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**An Empirical Analysis of the Relationship Between Individual
Characteristics and Research Productivity: Relationship
Between Experience as Practical Physician and Productivity**

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An Empirical Analysis of the Relationship Between Individual Characteristics and Research Productivity: Relationship Between Experience as Practical Physician and Productivity

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Abstract

This paper provides an analysis of the relationship between research performance and individual characteristics (e.g., career path information) of researchers, based on information provided in the Curriculum Vitae (CVs) of 565 excellent researchers within the life sciences and medical sciences fields in Japan. I specifically analyzed the relationship between the experiences of practical physicians and research performance. As a result, I found that the experience as a practical physician had a statistically positive relationship with the number of research papers, but there was not a significant relationship with the number of citations. Moreover, the diversity of a researcher's career related significantly to the number of citations and patents. An employment experience at a young age with a company or independent administrative agency had a significant and positive relationship with number of coauthors. However, a significant relationship between work experience in a foreign country and research performance was not observed.

Keywords

Research productivity • Curriculum Vitae • Career path • Practical physician • Diversity of career • Research grant

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1. Introduction

A researcher's characteristics, such as the affiliated research organization, international work experience, college degrees, and funding from research grants, differ considerably from one researcher to the next. Therefore, it is important to clarify the relationship between a researcher's individual characteristics, including career path and research performance, quantitatively.

This paper offers an empirical analysis regarding the factors that contribute to research productivity (e.g., number of papers, citations, patents, and coauthors) in the life sciences and medical sciences fields in Japan. I analyzed the relationship between the experiences of practical physicians and research performance, that had not been examined previously. In addition, I have provided an explanation of the relationships between research performance and career path (e.g., employment experience in an administrative agency, independent agency, company, or university).

Previous studies have analyzed the relationships between career path and research productivity; for example, Dietz et al. (2000) assessed the utility of the Curriculum Vitae (CV) as a data source for examining the career paths of scientists and engineers. As a result of an ordinary least squares (OLS) regression using CV data of 190 researchers in biotechnology and microelectronics areas, three independent variables—number of publications during Ph.D. studies, time in assistant professorship rank, and patents—related significantly and positively to the number of publications per year after receipt of the doctoral degree. Dietz and Bozeman (2005) showed that career patterns and some degree of career diversity are associated with both publication and patent productivity; their findings were based on CV data of scientists and engineers working at university-based research centers in the United States.

Jonkers and Tijssen (2008) debated the relationship between scientific mobility and international collaboration using 76 plant molecular life scientists at the senior level of professor/principal investigator in China's research organizations. As a result of their analysis, they showed that overseas experience and time since returning to China had significantly positive correlations with the number of publications and international co-publications. Time spent abroad also correlated with international co-publications. Cañibano et al. (2008) showed that international mobility in the post- or pre-doctoral stage had no statistically positive association to publication productivity, based on CVs of 266 researchers in Spain. Moreover, as a result of categorizing researchers into four groups (i.e., mobile, immobile, excellent, and entrepreneurial) based on data from CVs of 326 researchers who were grant holders at a Swedish research foundation, Sandström (2009) showed that immobile scientists are less productive and less entrepreneurial, while entrepreneurial researchers dedicated to patenting and groundbreaking activity have changed their affiliations many times in their careers. Su (2011) showed that post-doctoral training resulted in an increase of 17% for published articles within three years of earning doctorate degrees, although this positive effect appears to have faded quickly. Furthermore, findings showed that industry experience within three years after earning a doctoral

degree resulted in a 28% decrease in publications, based on the CVs of tenured scientists and engineers working at research universities. The CV appears to be useful when investigating a researcher's career, as noted in many previous studies (Gaughan and Bozeman 2002; Gaughan and Ponomariov 2008; Gaughan 2009; Jonkers 2011; Cañibano et al. 2011).

Moreover, a trend within the medical sciences and clinical sciences fields has been observed in recent years in Japan; Kanda and Kuwahara (2011) showed that the largest ratio of research time (53.3%) was devoted to basic medicine; further, clinical fields¹ researchers were identified as having the smallest ratio (22.0%), based on four activities (research activity², education, social service³, and others) in the faculty teacher in 2008. In addition, a decrease in time devoted to research was noted when compared with 2002 findings, and this decrease was especially large in national and public universities and local national universities. On the other hand, the ratio of time devoted to social services, including diagnosis and treatment activity, increased. The authors pointed out, "National universities turn into independent administrative entities, and having changed the organization and management greatly cause the phenomenon of increasing the social service activity ratio, like the diagnosis and treatment in the university attachment hospital in the clinical sciences fields." ⁴

Toyoda (2012) showed that the number of papers in clinical medicine fields has displayed a slight uptrend at reputable national universities and private universities, but a stagnation tendency was observed for public universities; furthermore, a decreasing tendency has been noted for local universities in Japan since 2000.

Therefore, it is suggested that the ratio of time devoted to research decreases in the clinical medicine fields, and time devoted to diagnosis and treatment activity becomes greater as social services increase. Additionally, the number of published papers from reputable national universities and private universities has experienced a slight uptrend.

Furthermore, this study includes an analysis of the relationship between the experiences of the practical physician and research productivity. In other words, it verifies whether the experience as a practical physician has a negative relationship to research activities by decreasing research time, or if it has positive relationship based on the acquisition of knowledge for diagnosis and treatment activities. In addition, the relationship between a researcher's career path and research productivity is verified. Until now, there has been no study with an empirical analysis about the relationship among the researcher's features, career path, and productivity through econometrics for researchers in

¹Clinical fields were classified as internal medicine and surgery.

²Research activity includes collecting data and information associating research, data processing, measurements and experiments, and research meetings.

³Diagnosis and treatment activity is included in the social services classification.

⁴The independent administrative agency system is a system designed to give an independent corporate status to the organization. This system has aimed to improve the quality, efficiency, transparency of operations, and autonomous management.

Japan.

This paper is organized as follows. Section 2 describes the hypothesis. Section 3 provides details regarding data. Section 4 explains the method of analysis. Section 5 describes the estimation results, and Section 6 presents discussions and conclusions.

2. Hypotheses

This section explains the hypotheses regarding the relationship between the researcher's features and research productivity. First, the relationship between experience as a practical physician and research productivity has not been analyzed. There are two hypotheses concerning the practical physician experience:

- (1) Experience as a practical physician, except for the residency period, has a negative relationship with research performance by decreasing time devoted to research
- (2) The experience and the knowledge obtained by the practical physician are associated positively with research productivity.

Next, concerning career and research productivity, Dietz and Bozeman (2005) have analyzed four hypotheses by examining the relationship between career patterns and the number of papers and patents. The authors used scientists and engineers working at university-based research centers in the United States. They found that: (a) job changes throughout one's career provide access to new social networks, resulting in higher productivity; (b) the traditional career path, defined as spending one's entire post-Ph.D. career at a university will yield higher productivity; (c) early career experiences through graduate assistantships and post-doctoral research experiences result in higher productivity; and (d) early productivity based on publishing before obtaining a doctoral degree will yield higher productivity (precocity). Using the Tobit model, the authors showed that the relationship between precocity and productivity appears to be weak; furthermore, they observed that postdoctoral research positions may inhibit productivity. They also showed that more traditional academic career paths that result in higher publication, and patent rates were associated with careers in industry.

Based on the above, this study provides an analysis of the following hypotheses:

- (1) As for the variables of job change, employment experience is obtained in an administrative agency, company, independent administrative agency, foreign country⁵, or through receipt of a doctoral degree in a foreign country. Jonkers and Tijssen (2008) observed, "Foreign experience is expected to have an effect on the researcher's English proficiency, which influences his [or her] ability to publish in English language international journals."
- (2) As for the traditional career path, the relationship between research activities and career at the same university from which one graduated or pursued a doctorate, or all positions at the same

⁵Experience as a researcher in a research institution in a country other than Japan is referenced.

institution, is verified.

- (3) As for the early career experiences and precocity, I examined the experiences of the researchers selected for the Research Fellowship for Young Scientists⁶ and assistants. It is possible that the fellowship experience relates positively to research activities because of the environment that promotes productive research from a young age. The assistant experience is especially applicable to the medical sciences fields. While an assistant learns a great deal, actual time spent in research activities is short. According to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) (2008), the engagement ratio to an assistant's research activities is 36.6% while the average is 39.1%. Moreover, though the ratio of time typically devoted to social service activities, including diagnosis/treatment, and office work is 23.4% on average, an assistant devotes 31.5% of his/her time to such activities. Therefore, it can be said that experience both a research fellow and assistant is a proxy variable associated with independence as researcher.

3. Data

In this analysis, data were obtained from researchers in the life sciences and medical sciences fields who had been selected for the 21st Century Centers of Excellence (COE) program established in 2002 by the Japan Society for the Promotion of Science. The objective of this program is to cultivate a competitive academic environment among Japanese universities. 23 researchers did not have the paper among 1,255 researchers in this field. 565 responded with career information among 1,232 researchers; ultimately, this group was analyzed for the purposes of this study.

First, I used the Scopus database to document each researcher's data (i.e., number of papers and citations) because Scopus assigns author IDs to prominent researchers, facilitating full name searches and researcher's institution searches. The author ID function on the Scopus database is not completely error-free, thus leading to problems in identifying authors with affiliation changes. To avoid problems in data accuracy, the collected data were filtered by matching affiliations and departments. Since this process could lead to the accidental omission of researchers who had changed their affiliations a number of times, I contacted each researcher via e-mail to confirm his/her list of publications. Moreover, I counted the number of coauthors per paper.

The number of patents, for which I used Espacenet Patent search, offered by the European Patent Office. Espacenet offers free access to more than 80 million patent documents worldwide, and it contains information about inventions and technical developments since 1836. Furthermore, it is

⁶Japan Society for the Promotion of Science (JSPS) provides a special program that grants fellowships to (1) young Japanese postdoctoral researchers who conduct research activities at Japanese universities or research institutions on a non-employment basis and to (2) graduate students who conduct research in Japanese university doctoral programs. Please refer to <http://www.jsps.go.jp/english/e-pd/index.html>.

possible to search by connecting with Scopus (using SciVerse Hub); searches can be conducted according to author's name, institution, year, and field. For this study, searches were conducted for number of patents, author's full name, and institutions where employed. I refer to publication date in this paper; it represents the date that a patent application was published. Thus, it represents the date the document became available to the public. It is necessary to note that the patent used for this analysis were limited to the ones for which researchers were identified as inventors.

In addition, I used the KAKEN⁷ database for the research grant. KAKEN is the database of Grants-in-Aid for Scientific Research. It was established and provided by the National Institute of Informatics, with the support of the MEXT and the JSPS. Grants-in-Aid are awarded to promote creative and pioneering research across a wide spectrum of scientific fields, ranging from the humanities and social sciences to the natural sciences. Grants are awarded to projects organized by individual researchers or research groups at Japanese universities or research institutes. Research results obtained under these grants are published in a number of academic journals. In this study, I analyzed only those research studies headed by researchers, and I used only direct expenses.

Moreover, information on each researcher's career was obtained from the CV that was publicly available on the Web and ReaD&Researchmap database. ReaD&Researchmap⁸ is a service that the Japan Science and Technology Agency provides on the Internet to support the researchers' database and performance management system constructed by the university and research institutions. This database can search for 22,000 researchers based on names and affiliated institutions. The template for a CV was developed for this database; it contains career information, as well as research fields and papers published.

For the 565 researchers included in this study, I explored their research careers after graduation from a university. The cross-section data covers 1996 to 2009.

4. Methods of analysis

Regarding methodology used for this study, the numbers of papers and citations reflect research performance, and the numbers of patents and coauthors used for explained variables. The decline in citations of recent papers is a major problem. To address it, some studies have used normalization, which is used with forward citation of patents (Hall et al. 2001). The normalization approach was used in this study by dividing each citation by the corresponding year's citation mean. Additionally, each explained variable was divided by the researcher's career length to resolve problems associated with differences in length of researchers' careers. Because researchers' birth dates were not available, this study is based on the assumption that a researcher was employed initially at age 28. Furthermore, the retirement age was established as age 65 in 2009. As an example, if the first year of employments

⁷<http://kaken.nii.ac.jp/>

⁸<http://researchmap.jp/>

was 1999, the career length was ten years (i.e., $2009 - 1999 = 10$). Career length was defined based on the method noted above; it assumes career length as 37 years if it spans 38 years or more.

Because each explained variable is nonnegative, use of the Tobit model, Poisson model, and negative binomial model were appropriate for this study (Dietz and Bozeman, 2005). The explanatory variables were: experience of those selected for the Research Fellowship for Young Scientists, first employment according to three career divisions (i.e., administrative agency⁹, company, or independent administrative agency¹⁰), experience accrued in the above three career divisions, and diversity of career. Diversity is associated with the number of divisions through which a researcher belongs (i.e., 0 to 3). I examined diversity of employment excluding academia as it related to research activities. In addition, assistant experience, research careers in foreign countries, experience as a practical physician (residency period is excluded), gender (male = 1), amount of Grants-in-Aid for Scientific Research, career with the university from which one graduated, career at the same university where doctorate was received, all positions at the same institution, doctoral degree from foreign countries, type of doctoral degree (e.g., medical science, science, medical dentistry, engineering, agriculture, pharmacology), and cross-term of fellowship experience and assistant were considered. Table 1 shows the variables used.

<Insert Table 1>

5. Estimated results

This section shows the estimation results of selection probability for disclosing career information, and estimation results of the relationship between researcher's features and performance, according to the Tobit model, Poisson model, and negative binomial model. When the null hypothesis that data follows the Poisson distribution (i.e., assumes the average to be equal to variance) is rejected, findings of this study support the results of the negative binomial model.

5.1 Selection probability of career information disclosure

This study includes an analysis of the relationship between research performance and disclosed

⁹It includes research institute under the direct control of the administrative agency in this analysis.

¹⁰This variable refers to independent administrative agencies as of October 2012, other than the incorporated national university. It includes foundations and the Inter-University Research Institute Corporation (IURIC). IURIC is classified as an independent administrative agency in this study to distinguish it from a university, though it is based on an incorporated national university. IURIC has made an important contribution to the development of Japan's academic research by conducting effective joint research and providing researchers with benefits that are difficult for individual universities to maintain (e.g., large-scale facilities, considerable amounts of data, and academic materials).

career information, based on data from 1,232 researchers. I estimated the odds ratio using a logit model; explained variables included verification of complete researcher information (1 = Yes, 0 = No), and the number of papers and citations for the explanatory variables.

The odds ratio is the ratio of the odds of an event occurring in one group to the odds of it occurring in another group. Odds are the ratio of the probability of a variable becoming one or zero. Table 2 shows the findings from the logit model and the odds ratio.

<Insert Table 2>

According to the odds ratio, the ratio of the probability of disclosing career information to the probability of not disclosing, according to an increase in the number of published papers, was 1.340. In other words, this means that the probability of disclosing career information to the public increased relatively by 34%. The number of citations was not related necessarily to the selection probability of disclosing, because a significant result was not obtained by the citation count. Therefore, because the probability of disclosure is high for a highly published researcher, it is necessary to note that productivity of researchers targeted by this analysis was higher than that of researchers excluded from analysis because of non-disclosure.

5.2 Estimated results for number of papers

The following estimation is based on the analysis of 565 researchers who disclosed career information. Model 1 uses the diversity of career variable; Model 2 uses the first employment variable; and Model 3 uses the employment experience variable. The diversity of career variable was zero if a researcher belonged only to academia. The logarithm was taken after 1 was added to the grant.

Table 3 shows the estimated results for number of papers. The following variables were statistically positive for the number of papers in all models: research fellowship, first job with an independent administrative agency, employment with the same university from which the researcher graduated, experience as a practical physician, male gender, and grant amount. A significant relationship was not seen for diversity of career; moreover, first job or experience in an administrative agency showed a significantly negative relationship with the number of papers in the negative binomial model.

<Insert Table 3>

5.3 Estimated results for number of citations

Table 4 shows the estimated results for number of citations. Diversity of career, first employment,

experience in an independent administrative agency, and grant amounts had statistically positive relationships with citations. Furthermore, the experience as a practical physician was not significant but the sign was negative. These results differ from those regarding number of papers because the research fellowship experience did not relate significantly, nor did the graduation university.

<Insert Table 4>

5.4 Estimated results for number of patents

Table 5 shows the estimated results regarding number of patents. Assistant experience had a significantly negative relationship, but experience with an independent administrative agency and career diversity had significantly positive relationships to patent activity for all models. Moreover, though the research fellowship experience showed a statistically negative relationship, cross-term of the fellowship and assistant experiences showed positive relationships with patents. Though grant amount related to the number of papers and citations, it did not relate to patents. Because Grants-in-Aid for Scientific Research primarily support academic research, they do not relate statistically to number of patents. From the study sample, 359 researchers did not have patents (63.5%); further, 75.4% of researchers had zero or one patent numbers. Therefore, it is shown that patent activity was not the main focus of researchers, and the characteristics of researchers who had several patents differed from those of general researchers.

<Insert Table 5>

5.5 Estimated results regarding number of coauthors

Though the number of papers and experience as a practical physician showed significantly positive relationships, joint authorship through research collaboration was shown in previous studies to have a positive relationship to research productivity (Price and Beaver 1966; Zuckerman 1967; Pao 1982; Pravdic and Oluic-Vukovic 1986; Lee and Bozeman 2005; Sooryamoorthy, 2013). Beaver (2001) showed that one of the purposes for collaboration is to enhance efficiency and productivity. Therefore, the possibility exists that the researcher who is experienced as a practical physician and who collaborates with many coauthors can maintain a high level of research productivity despite limited time for research. Consequently, I analyzed the relationship between the number of coauthors and each variable identified in this study.

Table 6 shows the estimated results for number of coauthors. A significantly positive relationship was not identified between experience as a practical physician and number of coauthors. Moreover, though experiences in various career divisions related to the number of coauthors, diversity of career was not a significant factor. There were many coauthors when a researcher was initially employed by

a company or independent administrative agency. Therefore, experience in a nonacademic career while young appears to have an influence on the number of coauthors due to an expanding network of collaborators. However, if a first job was with an administrative agency, a significantly negative association in number of coauthors was found. In addition, though fellowship or assistant experience had significantly positive relationships, experiencing both resulted in a significantly negative relationship to the number of coauthors. Therefore, the negative relationship appears to be linked to time required to become independent as a researcher.

<Insert Table 6>

5.6 Estimations for researchers who are Doctors of Medical Science (DMSc)

Though there were 188 researchers with experience as practical physicians among the sample of 565 researchers. Therefore, I analyzed only 296 researchers who had DMSc . Tables 7–9 show the estimated results for number of papers, citations, and coauthors. For researchers who were DMSc, the first job with an independent administrative agency related significantly to each explained variable.

Experience as a practical physician and grant amount had a significantly positive relationship with number of papers. Regarding number of citations, experience with a company was significantly positive in the negative binomial model. Cross-term of the fellowship experience and employment as an assistant were associated positively with citations.

Regarding number of coauthors, first employment with or experience with a company, and first employment with an independent administrative agency were significantly positive. Thus, the experience of nonacademic careers at a young age related to the number of coauthors. Experience as a practical physician did not have a significantly positive relationship with number of coauthors. Moreover, though diversity of career had no relationship with number of papers, it had a positive relationship for citations.

<Insert Table 7>

<Insert Table 8>

<Insert Table 9>

6. Conclusion

As a result of analyzing the relationship between experience as a practical physician and research performance, experience as a practical physician had a significantly positive relationship with

number of papers but not with number of citations. Regarding the hypothesis that assesses whether the experience as a practical physician has a negative or positive relationship to research, this paper suggests that knowledge obtained by the practical physician has a positive influence on the number of papers. On the other hand, it is suggested that decreasing research time leads to difficulty in producing papers with strong impact. However, since this analysis does not use research time and practical knowledge as variables, I cannot assert that a decrease in research time and knowledge acquired from experience as a practical physician influences research performance. Further, this study does not encompass all features of the field of clinical medicine, so it cannot explain fully the reason for a relationship between the practical physician and the number of papers.

Moreover, although it is possible that researchers who have many coauthors maintain their productivity even if research time is limited, my analysis indicated that the practical physician experience did not relate significantly to the number of coauthors. On the other hand, experience with a company or independent administrative agency at a young age had a positive relationship with number of coauthors. Though research experience in a foreign country was expected to relate to research performance, no significant relationship was noted.

As for the researcher's experience from a young age, research fellowship experience had a significantly positive relationship to the number of papers. There is a possibility that researchers selected as research fellows were either excellent scholars originally or individuals focused entirely on research from an early stage. Moreover, a career with an independent administrative agency related positively to the numbers of papers and citations. It also appears that using large-scale environmental facilities offered no educational function for students in the Inter-University Research Institute Corporation related positively to research.

As for diversity of career and research performance, there was no relation with number of papers. Though a career with the university from which one graduated and jobs at the same institution had a positive trend for number of papers, there was a positive relationship between citation count and career diversity. The findings suggest that a variety of employment experiences are advantageous for producing an impact of papers.

However, this study cannot explain all trends in the life sciences and medical sciences field because this analysis was applicable only to researchers who could attract large-scale competitive research funding (21st COE program) and who had disclosed career information.

References

- Beaver, D. (2001). Reflections on Scientific Collaboration (and Its Study): Past, Present, and Future. *Scientometrics*, 52(3), 365-277.
- Cañibano, C., Otamendi, J., and Andújar, I. (2008). Measuring and Assessing Researcher Mobility from CV Analysis: the Case of the Romón y Cajal programme in Spain. *Research Evaluation*, 17(1), 17-31.
- Cañibano, C., Otamendi, F., and Solís, F. (2011). International Temporary Mobility of Researchers: a Cross-discipline Study. *Scientometrics*, 89(2), 653-675.
- Dietz, J. and Bozeman, B. (2005). Academic Careers, Patents, and Productivity: Industry Experience as Scientific and Technical Human Capital. *Research Policy*, 34(3), 349-367.
- Dietz, J., Chompalov, I, Bozeman, B., Lane, E., and Park, J. (2000). Using the curriculum vitae to the study the career paths of scientists and engineers: An exploratory assessment. *Scientometrics*, 49(3), 419-442.
- Gaughan, M. and Bozeman, B. (2002). Using Curriculum Vitae to Compare Some Impacts of NSF Research Grants with Research Center Funding. *Research Evaluation*, 11(1), 17-26.
- Gaughan, M. and Ponomarev, B. (2008). Faculty Publication Productivity, Collaboration, and Grants Velocity: Using Curricula Vitae to Compare Center-Affiliated and Unaffiliated Scientists. *Research Evaluation*, 17(2), 103-110.
- Gaughan, M. (2009). Using the Curriculum Vitae for Policy Research: An Evaluation of National Institutes of Health Center and Training Support on Career Trajectories. *Research Evaluation*, 18(2), 117-124.
- Hall, B., Jaffe, A. and Trajtenberg, M. (2001). The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools. *NBER Working Paper*, 8498.
- Jonkers, K. and Tijssen, R. (2008). Chinese Researchers Returning Home: Impacts of International Mobility on Research Collaboration and Scientific Productivity. *Scientometrics*, 77(2), 309-333.
- Jonkers, K. (2011). Mobility, Productivity, Gender and Career Development of Argentinean life Scientists. *Research Evaluation*, 20(5), 411-421.
- Kanda, Y. and Kuwahara, T. (2011). Shrinking Research Time for University Faculty Members Comparison of 2002 and 2008 in the “Survey on Full-Time Equivalents at Universities”, National Institute of Science and Technology Policy, Mext, Discussion Paper No.80. <http://hdl.handle.net/11035/497>
- Lee, S. and Bozeman, B. (2005). The Impact of Research Collaboration on Scientific Productivity. *Social Studies of Science*, 35(5), 673-702.
- Ministry of Education, Culture, Sports, Science and Technology in Japan. (2008). Survey on Full-Time Equivalents at Universities. http://www.mext.go.jp/b_menu/houdou/21/09/_icsFiles/afieldfile/2009/09/14/1283868_2.pdf

- Pao, M. (1982), Collaboration in Computational Musicology. *Journal of the American Society for Information Science*, 33(1), 38-43.
- Pravdic, N. and Oluic-Vukovic, V. (1986). Dual Approach to Multiple Authorship in the Study of Collaborator and Scientific Output Relationship. *Scientometrics*, 10(5), 259-80.
- Price, D. and Beaver, D. (1966). Collaboration in an Invisible College. *American Psychologist*, 21(11), 1011-18.
- Sandström, U. (2009). Combining Curriculum Vitae and Bibliometric Analysis: Mobility, Gender and Research Performance. *Research Evaluation*, 18(2), 135-142.
- Sooryamoorthy, R. (2013). Publication Productivity and Collaboration of Researchers in South Africa: New Empirical Evidence. *Scientometrics*, Article in Press.
- Su, X. (2011). Postdoctoral Training, Departmental Prestige and Scientist's Research Productivity. *The Journal of Technology Transfer*, 36(3), 275-291.
- Toyoda, N. (2012). Medical Publication Trends in Japan. *The Japanese Congress of Neurological Surgeons*, 21(6), 446-451.
- Zuckerman, H. (1967), Nobel laureates in Science: Patterns of Productivity, Collaboration, and Authorship. *American Sociological Review*, 32(3), 391-403.

Table 1: Description of variables

Variable	Description
Number of papers	Cross-section data of the number of papers of each researcher (divided by researcher's career length)
Number of citations	Cross-section data of the number of papers by researcher (divided by number of average citations each year and researcher's career length)
Number of patents	Cross-section data of number of patents for each researcher (divided by researcher's career length)
Number of coauthors	Cross-section data of number of coauthors per paper (divided by researcher's career length)
Research Fellowship for Young Scientists	Experience and encouragement received from grant awarded to young researcher (1 = Yes, 0 = No)
Diversity of career	How many career experiences were obtained in the three divisions: administrative agency, company, and independent administrative agency? (0 to 3, i.e., 0 = They belonged only to academia)
First employment with an administrative agency	1 = Yes, 0 = No
Employment experience in an administrative agency	1 = Yes, 0 = No
First employer with a company	1 = Yes, 0 = No
Employment experience with a company	1 = Yes, 0 = No
First employment with independent administrative agency	1 = Yes, 0 = No
Employment experience in an independent administrative agency	1 = Yes, 0 = No
Assistant experience	1 = Yes, 0 = No
Foreign research experience	1 = Yes, 0 = No
Experience as a practical physician	The residency period is excluded: 1 = Yes, 0 = No
Male gender	1 = Yes, 0 = No
Amount of Grants-in-Aid for Scientific Research	Grants-in-Aid are awarded to promote creative and pioneering research across a wide spectrum of scientific fields. Grants are awarded to projects organized by individual researchers or research groups at Japanese universities or research institutes. The logarithm was taken after 1 was added to the grant.
Career at university from which the researcher graduated	Is career as faculty member at the same university from which one graduated? 1 = Yes, 0 = No
Career at the same university as doctoral program	Is career at same university as doctoral program? 1 = Yes, 0 = No
All careers at the same institution	1 = Yes, 0 = No
Doctoral degree from a foreign country	1 = Yes, 0 = No
Doctor of Medical Science (DMSc)	1 = Yes, 0 = No
Doctor of Science	1 = Yes, 0 = No
Doctor of Dentistry	1 = Yes, 0 = No
Doctor of Engineering	1 = Yes, 0 = No
Doctor of Agriculture	1 = Yes, 0 = No
Doctor of Pharmacology	1 = Yes, 0 = No
Other doctoral degree	1 = Yes, 0 = No
Experience as research fellow for young scientists and as assistant	Cross-term of experience in research fellowship and assistant (1 = Yes, 0 = No)

Table 2: Selection probability of career information disclosure

Variables	Coef.(Std. Err.)	Odds ratio	P> z
The number of papers	0.293*** (0.0477)	1.340	0.000
The number of citations	0.101 (0.134)	1.106	0.439
Constant	-0.775*** (0.0854)		

Log likelihood is -790.2. Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

Table 3: Estimated results for number of papers

	Tobit model			Negative binomial model		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Research Fellowship	1.641*(0.845)	1.569* (0.835)	1.608* (0.845)	0.603** (0.251)	0.499** (0.246)	0.586** (0.251)
Diversity of career	-0.139 (0.274)			-0.0465 (0.0848)		
Administrative agency (first)		-1.558 (1.279)			-1.990** (0.835)	
Administrative agency			-0.715 (0.812)			-0.623** (0.293)
Company (first)		-0.115 (0.719)			0.00676 (0.245)	
Company			-0.509 (0.556)			-0.188 (0.185)
Independent administrative agency (first)		1.248** (0.577)			0.526*** (0.172)	
Independent administrative agency			0.0394 (0.319)			0.0466 (0.0968)
Assistant experience	-0.398 (0.328)	-0.281 (0.331)	-0.437 (0.330)	-0.127 (0.0970)	-0.0731 (0.0974)	-0.139 (0.0974)
Foreign research experience	-0.0237 (0.291)	-0.0379 (0.290)	-0.0397 (0.291)	0.0117 (0.0878)	0.0122 (0.0876)	0.00745 (0.0877)
Experience as practical physician	0.866** (0.340)	0.915*** (0.338)	0.873** (0.339)	0.237** (0.0982)	0.268*** (0.0971)	0.243** (0.0980)
Male gender	1.333* (0.780)	1.348* (0.776)	1.337* (0.779)	0.678** (0.285)	0.702** (0.283)	0.673** (0.284)
Amount of Grants-in-Aid	0.175*** (0.0588)	0.176*** (0.0585)	0.174*** (0.0588)	0.0632*** (0.0175)	0.0662*** (0.0174)	0.0624*** (0.0175)
Career at same university (graduated)	0.757* (0.428)	0.783* (0.428)	0.772* (0.428)	0.324** (0.137)	0.347** (0.136)	0.328** (0.137)
Career at same university (doctoral)	-0.0879 (0.451)	-0.0838 (0.455)	-0.109 (0.450)	-0.0320 (0.147)	-0.0101 (0.149)	-0.0292 (0.147)
All careers at the same institution	0.397 (0.452)	0.477 (0.444)	0.389 (0.452)	0.122 (0.134)	0.156 (0.131)	0.119 (0.133)
Doctoral degree from foreign country	-0.389 (1.083)	-0.251 (1.083)	-0.341 (1.084)	-0.171 (0.345)	-0.0404 (0.347)	-0.129 (0.346)
Doctor of Medical Science (DMSc)	3.299*** (1.064)	3.174*** (1.069)	3.344*** (1.066)	0.697*** (0.265)	0.666** (0.264)	0.881*** (0.280)
Doctor of Science	2.876*** (1.087)	2.661** (1.093)	2.950*** (1.088)	0.503* (0.274)	0.448* (0.271)	0.698** (0.287)
Doctor of Dentistry	2.446** (1.235)	2.329* (1.239)	2.497** (1.235)	0.379 (0.324)	0.351 (0.322)	0.561* (0.335)
Doctor of Engineering	2.253** (1.118)	2.144* (1.118)	2.407** (1.125)	0.0952 (0.275)	0.0865 (0.271)	0.338 (0.292)
Doctor of Agriculture	2.171* (1.177)	2.040* (1.172)	2.324* (1.184)	0.0570 (0.318)	0.0526 (0.315)	0.301 (0.335)
Doctor of Pharmacology	3.942*** (1.136)	3.698*** (1.139)	4.036*** (1.140)	0.837*** (0.274)	0.775*** (0.270)	1.048*** (0.290)
Other doctoral degree	3.209*** (1.121)	2.977*** (1.123)	3.263*** (1.122)	0.662** (0.310)	0.517* (0.307)	0.814** (0.320)
Research fellow and assistant (cross-term)	-0.978 (0.978)	-0.791 (0.962)	-0.967 (0.977)	-0.327 (0.290)	-0.175 (0.284)	-0.326 (0.290)
Constant	-3.611*** (1.384)	-3.706*** (1.400)	-3.624*** (1.388)	-1.039** (0.409)	-1.179*** (0.416)	-1.217*** (0.421)

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

Table 4: Estimated results for number of citations

	Tobit model			Negative binomial model		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Research Fellowship	-0.0399 (0.354)	0.123 (0.349)	-0.0472 (0.354)	-0.106 (0.401)	0.0991 (0.402)	-0.119 (0.403)
Diversity of career	0.211* (0.115)			0.290** (0.119)		
Administrative agency (first)		-0.357 (0.535)			-2.426 (2.174)	
Administrative agency			-0.0674 (0.343)			-0.266 (0.433)
Company (first)		0.318 (0.301)			0.509 (0.361)	
Company			0.216 (0.233)			0.385 (0.271)
Independent administrative agency (first)		0.722*** (0.241)			0.901*** (0.222)	
Independent administrative agency			0.245* (0.134)			0.332** (0.136)
Assistant experience	0.0263 (0.138)	0.0647 (0.139)	0.0221 (0.139)	-0.0131 (0.145)	0.0490 (0.147)	-0.00661 (0.145)
Foreign research experience	0.114 (0.122)	0.114 (0.122)	0.109 (0.122)	0.171 (0.132)	0.183 (0.133)	0.168 (0.133)
Experience as practical physician	-0.0583 (0.142)	-0.0566 (0.141)	-0.0567 (0.142)	-0.0598 (0.142)	-0.0541 (0.141)	-0.0587 (0.141)
Male gender	0.264 (0.326)	0.284 (0.324)	0.270 (0.326)	0.589 (0.477)	0.638 (0.478)	0.595 (0.478)
Amount of Grants-in-Aid	0.0978*** (0.0246)	0.100*** (0.0245)	0.0981*** (0.0246)	0.159*** (0.0324)	0.166*** (0.0323)	0.160*** (0.0325)
Career at same university (graduated)	0.168 (0.180)	0.177 (0.179)	0.175 (0.180)	0.260 (0.203)	0.280 (0.209)	0.283 (0.206)
Career at same university (doctoral)	-0.104 (0.189)	-0.0780 (0.191)	-0.108 (0.189)	-0.138 (0.217)	-0.0607 (0.227)	-0.148 (0.219)
All careers at the same institution	0.0704 (0.189)	0.0480 (0.186)	0.0676 (0.189)	0.132 (0.213)	0.108 (0.210)	0.130 (0.213)
Doctoral degree from foreign country	-0.211 (0.453)	-0.0370 (0.453)	-0.186 (0.454)	-0.405 (0.617)	-0.121 (0.612)	-0.357 (0.617)
Doctor of Medical Science (DMSc)	0.844* (0.445)	0.845* (0.447)	0.873* (0.446)	0.974*** (0.378)	1.062*** (0.385)	1.164*** (0.406)
Doctor of Science	0.419 (0.455)	0.399 (0.457)	0.446 (0.456)	0.405 (0.391)	0.484 (0.396)	0.578 (0.416)
Doctor of Dentistry	0.392 (0.517)	0.391 (0.518)	0.419 (0.517)	0.332 (0.488)	0.444 (0.494)	0.513 (0.509)
Doctor of Engineering	0.169 (0.468)	0.189 (0.468)	0.209 (0.471)	-0.136 (0.404)	-0.00807 (0.405)	0.0596 (0.438)
Doctor of Agriculture	0.122 (0.493)	0.143 (0.491)	0.168 (0.496)	-0.490 (0.531)	-0.325 (0.532)	-0.276 (0.558)
Doctor of Pharmacology	0.548 (0.475)	0.488 (0.477)	0.590 (0.477)	0.600 (0.394)	0.621 (0.397)	0.804* (0.425)
Other doctoral degree	0.266 (0.469)	0.178 (0.470)	0.291 (0.470)	0.0293 (0.488)	-0.0214 (0.489)	0.173 (0.497)
Research fellow and assistant (cross-term)	0.194 (0.409)	0.0803 (0.403)	0.205 (0.409)	0.365 (0.458)	0.214 (0.456)	0.390 (0.461)
Constant	-1.199** (0.579)	-1.276** (0.586)	-1.235** (0.581)	-3.321*** (0.657)	-3.634*** (0.677)	-3.541*** (0.681)

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

Table 5: Estimated results for number of patents

	Tobit model			Poisson model		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Research Fellowship	-0.744** (0.290)	-0.610** (0.280)	-0.766*** (0.295)	-3.590 (4.076)	-3.139 (4.075)	-3.585 (4.076)
Diversity of career	0.136** (0.0570)			0.756** (0.332)		
Administrative agency (first)		-0.0631 (0.276)			-0.253 (1.826)	
Administrative agency			-0.199 (0.191)			-0.700 (1.455)
Company (first)		0.255* (0.141)			0.694 (0.758)	
Company			0.154 (0.114)			0.457 (0.705)
Independent administrative agency (first)		0.119 (0.120)			0.432 (0.616)	
Independent administrative agency			0.167** (0.0653)			0.946*** (0.360)
Assistant experience	-0.172*** (0.0660)	-0.172** (0.0677)	-0.176*** (0.0663)	-0.884** (0.374)	-0.950** (0.381)	-0.890** (0.375)
Foreign research experience	0.000830 (0.0610)	0.00263 (0.0616)	-0.00178 (0.0609)	0.0812 (0.384)	0.0813 (0.386)	0.0621 (0.385)
Experience as practical physician	0.0309 (0.0700)	0.0179 (0.0703)	0.0327 (0.0698)	-0.0878 (0.426)	-0.135 (0.425)	-0.0885 (0.427)
Male gender	-0.0407 (0.162)	-0.0292 (0.163)	-0.0364 (0.161)	0.289 (1.204)	0.400 (1.200)	0.286 (1.204)
Amount of Grants-in-Aid	0.0120 (0.0122)	0.0135 (0.0123)	0.0124 (0.0122)	-0.0331 (0.0658)	-0.0323 (0.0678)	-0.0340 (0.0657)
Career at same university (graduated)	0.105 (0.0962)	0.110 (0.0972)	0.115 (0.0967)	0.335 (0.637)	0.488 (0.679)	0.450 (0.666)
Career at same university (doctoral)	-0.0530 (0.100)	-0.0429 (0.103)	-0.0578 (0.101)	-0.389 (0.665)	-0.474 (0.712)	-0.512 (0.691)
All careers at the same institution	0.0754 (0.0934)	0.0477 (0.0925)	0.0729 (0.0931)	0.331 (0.664)	0.0762 (0.648)	0.325 (0.667)
Doctoral degree from foreign country	0.184 (0.227)	0.252 (0.230)	0.210 (0.227)	-0.00631 (1.456)	0.201 (1.418)	0.105 (1.428)
Doctor of Medical Science (DMSc)	0.158 (0.211)	0.187 (0.215)	0.234 (0.218)	0.879 (0.989)	0.992 (1.052)	1.335 (1.199)
Doctor of Science	0.0481 (0.218)	0.0813 (0.221)	0.122 (0.224)	0.206 (1.042)	0.416 (1.096)	0.666 (1.239)
Doctor of Dentistry	0.118 (0.248)	0.141 (0.251)	0.193 (0.253)	0.366 (1.454)	0.419 (1.501)	0.821 (1.612)
Doctor of Engineering	0.103 (0.219)	0.125 (0.221)	0.197 (0.228)	-0.0666 (1.014)	0.171 (1.081)	0.604 (1.275)
Doctor of Agriculture	0.104 (0.236)	0.144 (0.237)	0.199 (0.245)	-0.366 (1.274)	0.0954 (1.296)	0.388 (1.490)
Doctor of Pharmacology	0.326 (0.220)	0.343 (0.223)	0.412* (0.227)	1.280 (0.986)	1.386 (1.058)	1.763 (1.216)
Other doctoral degree	-0.0373 (0.235)	-0.0436 (0.237)	0.0251 (0.238)	-0.170 (1.371)	-0.109 (1.365)	0.249 (1.431)
Research fellow and assistant (cross-term)	0.821*** (0.309)	0.697** (0.299)	0.848*** (0.315)	4.817 (4.113)	4.332 (4.107)	4.824 (4.115)
Constant	-0.434 (0.281)	-0.469 (0.290)	-0.519* (0.288)	-3.127* (1.603)	-3.114* (1.694)	-3.587** (1.775)

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

Table 6: Estimated results for number of coauthors

	Tobit model			Negative binomial model		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Research Fellowship	2.615*** (0.585)	2.862*** (0.567)	2.610*** (0.582)	0.642*** (0.139)	0.694*** (0.134)	0.639*** (0.139)
Diversity of career	0.0968 (0.190)			0.0365 (0.0536)		
Administrative agency (first)		-1.443* (0.869)			-0.837** (0.393)	
Administrative agency			-0.894 (0.560)			-0.353* (0.191)
Company (first)		1.392*** (0.489)			0.449*** (0.138)	
Company			0.618 (0.383)			0.208* (0.110)
Independent administrative agency (first)		1.684*** (0.392)			0.447*** (0.0996)	
Independent administrative agency			0.0773 (0.220)			0.0330 (0.0613)
Assistant experience	0.221 (0.227)	0.425* (0.225)	0.242 (0.228)	0.0679 (0.0639)	0.126** (0.0638)	0.0751 (0.0640)
Foreign research experience	0.106 (0.201)	0.125 (0.197)	0.0910 (0.200)	0.0373 (0.0563)	0.0408 (0.0555)	0.0320 (0.0562)
Experience as practical physician	0.293 (0.235)	0.322 (0.229)	0.292 (0.234)	0.0803 (0.0621)	0.0864 (0.0606)	0.0819 (0.0617)
Male gender	0.225 (0.540)	0.286 (0.527)	0.255 (0.537)	0.0716 (0.154)	0.0882 (0.151)	0.0802 (0.153)
Amount of Grants-in-Aid	0.0242 (0.0407)	0.0305 (0.0397)	0.0277 (0.0405)	0.00644 (0.0112)	0.00754 (0.0109)	0.00721 (0.0111)
Career at same university (graduated)	0.196 (0.296)	0.210 (0.291)	0.227 (0.295)	0.0634 (0.0831)	0.0724 (0.0830)	0.0806 (0.0834)
Career at same university (doctoral)	-0.187 (0.312)	-0.0847 (0.309)	-0.185 (0.311)	-0.0517 (0.0879)	-0.0172 (0.0891)	-0.0583 (0.0881)
All careers at the same institution	0.366 (0.313)	0.472 (0.302)	0.357 (0.312)	0.111 (0.0862)	0.137 (0.0836)	0.108 (0.0859)
Doctoral degree from foreign country	-0.887 (0.750)	-0.512 (0.736)	-0.796 (0.748)	-0.254 (0.223)	-0.132 (0.220)	-0.226 (0.223)
Doctor of Medical Science (DMSc)	1.071 (0.736)	1.044 (0.726)	1.192 (0.735)	0.322* (0.192)	0.341* (0.198)	0.389* (0.202)
Doctor of Science	-0.0410 (0.753)	-0.210 (0.743)	0.0262 (0.751)	-0.00536 (0.198)	-0.0250 (0.203)	0.0466 (0.207)
Doctor of Dentistry	0.210 (0.855)	0.174 (0.842)	0.309 (0.852)	0.0780 (0.229)	0.0952 (0.233)	0.139 (0.237)
Doctor of Engineering	-0.465 (0.774)	-0.635 (0.760)	-0.402 (0.776)	-0.181 (0.207)	-0.216 (0.212)	-0.136 (0.220)
Doctor of Agriculture	-0.840 (0.815)	-1.014 (0.796)	-0.753 (0.817)	-0.324 (0.226)	-0.341 (0.229)	-0.271 (0.236)
Doctor of Pharmacology	0.302 (0.786)	0.0501 (0.774)	0.440 (0.786)	0.114 (0.207)	0.0658 (0.212)	0.190 (0.219)
Other doctoral degree	0.761 (0.776)	0.514 (0.763)	0.846 (0.773)	0.201 (0.199)	0.141 (0.202)	0.253 (0.205)
Research fellow and assistant (cross-term)	-1.871*** (0.677)	-1.933*** (0.654)	-1.814*** (0.674)	-0.422** (0.167)	-0.422*** (0.160)	-0.404** (0.166)
Constant	1.994** (0.958)	1.580* (0.951)	1.793* (0.957)	0.776*** (0.259)	0.631** (0.266)	0.685** (0.268)

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

Table 7: Estimated results for number of papers (Only DMSc)

	Tobit model			Negative binomial model		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Research Fellowship	-0.952 (1.742)	-1.376 (1.720)	-1.113 (1.786)	-0.298 (0.490)	-0.356 (0.491)	-0.355 (0.503)
Diversity of career	-0.341 (0.482)			-0.0762 (0.130)		
Administrative agency (first)		-2.567 (2.393)			-2.565 (1.607)	
Administrative agency			1.960 (1.493)			0.379 (0.366)
Company (first)		0.0806 (3.375)			0.0832 (0.959)	
Company			1.176 (2.058)			0.356 (0.537)
Independent administrative agency (first)		1.529 (1.158)			0.584* (0.305)	
Independent administrative agency			-0.656 (0.509)			-0.170 (0.141)
Assistant experience	-0.711 (0.469)	-0.566 (0.471)	-0.705 (0.470)	-0.209* (0.124)	-0.156 (0.124)	-0.213* (0.124)
Foreign research experience	0.550 (0.461)	0.462 (0.465)	0.609 (0.460)	0.166 (0.125)	0.135 (0.125)	0.168 (0.125)
Experience as practical physician	0.812* (0.416)	0.879** (0.413)	0.821** (0.416)	0.239** (0.111)	0.279** (0.111)	0.237** (0.112)
Male gender	1.533 (1.305)	1.487 (1.301)	1.483 (1.298)	0.729* (0.427)	0.689 (0.425)	0.726* (0.425)
Amount of Grants-in-Aid	0.159** (0.0800)	0.158** (0.0796)	0.162** (0.0803)	0.0398* (0.0204)	0.0433** (0.0204)	0.0407** (0.0207)
Career at same university (graduated)	0.681 (0.721)	0.700 (0.726)	0.640 (0.725)	0.218 (0.200)	0.232 (0.200)	0.223 (0.200)
Career at same university (doctoral)	0.123 (0.818)	0.175 (0.838)	0.173 (0.819)	0.0331 (0.231)	0.102 (0.239)	0.0128 (0.231)
All careers at the same institution	0.974 (0.719)	1.017 (0.713)	1.001 (0.715)	0.271 (0.189)	0.280 (0.188)	0.269 (0.188)
Doctoral degree from foreign country	-1.317 (1.950)	-1.247 (1.944)	-1.231 (1.940)	-0.513 (0.600)	-0.467 (0.598)	-0.475 (0.598)
Research fellow and assistant (cross-term)	0.840 (2.047)	1.366 (2.008)	0.967 (2.084)	0.321 (0.575)	0.414 (0.570)	0.374 (0.586)
Constant	-0.479 (1.587)	-0.684 (1.584)	-0.509 (1.589)	-0.175 (0.485)	-0.317 (0.488)	-0.161 (0.488)

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

Table 8: Estimated results for number of citations (Only DMSc)

	Tobit model			Negative binomial model		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Research Fellowship	-0.552 (0.846)	-0.657 (0.823)	-0.792 (0.869)	-0.620 (0.679)	-0.595 (0.695)	-0.912 (0.708)
Diversity of career	0.295 (0.234)			0.322* (0.175)		
Administrative agency (first)		-0.717 (1.145)			-3.413 (4.671)	
Administrative agency			0.548 (0.727)			0.310 (0.493)
Company (first)		-0.0345 (1.615)			-0.00423 (1.414)	
Company			1.526 (1.002)			1.553** (0.670)
Independent administrative agency (first)		1.956*** (0.554)			1.412*** (0.350)	
Independent administrative agency			0.226 (0.248)			0.277 (0.192)
Assistant experience	-0.144 (0.228)	-0.0663 (0.225)	-0.115 (0.229)	-0.176 (0.181)	-0.126 (0.181)	-0.139 (0.183)
Foreign research experience	0.174 (0.224)	0.162 (0.223)	0.195 (0.224)	0.213 (0.183)	0.240 (0.186)	0.229 (0.184)
Experience as practical physician	-0.0787 (0.202)	-0.0562 (0.198)	-0.0566 (0.203)	-0.0657 (0.161)	-0.0152 (0.160)	-0.0310 (0.162)
Male gender	0.532 (0.633)	0.462 (0.622)	0.517 (0.631)	0.768 (0.641)	0.674 (0.638)	0.757 (0.641)
Amount of Grants-in-Aid	0.102*** (0.0388)	0.104*** (0.0381)	0.108*** (0.0391)	0.116*** (0.0336)	0.131*** (0.0338)	0.131*** (0.0350)
Career at same university (graduated)	0.273 (0.350)	0.233 (0.347)	0.315 (0.353)	0.362 (0.283)	0.354 (0.289)	0.421 (0.286)
Career at same university (doctoral)	-0.141 (0.397)	-0.0103 (0.401)	-0.173 (0.399)	-0.269 (0.312)	-0.110 (0.330)	-0.331 (0.314)
All careers at the same institution	0.186 (0.349)	0.154 (0.341)	0.201 (0.348)	0.239 (0.286)	0.236 (0.283)	0.254 (0.286)
Doctoral degree from foreign country	-0.490 (0.947)	-0.346 (0.930)	-0.467 (0.944)	-0.866 (1.023)	-0.633 (1.011)	-0.850 (1.022)
Research fellow and assistant (cross-term)	1.340 (0.993)	1.405 (0.961)	1.577 (1.014)	1.393* (0.779)	1.337* (0.785)	1.701** (0.803)
Constant	-0.648 (0.771)	-0.722 (0.758)	-0.740 (0.773)	-2.040*** (0.731)	-2.287*** (0.732)	-2.222*** (0.742)

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

Table 9: Estimated results for number of coauthors (Only DMSc)

	Tobit model			Poisson model		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Research Fellowship	1.395 (1.097)	1.097 (1.066)	0.726 (1.119)	0.323 (0.240)	0.238 (0.237)	0.160 (0.251)
Diversity of career	-0.415 (0.303)			-0.103 (0.0761)		
Administrative agency (first)		-1.819 (1.484)			-0.699 (0.530)	
Administrative agency			-0.844 (0.936)			-0.246 (0.258)
Company (first)		6.186*** (2.092)			1.043*** (0.347)	
Company			2.654** (1.290)			0.504** (0.255)
Independent administrative agency (first)		1.308* (0.718)			0.292* (0.159)	
Independent administrative agency			-0.462 (0.319)			-0.114 (0.0809)
Assistant experience	-0.181 (0.295)	0.0410 (0.292)	-0.0944 (0.295)	-0.0422 (0.0712)	0.0126 (0.0724)	-0.0217 (0.0721)
Foreign research experience	0.0660 (0.290)	0.0834 (0.288)	0.100 (0.288)	0.0160 (0.0705)	0.0205 (0.0717)	0.0239 (0.0707)
Experience as practical physician	0.169 (0.262)	0.260 (0.256)	0.234 (0.261)	0.0427 (0.0632)	0.0642 (0.0633)	0.0591 (0.0636)
Male gender	0.0107 (0.821)	-0.0969 (0.807)	-0.0102 (0.813)	0.00199 (0.191)	-0.0245 (0.191)	-0.00116 (0.191)
Amount of Grants-in-Aid	-0.0105 (0.0503)	-0.0128 (0.0494)	0.00666 (0.0503)	-0.00315 (0.0120)	-0.00365 (0.0119)	0.00105 (0.0121)
Career at same university (graduated)	-0.0324 (0.454)	-0.00263 (0.450)	0.120 (0.454)	-0.00760 (0.108)	-0.000945 (0.110)	0.0339 (0.111)
Career at same university (doctoral)	0.151 (0.515)	0.363 (0.520)	0.0245 (0.513)	0.0402 (0.124)	0.0931 (0.129)	0.00389 (0.125)
All careers at the same institution	0.263 (0.452)	0.417 (0.442)	0.296 (0.448)	0.0632 (0.107)	0.100 (0.107)	0.0711 (0.108)
Doctoral degree from foreign country	-0.868 (1.228)	-0.712 (1.206)	-0.842 (1.215)	-0.256 (0.340)	-0.219 (0.340)	-0.250 (0.340)
Research fellow and assistant (cross-term)	0.262 (1.288)	0.671 (1.245)	0.942 (1.306)	0.0249 (0.278)	0.136 (0.273)	0.192 (0.287)
Constant	3.976*** (0.999)	3.502*** (0.982)	3.702*** (0.996)	1.381*** (0.236)	1.264*** (0.236)	1.314*** (0.238)

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.