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Title: What factors are associated with increasing co-authorship in the Social Sciences? A case study of Danish Economics and Political Science

Abstract: The number of co-authors has in the social sciences has been rising over the last decades, but a deeper understanding of why this rise is occurring is lacking. Previous studies of co-authorship in the social sciences often refer to the physical or life sciences or anecdotal evidence to explain these changes. This article examines the relationship between changes in co-authorship and research in Danish economics and political science to gain greater insights into whether there are changes in the research or in researchers' behavior. The analysis shows that articles with empirical research, quantitative research and/or survey are more likely to have a higher number of co-authors than articles based on theoretical, interview, and qualitative research. Furthermore, international and interinstitutional Danish articles tend to have more co-authors than interinstitutional articles. The analysis also reveals that the average number of authors increases for articles with all types of research and research approaches. This indicates that the collaboration behavior of the researchers is changing.

Keywords: Co-authorship; Social sciences; Research collaboration; Bibliometrics; Internationalization; Scholarly Communication;

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Introduction

Research collaboration and co-authorship in peer-reviewed research articles has become the norm in most research fields. Extreme co-authorship tendencies with hundreds or even thousands of co-authors in high-energy physics and biomedicine (Cronin 2001) often overshadow that the same tendency is occurring in the social sciences, though at a much smaller scale (Henriksen 2016). Furthermore, these changes in co-authorship cannot be attributed to the need for larger laboratories or expensive equipment as in the natural and life sciences (Birnholtz 2006).

Several studies have documented a steady increase in co-authorship in Economics (Hudson 1996; Laband and Tollison 2000; Sutter and Kocher 2004) and Political Science (Adams et al. 2014; Fisher et al. 1998), and they offer various explanations for the increases. For example, rapid growth of knowledge, increasing complexity of research, and interdisciplinary research require more collaboration among researchers. However, these explanations are often based on anecdotal evidence such as personal experiences.

Hence, studies attribute the increase in co-authorship to a simultaneous increase in empirical studies, quantitative methods and more advanced statistical techniques. Co-authorship is therefore less common for theoretical and qualitative work (Corley and Sabharwal 2010; Fisher et al. 1998). Furthermore, the general growth in number of researchers creates more opportunities to find suitable co-authors. Likewise, researchers who are far apart can more easily collaborate because of lower travel costs and innovations in information and communication technologies (Hoekman et al. 2010).

However, the rise in co-authorship could also be affected by changes in attitudes to the requirements of co-authorship. Researchers may be faster to claim and offer co-authorships when assisting others, exchanging data, mentoring, and engaging in collaborations. The “publish or perish” mantra and the increasing use of performance indicators pressure researchers to improve productivity on their resumes. By collaborating and co-authoring, researchers can optimize their research production by sharing tasks and taking advantage of each other’s expertise. This also lowers the risks of having a no-publishing period caused by negative results, data sampling problems or long peer-review processes. However, it also makes it harder to identify the individual’s contribution and assign appropriate credit and responsibility (Birnholtz 2006; Biggs 2008; Cronin 2001).

This article examines co-authorship practices and discusses how changes in research culture affect co-authorship tendencies. It looks at characteristics of Political Science and Economics articles related to increases in co-authors and how research approaches in these fields have changed over time. The article finds that co-authorship has become the norm in Danish Economics, and it has become more frequent in Danish Political Science. These results support a previous study by Henriksen (2016) that includes all articles from the Social Science Citation Index (SSCI) in the Web of Science (WoS).

The study builds on Fisher et al. (1998) and Schymura and Loschel (2014), which coded the content of articles from respectively one and three journals. It extends their studies by using a larger sample, which includes all Danish Economics and Political Science articles published in the period 1980-2014. Furthermore, it adds an additional level of coding through a manual coding procedure based on the full-text version of all the articles, which is fully described in the methods section and displayed in figure 1. It is assessed whether an article is empirical, theoretical, qualitative or quantitative, and how the research methods influence the average number of co-authors. The extra level of coding makes it possible to better assess the relation between number of co-authors and certain factors.

After a review of how characteristics of articles are related to co-authorship, the methods and data section describes the coding algorithm and the statistics. The results section presents descriptive statistics followed by regression analyses for each field. The final section discusses the results in relation to research culture and the effect on co-authorship.

Literature review of factors

Is theory the lone scholars' game?

Many studies have found that co-authoring is more common for empirical than for theoretical articles. They found that articles in mainly theoretical journals have a lower average number of authors than the same types of articles in mainly empirical journals in the respective fields psychology and sociology (Sacco and Milana 1984; O'Neill 1998). Similar results are found by Piette and Ross (1992), who investigated 15 Economics journals. Several studies suggest that empirical research is more often co-authored since researchers can divide tasks among them, and it often requires researchers with different expertise and skills (Barnett et al. 1988; Kumar and Ratnavelu 2016). Therefore, this article expects that theoretical articles are more likely to be single authored and have few authors, while empirical articles have an increase in co-authorship over time.

Does the methodological approach affect the number of co-authors?

Studies of social science co-authorship suggest that quantitative research is more likely than qualitative research to be co-authored. The argument is that the tasks in quantitative research analysis are easier to divide among co-authors in contrast to the more holistic approaches in qualitative research analysis (Zawacki-Richter and von Prümmer 2010; Moody 2004; Hunter and Leahey 2008). This article will examine this suggestion in addition to whether secondary data are more likely to be co-authored.

Are international and interinstitutional collaborations related to an increase in co-authorship?

Overall, international co-authorship in the social sciences has increased (Henriksen 2016; Lariviere et al. 2006), but the geographical distance between co-authors is generally smaller in social science than in the physical and life sciences (Hoekman et al. 2010), i.e., researchers tend to collaborate with people in close geographical proximity (Wagner and Leydesdorff 2005; Zitt et al. 2000). Thus, studies suggest that researchers still favor face-to-face meetings to establish collaboration and prefer collaboration within the same cultural proximity (Jeong et al. 2011; Hoekman et al. 2010).

However, developments in information technologies – especially the launch of the World Wide Web in the 1990s (CERN, 2017) – have probably contributed to an increase in co-authorship as well as co-authors. Since, it has become easier to interact, communicate, work and share information with researchers from other institutions and countries (Zutshi et al. 2012; Hoekman et al. 2010).

In the Danish context, it would be expected that it would be normal for the researchers to seek international collaboration partners, since Denmark has a very small population. Therefore, this study expects an increase in the geographical distance between co-authors and in the share of international and interinstitutional co-authored articles. The geographical distance (GCD) is measured as the longest distance in kilometers between the co-authors (For a more detailed description see Waltman et al. 2011)

Do articles with a higher Normalized Journal Score (NJS) have more co-authors?

Research on co-authorship is inconclusive on whether there is a positive or negative relationship between number of co-authors and Journal Impact Factor (JIF) (Rutledge et al. 2011; Brown et al. 2006). Brown et al. (2006) suggest that articles published in journals with high JIF are of higher quality, since they require more work and therefore are more likely to be co-authored. Rutledge et al. (2011) claim that researchers prefer to publish alone or with few researchers in high JIF journals to ensure that citations and credit do not have to be shared. However, the last argument entails that researchers choose co-authors and co-authoring depending on the perceived “quality” of the work, and that co-authors are added and removed at a whim.

The JIF is a much debated indicator because it does not take field differences in citation behavior into consideration. This study will instead use the Normalized Journal Score NJS¹, because it examines two social science fields that each include a number of sub-disciplines. The NJS is the average normalized citation to a journal divided by the average normalized citation journal score to the whole field. Thus, the study investigates whether there is a positive or a negative relationship between number of authors and NJS.

Does interdisciplinarity affect the number of co-authors?

It is often claimed that research has become more interdisciplinary, which result in more co-authored articles. Porter and Rafols (2009) find that the number of co-authors and cited disciplines has increased substantially over a 30-year period, but articles often refer to neighboring disciplines, and the increase to more distant cognitive areas is very modest. It is therefore debatable whether research has really become more interdisciplinary.

This article uses the Rao-Stirling Indicator to measure interdisciplinarity. The indicator is defined by $I = \sum_{i,j(i \neq j)} p_i p_j (1 - s_{ij})$, where p_i is the proportion of references in journal i , and s_{ij} is the similarity between journals i and j . The similarity s_{ij} is obtained by using Cosine Similarity measure, which is defined by $\cos \theta = \frac{\vec{i} \cdot \vec{j}}{\|\vec{i}\| \|\vec{j}\|}$. The journals are considered to have strong relationship if they both have a tendency to cite the same journal's articles. Hence, when the s_{ij} is high, articles in the journals have a strong tendency to cite the same journals.

Several studies suggest that researchers are working in interdisciplinary teams to be able to solve more difficult and complex research problems, and this is reflected in increased co-authorship and number of authors in the byline (Schymura and Loschel 2014; Bennett and Gadlin 2012). This study will examine whether more interdisciplinary research is related to an increase in co-authors.

Methods and data

All research articles belonging to Economics and Political Science² subject categories with at least one Danish address were downloaded from SSCI in WoS on 19 October 2015. The period spans 35 years from 1980 to 2014. The original sample consisted of 4,646 articles, but it was not possible to access the full text for 272 articles, so they were removed from the sample. Hence, the final sample contains 4,548 articles; 3,157 Economics articles,

¹ The NJS are calculated in the WoS database maintain by CWTS, Leiden University

² Political Science is fairly broadly defined for the purposes of this study and includes the subject areas Public Administration and International Relations.

1,391 Political Science articles. 193 articles belong to both fields. The data are divided into different time periods to show the development in co-authorship and changes in the role of different article characteristics.

Data coding

Bibliographic information about the articles was downloaded in the original sample. Data about authors' institutional and national affiliations was subsequently retrieved and matched. The variables international (IN) and interinstitutional (II) collaboration were dummy coded. The calculation of the variables GCD, NJS and interdisciplinarity is described above. However, coverage of social science references before 1995 is scarce, and the interdisciplinarity variable can only be used in the analysis of data after this year, and will only be included in the last regression models.

The publication data were manually coded with regard to the content of the publications. This required that the full text of each article were accessed, and the online access provided by Aarhus University Library made it possible to locate 98% of the articles. After the full text of the article were located, the algorithm in Figure 1 was used to assess the content of the article. The following criteria were used in the coding: 1) Assess if the article is empirical or theoretical/review by examining the method or data section for usage of data or data collection. If the article is theoretical or a review article, it is coded as theoretical. It is beyond the scope of this study to assess whether an article is a review and/or its theoretical contribution. 2) Empirical articles are assessed as quantitative, qualitative or mixed method. 3a) Quantitative articles are coded according to the usage of survey or data. 3b) Qualitative articles are coded according to the usage of interview, ethnographic or anthropological methods or documents in their study. 3c) Articles that use both qualitative and quantitative methods are coded as mixed method. A random selection of 20 articles was checked by a political scientist who confirmed the existing coding. All content variables are dummy coded, for example 1 for survey and 0 for not survey.

Figure 1 coding algorithm

Insert Figure 1

Statistics

Descriptive statistics

Figure 2 shows the distribution of articles and number of authors. How to deal with extreme values is a recurring problem in bibliometrics (Glänzel and Moed 2013). This study alters the number of authors for articles with more than 10 authors in the descriptive statistics, so they are included as having 10 authors. This is done to better examine the general rise in the mean number of authors and avoid having mean values greatly influenced by single papers. Furthermore, this change will only affect 12 Economics articles (less than 0.4% of the Economics data sample) and 10 Political Science articles (less than 0.7% of the Political Science data sample), and the differences are displayed in detail in the appendix table 1, 2, 4 and 5.

Figure 2 Distribution of number of articles and authors

Insert Figure 2

Regression count models

This study uses Poisson regression (Poisson) and negative binomial regression (NBR) count models to examine how the different factors relate to the number of co-authors. Because, the dispersion for the outcome count variable "number of co-authors per article" varies across fields and sub-periods. In some cases, it is over-

dispersed; in others, its dispersion parameter is almost equal to 1. When it is over-dispersed it fits the criteria for an NBR model, and when the dispersion parameter is almost 1, it fits the criteria for a Poisson model. Because the analysis is based on count models, the exponent of the different coefficients is calculated to make a clearer interpretation of the results. Thus, if all variables are kept constant in the count model, the exponent is the changes in the dependent variable (number of co-authors).

The formula for count models can be written as

$$N_{co-authors} = Intercept + \beta_1 x + \beta_2 x + \beta_3 x \dots + e$$

Previous studies of co-authorship emphasize multiple factors associated with co-authorship tendencies. This study uses different models to investigate what factors are associated with more co-authors since some of the factors overlap. Each regression model is presented for the overall period and for the three individual periods (1980-1994, 1995-2004, and 2005-2014). The first period include research conducted in the pre-internet era. Followed by a period with improvement in long distance communication possibilities as well as cheaper travel opportunities. In the last period, there is a tendency in the Danish context to focus on research performance measurement in the university sector. The results are divided by field: Economics first, Political Science second. The variables NJS, GCD, IN and II are included in all models and are thoroughly discussed the first time they are presented.

Results

Economics

The graphs in figure 2 and 3 show how the mean number of authors and number of articles are distributed over the 35-year period. The mean number of authors for the total number of articles increases by 98.41% (from 1.26 to 2.50). In the first period, the mean number of authors and the median number of authors are similar for theoretical and empirical articles. However, this changes over time and the mean number of authors increases for empirical articles by 111.2% (from 1.25 to 2.64) and for theoretical articles by 70.63% (from 1.26 to 2.13). However, the median number of authors continues to be similar for both kinds of articles (see appendix table 1).

Figure 3 the evolution of the mean number of authors and the number of economic articles (N authors<=10)

Insert Figure 3

The descriptive results for Economics show that the share of articles with empirical research has consistently increased from 30.5% in the 1980s to 71.1% in the 2010s (see figure 3), and the total number of articles has increased rapidly over the years. The development shows a change from a theoretical to a more empirical focus in Danish Economics research.

Figure 3 the evolution of co-authorship in Economics

Insert Figure 4

Figure 4 shows the development of co-authorship for empirical, theoretical and all articles as well as the share of international co-authored articles, which increases from 15-23% to 72-84%, regardless of research approach. The share of international co-authored articles rose from 7% in 1980-1984 to 59% in 2010-2014. Furthermore, the mean number of authors (2.11-3.11) of international articles is constantly higher than in the other co-authored articles in the study. 90% of empirical articles use quantitative methods, and the last 10% use qualitative and mixed methods (see appendix table 1). Because of the great overlap between quantitative

methods and empirical articles, the descriptive statistics are fairly similar and will not be included in a regression model.

The next step is to examine the development of mean number of authors and number of articles according to research methods (see appendix table 2). The mean number of authors has increased for all types of research methods. It is very high for survey studies; in the last period 91% are co-authored, which to some extent confirms that using this kind of research method corresponds with working in larger teams. Interestingly, number of articles and mean number of authors have also increased for interview studies; perhaps an indication of greater method diversity in Economics.

Use of secondary data is the method with the largest increase in number of articles, and mean number of authors has increased by more than 1. As suggested in the review section, the reason may be that data from external sources is easier to share. However, some articles apply more than one research method, which requires researchers with different skills. Articles with 24 and 26 authors in the byline use both survey and secondary data.

Economics regression models

The first Economics model in Table 1 is based on the formula:

$$N_{co-authors} = Intercept + \beta_1 NJS + \beta_2 GCD + \beta_3 IN + \beta_4 II + \beta_5 Empirical + e$$

In the first period, the model indicates that NJS has a positive effect on the number of co-authors. If the article is empirical, it has on average 7% fewer co-authors than theoretical articles. An increase in GCD does not seem to be positively or negatively related with the number of co-authors, while the variables IN have on average 8.70 times more co-authors, and II have 7.09 times more co-authors than an article with only internal or no collaboration. The p-values show that the variables NJS, GCD and empirical are not statistically significant, while the results for IN and II are statistical significant.

In the second period, IN and II have on average 4.79 and 3.30 times more co-authors than non-international and intra-institutional Danish articles, while GCD seems unchanged. The empirical articles have on average 80% more co-authors than a theoretical article. In the third period, an empirical article has on average 38% more co-authors than theoretical articles. NJS does not seem to affect the number of co-authors and is not statistically significant at any time. IN and II articles have on average 3.46 and 2.94 times more co-authors in the third period.

Note that the variables IN and II always involve collaboration with at least two co-authors. To control for this, the study examines whether these variables would remain influential if the sample consisted of solely co-authored articles. The model was recalculated, and even though the coefficients are lower (see appendix table 3), the variables remain positively associated with the number of co-authors. Hence, IN and II show approximately 30% and 10-30% more co-authors on average throughout the period and in each period.

The first model shows that international and interinstitutional Danish co-authored articles tend to have more co-authors in the entire period. However, the GCD indicates that these international co-authored articles are probably from neighboring countries. Empirical articles have a positive association with the number of co-authors from 1995, though the coefficient becomes smaller in the last period. This aligns with the results for the whole period and confirms that empirical, international and interinstitutional Danish co-authored articles have a positive link with the average number of co-authors.

Table 1 Economics regression count model: Research approach

Insert Table 1

The next model includes variables for the research methods used in the articles:

$$N_{co-authors} = Intercept + \beta_1 NJS + \beta_2 GCD + \beta_3 IN + \beta_4 II + \beta_5 Data + \beta_6 Interview + \beta_7 Survey + \beta_8 Document + e$$

In the first period are none of the variables statistical significant. This changes in the second period, where survey and secondary data articles respectively has 195% and 89% more co-authors than average. In the third period, the coefficient decrease, but these variables still have positive relationship with the number of co-authors.

In the third period, the model shows that interviews have 35% more co-authors on average in the third period. The coefficient for document analysis articles remains negative for the whole period, and it seems that researchers using this kind of data collection prefer to be single authors. The results for the whole period are similar to the results from the third period.

The last model is based on the formula:

$$N_{co-authors} = Intercept + \beta_1 PG + \beta_2 NJS + \beta_3 GCD + \beta_4 IN + \beta_5 II + \beta_6 Empirical + \beta_7 Interdisciplinary + e$$

It was not possible to calculate the interdisciplinarity of all articles because of the WoS coverage of their references, so the number of articles included in this model is slightly lower. The last model shows that the degree of interdisciplinary research is related to more co-authors' per article, and finds that there is a continuous tendency after 1995 towards more collaborators if the research is interdisciplinary.

Table 2 Economics regression count model: Research methods

Insert Table 2

Table 3 Economics regression count model: Interdisciplinary

Insert Table 3

Political Science

Figure 5 illustrates the increases in mean number of authors for Political Science articles over the 35 years. There are 973 empirical articles and 418 theoretical articles. The mean number of authors increases from 1.3 to 2.1 (63%) for empirical articles and from 1.2 to 1.8 (57%) for theoretical articles. This is only 6% difference. The median number of authors stays at 1 regardless of research approach, until the last period where it rises to 2 for empirical articles.

Figure 5 the evolution of the mean number of authors and the number of Political Science articles (N authors <= 10)

Insert figure 5

Figure 6 the evolution of co-authorship in Political Science

Insert figure 6

Figure 6 shows the development of co-authorship for empirical, theoretical, international and all articles. The share of co-authored articles rises from 17-18% to 41-59%, so there are still a lot single authors in the Political Sciences. The increase in co-authorship is higher for empirical than for theoretical articles, but both are to a greater extent co-authored. Furthermore, half of co-authored articles in 1980-1994 were a result of

international collaboration, which only rises slightly during the 35 years. The mean number of authors rises for international articles from 2.8 in 1980-1994 to 3.5 in 2010-2014 and is higher in the whole period.

The next step is to examine the usage and distribution of different research methodologies in Political Science articles. 54.7% of the articles are quantitative, 39.7% are qualitative and only 5.7% are mixed methods. The mean number of authors increases for mixed methods from 1 to 2.2, qualitative articles from 1.3 to 1.8 and quantitative articles from 1.4 to 2.2. Likewise, the percentage of co-authored articles increases for mixed methods (0- 72%), qualitative articles (17%-49%) and quantitative articles (13% to 63%) (see appendix table 4).

The results for the research methods show that the mean number of authors increases for all Political Science articles: interviews from 1.67 to 1.90, survey from 1.60 to 2.52, data from 1 to 2.22, and document from 1.36 to 1.71. In addition, the percentage of co-authored articles increases regardless of research method (see appendix table 4). Articles based on quantitative research are more co-authored. It is far from the norm to co-author in Political Science, but the development indicates a greater tendency to co-author in larger groups in almost all types of research.

Political Science Regression models

The first Political Science model in Table 4 is based on the formula:

$$N_{co-authors} = Intercept + \beta_1 NJS + \beta_2 GCD + \beta_3 IN + \beta_4 II + \beta_5 Empirical + e$$

In the first period, it is only the results for the variable IN that is statistical significant. Thus the model shows that international co-authored articles typically had 18.7% more co-authors than the average. In the first period, the variable II is omitted, since there are no articles with interinstitutional Danish collaboration, and there are only 10 articles with international collaboration. In total, there are 20 co-authored articles out of 112 articles in the first period. This of course affects the robustness of the result, and explain the low number of statistical significant results.

In the second period, articles with international or interinstitutional Danish collaboration have on average 7.92 and 6.45 times more co-authors than articles where the researchers collaborate internally at their research institution or do not collaborate. In the last period, the empirical articles have on average 30% more co-authors than theoretical articles, and articles with a higher NJS now have on average 18% more co-authors. The GCD stays at zero. The coefficient for II articles has decreased and these articles now have 6.60 times more co-authors, and IN articles have 4.11 times more co-authors than internally co-authored or single-authored articles. If the model includes all years, the results are similar. Thus, the first model show that articles with international collaboration and interinstitutional Danish collaboration have a positive association with number of co-authors. Furthermore, in the last period, empirical articles tend to have a higher average number of co-authors, and NJS is positively associated with the number of co-authors.

The model was recalculated for the second and third period with only co-authored articles to investigate if IN and II actually are positive associated with more co-authors, since they can only be co-authored. The study found that the coefficients are still positive, so IN and II articles have more co-authors on average than intra-institutional articles (see appendix table 6).

The second Political Science model includes different research methodologies and is based on the formula:

$$N_{authors} = Intercept + \beta_1 NJS + \beta_2 GCD + \beta_3 IN + \beta_4 II + \beta_5 quantitative + \beta_6 qualitative + e$$

Table 5 shows that in the first period, quantitative research articles are more likely to have more co-authors than qualitative research articles, since quantitative research articles on average have 133% more authors theoretical research articles. In the second period, neither of the research methodology variables are statistical significant. In the last period, quantitative articles have 36% times more authors than the theoretical and mixed methods articles. The model for the whole period corresponds to the last period.

The third model includes different research methods for Political Science and is based on this formula:

$$N_{co-authors} = Intercept + \beta_1 NJS + \beta_2 GCD + \beta_3 IN + \beta_4 II + \beta_5 SecondaryData + \beta_6 Interview + \beta_7 Survey + \beta_8 Documents + e$$

The third model explores how the different research methods correspond to the number of co-authors. This model is only calculated for the second, third, and whole period, since the data for the first period is scarce, and it is not possible to create a suitable model when the data is divided into more variables. However, neither of the research methods variables are statistical significant in the second period. The results for the third model estimates that survey articles on average have more co-authors, while document articles have fewer co-authors. Neither of the coefficients for secondary data and interview are statistical significant, but they both show a positive relationship with the number of authors when examining the standard errors. Finally, the model for the whole period estimates that articles with secondary data, interviews and surveys have a positive association with number of co-authors, while documents have a negative association with number of co-authors.

Table 4 Political Science regression count model: Research approach

Insert Table 4

Table 5 Political Science regression count model: Research methodology

Insert Table 5

Table 6 Political Science regression count model: Research methods

Insert Table 6

Table 7 Political Science regression count model: Interdisciplinary

Insert Table 7

The last model investigates whether interdisciplinarity influences the number of co-authors, and it is based on the formula:

$$N_{co-authors} = Intercept + \beta_1 NJS + \beta_2 GCD + \beta_3 IN + \beta_4 II + \beta_5 Empirical1 + \beta_6 Interdisciplinary + e$$

The model is only calculated using data from the periods 1995-2004, 2005-2014 or the whole period, since coverage of references in the first period is not sufficient to add an interdisciplinary variable. This also means that the number of articles included for each period in this model is slightly lower. The model shows that in the last period a more interdisciplinary article on average has 100% more co-authors, and for the whole period on average 71% more co-authors.

Limitations of the study

There are some limitations in the study. First, the results might be affected by the selection of Danish articles, since certain areas of the fields are very nationally oriented. Thus, Economics and Political Science in other countries might display other research patterns. However, the findings align with anecdotal and empirical results in other studies. Second, the selection of WoS articles as the unit of analysis could be problematic, especially for

Political Science, which has a more heterogeneous publication pattern than Economics (Ossenblok et al. 2012). However, the selection of articles made it possible to include a longer period in the study.

Discussion and conclusion

The article shows that there have been changes in scholarly communication and collaboration in Economics and Political Science. The research focus in Economics have changed from being mainly theoretical to empirical, while the changes in Political Science are minor, research-wise. Both fields have experienced a growth in number of articles as well as number of co-authored articles independent of research approach or type. The results show that the productivity of Danish researchers in international journals has increased along with co-authorship during the last 35 years, which corresponds with the general increase in the number of researchers and overall productivity in that period (Henriksen 2016; Sutter and Kocher 2004; Adams et al. 2014).

The article finds that even though the field of Danish Economics is quantitatively based, its research approach has become more diverse during the last couple of years. It seems that quantitative studies with primary data, such as surveys, have more authors than quantitative studies with secondary data. However, most Economics research is based on secondary data. Interestingly, there is an increase in articles based on the qualitative research method interview, which in general are less co-authored and have fewer authors, but this changes in the last period where 76.6% of the articles are co-authored and the mean number of authors has risen by more than 1.

Danish Political Science is more diverse in research methodology and methods than Danish Economics. The number of co-authored articles is much lower, but there has been a clear development towards more co-authors and more co-authored articles regardless of research method. Quantitative research has a greater tendency to be co-authored than qualitative research, but this difference diminishes when the articles are divided according to method. Articles containing survey studies have the highest mean number of co-authors followed by studies using secondary data. These data collection methods contain tasks that can be divided among team members, and this encourages a labor-division approach to research as in natural, life or health sciences. Additionally, the study finds that articles using interviews are co-authored to some extent, but a greater sample is needed to explore this further. Furthermore, articles with document or text analysis have a lower mean number of authors and co-authored articles. Thus, the finding that these types of research are more single authored matches results from previous studies (Corley and Sabharwal 2010; Fisher et al. 1998).

Danish Economics and Political Science articles are increasingly produced in international collaboration. The share of international co-authored articles has risen from 7% to 59% for Economics and 8% to 31% for Political Science. In comparison, Henriksen (2016), which includes all articles in WoS Social Science Citation Index, found that the share of internationally co-authored articles rose from approximately 6% to 29% for Economics and 1.2% to 12% for Political Science in the period 1980-2013. Thus, Danish researchers have a great tendency to collaborate with foreign partners, but as the regression analysis estimated, it is typically with researchers in close geographical proximity. Furthermore, the examination of interinstitutional Danish collaboration in the descriptive data and regression models revealed that collaborating with researchers from other institutions often results in more co-authors on an article. Therefore, the increase in international and interinstitutional collaboration is associated with an increase in co-authors.

The results show that the increase in number of co-authors and share of co-authorship in Danish Economics and Political Science is to some extent a result of changes in research methods, research approaches, and collaboration with researchers from other institutions. However, the results also revealed that the increase in the average number of authors and co-authorship is occurring across the field of Danish Economics and Political Science, regardless of research methods or approaches. These changes indicate that the research culture is changing. The question is whether researchers nowadays collaborate more or whether the increase in number of authors is a reflection of changes in how researchers perceive and practice co-authorship or new ways of conducting research. To answer this question, further science communication studies are needed to explore researchers' practices and perception of co-authorship.

References

- Adams, W. C., Infeld, D. L., Minnichelli, L. F., & Ruddell, M. W. (2014). Policy Journal Trends and Tensions: JPAM and PSJ. [Article]. *Policy Studies Journal*, 42, S118-S137, doi:10.1111/psj.12051.
- Barnett, A. H., Ault, R. W., & Kaserman, D. L. (1988). The rising incidence of co-authorship in economics - further evidence. [Note]. *Review of Economics and Statistics*, 70(3), 539-543, doi:10.2307/1926798.
- Bennett, L. M., & Gadlin, H. (2012). Collaboration and Team Science: From Theory to Practice. *Journal of Investigative Medicine*, 60(5), 768-775.
- Biggs, J. (2008). Allocating the Credit in Collaborative Research. [10.1017/S1049096508280364]. *PS: Political Science & Politics*, 41(01), 246-247.
- Birnholtz, J. P. (2006). What does it mean to be an author? The intersection of credit, contribution, and collaboration in science. [Article]. *Journal of the American Society for Information Science and Technology*, 57(13), 1758-1770, doi:10.1002/asi.20380.
- Brown, C. L., Chan, K. C., & Lai, P. (2006). Marketing Journal Coauthorships: An Empirical Analysis of Coauthor Behavior. *Journal of Marketing Education*, 28(1), 17-25, doi:10.1177/0273475305279951.
- Corley, E. A., & Sabharwal, M. (2010). Scholarly collaboration and productivity patterns in public administration: Analysing recent trends. *Public Administration*, 88(3), 627-648, doi:10.1111/j.1467-9299.2010.01830.x.
- Cronin, B. (2001). Hyperauthorship: A postmodern perversion or evidence of a structural shift in scholarly communication practices? *Journal of the American Society for Information Science and Technology*, 52(7), 558-569, doi:10.1002/Asi.1097.Abs.
- Fisher, B. S., Cobane, C. T., Vander Ven, T. M., & Cullen, F. T. (1998). How many authors does it take to publish an article? Trends and patterns in political science. *Ps-Political Science & Politics*, 31(4), 847-856, doi:10.2307/420730.
- Glänzel, W., & Moed, H. F. (2013). Opinion paper: thoughts and facts on bibliometric indicators. [journal article]. *Scientometrics*, 96(1), 381-394, doi:10.1007/s11192-012-0898-z.
- Henriksen, D. (2016). The rise in co-authorship in the social sciences (1980–2013). *Scientometrics*, 1-22, doi:10.1007/s11192-016-1849-x.
- Hoekman, J., Frenken, K., & Tijssen, R. J. W. (2010). Research collaboration at a distance: Changing spatial patterns of scientific collaboration within Europe. *Research Policy*, 39(5), 662-673, doi:10.1016/j.respol.2010.01.012.
- Hudson, J. (1996). Trends in multi-authored papers in economics. *Journal of Economic Perspectives*, 10(3), 153-158.
- Hunter, L., & Leahey, E. (2008). Collaborative Research in Sociology: Trends and Contributing Factors. [journal article]. *The American Sociologist*, 39(4), 290-306, doi:10.1007/s12108-008-9042-1.
- Jeong, S., Choi, J. Y., & Kim, J. (2011). The determinants of research collaboration modes: exploring the effects of research and researcher characteristics on co-authorship. *Scientometrics*, 89(3), 967-983, doi:10.1007/s11192-011-0474-y.
- Kumar, S., & Ratnavelu, K. (2016). Perceptions of Scholars in the Field of Economics on Co-Authorship Associations: Evidence from an International Survey. *Plos One*, 11(6), e0157633, doi:10.1371/journal.pone.0157633.
- Laband, D. N., & Tollison, R. D. (2000). Intellectual collaboration. *Journal of Political Economy*, 108(3), 632-662.
- Lariviere, V., Gingras, Y., & Archambault, E. (2006). Canadian collaboration networks: A comparative analysis of the natural sciences, social sciences and the humanities. *Scientometrics*, 68(3), 519-533, doi:10.1007/s11192-006-0127-8.

- Moody, J. (2004). The structure of a social science collaboration network: Disciplinary cohesion from 1963 to 1999. *American Sociological Review*, 69(2), 213-238.
- O'Neill, G. P. (1998). Authorship patterns in theory based versus research based journals. *Scientometrics*, 41(3), 291-298.
- Ossenblok, T. L. B., Engels, T. C. E., & Sivertsen, G. (2012). The representation of the social sciences and humanities in the Web of Science-a comparison of publication patterns and incentive structures in Flanders and Norway (2005-9). *Research Evaluation*, 21(4), 280-290, doi:10.1093/reseval/rvs019.
- Piette, M. J., & Ross, K. L. (1992). An Analysis of the Determinants of Co-authorship in Economics. *The Journal of Economic Education*, 23(3), 277-283, doi:10.1080/00220485.1992.10844762.
- Porter, A. L., & Rafols, I. (2009). Is science becoming more interdisciplinary? Measuring and mapping six research fields over time. *Scientometrics*, 81(3), 719-745, doi:10.1007/s11192-008-2197-2.
- Rutledge, R. W., Karim, K. E., & Reinstein, A. (2011). What factors influence the number of coauthors in the published research of the most productive authors in accounting literature? a long-term study. *Advances in Accounting Behavioral Research* (Vol. 14, pp. 191-225).
- Sacco, W., & Milana, S. (1984). Increase in number of authors per article in ten APA journals: 1960–1980. *Cognitive Therapy and Research*, 8(1), 77-83, doi:10.1007/BF01315100.
- Schymura, M., & Loschel, A. (2014). Incidence and extent of co-authorship in environmental and resource economics: evidence from the Journal of Environmental Economics and Management. [Article]. *Scientometrics*, 99(3), 631-661, doi:10.1007/s11192-014-1248-0.
- Sutter, M., & Kocher, M. (2004). Patterns of co-authorship among economics departments in the USA. [Article]. *Applied Economics*, 36(4), 327-333, doi:10.1080/00036840410001674259.
- Wagner, C. S., & Leydesdorff, L. (2005). Mapping the network of global science: comparing international co-authorships from 1990 to 2000. *International Journal of Technology and Globalisation*, 1(2), 185-208, doi:10.1504/ijtg.2005.007050.
- Waltman, L., Tijssen, R. J. W., & van Eck, N. J. (2011). Globalisation of science in kilometres. *Journal of Informetrics*, 5(4), 574-582, doi:10.1016/j.joi.2011.05.003.
- Zawacki-Richter, O., & von Prümmer, C. (2010). Gender and collaboration patterns in distance education research. *Open Learning*, 25(2), 95-114, doi:10.1080/02680511003787297.
- Zitt, M., Bassecoulard, E., & Okubo, Y. (2000). Shadows of the past in international cooperation: Collaboration profiles of the top five producers of science. *Scientometrics*, 47(3), 627-657, doi:10.1023/A:1005632319799.
- Zutshi, A., McDonald, G., & Kalejs, L. (2012). Challenges in collaborative writing: addressing authorship attribution. *European Business Review*, 24(1), 28-46, doi:10.1108/09555341211191535.

Figure 1 coding algorithm

Figure 2 Distribution of number of articles and authors

Figure 3 the evolution of the mean number of authors and the number of economic articles (N authors ≤ 10)

Figure 4 the evolution of co-authorship in economics

Figure 5 the evolution of the mean number of authors and the number of Political Science articles (N authors <= 10)

Figure 6 the evolution of co-authorship in Political Science

Table 1 Economics regression count model: Research approach

Dependent variable: No. of co-authors	All years (NBR)	1980-1994 (Poisson)	1995-2004 (NBR)	2005-2014 (Poisson)
	<i>B</i>	<i>B</i>	β	<i>B</i>
Intercept	-1.269**** (0.051)	-1.662**** (0.121)	-1.307**** (0.109)	-0.971**** (0.068)
NJS	0.035* (0.019)	0.029 (0.063)	-0.036 (0.046)	0.034 (0.022)
GCD	0.000**** (0.000)	0.000**** (0.000)	0.000**** (0.000)	0.000**** (0.000)
IN	1.502**** (0.053)	2.164**** (0.194)	1.566**** (0.123)	1.241**** (0.063)
II	1.284**** (0.069)	1.958**** (0.215)	1.193**** (0.147)	1.078**** (0.083)
Empirical	0.395**** (0.039)	-0.070 (0.161)	0.589**** (0.589)	0.321**** (0.046)
No. of observations	3,157	542	746	1,869

NS: Not statistically significant

* $p < .10$

** $p < .05$

*** $p < .01$

**** $p < .00$

Std. Err. in parentheses

Table 2 Economics regression count model: Research methods

Dependent variable: No. of co-authors	All years (NBR)	1980-1994 (Poisson)	1995-2004 (NBR)	2005-2014 (Poisson)
	β	B	B	β
Intercept	-1.191*** (0.049)	0.304 exp(β)	-1.245*** (0.104)	-0.876*** (0.064)
NIS	0.030 (0.019)	1.030	-0.051 (0.045)	0.037 (0.023)
GCD	0.000*** (0.000)	1.000	0.000** (0.000)	0.000*** (0.000)
IN	1.522*** (0.053)	4.581	1.534*** (0.122)	1.263*** (0.064)
II	1.260*** (0.069)	3.524	1.191*** (0.146)	1.048*** (0.083)
Secondary data	0.288*** (0.038)	1.334	0.635* (0.090)	0.149*** (0.042)
Interview	0.255*** (0.090)	1.290	-0.021 (0.305)	0.302*** (0.089)
Survey	0.572*** (0.057)	1.771	1.083*** (.165)	0.418*** (0.059)
Document	-0.224 (0.129)	0.800	-0.408 (0.370)	-0.263* (0.136)
No. of observations	3,157	542	746	1,869

NS: Not statistically significant

*p<0.10

**p<0.05

***p<0.01

****p<0.00

Std. Err. in parentheses

Table 3 Economics regression count model: Interdisciplinary

Dependent variable: No. of co-authors	All years (NBR)	1980-1994 (Poisson)	1995-2004 (NBR)	2005-2014 (Poisson)
	β	B	β	β
Intercept	-1.436**** (0.074)	0.238	$exp(\beta)$	$exp(\beta)$
NIS	0.023 (0.020)	1.023	0.238 (0.152)	-1.394**** (0.106)
GCD	0.000**** (0.000)	0.996	0.965 (0.046)	0.040 (0.024)
IN	1.000	1.000	1.000	1.000
II	0.000**** (0.000)	1.000	1.000	1.000
Empirical	1.373**** (0.054)	7.583 (0.221)	4.472 (0.125)	3.398 (0.064)
Interdisciplinary	1.157**** (0.071)	6.265 (0.270)	3.117 (0.149)	2.845 (0.084)
	0.318**** (0.041)	0.740 (0.302 (0.201))	1.762 (0.092)	1.300 (0.048)
	0.593**** (0.593)	1.387	1.474	2.098 (0.135)
No. of observations	2,868	342	713	1,813

NS: Not statistically significant

* $p < .10$

** $p < .05$

*** $p < .01$

**** $p < 0.00$

Std. Err. in parentheses

Table 4 Political Science regression count model: Research approach

Dependent variable: No. of co-authors	All years (NBR)	1980-1994 (Poisson)	1995-2004 (NBR)	2005-2014 (NBR)
	β	β	B	β
Intercept	-1.716*** (0.103)	-2.832*** (0.520)	-1.669*** (0.256)	-1.622*** (0.119)
NIS	0.147*** (0.040)	1.158 (0.119 (0.123))	1.126 (0.047 (0.140))	1.184 (0.169*** (0.047))
GCD	0.000*** (0.000)	1.000 (0.000 (0.000))	1.000 (0.000 (0.000))	1.000 (0.000*** (0.000))
IN	2.002*** (0.088)	7.403 (0.433)	18.728 (0.227)	6.603 (1.887*** (0.098))
II	1.568*** (0.136)	4.798 (omitted)	6.454 (1.865*** (0.290))	4.115 (1.415*** (0.154))
Empirical	0.259*** (0.084)	1.296 (0.643 (0.476))	1.110 (0.105 (0.200))	1.303 (0.265*** (0.094))
No. of observations	1,385	112	263	1010

NS: Not statistically significant

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

**** $p < 0.00$

Std. Err. in parentheses

Table 5 Political Science regression count model: Research methodology

Dependent variable: No. of co-authors	All years (NBR)	1980-1994 (Poisson)	1995-2004 (NBR)	2005-2014 (NBR)
	β	β	β	β
Intercept	-1.610*** (0.099)	-2.783 *** (0.521)	-1.664*** (0.254)	-1.505*** (0.113)
NJS	0.129*** (0.040)	0.106 (0.125)	0.067 (0.141)	0.147*** (0.047)
GCD	0.000*** (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 *** (0.000)
IN	1.986*** (0.085)	2.906*** (0.437)	2.076*** (0.228)	1.873*** (0.098)
II	1.524*** (0.136)	(omitted)	1.862*** (0.291)	1.358*** (0.154)
Quantitative	0.311*** (0.085)	0.848* (0.498)	0.179 (0.225)	0.306*** (0.094)
Qualitative	-0.071 (0.102)	0.277 (0.589)	-0.045 (0.230)	-0.081 (0.116)
No. of observations	1,385	112	263	1,010

NS: Not statistically significant

*p<0.10

**p<0.05

***p<0.01

****p<0.00

Std. Err. in parentheses

Table 6 Political Science regression count model: Research methods

Dependent variable: No. of co-authors	All years (NBR)		1995-2004 (NBR)		2005-2014 (Poisson)	
	β	$exp(\beta)$	β	$exp(\beta)$	β	$exp(\beta)$
Intercept	-1.556**** (0.090)	0.211	-1.646**** (0.231)	0.193	-1.435**** (0.105)	0.238
NJS	0.119*** (0.040)	1.127	0.023 (0.146)	1.023	0.168** (0.036)	1.183
GCD	0.000** (0.000)	1.000	0.000 (0.000)	1.000	0.000**** (0.000)	1.000
IN	2.001**** (0.088)	7.395	2.061**** (0.228)	7.850	1.877**** (0.086)	6.534
II	1.528**** (0.136)	4.608	1.818**** (0.301)	6.161	1.372**** (0.135)	3.943
Secondary data	0.219** (0.091)	1.244	0.302 (0.229)	1.352	0.122 (0.080)	1.130
Interview	0.220* (0.125)	1.246	0.301 (0.362)	1.351	0.163 (0.111)	1.177
Survey	0.412**** (0.105)	1.510	0.332 (0.323)	1.393	0.264*** (0.089)	1.302
Document	-0.281*** (0.106)	0.755	-0.110 (0.246)	0.896	-0.372*** (0.104)	0.689
No. of observations	1,385		263		1,010	

NS: Not statistically significant

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

**** $p < 0.00$

Std. Err. in parentheses

Table 7 Political Science regression count model: Interdisciplinary

Dependent variable: No. of co-authors	All years (NBR)	1995-2004 (NBR)	2005-2014 (NBR)
	β	β	β
Intercept	-1.929**** (0.151)	-1.511**** (0.318)	-1.970**** (0.201)
NIS	0.106** (0.044)	1.111 (0.165)	0.126*** (0.049)
GCD	0.000*** (0.000)	1.000 (0.000)	0.000*** (0.000)
IN	1.974**** (0.092)	7.201 (0.239)	1.884**** (0.102)
II	1.625**** (0.140)	5.079 (0.304)	1.506**** (0.158)
Empirical	0.199** (0.087)	1.220 (0.187 (0.214)	0.189* (0.097)
Interdisciplinary	0.539**** (0.188)	1.715 (0.372)	0.693*** (0.257)
No. of observations	1,244	231	939

NS: Not statistically significant

*p<0.10

**p<0.05

***p<0.01

****p<0.00

Std. Err. in parentheses

Appendix

Table 1 Descriptive statistics: Economics

No. authors	Year	Mean (μ)	p25	p50	p75	p90	p95	min	max	pct coauthors	N
All articles ¹	1980-1984	1.26	1	1	1	2	2	1	10	17.7%	130
	1985-1989	1.25	1	1	1	2	2	1	3	23.5%	153
	1990-1994	1.45	1	1	2	2	3	1	5	31.8%	255
	1995-1999	1.74	1	2	2	3	4	1	26	56.4%	303
	2000-2004	1.95	1	2	2	3	4	1	21	63.1%	428
	2005-2009	2.13	1	2	3	3	4	1	9	70.3%	656
	2010-2014	2.48	2	2	3	4	5	1	19	81.2%	1134
Empirical ²	1980-1984	1.26	1	1	1	2	2	1	3	23.1%	39
	1985-1989	1.29	1	1	2	2	2	1	2	29.3%	41
	1990-1994	1.41	1	1	2	2	3	1	4	30.9%	94
	1995-1999	1.74	1	2	2	3	4	1	26	57.3%	117
	2000-2004	2.19	1	2	3	4	4	1	21	67.9%	187
	2005-2009	2.30	2	2	3	4	4	1	9	75.2%	375
	2010-2014	2.63	2	2	3	4	5	1	19	84.9%	794
Theoretical ³	1980-1984	1.26	1	1	1	2	2	1	10	15.4%	91
	1985-1989	1.23	1	1	1	2	2	1	3	21.4%	112
	1990-1994	1.47	1	1	2	2	4	1	5	32.3%	161
	1995-1999	1.74	1	2	2	3	3	1	5	55.9%	186
	2000-2004	1.77	1	2	2	3	3	1	5	59.3%	241
	2005-2009	1.90	1	2	2	3	4	1	6	63.7%	281
	2010-2014	2.13	1	2	3	3	4	1	14	72.7%	340
Quantitative ⁴	1980-1984	1.30	1	1	2	2	2	1	3	27.3%	33
	1985-1989	1.30	1	1	2	2	2	1	2	30.0%	40
	1990-1994	1.41	1	1	2	2	3	1	4	30.6%	85
	1995-1999	1.81	1	2	2	3	5	1	26	61.6%	99
	2000-2004	2.32	1	2	3	4	5	1	21	73.8%	164
	2005-2009	2.33	2	2	3	4	4	1	7	77.3%	331
	2010-2014	2.63	2	3	3	4	5	1	19	86.0%	713
Qualitative	1980-1984	1.00	1	1	1	1	1	1	1	0.0%	6
	1985-1989	1.00	1	1	1	1	1	1	1	0.0%	1
	1990-1994	1.43	1	1	2	3	3	1	3	28.6%	7
	1995-1999	1.33	1	1	2	2	3	1	3	26.7%	15

¹ The mean without the limit of 10 authors: 1995-1999 $\mu = 2.05$; 2000-2004 $\mu = 2.03$; 2010-2014 $\mu = 2.54$

² The mean without the limit of 10 authors: 1995-1999 $\mu = 2.55$; 2000-2004 $\mu = 2.36$; 2010-2014 $\mu = 2.70$

³ The mean without the limit of 10 authors: 2010-2014 $\mu = 2.17$

⁴ The mean without the limit of 10 authors: 1995-1999 $\mu = 2.76$; 2000-2004 $\mu = 2.51$; 2010-2014 $\mu = 2.71$

	2000-2004	1.31	1	1	2	2	2	1	2	30.8%	13
	2005-2009	1.63	1	1	2	2.5	4	1	5	43.3%	30
	2010-2014	2.05	1	2	3	3	4	1	5	62.8%	43
Mixed methods	1990-1994	1.50	1	1.5	2	2	2	1	2	50.0%	2
	1995-1999	1.67	1	2	2	2	2	1	2	66.7%	3
	2000-2004	1.30	1	1	1	2.5	3	1	3	20.0%	10
	2005-2009	3.00	2	2	3	5	9	1	9	92.9%	14
	2010-2014	3.18	2	3	4	6	6	1	7	89.5%	38

Table 2 Descriptive statistics: Economics research methods

No. authors	Year	Mean (μ)	p25	p50	p75	p90	p95	min	max	pct coauthors	N
Interviews ⁵	1985-1989	1.00	1	1	1	1	1	1	1	0.0%	1
	1990-1994	1.50	1	1.5	2	2	2	1	2	50.0%	2
	1995-1999	1.33	1	1	2	2	2	1	2	33.3%	6
	2000-2004	1.88	1	1	2	3	9	1	9	35.3%	17
	2005-2009	2.07	1	2	2	4	5	1	9	55.2%	29
	2010-2014	2.72	2	2.5	4	5	6	1	19	77.6%	76
Survey ⁶	1980-1984	1.00	1	1	1	1	1	1	1	0.0%	1
	1985-1989	1.67	1	2	2	2	2	1	2	66.7%	3
	1990-1994	1.40	1	1	2	2	2	1	2	40.0%	5
	1995-1999	2.13	1	2	4	25	26	1	26	70.0%	10
	2000-2004	2.16	1	2	3	4	6	1	6	63.2%	19
	2005-2009	2.55	2	2	3	4	5	1	9	85.5%	55
	2010-2014	3.17	2	3	4	5	6	1	13	92.2%	141
Secondary data ⁷	1980-1984	1.33	1	1	2	2	2	1	3	29.6%	27
	1985-1989	1.25	1	1	1.5	2	2	1	2	25.0%	28
	1990-1994	1.45	1	1	2	2	3.5	1	4	31.7%	60
	1995-1999	1.76	1	2	2	3	5	1	26	60.0%	70
	2000-2004	2.43	2	2	3	4	6	1	21	75.7%	115
	2005-2009	2.40	2	2	3	4	5	1	7	76.5%	217
	2010-2014	2.49	2	2	3	4	4	1	19	85.2%	432
Document	1980-1984	1.00	1	1	1	1	1	1	1	0.0%	6
	1990-1994	1.60	1	1	2	3	3	1	3	40.0%	5
	1995-1999	1.38	1	1	2	2	3	1	3	30.8%	13
	2000-2004	1.29	1	1	2	2	2	1	2	28.6%	14
	2005-2009	1.92	1	2	2	3	4	1	5	61.5%	26
	2010-2014	2.08	1	2	3	3	5	1	7	61.5%	39

⁵ The mean without the limit of 10 authors: 2010-2014 μ = 2.93

⁶ The mean without the limit of 10 authors: 1995-1999 μ = 6.70; 2010-2014 μ = 3.31

⁷ The mean without the limit of 10 authors: 1995-1999 μ = 2.76; 2000-2004 μ = 2.70; 2010-2014 μ = 2.55

Table 3 Economics regression Model (only co-authored articles)

Dependent variable: No. of co-authors	All years (NBR)		1980-1994 (Poisson)		1995-2004 (NBR)		2005-2014 (Poisson)	
	β	$exp(\beta)$	β	$exp(\beta)$	β	$exp(\beta)$	β	$exp(\beta)$
Intercept	0.075 (0.053)	1.078	0.229* (0.124)	1.257	-0.029 (0.114)	0.972	0.108 (0.070)	1.114
NJS	0.015 (0.019)	1.015	-0.028 (0.067)	0.973	-0.019 (0.044)	0.981	0.030 (0.023)	1.030
GCD	0.000**** (0.000)	1.000	0.000 (0.000)	1.000	0.000**** (0.000)	1.000	0.000**** (0.000)	1.000
IN	0.238**** (0.052)	1.269	0.264 (0.205)	1.303	0.286** (0.126)	1.332	0.218**** (0.064)	1.244
II	0.157** (0.068)	1.170	0.160 (0.213)	1.173	0.064 (0.150)	1.066	0.195** (0.083)	1.216
Empirical	0.291**** (0.038)	1.337	-0.129 (0.160)	0.879	0.532**** (0.087)	1.702	0.236**** (0.046)	1.266
No. of observations	2,018		140		449		1,429	

*p<.10

**p<.05

***p<.01

****p<.00

Std. Err. in parentheses

Table 4 Descriptive statistics: Political Science

No. authors	Year	Mean (μ)	p25	p50	p75	p90	p95	min	max	pct coauthors	N
All articles ⁸	1980-1984	1.30	1	1	1	2	3	1	4	17.4%	23
	1985-1989	1.17	1	1	1	2	2	1	2	16.7%	30
	1990-1994	1.31	1	1	1	2	3	1	5	18.8%	48
	1995-1999	1.41	1	1	2	3	3	1	5	28.3%	99
	2000-2004	1.65	1	1	2	3	3	1	11	41.3%	138
	2005-2009	1.63	1	1	2	3	3	1	13	41.1%	324
	2010-2014	2.00	1	2	2	3	4	1	35	54.3%	637
Empirical ⁹	1980-1984	1.33	1	1	1	3	4	1	4	16.7%	18
	1985-1989	1.19	1	1	1	2	2	1	2	19.1%	21
	1990-1994	1.38	1	1	1	3	3	1	5	20.6%	34
	1995-1999	1.38	1	1	2	2	3	1	4	28.3%	60
	2000-2004	1.71	1	1	2	3	3	1	11	45.5%	99
	2005-2009	1.66	1	1	2	3	3	1	13	43.5%	232
	2010-2014	2.06	1	2	2	4	4	1	35	59.4%	470
Theoretical ¹⁰	1980-1984	1.20	1	1	1	2	2	1	2	20.0%	5
	1985-1989	1.11	1	1	1	2	2	1	2	11.1%	9
	1990-1994	1.14	1	1	1	2	2	1	2	14.3%	14
	1995-1999	1.46	1	1	2	3	3	1	5	28.2%	39
	2000-2004	1.59	1	1	2	3	6	1	6	30.8%	39
	2005-2009	1.55	1	1	2	3	3	1	7	34.8%	92
	2010-2014	1.84	1	1	2	3	4	1	14	40.1%	167
Quantitative ¹¹	1980-1984	1.43	1	1	1	4	4	1	4	14.3%	7
	1985-1989	1.27	1	1	1.5	2	2	1	2	25.0%	11
	1990-1994	1.58	1	1	2	3	5	1	5	26.3%	19
	1995-1999	1.39	1	1	2	2	2	1	3	34.8%	23
	2000-2004	1.79	1	1	2	3	4	1	11	46.2%	52
	2005-2009	1.88	1	2	2	3	3	1	13	56.5%	131
	2010-2014	2.22	1	2	3	4	5	1	35	63.1%	282
Qualitative	1980-1984	1.27	1	1	1	2	3	1	3	18.2%	11
	1985-1989	1.11	1	1	1	2	2	1	2	11.1%	9
	1990-1994	1.13	1	1	1	2	2	1	2	13.3%	15
	1995-1999	1.40	1	1	2	3	3	1	4	25.7%	35

⁸ The mean without the limit of 10 authors: 2000-2004 μ = 1.69; : 2000-2004 μ = 1.65; 2010-2014 μ = 2.08

⁹ The mean without the limit of 10 authors: 2000-2004 μ = 1.73; : 2000-2004 μ = 1.69; 2010-2014 μ = 2.17

¹⁰ The mean without the limit of 10 authors: 2010-2014 μ = 1.87

¹¹ The mean without the limit of 10 authors: 2000-2004 μ = 1.81; : 2000-2004 μ = 1.90; 2010-2014 μ = 2.36

	2000-2004	1.63	1	1	1	3	3	1	7	41.5%	41
	2005-2009	1.43	1	1	2	2	3	1	9	27.5%	91
	2010-2014	1.84	1	1	2	3	4	1	13	49.3%	152
Mixed methods	1980-1984	.	.	.	.	.	.	.	.	.	0
	1985-1989	1.00	1	1		1	1	1	1	0.0%	1
	1990-1994	.	.	.	.	.	.	.	.	.	0
	1995-1999	1.00	1	1	1	1	1	1	1	0.0%	2
	2000-2004	1.67	1	2	2	2	2	1	2	66.7%	6
	2005-2009	1.30	1	1	1	2.5	3	1	3	20.0%	10
	2010-2014	2.14	1	2	3	3	4	1	5	72.2%	36

Table 5 Descriptive statistics: Political Science Methods

No. authors	Year	Mean (μ)	p25	p50	p75	p90	p95	min	max	pct coauthors	N
Interviews	1980-1984	1.00	1	1	1	1	1	1	1	0.0%	1
	1990-1994	2.00	2	2	2	2	2	2	2	100.0%	1
	1995-1999	2.50	1	2.5	4	4	4	1	4	50.0%	2
	2000-2004	1.67	1	2	2	2	3	1	3	58.3%	12
	2005-2009	1.78	1	1	2	4	5	1	9	29.6%	27
	2010-2014	1.94	1	2	2	4	4	1	6	58.6%	87
Survey ¹²	1980-1984	1.60	1	1	1	4	4	1	4	20.0%	5
	1985-1989	1.00	1	1	1	1	1	1	1	0.0%	2
	1990-1994	1.33	1	1	1	3	3	1	3	16.7%	6
	1995-1999	2.00	2	2	2	2	2	2	2	100.0%	4
	2000-2004	1.92	1	2	2	2	6	1	6	58.3%	12
	2005-2009	1.76	1	1.5	2	3	4	1	8	50.0%	38
	2010-2014	2.52	1	2	3	4	5	1	13	71.1%	90
Secondary data	1980-1984	1.00	1	1		1	1	1	1	0.0%	3
	1985-1989	1.50	1	1.5	2	2	2	1	2	50.0%	4
	1990-1994	1.60	1	1	2	3	3	1	3	40.0%	5
	1995-1999	1.53	1	1	2	3	4	1	4	33.3%	15
	2000-2004	1.89	1	1	2	3	3	1	11	48.2%	27
	2005-2009	2.04	1	2	2	3	3	1	13	66.2%	68
	2010-2014	2.22	1	2	2	3	6	1	16	60.0%	130
Document	1980-1984	1.43	1	1	2	3	3	1	3	28.6%	7
	1985-1989	1.11	1	1	1	2	2	1	2	11.1%	9
	1990-1994	1.22	1	1	1	2	2	1	2	22.2%	9

¹² The mean without the limit of 10 authors: 2010-2014 μ = 2.59

1995-1999	1.68	1	1	2	3	4	1	4	42.1%	19
2000-2004	1.46	1	1	2	2	3	1	3	39.3%	28
2005-2009	1.36	1	1	2	2	3	1	4	28.8%	66
2010-2014	1.71	1	2	2	3	3	1	5	50.7%	138

Table 6 Political Science regression model (only co-authored articles)

Dependent variable: No. of co-authors	All years (NBR)		1995-2004 (NBR)		2005-2014 (NBR)	
	β	$exp(\beta)$	β	$exp(\beta)$	β	$exp(\beta)$
Intercept	0.000 (0.107)	1.000	0.238 (0.252)	1.268	-0.024 (0.124)	0.976
NJS	0.161*** (0.039)	1.175	0.045 (0.135)	1.046	0.179*** (0.045)	1.195
GCD	0.000*** (0.000)	1.000	0.000 (0.000)	1.000	0.000*** (0.000)	1.000
IN	0.437*** (0.089)	1.548	0.284 (0.216)	1.329	0.452*** (0.100)	1.571
II	0.146 (0.132)	1.157	0.289 (0.270)	1.335	0.104 (0.151)	1.109
Empirical	0.009 (0.081)	1.009	-0.116 (0.188)	0.890	0.016 (0.092)	1.016
No. of observations	614		94		500	

*p<.10

**p<.05

***p<.01

***p<.00

Std. Err. in parentheses