Do productive academics earn higher salaries? A Norwegian case

Frode Eika Sandnes[1*,2]

[1]Department of Computer Science, Faculty of Technology, Art and Design, Oslo and Akershus University College of Applied Sciences, P.O. Box 4, St. Olavs plass, 0130 Oslo, Norway

[2]Faculty of Technology, Westerdals Oslo School of Art, Communication and Technology, Christian Krohgs gate 32, 0186 Oslo, Noway

Email: Frode-Eika.Sandnes@hioa.no

Tel: +47 466 97 592

ORCID: 0000-0001-7781-748X

MSC: N/A

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Abstract

Based on a sense of justice one may expect that productive academics with high publication outputs earn higher salaries than less productive academics. However, there is little evidence to support or reject such a belief. This explorative study correlated salary data with publication data for the academic employees of one of the largest HEIs in Norway. The results show that overall there is a weak correlation between publication output and salary. Salary correlates with rank (low, medium, top), and rank correlates with publication output. Within each of the groups, apart from the full professors, there is no positive correlation between how productive an academic is and what an academic earns. In fact, when comparing inactive and active low-ranking contract researchers, the results showed that active researchers earned significantly less than what their inactive colleagues did. The results suggest that publishing is not rewarded monetarily and aspiring early career academics should adopt a strategy involving more diverse activities than just publishing to climb the salary ladder.

Keywords: salary, publication output, academic rank, higher education institution, contract researcher, practical pedagogical career path

Introduction

Most academics focus on publishing, both in quantity and quality. Academics are generally motivated by having their work published and receiving admiration from peers. As academics usually have salary adjustments every few years, one may assume that there exists a connection between publishing success and salary increase. Is this just a myth based on academics' wishes? Expressions such as "publish or perish" contribute to reinforce this myth.

This study set out to explore the relationship between publication output and salary. Few studies have addressed this topic since information about salaries often is considered sensitive and it is usually not easily available. Moreover, there is no widely accepted standard for measuring publication output as publication traditions vary greatly across the academic disciplines.

This study also provides new insight into salary formation for different academic groups employing Norway as an example, since Norway has three parallel career-paths with respective focus on research and teaching (scientific), teaching (practical/pedagogical) and applied contract research.

Background

There is much research that addresses publication productivity and quality (for instance, Abramo and D'Angelo 2014; Lindsey 1989; Haugen and Sandnes 2016). Common productivity metrics include the cumulative publication count of academics and publication counts per year (Hoffmann 1978). Publication counts are probably popular measures as they are simple to collect, administer, and understand. More sophisticated measures of productivity and quality have been proposed, including considering the author order (Walters 2016), and the Integrated research productivity index (Duffy 2011) which is the product of an author's author weighted publication and their mean citation count divided by their years in the field. Lotka's law predicts the number of authors with a certain number of publications (Egghe 2005). Typically, a few authors produce most of the publications while most authors produce few publications.

Much of the discussion relates to the suitability of citations for measuring quality and ranking academics (MacRoberts and MacRoberts 1996; Lindsey 1989; Folly 1981) and particularly the h-index (Bornmann and Daniel 2005). Most studies employ standardized publication databases, but general Internet citations have also been explored (Barjak 2006). It has been pointed out that the established publication databases give an inaccurate picture of the situation in certain low GDP-countries. For example, Shrum (1997) found a large discrepancy between the research listed in the databases and the actual research activities reported when interviewing agricultural researchers in an African country.

Several studies have explored factors that affect publication productivity. Regression analysis is a commonly applied method. Factors investigated include characteristics of who the researcher is, what the researcher has done, what the researcher is doing and the academic rank and status of the researcher. Gender, race, and age are examples of researcher characteristics that have been correlated with productivity. Gupta et al. (1999) compared the research productivity of males and females and found no differences. Hopkins et al. (2013) conducted a similar study but also included ethnicity. They did observe a difference with respect to ethnicity. Diamond (1987) studied a model showing that the research productivity decreases with age. Bonaccorsi et al. (2003) observed a similar trend among Italian academics. Van Heeringen et al. (1987) did not find such a distinct trend according to age among Dutch chemistry researchers. However, they did find that the rate of growth in productivity was larger for individuals less than 35 years old, compared to those 35 years or older.

Other studies have addressed what academics can do to improve their productivity. Fonseca et al. (1997) found that bursts in productivity among academics were caused by human relationships and not material conditions. Collaboration has been found to correlate with career stages (Hu et al. 2014) and co-authorship has been found to correlate with productivity among Italian economy researchers (Cinelli et al. 2015). Van Heeringen and Dijkwel (1987) studied the effects of mobility. They concluded that mobility is a characteristic of productivity, but it is not a direct means to achieve productivity. They also found that field mobility, that is, the change of research field, has a positive effect and that outstanding researchers have more contact with researchers in other non-related fields. Long and McGinnis (1985) studied the effect of mentoring on productivity and found a positive correlation between students who collaborated with mentors over those who did not, and that the effect was sustained over time. A study of surgeons who concurrently pursued a second degree showed that this activity did not affect their publication productivity (Shah et al. 2017).

In an effort to study the effect of education on productivity, it was found that Indian researchers with a foreign degree were more productive than those without (Sahoo et al. 2017). More generally, it has been found that grades do not correlate with adult accomplishments (Baird 1985).

Researchers have also addressed the relationship between the rank and status of academics and their productivity. Senter (1986) and Dizon and Sadorra (1995) found that productivity is related to academic rank. Professors on top of the career ladders are generally the most productive. Note that the title professor is used herein to refer to the top academic rank in higher education institutions. Some research students sometime speculate whether the rank and status of professors makes it easier to get publications accepted. Knorr and Mittermeir (1980) found that academic rank has no effect on getting manuscripts accepted. However, they argued that the rank and status a professor enjoys within an organization may make it easier to become coauthor, which again results in a higher measured productivity. Another cause of professors' higher

productivity can perhaps be explained by a positive correlation between productivity and grants, international collaboration, and supervision – responsibilities often resumed by professors, while teaching correlates with lower publication rates (Miller et al. 2013). In a study of top scientists at the national level in Croatia, it was found that typical characteristics of a highly successful academic are a higher publication count than the average and more international co-authors than average (Prpić 1996; Prpić 1996). They are often older men. Their research and publishing activities can often be traced back to their undergraduate studies; they have held supervisory positions and often hold gatekeeping roles in the international academic community (Prpić 1996).

In the few studies addressing the salary of academics, most focus on gender pay gaps (Balzer et al. 2005; Moore 1993; Toutkoushian 1994). For instance, Barbezat and Hughes (2005) have measured a 20% difference between males and females in academia. Academic rank has also been correlated with salary where higher ranking academics such as full professors earn more than lower ranking academics (Stratman 2000). It seems logical that academics who are promoted to higher ranks also see the effect of a promotion in terms of a salary increase. Years of service and salary have also been shown to correlate with each other (Hoffman 1978; Barbezat 2004). Again, with regular salary appraisals, it is logical that most academics in long service accumulate a higher salary than recently recruited early career researchers. The effect of years since obtaining a doctoral degree and salary has even been documented back to Italian Renaissance professors, where long service and not fame attributed to professors' salaries (Wray 2009).

The postdoctoral role has changed in recent years due to few faculty openings. Yang and Webber (2015) found that holding a postdoctoral position has positive effects on getting an academic position, to get tenure and to exhibit a high publication output. No correlations could be found between postdoctoral positions and salary (Yang and Webber 2015). Chestlock and Callie (2015) explored the effects of funding cuts on the restructuring of staff in a business school. They found that salaries were actually raised, but the number of staff was reduced to achieve this (Chestlock and Callie 2015).

The relationship between publication patterns and salary has also been investigated. In a study of 223 economists at the University of California, Gibson (2014) found that splitting results into several shorter articles instead of fewer longer articles gives higher salaries. Jin and Cho (2015) found a correlation between Korean academic salaries and international journal articles, while no correlation between salaries and national journals. Based on an analysis of 45 mathematicians at the University of California at Berkeley and their 554 publications, Diamond (1985) found that there was more money value with citations to multiple authored papers compared to single authored papers. Gibson et al. (2014) correlated journal rankings with academic salaries from the standpoint that journal rankings should not be used as basis for setting salaries as journal rankings can easily be manipulated. Gunn (1989) claimed most research evaluation systems are spurious and lead to rivalry among academics and therefore argued for valuing teamwork during salary appraisals. Hanley and Forkenbrock (2006) argued that there should be an equal balance between teaching, research, and service when adjusting salaries.

Method

HEI characteristics

This study is based on data from the author's home institution, Oslo and Akershus University College of Applied Sciences, hereafter referred to using its Norwegian acronym HiOA. HiOA is the third largest higher education institution (HEI) in Norway, offering bachelor, master, and PhD study programmes. HiOA spends approximately 25% of its budget on research.

Norway has a tertiary education system with universities, scientific university colleges, and university colleges. HiOA is a university college with a strategic goal of achieving full university accreditation within a few years. The institution has therefore had a strategic focus on research by establishing more PhD programmes, recruiting more people with doctoral degrees, encouraging the faculty members to publish more scientific papers, and soliciting external funding. Publication output is one of the most important indicators in the Norwegian university accreditation process. It is therefore particularly interesting to observe whether salary adjustments have been used as incentives to achieve the strategic goal of higher publication output.

Rank	practical/pedagogical	contract research	scientific
Top	docent	researcher I	professor
Medium	first lecturer	researcher II	associate professor
Low	assistant professor	researcher III	assistant professor

Table 1. Norwegian three-way academic career system

Norwegian academic system

The Norwegian academic career system comprises three types of career paths (see Table 1). Two of these paths have existed in all Norwegian HEIs since an academic reform in 1994, namely, a traditional scientific path from assistant professor, associate professor to full professor, and a practical-pedagogical path from assistant professor, practical associate professor (first lecturer, or førstelektor in Norwegian) to docent. Note that the practical/pedagogical titles such as first lecturer and docent usually are translated as associate professor and professor in English that may cause some confusion. The low-rank academics (assistant professors) do not usually hold a PhD. Exceptions include individuals employed into teaching positions that do not match the area of their PhD, for example, mathematicians with PhD teaching computer science. The practical path usually does not require a PhD for the medium and top-ranks, while the traditional scientific path usually does require a PhD for the medium and top-ranks. Again, there are exceptions to this rule. Professors of art and design are usually promoted based on their portfolio of practical work instead of academic publications. Moreover, a handful of individuals have been promoted to associate professor and full professor without a PhD based on exceptional impact on a field. It is assumed that the number of such special cases is too small to affect the overall results herein.

Contract research institutes have a career path from researcher III, researcher II, to researcher I. These three ranks mirror the scientific ranks of assistant, associate, and full professor. Note that contract researchers are not required to have any teaching competences. HiOA is in a unique situation as it is currently the only HEI in Norway with three parallel career paths as it has recently acquired four independent research institutes.

Common for all the three career paths is that when someone applies for promotion to the top-rank it is usually required that the applicant produces a number of publications at a certain level of quality. One can assume that there are differences in publication output for the three ranks, where the top-ranks exhibit higher publication outputs than the low-ranks.

Salary data

Individuals' salary data is often considered a private matter. However, salary information for public HEIs in Norway is not confidential. Yet, salary data are often not easily accessible. Anyone is legally entitled to request the salary data from a publicly funded HEI. This study was based on salary data for 2014 for all the employees of HiOA. The data were provided in an Excel document produced by the finance office to be used by the unions during salary negotiations to ensure balance in the institutional salary development and gender balance.

The file contained 2,094 records with full name, gender, academic rank, affiliation, and salary information. Salary records used herein were normalized according to 100% employment, that is, individuals' gross salaries were multiplied by the employment ratio (ranging from 20% to 100%). Results are presented in an aggregated manner to maintain the anonymity of the employees.

Publication data

The publication data were extracted from the national Norwegian publication database cristin (Current Research Information System in Norway) that contains complete publication data back to 2004. A web crawling robot was written in java to extract the publication information for each of the salary records. The information extracted included the total number of publications per year in the period 2004-2016 and the number of so-called level-2 publications during the same interval. A level-2 publication represents more prestigious or top tier publication, defined as 20% of the best publications.

The advantage employing the cristin database is that the records are complete; they are quality checked and adhere to a standard that incorporates most subject areas.

Publication counts include journal papers, chapters in anthologies, and monographs. All the records included meet the national criteria of scientific work, viz., presenting new research and having been subjected to peer-review quality control.

Procedure

The total number of publications measure for each person for the period 2004-2016 was used. The publications were recorded also if a person was employed at a different institution during this period. This measure does not account for people who started publishing before 2004. The number of publications per year measure was estimated. Information about the actual starting year of employment was not available. The publications per year measure was therefore estimated by including only the range of years from the first year a person had a recorded publication to 2016.

The data were analyzed according to academic rank. For each academic rank, the data were divided into individuals with publications and individuals without any recorded publications.

Several employee groups were omitted, inclusive of administrative personnel, postdocs, and PhD-students. Actually quite a few administrative personnel do publish, including former academics who have decided to change roles and some leaders who remain active in research. This group constitutes a small and scattered group of outliers. There are few postdocs at HiOA. PhD students are usually also employees in Norway, but these were omitted since they are training to become researchers. Postdocs and PhD students are temporarily employed and are not part of the regular salary appraisal system.

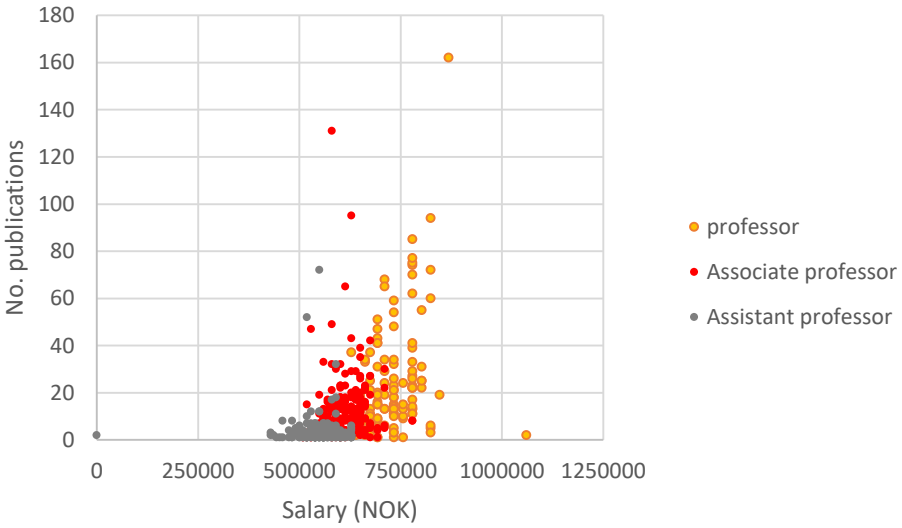

Figure 1. Publications versus salary – scientific career path

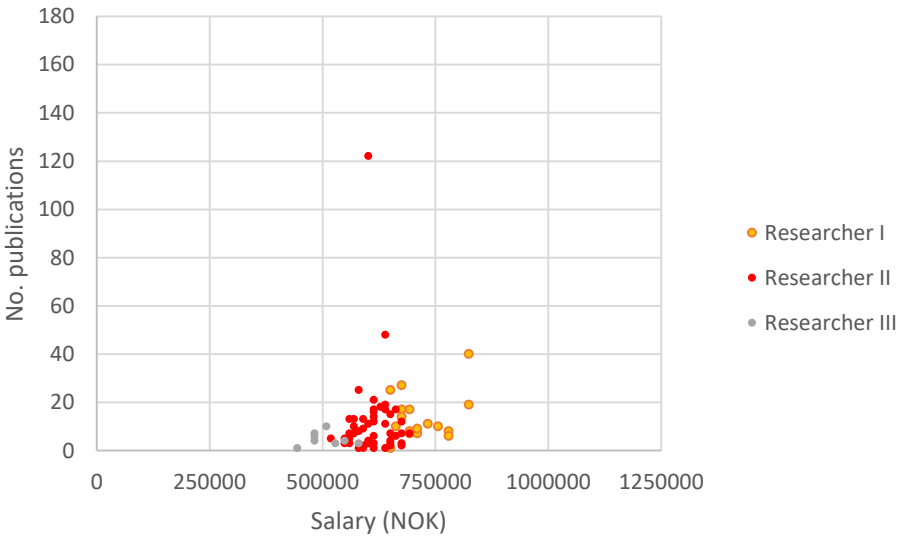

Figure 2. Publications versus salary – contract researcher career path

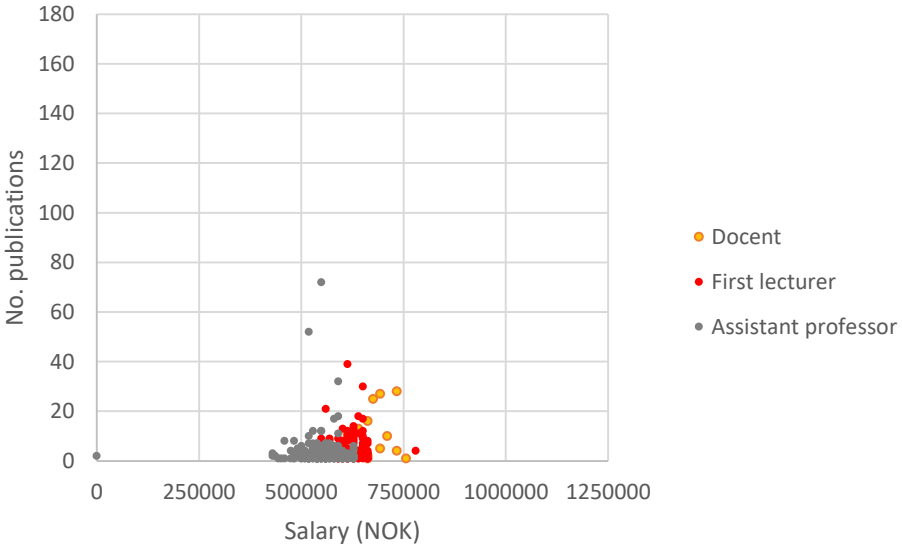

Figure 3. Publications versus salary – practical/pedagogical career path

Results and discussion

Publication output versus salary

Figures 1, 2, and 3 show the absolute publication output of academics for the period 2004-2016 plotted against salary for the three career paths, respectively. Color is used to differentiate between the ranks where orange represents the top-rank (professor, docent, researcher I), red represents medium-rank (associate professors, researcher II, and first lecturers) and gray represents the low-rank (assistant professors and researcher III). Note that the plot only includes individuals who at least have one publication or more during 2004 to 2016.

The scatterplots show that all the three career paths occupy a similar range on the salary scale. Moreover, it is clear from the scatterplots that salary generally increases with rank. That is, low-rank academics are associated with the lowest salaries and the top-rank academics enjoy the highest salaries. This result is consistent with Strathman's (2000) observations of academic rank effects.

The scatterplots also reveal several exceptions to this pattern. For example, one first lecturer enjoys a much higher salary than all the docents (see Figure 3). This particular individual has previously held a leadership position and kept the salary after returning to the academic position. Another visible outlier is one professor enjoying a much higher salary than other professors do yet with a moderate publication output. Again, this professor has previously held a leadership position and kept the salary. The salary differences between the respective groups are subjected to regular scrutiny during periodical appraisals and will not be discussed further herein.

The plots also reveal that the traditional scientific career path is associated with the largest publication output and also the largest spread in publication output of the tree groups (see Figure 1), while the practical/pedagogical career path is associated with the lowest spread and quantity of publications. Interestingly, two assistant professors (low-rank) publish more than all the first lecturers (medium-rank), yet they have lower salaries than the first lecturers. It could be that these assistant professors are working intensively towards a promotion and consequently are very productive. Note that Figures 1 and 3 show the same assistant professor group (gray). The group of assistant professors is also the largest, followed by associate professors.

Among contract researchers (see Figure 2), the group of researcher II (medium-rank) is by far the largest. This group also appears to have a larger spread and the highest number of publications – more so than the group of researcher I (top-rank).

When considering all employees as one, there was a small yet highly significant correlation between publication output and salary ($r(2093) = .34$, $p < .001$). This correlation can mostly be attributed to academic rank (top, medium, low). When exploring each group in isolation, only a small positive and significant correlation was detected for the professors ($r(117) = .31$, $p < .001$). The researcher III group showed a weak non-significant correlation ($r(16) = .25$, p = ns) and docents no correlation ($r(10) = -.02$, p = ns). The correlation in the professor group may be explained as follows: professors are actively aware of their publication output and use these actively during appraisals. Professors may also get more attention as they represent the academic leaders in their respective academic communities. The other two top-rank groups show similar trends, however, the samples for both groups are too small to trigger statistical significance.

There is no significant correlation between publication output and salary for the medium-rank groups where associate professor yields $r(227) = .06$, p = ns, first lecturer $r(96) = .04$, p = ns, and researcher II $r(47) = .02$, p = ns. These groups make up a large portion of employees. It is noteworthy that publication output seemingly is not rewarded among these groups, especially among associate professor and researcher II as these are expected to publish.

Similarly, there are no significant correlations for the low-rank groups: for assistant professors, r(199) = .01, p = ns, and for researcher III, $r(7) = -.02$, p = ns.

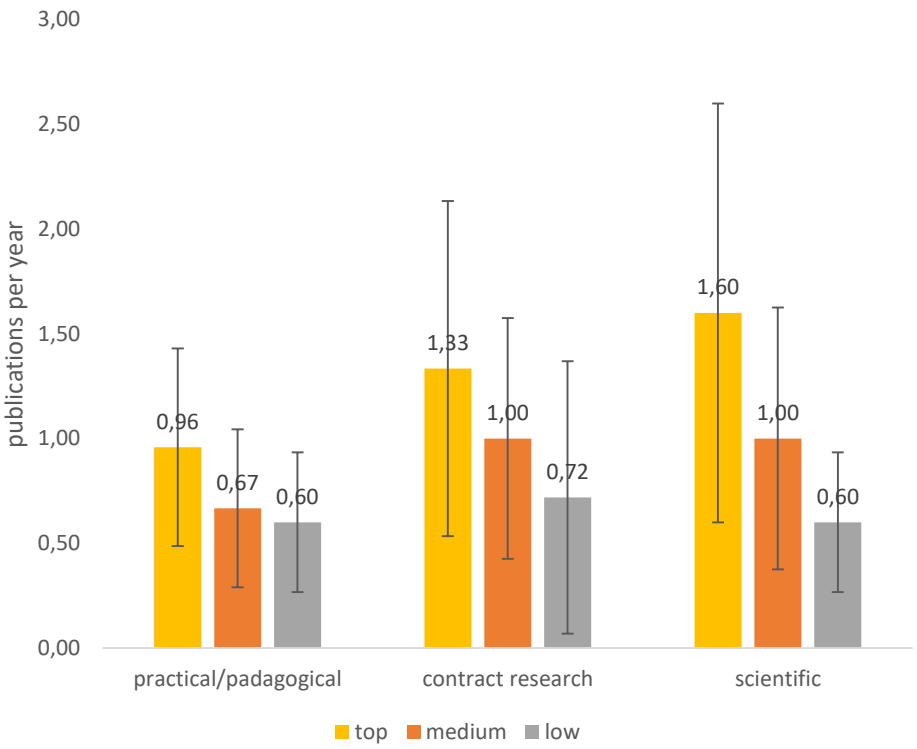

Figure 4. Median number of publications per year. Error bars show inter-quartile-range (IQR).

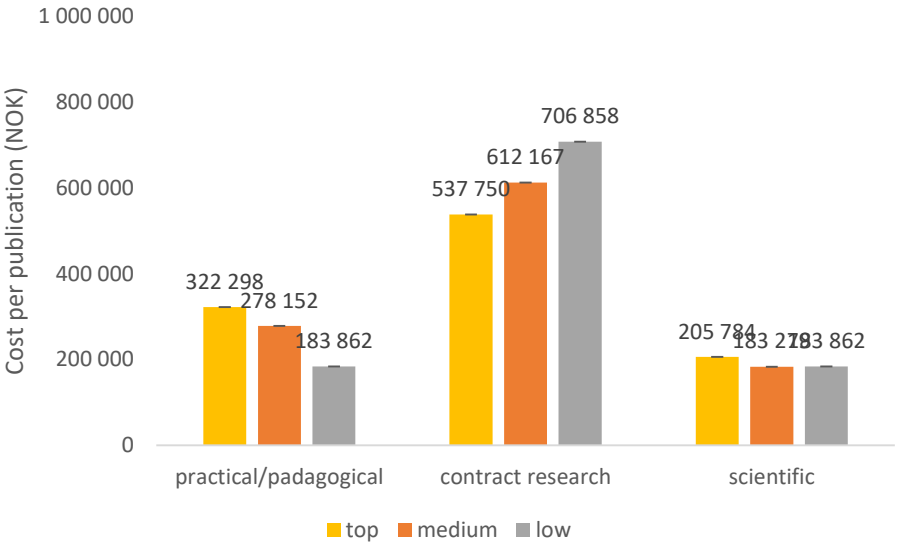

Figure 5. Estimated cost per publication.

Publication rate and cost per publication

The scatter plots reveal publication output differences between the various groups. To explore these differences further, the median number of publications per year is plotted in Figure 4. Note that the duration of active years is counted from the year of the first registered publication. The spread is indicated using the inter quartile range (IQR). The median and IQR are used as the data contains many outliers.

Figure 4 supports expectations that there is a distinct difference in publication output for the three career-paths and within each career path. The academic group is the most productive and the practical/pedagogical group is the least productive. Moreover, the top-rank groups are more productive than medium-rank groups, which again are more productive than the low-rank groups.

Figure 5 shows an estimate of the cost per publication for each group based on the HEI policy that top academic rank gives 45% time to do research, medium rank gives 30%, and low-rank gives 20%, where the other part goes towards teaching obligations and administrative duties. The model assumes 100% time to conduct research for all the contract researcher ranks.

Contract researchers yield the most expensive publications, while the scientific group yields the cheapest. Low-rank contract researchers produce the most expensive publications (706,000 NOK/publication) simply because they produce fewer but have the same time resource available. The results for the academic and practical/pedagogical career paths are different as the top academic ranks produce the most expensive publications (professors 205,000 NOK/publication and docents 322,000 NOK/publication). Associate professors produce the least expensive publications of approximately 183,000 NOK/publication. This is because the amount of time resources available increases with the academic rank. Note that these are simple estimates based on academics that publish as local conditions for conducting research may vary. If inactive academics are included, the overall cost for each publication will be higher as some individuals are inactive despite being allocated research time.

Quality vs. salary

The national Norwegian incentive system divides publications into an ordinary and a high quality category, where the high quality category is designed to represent about 20% of the best publications. To check if there are any relationships between this measure of quality and salary, the total number of high quality publications for the reporting period of 2004-2016 was correlated with salary for the nine groups. No significant correlations could be detected. A small positive, yet non-significant correlation was observed for docents ($r(11) = .4$, p = ns).

These results are in fact consistent with the articulated intentions of the incentive system in that the quality measure of level-2 is only to be used at aggregated levels.

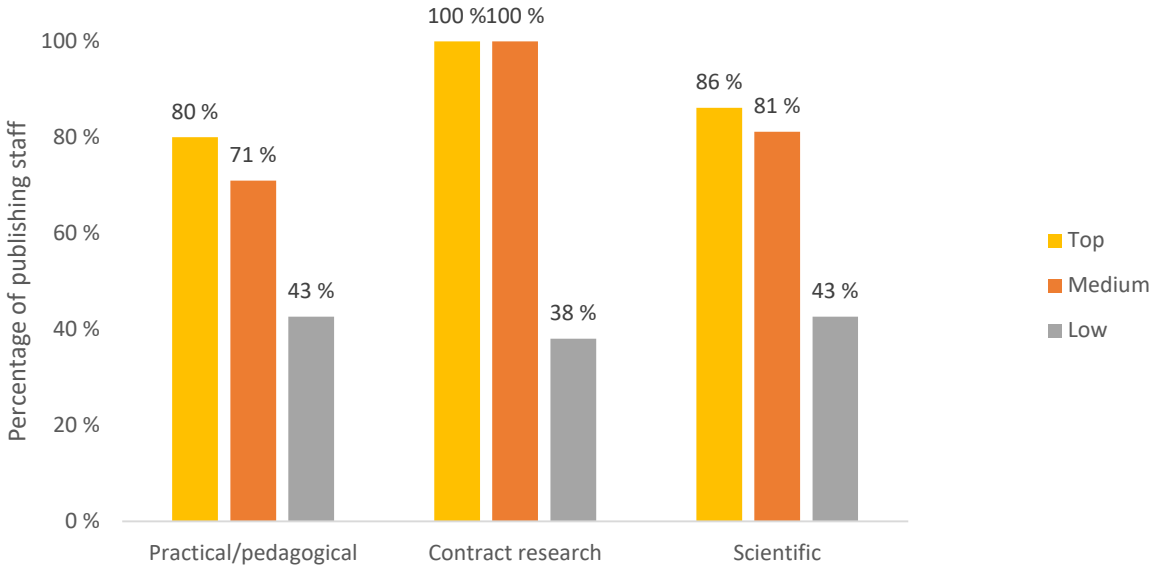

Figure 6. Percentage of academics that publishes actively.

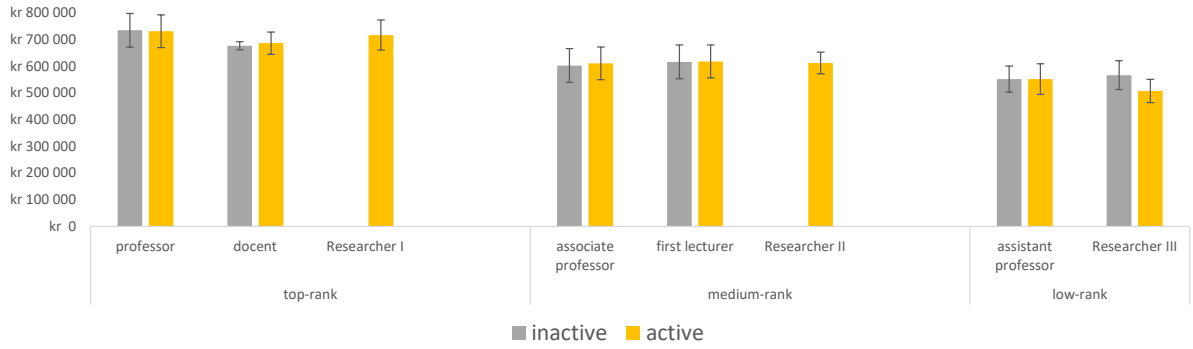

Figure 7. Mean salary for each group. Error bars show SD.

Salary of active vs. non-active academics

Figure 6 shows that a large portion of academics at HiOA is not publishing actively and Figure 7 plots the mean salary for each of the active and inactive groups. An active academic is defined as someone who at least has published one publication during the reporting period 2004-2016, while non-active academics are those with no recorded publications.

As expected, the ratio of active academics is higher for the top-rank academics compared to medium-rank academics, and the low-rank academics comprise most inactive academics. The ratio of active top-rank and medium-rank groups are marginally larger than the ratio for the practical/pedagogical group, while all the top and medium-rank contract researchers are active.

T-tests were performed on each of the nine groups to determine whether there are differences between active and inactive academics. Only the low-rank researcher III had a statistically significant difference in salary where the mean salary for active contract researchers is 507,487 NOK and for inactive contract researchers is 566,653 NOK ($t(19) = 2.6$, $p < .02$). In other words, inactive low-rank researchers III earn 9.7% more than active researchers III. One needs to go beyond the data to find the reasons for this pattern. One explanation is that some contract researchers do not prioritize qualifying for a PhD and hence to not reach the rank of researcher II. Instead, they may excel in non-publication activities such as managing projects and soliciting funding. Such activities are probably rewarded through salary increases. All individuals in the researcher I and II groups are active.

Next, inactive professors earn marginally more (M = 734,726 NOK) than active professors (M = 731,384) but the difference is not significant ($t(135) = 0.21$, p = ns). Yet, salary correlated positively with publication output for professors since the correlation was based on active professors only. Some of these inactive professors (14%) may enjoy higher salaries as they have accepted leadership responsibilities. In contrast, inactive docents earn less (M = 677,133 NOK) than active docents (M = 686,375 NOK), and also this difference is not significant ($t(13) = 0.36$, p = ns).

At medium-rank, active associate professors earn insignificantly more (M = 610,929 NOK) than inactive associate professors (M = 602,758 NOK), $t(279) = 1.23$, p = ns. A similar pattern was observed for first lecturers: active (618,116 NOK), inactive (616,532 NOK), $t(136) = 0.21$, p = ns.

Inactive assistant professors earn marginally more (M = 552,076 NOK) than active assistant professors (M = 551,584) although the difference is statistically insignificant ($t(13) = 0.37$, p = ns).

Overall, there is no evidence to support that active publishing rewards itself in a higher salary. In fact, the observations indicate that it is disadvantageous to be an active low-rank researcher III especially if one has no intention to apply for promotion.

Limitations

Using total publication counts may be slightly unfair as different disciplines exhibit different publication patterns. For example, academics in technology and the health sciences tend to publish more than academics

in social science. However, the dataset is too small and unbalanced to perform correlation analysis at departmental level as some departments have none or very few professors.

Another potential source of error is that HiOA is a result of a merger between two University Colleges in 2011. An inspection of the data reveals that the salary differences between the two institutions were larger among administrative personnel than among academic personnel. Note that the two contract research units included in this study were acquired in 2013. Contract researchers were treated as separate categories in the analysis.

The results are based on a window of publication from 2004 to 2016 and the results do not take the employment start date or promotion dates into consideration. More experienced and senior academics are likely to have developed better techniques and practices for publishing, yet early career researchers may be productive due to their ambition for promotion. Unfortunately, it is not possible to explore these factors with the available data.

Conclusions

This study has explored the correlation between publication output and academics salary at a large HEI in Norway. The results show that there was no correlation between publication output and salary within each group, but that salary correlated with academic rank. Salary increase is in part affected by academic promotion processes involving qualitative and broad evaluation of achievements. There is no clear evidence that simple bibliometric measures affect salaries, which is positive in light of the many criticisms of such measures. Still, academic promotion is usually linked to publication output and one may argue that publication output is indirectly linked to salary.

Full professors on the other hand exhibited a positive correlation between publication output and salary. Full professors are usually more conscious about their publication activities and their rank may serve as a means of power and influence within their HEI. It is indeed positive that publication output is linked to salary for this group as there is no further academic rank of promotion beyond full professor in Norway. Other countries such as Taiwan have established additional academic ranks beyond full professor such as distinguished professor and chair professor. Additional academic ranks may stimulate high publication output if these are linked to additional privileges.

The results also show that there are no significant differences in salaries between academics that publish and academics that do not publish. This result seems to suggest that other non-publication activities such as teaching and supervising are highly valued. Researcher III was the only exception where the inactive academics had a significantly higher salary than active academics. Although possible explanations exist, this tendency is indeed a cause for some concern as it may send incorrect and mixed signals to early career researchers.

The weak connections observed between publication output and salary may also be linked to cultural factors. Hofstede and Hofstede's (1991) framework for comparing cultures may provide an explanation particularly in terms of masculinity and power distance as it has been used to compare collaborations (Jian et al. 2010a), students' preferences (Jian et al. 2010b), and university life (Jian et al. 2010c). The masculinity dimension gives an indication of the competitiveness level of a society where Norway has a very low score signaling a feminine society characterized by care for others, sympathy for the underdog, solidarity, consensus, and valuing quality of life. To stand out from the crowd is not a positive attribute. To enjoy one's work is considered more important than being the best. Actually, trying to be better than others is generally frowned upon. Power distance addresses the notion that individuals in a society are not equal; the relatively low Norway score indicates that hierarchies are considered pragmatic structures, equal rights are valued, and power is decentralized. It is hence likely that other more masculine cultures with larger power distances may exhibit stronger correlations between publication output and salary.

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