Working Paper No. 133

You get what you 'pay' for: Academic attention, career incentives and changes in publication portfolios of business and economics researchers

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You get what you 'pay' for: Academic attention, career incentives and changes in publication portfolios of business and economics researchers

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Abstract. Since the 1990s, research on publication outputs in business and economics has almost exclusively focused on journal articles. While earlier work has shown that journal articles and other publications were indeed complements in the 70s and 80s, we find that this is no longer the case when we include the most recent decades. Apparently, the notable shift in the scientific community's attention in the 90s on journal articles and the corresponding incentives towards publications in internationally highly ranked journals on average led researchers to focus one-sidedly on journal publications at the expense of other publication forms. To see whether the aggregate result also holds for individual researchers, we perform a cluster analysis and find four different types of individual researchers: "*Journal Specialists*", "*Book-Based Publishers*", a small group of "*Highly Productive All-round Publishers*" and a large group of what we call "*Inconspicuous*" researchers, with a very modest publication productivity in all forms. In addition, we find that researchers' age matters for their publication patterns: in our sample, more experienced researchers are *less* productive with respect to journal articles, but more productive with respect to other publication forms. This, however, is *not* the result of an individual career effect. Rather, it can be attributed to a cohort effect: among today's active researchers, the younger cohorts are more productive in journal articles than the older ones. Our explanation is as follows: the younger cohorts were still in their socialization and hiring phase and were more strongly affected by the newly introduced incentives towards international journal publications – and have thus reacted more strongly to the "regime change" resulting from the scientific community's one-sided attention to publications in internationally highly ranked journals.

JEL classification: A14, I23, J24.

Keywords: Research productivity; publication forms; journal articles.

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1. Introduction

Since the 1990s, research on publication outputs has almost exclusively focused on journal articles (Combes and Linnemer 2003; Davis and Patterson 2001; Fabel et al. 2008; Fox 1992; Levin and Stephan 1991; Rauber and Ursprung 2008; Sinatra et al. 2016). Besides limited data availability (Combes and Linnemer 2003: 1250) a justification for such a one-sided focus on journal publication output was that it is highly correlated with publication output in other outlets (see Fabel and Heße 1999: 198, Backes-Gellner 1989, Hicks and Potter 1991, Nederhof et al. 1989 and Hicks 2004). However, although journal article publications were positively correlated with other publication forms in the 70s and 80s, it is unclear whether this is still the case – especially after the attention of the scientific community has shifted almost exclusively toward journal publications, thus providing explicit incentives to concentrate on journals publications only.

Therefore, in our paper, we empirically investigate how productivity in journal articles is related to productivity in other publication forms and whether it changed in the last decades. We do this for business and economics researchers from Germany, Austria, and the German-speaking part of Switzerland. We are interested in whether there has been a change in the relation between journal publication outputs and other publication outputs and whether this coincides with the shift in the scientific community's attention toward journal publications in the 90s.

In the literature, there are several hints for the scientific community's increased attention towards journal publications during the 1990s. Already back in 1986, Pommerehne (1986) noted that quality-adjusted journal publications were becoming more important in the German-speaking world: for applications, salary negotiations, the allocation of research funds, and for the prestige of a researcher (cf. 282 f.). In 1997, Bommer and Ursprung (1997) reported an increasing political pressure in the German-speaking world to assess and critically

evaluate the publication productivity of institutions and faculties. To this aim, the authors developed an analysis of the publication productivity of the economics departments in Germany, Austria, and Switzerland and only counted quality-weighted journal articles in their analysis. Likewise, Combes and Linnemer (2003) who analyzed the publication productivity of European economics departments, fully concentrated on (quality-adjusted) journal article publications, and the 'Symposium on Evaluating Economics Research in Europe' (European Economic Association 2003) was also creating more attention and reputation solely for journal publications. Similarly, Fabel and Heße (1999) ranked business administration departments also mainly with respect to journal article publications and only to a small extent (less than one percent) book chapters (cf. 197 f.).

The well-known "equal compensation principle" from personnel economics clearly predicts that such a strong shift in attention and – even more so – the provision of explicit incentives toward one particular task (here: journal articles) in a multi-task-framework will decrease the output in other tasks (i.e., other types of publications that gain no or less attention). That is, if the scientific community one-sidedly focusses on journal publications and increasingly attaches more or less explicit incentives to publishing in journals, then researchers can be expected to subsequently focus on this one output indicator and publish less in other publication forms.

In our paper, we thus empirically analyze whether the increased *incentives to focus on journal articles* go along with a change in publication patterns, and particularly we look at whether the change in incentives is stronger than a potential complementarity between the production of journal articles and other forms of research output.

Our study contributes to the literature in five ways. F*irstly*, by analyzing publication productivity in different forms: not only journal articles but also monographs, book chapters, book editorships, and journal editorships, and how these are related. We thus follow a recent

claim by Rost and Frey (2011) to not only concentrate on journal publications as an output indicator. Here we find that – across cohorts and including the last decades – there is a significantly *negative* correlation between journal article productivity and productivity in other publication forms (except journal editorships). That is, our results indicate that journal productivity nowadays is no longer a good proxy for overall publication productivity and that measuring journals only will result in an inadequate measurement of total publication productivity.

Secondly, investigating the composition of the aggregate result, we find four distinct types of researchers with respect to their publication profiles: One type can be described as "*Journal Specialists*", a second type as "*Book-Based Publishers*", a third, albeit small group as "*Highly Productive All-round Publishers*", and a fourth and very large group of researchers as the "*Inconspicuous*" which are quite modest in all publication dimensions.

Thirdly, we find (career) age to be an important variable in distinguishing between those two types of researchers that specialize in journal publications or book-based publications, respectively: "*Journal Specialists*" in our sample of today's active researchers are on average less experienced than the rest of the researchers, and "*Book-Based Publishers*" are on average more experienced. Correspondingly, we find *career age* to be significantly negatively correlated with journal article productivity, but positively with productivity in book-based publication forms.

Fourthly, we investigate whether these "age effects" can be attributed to an individual age or *career effect* where researchers change their publication portfolio over their careers (with researchers publishing more in journals when they are young and less experienced and more in books when they get older and advance in their career) or whether it can be attributed to a *cohort effect* induced by a regime change in incentives (fostered by the scientific community's one-sided shift in attention toward journal publications). Such a regime change

affected the younger cohorts more than it affected the older ones because the younger cohorts were still in their socialization and hiring phase at the time of the regime shift and thus had stronger incentives to react. We find that the negative correlation between *career age* and journal article productivity is not the result of an individual age or career effect because yearly publication output significantly increases over the individual careers in *all* publication forms, including (quality-adjusted) journal articles. Concerning potential cohort effects, we do find younger cohorts to have a significantly higher publication productivity with respect to journal articles than the older ones, suggesting that the younger cohorts were more strongly affected by the regime change resulting from the notable shift in the scientific community's attention toward journal article publications and the corresponding incentives to publish in journals.

Fifthly, our analysis of researchers' publication behavior contributes to the discussions about academic performance management and the incorporation of "market structures" into the public sector by New Public Management (NPM). NPM has also affected universities, in particular by increasing competition within and between universities (De Boer et al. 2007). One element of the reforms is the use of performance indicators at universities (Taylor 2001, Rabovsky 2014). These include performance-based budgets, tenure decisions based on the number of journal publications, bonuses based on *Handelsblatt* points, or similar.

To understand the consequences of these new management trends, it is necessary to understand what these indicators actually measure – for example, whether indicators of publication productivity only measure publications in journal articles or also proxy other types of publication – and how the indicators possibly change researchers' behavior.

So we conclude that after the regime shift, journal publications are no longer a good proxy for a researcher's overall publication productivity, book-based publication forms are on the decline, and especially younger cohorts increasingly focus on journal articles. But should we

even care? Even if high quality international journal publications are especially valuable for the development of scientific progress, other publication forms may serve other, not necessarily less important functions of a research system and may address different but important audiences. For instance, highly ranked international journals might not be interested in national or regional topics leading to certain research questions not even being asked anymore. Further, the access to journal articles is often restricted to relatively small audiences of highly specialized academics while publications in books can potentially have more impact by reaching a more general-interest audience. Also, edited books and monographs allow for an in-depth and more holistic analysis of a subject, for which there is no room in journal articles that are typically very narrowly focused with more and more specialized topics. Similarly, editing books and special issues serve the research community by bringing together the experts of a field to jointly publish on a certain topic and inspire one another. Further, as Osterloh and Frey (2009) point out, it might be difficult to publish innovative ideas that threaten existing paradigms in top ranked established journals. Book chapters or small field journals might be a better place to position such research. Last not least, there are several empirical findings that a book is on average more often cited than a journal article (see Hicks 2004: 481f. for an overview). Thus, only counting journal article points and heavily focusing on highly ranked international journals when assessing researchers' publication productivity might not only result in an inadequate measurement of some researchers' publication productivity (especially the "Book-based Publishers", but also the "Highly Productive All-Rounders" who have no chance to look more productive than the "Journal Specialists" even though they are) but also, and this is an even more severe consequence, in a "crowding out" of other – not necessarily less valuable – publication forms.

2. Data and variables

Our study is based on a unique and partly self-collected dataset of researchers in business and economics from Austria, Germany, and the German-speaking part of Switzerland. It contains information on researchers' journal article output as measured in co-author- and quality-adjusted *Handelsblatt* points (see Krapf 2011 for the details)[2], as well as information on year of PhD, age, gender, and discipline (business administration vs. economics). These data were collected via the online research monitoring portal initialized by the German Economic Association ("*Portal Forschungsmonitoring*") and quality-approved by the *Thurgau Institute of Economics* and the *Konjunkturforschungsstelle* KOF at ETH Zurich respectively. We matched this dataset with a self-collected dataset in which we gathered information on publication outputs other than journal articles. To get the data on additional publication forms, we surveyed all researchers in the database in 2010 and collected additional information via an analysis of the CVs of the participating researchers. In total, we have information on 345 researchers and 8'742 publications.

In the publication data of the research monitoring portal used for our study, all publications of all faculty members are collected on the basis of publication databases, and the names of faculty members are reported by the faculties who have every interest to report a full list of

[2] *Handelsblatt* points take the number of co-authors and the attributed quality (or prestige) of a journal into consideration when evaluating a journal article publication. Dependent on the journal, a publication is given a weight between 0.05 and 1 (0 if the journal is not listed in the *Handelsblatt* ranking). This weight is then divided by the number of co-authors. For example, a business researcher who publishes an article in the *Journal of Business Economics* together with a second author, receives 0.1 journal article points for the year in which the article is published. There are two different *Handelsblatt* journal rankings: one for business researchers and one for economists. Journal publications of business researchers are evaluated according to the *Handelsblatt* ranking for business administration, whereas journal publications of economists are evaluated according to the *Handelsblatt* ranking for economics.

names.[3] Hence, the research monitoring portal contains the full sample of business and economics researchers at universities in Germany, Austria and the German-speaking part of Switzerland. 422 researchers participated in the online survey, where we collected data on other publication forms (in addition to journal articles). We only find minor differences between this sample and the other researchers in the research monitoring portal. In addition to the online survey, we retrieved the CVs of the survey respondents to get information on the timing and the number of co-authors of the other publications. Only for 30 researchers, we did not succeed in gathering this information. Checking whether these 30 researchers are different from those with complete publication information, we do not find any significant differences with respect to gender, field, age, *career age* or journal article productivity.

With respect to the dependent variables, we distinguish between the following publication forms:

(a) journal articles (as assessed by *Handelsblatt* points),

(b) monographs (excluding doctoral theses),

(c) chapters in edited books (excluding conference proceedings),

(d) book editorships (including the editorship of journal special issues), and

(e) journal editorships.

Journal article points, monographs, book chapters, and book editorships are adjusted by the number of co-authors/co-editors. Further, when calculating publication *productivity*, we divide the total publication output by the number of years since the researcher obtained her/his doctoral degree (for a similar approach see Fabel et al. 2008; Rauber and Ursprung 2008). We calculate publication productivities separately for each publication form.

[3] Thus, unlike in the *Handelsblatt* ranking on individual researchers, there is no opt-out option for the database of the departmental publications.

3. Empirical patterns in publication portfolios

3.1 Descriptive statistics

Table 1 provides the descriptive statistics. We find, for example, that researchers on average achieve 0.209 *Handelsblatt* points per year, which means that they need on average about five years to reach one *Handelsblatt* point (e.g., the publish one single-authored article in the *American Economic Review* every 5 years). For monographs, we find a productivity of 0.100, i.e. researchers write a monograph every ten years, and for book chapters, we find a productivity of 0.691, i.e. researchers publish on average one chapter in an edited book about every two years.

Table 1: Descriptive statistics (N=345)

	Mean	**Standard deviation**	**Minimum**	**Maximum**
Annual publication output:				
Journal article points	0.209	0.190	0.000	1.029
Monographs	0.100	0.144	0.000	1.225
Book chapters	0.691	0.856	0.000	6.675
Edited books	0.056	0.120	0.000	1.042
Edited journals	0.035	0.087	0.000	0.750
Personal information:				
Career age (years since PhD) in 2010	12.603	9.305	1	45
Age in 2010	42.852	8.982	29	69
Business administration (1=yes, 0=economics)	0.577		0.000	1.000
Male (1=yes, 0=female)	0.841		0.000	1.000

3.2 Correlations between different publication productivities

How are publication productivities in different forms correlated? We find journal article productivity to be *not* positively related to monograph, book chapter or edited books productivity, but only to edited journals (table 2). Hence, journal productivity is not or no longer a good proxy for publication productivity in general or in other publication forms when more recent decades are included in the data set.

Table 2: Correlations between researchers' average annual publication outputs (N=345)

	Journal article points	Mono-graphs	Book chapters	Edited books	Edited journals
Journal article points	1.000				
Monographs	**–0.152*****	1.000			
Book chapters	**–0.114****	**0.531*****	1.000		
Edited books	**–0.132****	**0.284*****	**0.463*****	1.000	
Edited journals	**0.108****	**0.172*****	**0.198*****	**0.175*****	1.000

Annual publication output. *significant at 10% level **5% level ***1% level

3.3 Different Types of Researchers

What holds for the aggregate, might look different for different types of individuals. To investigate different "types" of researchers with respect to their publication portfolios, we perform a cluster analysis. To get comparable values and to facilitate the interpretation of the differences between clusters, we work with z-standardized productivity variables. For the clustering we use the k-means method[4] and compare possible solutions by their Caliński-

[4] In this paper, we use the results from the k-means method because it allows objects to change their cluster during the cluster building process, which is not possible in the case of hierarchical methods. However, we also used a Ward's linkage hierarchical cluster analysis as a robustness check, and the results are very similar and stable.

Harabasz pseudo-F value (Caliński and Harabasz 1974). We choose the solution with the highest distinctness.[5]

Table 3 presents the results of our cluster analysis. The *first cluster* represents a researcher type that mainly concentrates on journal article points; with respect to the other publication forms representatives of this type are below the means. We call these the "*Journal Specialists*". Researchers in the *second cluster* mainly concentrate on monographs, book chapters, and book editorships, so we call them the "*Book-Based Publishers*". The *third cluster* represents a small group of researchers that are highly productive with respect to nearly all publication forms. These "*Highly Productive All-round Publishers*" are on average more than a half standard deviation above the mean in all categories, except book editorships. However, they represent only 2.6% of all researchers. Researchers in the *fourth* and largest cluster show a rather modest performance (less than a half standard deviation below the mean) with respect to all publication forms.[6] We call them the "*Inconspicuous*", and they make up for the large majority of all researchers (60.9%).

[5] We compared the solutions with three, four, five, six, and seven clusters. The solution with four clusters mostly achieved the highest distinctness value. There is some random component, meaning that the same solution is not always achieved. However, the four-cluster solution regularly turns out be the most distinct one and is also theoretically reasonable. Alternative solutions lead to similar results.

[6] Note that most researchers do not reach the mean, because the mean reflects a relatively high productivity as it is influenced by some very productive researchers.

Table 3: Clusters of researchers with respect to their publication portfolios

Cluster name	Journal article points	Mono-graphs	Book chapters	Edited books	Edited journals	Cluster size (number of researchers: absolute and percent)
"Journal Specialists"	**1.384**	**–0.506**	–0.378	–0.353	–0.083	78 22,6%
"Book-Based Publishers"	–0.435	**1.132**	**1.663**	**1.733**	0.220	48 13,9%
"Highly Productive All-round Publishers"	**1.043**	**1.111**	**0.759**	–0.084	**4.680**	9 2,6%
"Inconspicuous"	–0.459	–0.118	–0.272	–0.261	–0.220	210 60,8%

All productivity variables are z-standardized with mean 0 and standard deviation 1. Values that are at least a half standard deviation different from the mean are underlined.

Our finding that there is a relatively small number of researchers who are highly productive in publishing and a relatively large number of low publishing researchers confirms earlier research on the very skewed distribution of publications that became known as 'Lotka's law' (Lotka 1926).

Our results thus show that there are substantial differences across different types of researchers and that a considerable number of researchers concentrates on either journal articles (the "*Journal Specialists*") or book-based publication forms (the "*Book-Based Publishers*"), thus driving the aforementioned negative correlation between journal article productivity and book-based publication productivities.

3.4 Differences in Career Age of Researchers

When we look at the career age structure of the researchers in different clusters, we find that being a "*Journal Specialist"* or being a "*Book-Based Publisher"* is related to career age: "*Journal Specialists*" tend to be significantly less experienced than the average researcher in

our dataset, and "*Book-Based Publishers*" tend to be significantly more experienced. Correspondingly, when we correlate the different publication productivities from Table 2 with researchers' *career age*, we find that *career age* is significantly *negatively* correlated with journal productivity (r = –0.148***; see Fabel et al. 2008 or Joecks et al. 2014 for similar results), but *positively* correlated with productivity in book chapters (r = 0.192***) and edited books (r = 0.221***) (monographs: r = 0.088, not significant). Thus, in our sample, on average, more experienced researchers publish less often in (refereed) journals and more often in book-based publication forms compared to less experienced researchers.[7]

However, the observable "age effect" in our data set of active researchers might stem from individual *career effects* where researchers change their publication behavior over their careers (with researchers publishing more in journals when they are young and less experienced and more in books or other outlets when they get older and advance in their career) or it might be attributed to *cohort effects* induced by a regime change in incentives that is fostered by the scientific community's one-sided shift in attention toward journal publications. Since a regime change affects the younger cohorts more than the older ones (because the younger ones were still in their socialization and hiring phase when the regime shift happened and had thus stronger incentives to react), the less experienced researchers in our sample drive the increase in journal publications, i.e. our *career age* effect results from a cohort effect. In what follows we investigate this question in more detail.

4. Differences across careers and cohorts

To see whether our results are driven by changes in the publication behavior during individual careers (*career effects*) or by a *regime change* differently affecting the different cohorts (*cohort effect*), we proceed in three steps. *First*, we analyze how publication productivity with

[7] The results hold when age instead of *career age* is used. The positive correlation with monographs is then also significant (at a 5% level).

respect to different publication forms changes over a researcher's individual career (subsection 4.1). *Second*, we search for general time trends by investigating whether, on average, researchers publish more or less in certain outlets over the years (subsection 4.2). *Third*, we use a regression analysis to investigate how the *career age* and cohort of a researcher are related to publication productivity in different publication forms (subsection 4.3). This allows us to disentangle career from cohort effects.

4.1 Publication output in different forms over the career

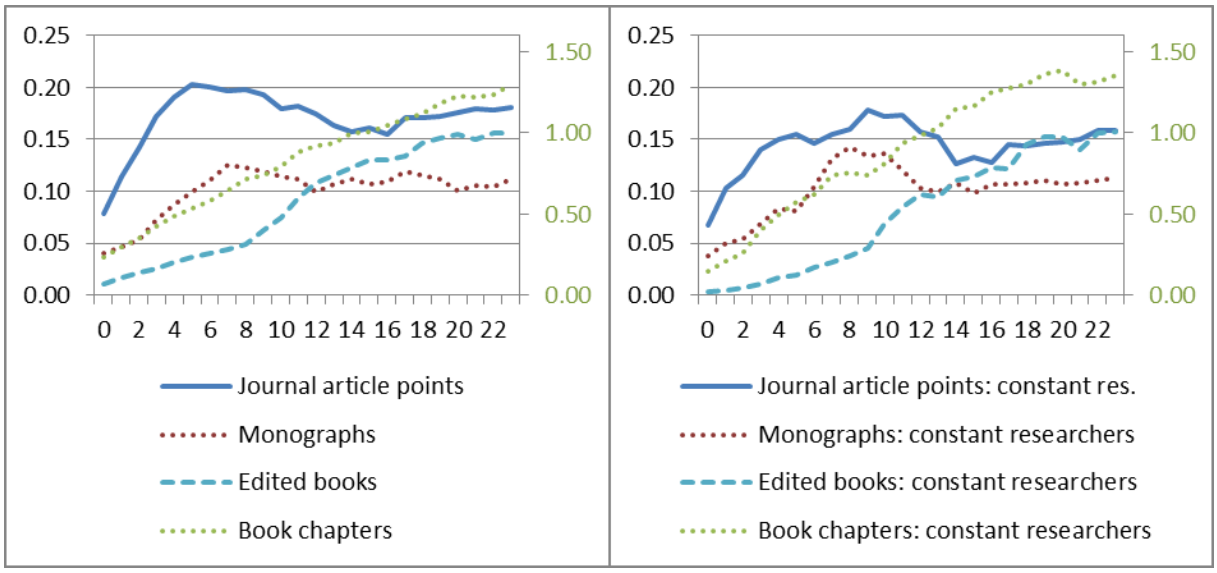
To find changes in the publication behavior over the career, we investigate the publication data according to *career age*, i.e. years since PhD. *Career age* is defined as 0 in the year of the PhD (reference year) and 1, 2, etc. in the following years. In our publication data, we consider two years before the PhD; earlier publications occur very rarely. Our procedure is in line with previous literature (Rauber and Ursprung 2008).

Figure 1 illustrates the changes in average yearly publications over the career.[8] Average publication output in all outlets appears to increase with career age, which is especially pronounced for book chapters and edited books (the latter including special issues of journals), while journal article points and monographs show a less clear pattern.

[8] Our career analysis, as well as our following analyses, does not include journal editorships because of data limitation: We only know the year when a journal editorship starts but cannot reconstruct the whole time span of journal editorships. But of course, journal editorships are also an important outcome and should be investigated in future research.

Figure 1: Yearly journal article points, monographs, book chapters and edited books per researcher in a given career year

Full Sample **Balanced Panel**



Centered moving averages over 5 years. The left half of the figure is based on our whole sample, while the right half is restricted to those researchers who are observed over the whole considered time span (until 25 years after their PhD). Y-axis on the left side of both graphs: journal article points, monographs, and edited books per researcher in a given career year. Y-axis on the right side of both graphs: book chapters per researcher in a given career year. The career year 0 is the year of the PhD.

We first regress the publications in the different forms on *career age* in linear models. All publication values have the left limit 0, and 0 is even the outcome that occurs most often in the panel dataset. Therefore, we use Tobit regressions instead of Ordinary Least Squares (OLS) to account for the censored data (see also Rauber and Ursprung 2008)[9]. The standard errors are robust with respect to heteroscedasticity, as the assumption of constant variance was rejected with a Breusch-Pagan/Cook-Weisberg test (Breusch and Pagan 1979; Cook and Weisberg 1983), and clustered at the individual level to account for the fact that each individual is observed over several years. On average, we find a significantly *positive*

[9] Rauber and Ursprung (2008) decide for a Poisson model, as they observe a distribution that resembles count data with spikes at certain steps. Nevertheless, they report that Tobit leads to very similar results (438). As we do not observe the pattern of count data and only have to take into account the left limit (0), the Tobit model clearly appears to be appropriate. All our coefficients remain positive and significant when we use OLS regressions instead of Tobit.

association between *career age* and all different forms of publications, *including* journal article points (monographs: β = 0.027***, book chapters: β = 0.092***, edited books: β = 0.050***, journal article points: β = 0.009***).[10]

The career analysis has the potential problem that later career years are only observed for those researchers who are sufficiently experienced, while earlier career years are observed for younger generations – and those who may have left or leave academia – as well. To check whether this biases our results, we also perform an analysis where we include only those researchers who are observed over the whole considered time span (from two years before the PhD until 25 years after the PhD). This leads to a balanced panel with a subset of 41 researchers. The results for this subset of researchers are similar to the ones for the whole sample (see the right half of figure 1). There is a significant increase in yearly publications with respect to all publication forms over the careers of these constant researchers, on average.

We conclude: The negative correlation between journal article productivity and *career age* that we observe in our data set of active researchers cannot be the result of individual *career effects* because *career age* is always positively correlated with each and every publication productivity, including journal publication productivity. The negative correlation between journal article productivity and *career age* that we observe in the aggregate may thus stem instead from a *cohort effect* induced by a regime change that differently affected younger and

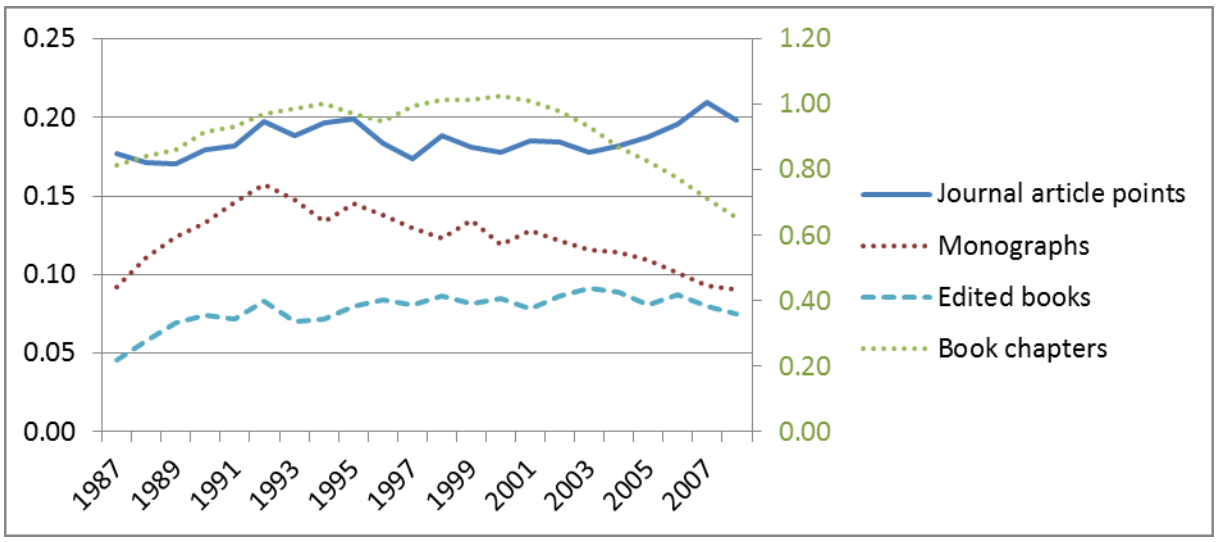
[10] Since previous research (Rauber and Ursprung (2008): 435f., 440f.; see also Goodwin and Sauer (1995): 729f., 735f.) has shown journal article points to not follow a linear pattern, but rather peak in the early career when tenure decisions usually take place, we additionally analyze the polynomial functions that fit the data best. Our analysis shows predicted yearly journal article points to sharply increase in the first career years and to not significantly change thereafter. That is, there is no significant decrease in journal article productivity at a later career age.

older age cohorts. Before we test this, we investigate whether there is a general change in publication patterns that would hint at a *regime change* during the period of observation.

4.2 General change in publication patterns

Figure 2 illustrates the use of different publication forms per researcher over time from 1985 to 2010.[11] It shows no clear general time trend for journal publications over the whole timespan, but an increase during the last decade that we consider. Edited books, which include special issues of journals, appear to have slightly increased over the years. Most remarkable is a decrease in monographs and a sharp decrease in book chapters approximately since the second half of the 1990s.

Figure 2: Yearly journal article points, monographs, book chapters and edited books per researcher in the years 1985 to 2010



Centered moving averages over 5 years. Left Y-axis: journal article points, monographs, and edited books per researcher in a given year. Right Y-axis: book chapters per researcher in a given year.

[11] We calculate the publication average by dividing the publications produced in a specific year by the number of researchers that were in the sample in a given year (or more precisely, by the number of researchers who have completed their PhD before the respective year). Using the completion of the PhD as the reference point is analogous to the procedure in the previous sections, where the years since the PhD defined the total number of career years of a researcher (see also Fabel et al. (2008): 518; Rauber and Ursprung (2008): 436). The average publication outcomes are calculated separately for each publication form.

Next, we estimate linear Tobit models[12] where we regress average publication output per researcher – separately for each publication form – on the calendar year. Here, we do not find a significant trend in journal article points. The coefficients for the other publication forms are also not significant except for edited books, which are increasing (β = 0.001*). A non-linear, polynomial model demonstrates more specific changes over time. While the trend for journal article points is not clear, monographs and book chapters decrease significantly since the second half of the 1990s.

Taken together, the results demonstrate that researchers overall tend to stay away from monographs and book chapters in recent years, whereas – interestingly – a general increase in journal article points is not shown.

4.3 Regression analysis: career, cohort, and yearly publication output in different forms

We finally use a regression analysis that includes both the *career age* and the *PhD cohort* of each researcher (year of PhD) to disentangle career effects and cohort effects.

Based on our panel dataset where we observe each researcher from *career age* –2 (two years before the PhD) onward, we use Tobit models as in the previous subsections and regress yearly publication output in different forms on *career age* and the year of the *PhD cohort* (see table 4). *Career age* is significantly and positively related to publication output in all forms, meaning that researchers overall tend to increase their yearly publications as they become more experienced, when the year of the *PhD cohort* is held constant. Furthermore, year of *PhD cohort* is significantly and positively associated with journal article points and edited books.[13]

[12] The results are qualitatively equal when we use OLS instead of Tobit.

[13] If the cohorts are not operationalized by our metric variable "years since PhD", but instead different groups are distinguished with dummy variables (PhD cohort 1965–1979; 1980–1989; 1990–1999; 2000–2009), where the earliest cohort (1965–1979) is the reference group (see Rauber and Ursprung

Table 4: Career age, PhD cohort, and yearly publication output in different forms[14]

VARIABLES	(1) Journal article points	(2) Monographs	(3) Book chapters	(4) Edited books
Career age	0.013***	0.025***	0.092***	0.060***
	(0.002)	(0.004)	(0.009)	(0.006)
Year of PhD cohort	0.006*	-0.002	0.001	0.013*
	(0.003)	(0.004)	(0.009)	(0.008)
Constant	-12.240*	2.784	-2.508	-27.285*
	(6.382)	(8.543)	(18.459)	(15.158)
Observations	5,381	5,381	5,381	5,381

Tobit models with yearly publication output – in different forms – as the dependent variable. Robust standard errors clustered at the individual level in parenthesis. *significant at 10% level **5% level ***1% level

Two main findings can be summarized based on our regression analyses.[15] First, for each PhD year cohort, quality-adjusted journal articles per year and book-based publications per

2008: 439f. for a similar approach), the results also support our interpretation that younger cohorts focus more and more on journal publications. We find that with respect to edited books, the PhD cohort 1980–1989 is more productive than the PhD cohort 1965–1979, while the two other PhD cohorts (1990–1999 and 2000–2009) are not significantly different from the PhD cohort 1965–1979. With respect to journal article points, all more recent cohorts are significantly more productive than the earliest cohort. The estimated coefficient increases with every more recent cohort, and the statistical significance for the two most recent cohorts is at the 1% level. Together with our results on general time trends, this supports the indication that younger generations of researchers focus more strongly on journal publications.

[14] We additionally checked models that include power terms of *career age*, up to (*Career age*)^5. The results are similar, with positive and significant effects of *career age* on the output in all publication forms, a significantly positive effect of the year of PhD cohort on edited books, and the latest cohort 2000–2009 being significantly more productive with respect to journal article points than the earliest cohort 1965–1979.

[15] In addition to the estimations that include business and economics researchers together, we also performed our estimations separately for business researchers on the one hand and economics researchers on the other, to see whether the two disciplines differ substantially – they do not, but results are more often insignificant due to lower case numbers: The correlation analysis, for example, yields qualitatively the same results as in table 2, except that some coefficients are not statistically

year (monographs, book chapters and edited books) are *all* positively related to a researcher's experience level. Second, we find evidence that younger cohorts publish more journal article points per year than previous cohorts. Thus, the observed negative correlation between *career age* and journal article productivity does not stem from a career effect but it results from a cohort effect where the increased focus of the scientific community apparently more strongly affected the younger generations of researchers who still had to strive for tenure, than the older ones who were socialized long before and who – being tenured – had less strong incentives to adapt their publication patterns to the scientific community's shift in attention.[16]

5. Conclusion: Academic attention and incentives do matter – reward structures drive research portfolios for better or worse

Journal publications are nowadays the center of academic attention in the business and economics scientific communities (as in other disciplines), in university governance and incentive systems. One underlying and historically well justified assumption is that journal publications are positively correlated with other kinds of potential research outputs, which can be explained by potential complementarities in the production of research output in the form of journal publications and other forms of published outputs like book chapters, or text books etc.

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significant anymore (which may be due to the smaller samples). Also, the positive career effects and the positive cohort effects for journal article points in the regression analysis hold when the discipline is included as a control variable. And the results of the cluster analysis and the career trends are also very similar.

[16] When we include a variable for whether a researcher worked at a top 10 institution in 2010 (according to the *Handelsblatt* ranking of departments 2010/2011), our results remain robust. Researchers that are located at a top 10 institutions in 2010, achieve more journal article points per year compared to other researchers, on average. With respect to the other publication forms, researchers at top institutions are not found to be more productive, with respect to edited books they are even less productive on average. *Career age* and cohort effects with respect to journal article points are not affected by whether a researcher works at a top institution in 2010.

Today it is, however, unclear whether such a positive correlation still holds after the incentives in the university system are more and more tied explicitly and exclusively on journal publications. This paper empirically analyzes the problem by explicitly taking into account the multi-task framework researchers find themselves in, and by studying changes in publication patterns across different types of publications, i.e. journal articles, monographs, book chapters and edited books.

To get a clearer picture of what is going on, we study in depth the publication patterns of researchers in business and economics. We find that journal publications and other publications do not always develop in the same way and that when looking at the aggregate of active researchers, *career age* is negatively related to journal productivity, but positively to other publication outcomes. We also find a significantly *negative* correlation between journal publications and other publications indicating that journal productivity is not or no longer a good proxy for overall publication productivity.

Going away from looking at aggregate averages by instead studying heterogeneous effects across different researchers and by taking into consideration the composition of the aggregate, we are able to identify different types of researchers with very distinct individual publication patterns. With the help of a cluster analysis we identify four different types of researchers with respect to their publication profiles: "*Journal Specialists*" who are on average less experienced, "*Book-Based Publishers*" who are on average more experienced, a small group of "*Highly Productive All-round Publishers*" and a large group of "*Inconspicuous*" who are very modest in all publication dimensions.

Furthermore, we analyze publication patterns by *career age*. Although we find a negative correlation between journal productivity and *career age* in the aggregate of active researchers, it is not the result of a career-age effect, as publications significantly increase over an individual's career for all publication forms, including journal article points. We find

evidence that the negative correlation between journal publications and *career-age* in the sample of active researchers is a cohort effect, with younger cohorts of researchers achieving more journal article points per year than older cohorts. We further find a general time trend between 1985 and 2010 of decreasing publications of monographs and book chapters. This can be explained by a change in incentives that stems from a change in the scientific community shifting all the attention and incentives toward journal article publications – particularly affecting the younger age cohorts who were still in their socialization process and striving for tenure or other career steps and hence had stronger incentives to follow the rules of the new regime.

Policy Implications and open research questions

Thus, our empirical evidence suggests that nowadays the production of journal articles has to be considered as a substitute to other publications. More recent cohorts more strongly focus on journal publications, while publications in other forms are overall reduced. As there are several arguments why these other publication forms might nowadays still be relevant – for example, they may better represent topics with country specific or regional specificities, they may reach a wider audience outside of academia, they may offer more in-depth and holistic analyses in monographs, they may have more overall impact because they are on average more often cited (cf. overview in Hicks 2004) and they may present more radical and exploratory research –, the increasingly one-sided focus on journal article points might become a problem.

A further question is what happens to other activities of researchers, like teaching or all kinds of community services. Based on our theoretical explanation from personnel economics, that builds on the "equal compensation principle", we suspect that researchers might also neglect not only other types of publications but also other types of outputs of the scientific

community that are not in the center of attention, such as teaching or participating in academic self-government or common goods.[17]

Personnel economics also provides ideas for alternative solutions to avoid such unintended trade-offs: either abolish using journal indicators or introduce additional explicit indicators for other important tasks. The first solution we do not consider an option because having used journal indicators also changed the profession in directions that were intended, i.e. particularly more internationalization and more focus on quality. Thus, the scientific community would be well advised to go for the second solution, i.e. instead of one-sidedly focusing on journal indicators putting more attention on alternative indicators covering other important academic outputs. These do not only include other types of publications but much more so other contributions such as teaching, contributing to the scientific community for example by editing journals or by chairing committees, contributing to technology transfer in the form of start-ups, or to knowledge transfer in a more general sense, and taking on academic leadership positions.

One limitation of our study originates in the limited number of observed researchers with a complete publication profile and the way the data were collected. Those researchers who responded to the online survey that collected information on publications other than journal articles, on average, had a slightly different publication pattern than those who did not respond: The individuals participating in the survey on non-journal outputs published slightly less before the PhD and slightly more since the PhD (in terms of journal article points) than those who did not participate. It could be argued that this biases our results toward a positive trend of journal article publication productivity over the career. However, our results on journal article productivity over the career are in line with the recent finding that publication

[17] Backes-Gellner and Zanders (1989) provide empirical evidence that in the fields of business and economics teaching and research can be substitutes as well as complements, depending on the level and type of teaching.

productivity with respect to journal articles tends to increase during the first 30 years of the career (Sinatra et al. 2016). Future research, for example based on larger datasets and ideally using publication databases inluding non-journal outputs rather than surveys, could address this problem in more detail.

A further limitation is that our study is correlational and cannot really determine whether the changes in publication patterns – the decrease in monographs and book chapters over time and the increase in journal article points among younger cohorts – are causal effects of the indicators and incentives used in the research system. It is, however, theoretically very plausible and fits to the observed time pattern that the changes in researchers' publication decisions are linked to the changes in academic attention. Further, our study is based on data from Germany, Austria and the German speaking parts of Switzerland, and it would be interesting to study the situation and the changes in other European countries, especially where the systems and the policy changes have been different or occurred at different times (e.g., Great Britain, Netherlands).

Lastly, it would be valuable to check whether the trends are similar for researchers at different institutions, such as higher and lower ranked institutions (more research- and more teaching-oriented institutions), and whether they depend on the teaching load.

Despite all such shortcomings of our study, it nevertheless seems reasonable to assume that the observed negative correlation between journal publications and age is a cohort effect, with younger cohorts of researchers achieving substantially more journal article points per year than older cohorts and shifting their attention away from other publication forms. It can be explained by a change in incentives resulting from the scientific community's one-sided shift towards journal publications, which mainly affected younger age cohorts still striving for tenure. Thus, even in the scientific community, "you get what you pay for": as academic

attention and career incentives shifted on journal articles only, publication portfolios of especially the young researchers changed quite rapidly and rather substantially.

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