than being a solitary author and the content of co-authorship network. A co-author in a foreign journal has a significant chance to become a collaborator in case of a Polish journal. Therefore we may hope that experience, expertise and contacts obtained while publishing in a good foreign

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[15] However, we decided to use a multilevel model over standard negative binomial model in this case, in order to enable comparisons with model 5.

journal may serve as a quality improvement in case of articles intended to be published in Polish journals.

Furthermore collaboration seems to matter especially for reaching foreign colleagues, which, as expected, turned out to beneficial for scientific performance, but only in case of the quantity of articles in international journals, and not in Polish ones. Additionally, in-house collaboration is a positive correlative of publishing in foreign journals, and contrary to expectations is not significant in Polish journals. At the same time it is more prevalent in domestic than foreign journals.

Senior researchers, with a longer history of publishing, have higher article count, but reverse tendency appears in case of foreign journals for employees who are from faculties with better research potential. Furthermore, promotion to assistant professor, at least in analyzed period, is, on average, still not connected with achievements in foreign journals, but is correlated with quantity of articles in Polish journals.

Lastly, department characteristics are important for the publication productivity of scientists. The evidence not only shows that research potential (an institutional-level variable) and its interaction with promotion are significant but also that multilevel modeling is in most cases a better fit than standard techniques (regression). Interestingly, research potential correlates with article count in Polish journals. For foreign journals, it turns out that publishing the higher number of articles is achieved more based on individual efforts and seeking collaborators and generally seems not to be facilitated by the faculty level, at least not for employees with longer tenure. Future studies should incorporate changes over time to distinguish between correlation and causation, which was not possible using our database.

Generally, scientists from a transition country faced with 'publish or perish' challenge seem to benefit from the same publishing strategies as those described in international literature. However differences between domestic and foreign journals prevail. As we argued above, important success factors for catching-up with western colleagues are those of social nature, connected with collaboration and institutional surrounding.

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STRUKTURA PUBLIKACJI POLSKICH AUTORÓW W KRAJOWYCH I ZAGRANICZNYCH CZASOPISMACH EKONOMICZNYCH

Streszczenie

Artykuł zawiera analizę wielopoziomową produktywności naukowej polskich ekonomistów z uwzględnieniem różnych czynników wpływających na wyniki publikacyjne. Analizowane dane dotyczą artykułów o tematyce ekonomicznej opublikowanych w latach 1999–2012 w pięciu wiodących czasopismach polskich oraz czasopismach zagranicznych indeksowanych w bazach Scopus i Web of Science. Okazuje się, że współpraca naukowa (której owocem są wspólne publikacje) jest częstsza w przypadku artykułów publikowanych w czasopismach zagranicznych. Autorzy publikujący artykuły we współautorstwie czynią to na łamach czasopism polskich najczęściej z udziałem tych samych współpracowników, co w przypadku publikacji w czasopismach zagranicznych. Jeśli chodzi czasopism zagraniczne prace zespołowe zwiększają szanse publikacji, zarówno w przypadku współautorów z zagranicy, jak i z tego samego wydziału. Potencjał naukowy macierzystych ośrodków badawczych ma większe znaczenie przy publikacjach krajowych niż zagranicznych.

Słowa kluczowe: produktywność naukowa, czasopisma ekonomiczne, współautorstwo, czynniki instytucjonalne, analiza wielopoziomowa

JEL: D02, I23, J24, J45, O31

Grażyna Bukowska, Beata Łopaciuk-Gonczaryk

PUBLISHING PATTERNS OF POLISH AUTHORS IN DOMESTIC AND FOREIGN ECONOMIC JOURNALS

Summary

This study develops a multilevel model of academic performance for Polish economists and investigates several factors correlated with individual publishing outcome. The data used are based on articles in the domain of economics published between 1999 and 2012 in five leading Polish journals and in foreign journals listed in Scopus and in Web of Science. The study argues that scientific collaboration (demonstrated by co-authorship) is more frequent in foreign journals than in Polish ones. Authors who choose collaborative publishing strategy tend to collaborate in case of Polish journals with the same coauthors as in case of foreign journals. The type of collaboration also matters. For publishing in foreign journals, both foreign cooperation and in-house collaboration create an advantage. Research potential of an university department turns out to matter more for publishing in Polish than foreign journals.

Key words: scientific productivity, economic journals, co-authorship, institutional factors, multilevel analysis

JEL: D02, I23, J24, J45, O31

СТРУКТУРА ПУБЛИКАЦИЙ ПОЛЬСКИХ АВТОРОВ В ОТЕЧЕСТВЕННЫХ И ЗАРУБЕЖНЫХ ЭКОНОМИЧЕСКИХ ИЗДАНИЯХ

Резюме

Статья содержит многоуровневый анализ научной эффективности польских экономистов с учетов разных факторов, влияющих на результаты публикаций. Анализируемые данные касаются статей на экономические темы, опубликованные в 1999–2012 гг. в пяти ведущих польских изданиях, а также в зарубежных изданиях, имеющих индексы в базах Scopus и Web of Science. Авторы показывают, что научное сотрудничество (результатом которого являются совместные публикации) имеет место чаще в случае статей, опубликованных в зарубежных изданиях. Если говорить то публикациях вместе с одними и теми же соавторами, то это происходит чаще на страницах польских изданий, чем зарубежных. В случае зарубежного издания коллективные работы увеличивают шансы появления публикации как при наличии зарубежного соавтора, так и соавтора из того же вуза. Научный потенциал исследовательских центров в случае отечественных публикаций имеет большее значение, чем в случае зарубежных.

Ключевые слова: научная эффективность, экономические издания, соавторство, институциональные факторы, многофакторный анализ

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