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Zusammenfassung / Abstract

Using a new panel dataset comprising publication and appointment data for 889 German academic economists over a quarter of a century, we confirm the familiar hypothesis that publications are important for professorial appointments, but find only a small negative effect of appointments on subsequent research productivity. In fact, a simple theoretical model leads us to hypothesise that no such effect exists for top researchers ("stars"), which is borne out by our estimation results. We also provide some evidence of the effects of the fundamental reform of economics in Germany and of affirmative action procedures.

1   Motivation

Most economists would agree, even though a few might silently deplore, that the key aspects of a career in economics can be succinctly summarised by the classic quip "publish or perish". According to this view, no other consideration, be it the quality of teaching or effort put into some other dimension of scholarly work, will outweigh the weighted number of refereed journal publications in the collective eye of a tenure commission. On the other hand, there is a widespread suspicion that professors, once they have obtained tenure, like to cut themselves some slack.[1] Of course, these two observations might be connected: if you subject young researchers to a rat race, you had better make the prize compelling if you need to compete with other options young people have over their life cycle.

The economics of education is rife with empirical papers on research productivity and career paths in economics. One part of the literature on academic career focuses on the effect of publishing on academic salaries. A clearly visible result of these papers is a significant and positive impact of publications on the academics' earnings (Diamond 1986; Grimes and Register 1997).

Beyond this there is a second stream of literature focusing on the changes in publications over the academic life cycle. As early as 1979, Cole showed that the performance of academic scientists fluctuates over the life cycle. More concretely, Levin and Stephan (1991) find for several non-economic research fields that scientists become less productive as they age. Hamermesh and Oster (1998) confirm this for the economic research field.

In contrast to many other labour markets, the market for academics is characterised by the existence of tenure contracts. Although this assures the possibility to produce new, creative, non-popular research output, it also may lower the *ex post* incentives to publish. Therefore, some authors focus on the question if tenure negatively influences the publication output. As a main result of this literature publication decreases after tenure but the decline in productivity sets in very slowly (Goodwin and Sauer 1995; Hutchinson and Zivney 1995). Particularly the top researches show little tendency for a decline in publication productivity (Goodwin and Sauer 1995).

Although most of the literature focuses on the US or the UK market, there are also a few papers analysing the situation in Germany. In line with the behaviour of academics in the US and in the UK German economists tend to publish most in the years before tenure while there is a post-tenure drop in the publications (Backes-Gellner and Schlinghoff 2004; Rauber and Ursprung 2008). Rauber and Ursprung (2008) also find evidence for a cohort

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[1]See McKenzie (1996) for a summary of popular arguments against tenure, as well as a forceful opposing view.

effect. Thus, there seems to be an institutional change in the market for German academics over the last decades.

In this paper we analyse the effect of publication on the probability to get an appointment as well as the reversed effect of an appointment on subsequent publication behaviour for German economists. Contrary to the existing literature we do not cull our data from curriculis vitae but from two officious journals– "Das unabhängige Hochschulmagazin" and "Forschung und Lehre" – that regularly list new appointments for the academic market. Thus, using a new panel data set we comprise publication and appointment data for almost 900 German economists over a quarter of a century (from 1981 to 2006).[2] Beyond providing a testing ground for general hypotheses on careers in economics, this period is interesting because it is roughly cut in half by a major informal reform of economics in Germany, which brought the practice of economics (or lack thereof) more in line with the Anglo-American mainstream. These decades also saw a growing sensitivity to gender issues, which prompted a number of reforms in public service hiring procedures in Germany (and, by extension, in German universities).

A main conclusion from our research is that while we can confirm the overwhelming importance of research productivity for being offered an appointment, we find little evidence of a disincentive effect of tenure on research productivity. Possible explanations for this include the fact that additional (post-appointment) efforts can still elicit further job offers, which are the major source of pay raises – either from the new or, by re-negotiation, from the old employer – in Germany.

The next section 2 sets out a simple theoretical model of the choice of publication effort in an academic career (sub-section 2.1), which we then distil into a couple of hypotheses (sub-section 2.2). The data set is described in section 3, while section 4 presents the estimation technique, tabulates the major results, and provides a short discussion. Section 5 concludes.

2   Theory

2.1   A simple model

To illustrate the mechanism behind the common hypotheses concerning the impact of appointments on research productivity, it appears best to use a simple two-period model. The first period represents the PhD, post-doc and assistant professor phases of an American's career,[3] with tenure (the German version being *Verbeamtung*) being granted at the start of the second.

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[2]We also have publication data for 2007, but refrain from using this as the collection is likely incomplete.

[3]For her German colleague, the first phase would end with the first award of a non-expiring contract, which is typically the first professorial appointment.

Denote the individual's publication output at time t as f_t and let society's marginal valuation of research be given by $v_t = a - bf_t$ while $\text{MC}_t = cf_t$ reflects the researcher's opportunity cost of research, such as not being able to play *Warcraft* or cutting back on teaching activities. In Germany, where remuneration for teaching is basically lump-sum with a minimum teaching requirement, the relevant trade-off will in fact be one between research and spare time unless intrinsic motivation for teaching intervenes. If there were a representative researcher and all parameters were known, the obvious solution would be for the authorities to set a per-publication wage ω_t equal to the marginal product and have $f_t = \frac{a}{b+c}$ for $t = 1, 2$.

But suppose that researchers can be a continuum of types, the individual type being private information. Specifically, we follow Walckiers (2008) in allowing the marginal cost c of producing papers to vary, but instead of considering a limited number of types, we use a continuous distribution: let c be uniform i.i.d. over the interval $[\underline{c}, \bar{c}]$, and assume $\underline{c} > 0$ for technical reasons. Let the university offer contracts which specify a base wage w_t and an output based wage $\omega_t f_t$ for $t = 1, 2$ (we can safely let $w_1 = 0$ for the remainder of the discussion as this is already sunk when researchers decide about f_1). In addition to wages, universities set a threshold level of publications f^* in such a way that only researchers whose first-period output exceeds this level will be kept on. The remainder will fail to obtain a professorial appointment and drop out, receiving reservation utility u_0.

Now consider researchers' incentives. The obvious interior optimum for both periods *taken separately* would be to produce $f_t^* = \frac{\omega_t}{c}$. There are two main cases to consider:

1. $f_1^* = \frac{\omega_1}{c} \geq f^*$ ("stars"). These are researchers whose marginal cost of research is so low that they exceed the threshold without really trying.

2. $f_1^* = \frac{\omega_1}{c} < f^*$. These researchers fail to meet the criteria for appointment unless they publish more than they would in an interior solution. Doing so is a good idea as long as the producer's surplus in $t = 2$ exceeds the first-period loss. This former is

$$w_2 + \int_0^{\frac{\omega_2}{c}} \omega_2 - cf \mathrm{d}f - u_0$$

while the latter is given by

$$\int_{\frac{\omega_1}{c}}^{f^*} cf - \omega_1 \mathrm{d}f$$

Computing the above integrals and normalising the outside option u_0 to zero, we obtain the following two sub-cases:

(a) $\frac{\omega_1}{f^*} < c \le \frac{w_2 + \sqrt{f^{*2}\omega_2^2 + 2f^* w_2 \omega_1 + w_2^2}}{f^*}$ ("hopefuls"). Hopefuls are re-searchers who stretch themselves to meet the appointment crite-ria in order to enjoy the second-period surplus of being a pro-fessor. It is evident that for equal wages $\omega_1 = \omega_2$, hopefuls will publish less after appointment. Generally speaking, their publica-tion output will drop relative to a colleague publishing f^* before appointment in an interior solution – after all, their investment has to pay off some time.[4]

(b) $\frac{w_2 + \sqrt{f^{*2}\omega_2^2 + 2f^* w_2 \omega_1 + w_2^2}}{f^*} < c \le \bar{c}$ ("losts"). Losts have no incen-tive to meet the quantity standard of research output in order to become a professor; they drop out after getting their PhD and move into other sectors, such as industry or consulting, presum-ably using their degree as an additional academic qualification for access to high-paying jobs.

This simple model is sufficient to illustrate the relationship between post-appointment (post-tenure), pre-appointment wages and admission standards, providing the underpinnings for typical "folk" hypotheses about the pub-lishing behaviour of professors over the life cycle. It also puts the relevant trade-offs into sharp relief: For instance, increasing w_2 has clearly no effect on second-period research, but makes hopefuls work harder in the first pe-riod (stars are not motivated in this manner, though, as they treat higher base salaries as a windfall that they will get anyway). Higher performance pay (ω_2) will boost research efforts in both periods, but again all of the first-period gain will come from an increasing number of hopefuls all publishing at f^*.

2.2 Hypotheses

Let us now turn to possible hypotheses. A direct corollary of the main assumption of our simple model is

(H1:) Research output in the recent past (measured by a moving average of ComLi publication points) is positively associated with the probability of obtaining an appointment in any given year.

The model in sub-section 2.1 suggest a bifurcation in the post-appointment behaviour of researchers: While the output of hopefuls drops as they move from a corner solution to the interior, *ceteris paribus*, stars will continue

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[4]We have implicitly assumed that the university is committed to its announced policy. For everyone bunched at f^* is clearly a hopeful, information which the administration might be tempted to exploit *ex post*. Also note that we do not state that the announced policy is in any way optimal – we have no need to analyse optimal policies in the present paper.

publishing at a higher rate. Put rather differently, a variation in f^* will have no effect on infra-marginal stars. The above model therefore implies:

(H2:) In general, publication output drops after (a) tenure and (b) any subsequent job offer.

The remaining task is to deal with the "stars". Of course, this begs the question of how we measure "stardom" in our empirical data. One approach, which we are going to follow below, relies on *multiple* appointments, suggesting that stars are professors who are able to switch universities (or re-negotiate with their existing employer) based on their performance. An alternative would be to consider a percentile of the publication distribution, say the top-ranking 25 % of researchers. As this would appear rather *ad hoc*, we settle on the first version, leading us to

(H3:) Professors receiving two or more job offers in different years are less likely, other things being equal, to exhibit a negative effect of appointments on subsequent publication output.

We also want to state a couple of ancillary hypotheses that do not follow from the model, but correspond to widely held beliefs. First, formal rules for hiring at German universities place increasing emphasis on equal opportunity issues, a practice which is apparently based on the popular

(H4:) There is a gender bias against women in the university recruitment process.

We might also want to consider a variant of this hypothesis stating that gender bias *used to be* present, but has been eroded since the implementation of reforms *(H4a)*.

Finally, a large number of studies confirm an age, or cohort, effect on publications (Levin and Stephan 1991; Hamermesh and Oster 1998). We need to capture this also, if only to control for experience effects on publication output as well as on the likelihood of employment. We summarise this in

(H5:) After completion of the post-doc phase, annual publication output decreases with years of experience, albeit at a declining rate.

3   Data

We are now in a position to confront the data. For the purposes of this study, we have assembled a new panel data set consisting, for the one part, of the standard *Verein für Socialpolitik* panel on the publications of German economists (Rauber and Ursprung 2008), and on appointment data from two officious journals of the German HEI community ("Das unabhängige Hochschulmagazin" and "Forschung und Lehre"). Amongst other things, these journals publicise offers of professorial appointment ("Rufe"), rejected offers as well as completed appointments. We use these data to compute a

dummy variable that takes on the value 1 if an individual received, declined, or accepted at least one *Ruf* in a given year.

There is also some information concerning the award of *Habilitation* – the old Germanic way qualifying for a professorial position – and the pay grade of the various appointments. The latter is, however, fairly incomplete, and we refrain from using this information in the present paper.

Publication output is measured using the Combes and Linnemer (2003) ("ComLi") weights for journal quality. We do not weight articles for length, and we follow the standard procedure of assigning each author $\frac{1}{n}$th of an article's score if there are $n-1$ co-authors. Books, book chapters as well as journal articles appearing in journals not listed in *Econlit* are not considered as a form of research output at all, as is standard in the literature.

We also have information on the year individuals received their PhDs, which allows us to construct our "years of experience" variable (German young economists spend more time working as research assistants than their American counterparts do, but we exclude this time from consideration for want of data), on individuals' gender, as well as on affiliation and individuals' scores in the MeinProf.de SET web site. The latter data are excluded from this analysis due to quality concerns (Beckmann and Schneider 2009).

Table 1: Descriptive statistics for individuals

	μ	σ	min	max
Publications (ComLi)	1.42	2.33	0	19.49
Action years	0.550	0.969	0	5
Year of PhD	1990	11.39	1958	2007
Gender (1=fem)	0.112			
N	889			

Table 1 on page 6 gives simple descriptive statistics (per individual) for the main variables in our analysis. As we can see, only one in nine economists in the panel is female. We also note the rather large spread in publications: While the average German economist has published, over her entire career up to 2007, the equivalent of one JPE article and a half, the standard deviation is almost twice the mean. In fact, 265 – almost one third – of the economists in the panel *have not published a single article* counting towards the ComLi score.

It is interesting to look at the publication output over time. Figure 1 on page 7 displays a sequence of box plots, one for each year, from 1980 to 2006, where years are plotted on the abscissa. Note that up to the early 1990s,
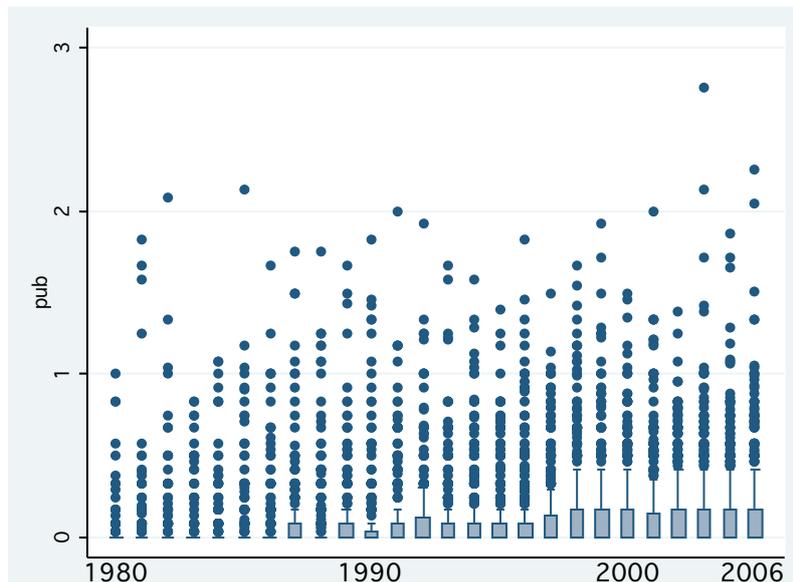
Figure 1: Distribution of publication activity over time in Germany, 1980-2006

outliers dominate the picture. It is not until 1987 that the box containing the middle 50 % of the distribution makes an appearance at all; and even for second half of the period of time covered in our panel, the confidence interval of ComLi scores still includes zero.

All the same, figure 1 reveals that the three decades in our data set differ; an increasing prevalence of ComLi-ranked publications – or, to phrase it negatively, an increasing relevance of American-style "publish or perish" modes of research to the detriment of the previous book-centric mode – is clearly visible. This is consistent with impromptu evidence and our personal experience with the German economics community: something happened in the early 90s to change the face of economics in Germany, for better or worse.

4 Results

4.1 Effects of publication activity on appointments

Addressing (H1) first, if publishing increases the probability to get an appointment, we estimate the effect of publishing on the dummy *action* that is 1 whenever there is at least one job offer (whether leading to an appointment or to re-negotiations with the present employer) at time t and 0

otherwise. Since we believe that the decision of the committee of appointment is affected by the average publication behaviour of the candidate we measure publishing by the 5-year $(p_{i,(t-5,t-1)})$ respectively 3-year-average $(p_{i,(t-3,t-1)})$ Combes-Linnemer index before the appointment. To account for the fact that $action_{i,t}$ is a binary, we run the following two panel probit regressions

$$\Phi^{-1}[P(action_{i,t} = 1)] = \beta_0 + \beta_1 p_{i,(t-5,t-1)} + \beta_2 s_i + \beta_3 y_{i,t} + \beta_4 y_{i,t}^2 + \epsilon_{i,t} \quad (1)$$

and

$$\Phi^{-1}[P(action_{i,t} = 1)] = \beta_0 + \beta_1 p_{i,(t-3,t-1)} + \beta_2 s_i + \beta_3 y_{i,t} + \beta_4 y_{i,t}^2 + \epsilon_{i,t} \quad (2)$$

where s_i is a sex dummy (1 = female) and $y_{i,t}$ describes work experience of individual i at time t measured as years since obtaining a PhD. In line with Mincer we also control for $y_{i,t}^2$ believing that the marginal effect of experience is not constant. The results of our regressions are given in table 2.

As in Germany university professors in general retire at the age of 65 we only include observations where the individual has less than 30 years' work experience (table 2, column 1 and 2).[5] To capture possible cohort effects, we also run the regression for a work experience smaller than 20 years (table 2, column 3 and 4) and for a work experience between 20 and 30 years (table 2, column 5 and 6).

Looking at the descriptive data (see figure 1 on page 7) we see that the mean of annual weighted publications increases over time. Thus we cut our data set into halves (before and after 1995) to check whether the correlation between publishing and getting an appointment has changed over time (table 2, column 7 and 8).

χ^2 statistics for all models reported in table 2 exceed standard confidence levels by a wide margin. As the results in table 2 illustrate, there is a highly significant influence of publications on getting an appointment. The regression coefficient β_1 lies between 1.0085 and 1.4621, i.e. holding all other

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[5]In fact, there are several reasons for excluding older individuals from our data set. For instance, regulations in *some* German *Länder* stipulate the no-one over a certain age – typically 53 to 55 years – can be appointed as tenured professor; this removes the main mechanism in our model underlying hypotheses 1 through 3. The average graduation age of German PhDs in the early 1980s exceeded 30, while the mandatory retirement age for tenured professors was 65 (although there was an option to stay on until age 67). Faced with this mess, we decided to use a cut-off of 30 years, although we also report estimations for a cut-off of 20 years of experience.

parameters constant one AER article per year (on average) for 5 respectively 3 years in sequence increases the probability to get an appointment by between 50.21% (column 8) and 58.08% (column 5). Using the 3-year average instead of the 5-year average always decreases the regression coefficient. Interestingly, we find a female discrimination that is often stressed in the literature (see e.g. Kahn 1993) only in one set-up (column 8). We are therefore unable to reject (H4a), while we can reject (H4).

This effect is only significant on the 10% level but with a decrease in probability of 33.78% it is quiet high. Nevertheless, concerning appointments we generally do not find a discrimination against women (rejecting H4). For every set up but the two looking on the work experience between 20-30 years we find a positive effect of experience on getting an appointment that decreases in every additional year. For set-ups 5 and 6 we do not see a significant effect of experience. Thus, experience matters in the early stage of the university career but not afterwards. More stressed, experience is important to get a first appointment but it is not important to get an additional one.

Table 2: Probit estimates for appointment

	all		< 20 yrs		20 < t < 30		t < 1995		t ≥ 1995		min 2 appts.	
ComLi5 (5-yr avg.)	1.3855 ***		1.2731 ***		1.4621 ***		1.2370 ***		1.4805 ***		0.6073 ***	
ComLi3 (3-yr avg.)		1.2103 ***		1.1349 ***		1.1377 ***		1.0085 ***		1.3304 ***		0.5831 ***
Female	-0.1432	-0.1488	-0.1883	-0.1912	0.1830	0.1554	-0.4987	-0.5102 *	-0.0677	-0.0739	-0.0099	-0.0142
Yrs since PhD	0.1604 ***	0.1694 ***	0.2643 ***	0.2769 ***	0.2131	0.1742	0.1727 ***	0.1767 ***	0.1503 ***	0.1626 ***	0.1957 ***	0.2012 ***
(Yrs)^2	-0.0059 ***	-0.0062 ***	-0.0114 ***	-0.0119 ***	-0.0067	-0.0058	-0.0059 ***	-0.0060 ***	-0.0057 ***	-0.0061 ***	-0.0075 ***	-0.0076 ***

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4.2 Post-appointment publishing

We now turn to the effects that appointments have on research productivity. The basic panel model we estimate in this section is

$$p_{i,(t+j,t+k)} = \beta_0 + \beta_1 s_i + \beta_2 y_{i,t} + \beta_3 y_{i,t}^2 + \epsilon_{i,t} \tag{3}$$

where $p_{i,(t+j,t+k)}$ is a moving average of Combes-Linnemer publication measures (weighted for co-authorships, but not for article length) over a period ranging from j years after the appointment at time t to k years after, s_i is a sex dummy (1 = female), and $y_{i,t}$ is years of post-doc experience at time of appointment t. The inclusion of the square of experience reflects the typical Mincer-type considerations, but with a twist: Hypothesis H5 holds that research output decreases with age, but at a decelerating rate, see sub-section 2.2).

For our data, a random effects model is clearly more appropriate. A Hausman test also did not reject this approach in favour of a fixed effects one. We consequently estimated a random effects version of (3) to control for unobserved heterogeneity. Table 3 on page 11 displays the results.

Table 3: Estimation results for post-appointment productivity

	Average annual publications (ComLi)			
	5 years	5 years, lagged	5 years, lagged, before 1995	5 years, lagged, 2 or more appts
Appt. dummy	-0.0087 **	-0.0073 *	-0.0022	0.00059
Female	-0.548 ***	-0.0606 ***	-0.0484	-0.0395
Yrs since PhD	-0.0053 ***	-0.0083 ***	-0.0040 ***	-0.0161 ***
(Yrs since PhD)^2	8.6×10^{-5} ***	1.8×10^{-4} ***	8.9×10^{-5} ***	3.8×10^{-4} ***
ρ	0.700	0.742	0.854	0.708

The second column in table 3 represents the baseline, giving the results for $p_{i,(t+1,t+6)}$. There is, in fact, a significant negative effect of appointment on average productivity. The coefficient, however, appears rather small, corresponding to about one-twentieth of an article in the *German Economic Review* (or a hundredth of an article in the *Journal of Political Economy*) per annum. To put it in perspective, though, note that the average annual

ComLi score for individuals in our sample, computed over the entire time horizon, is 0.0872 – which means that the coefficient amounts to an estimated 8.37 % reduction on average. While there appears to be some disincentive associated with obtaining an appointment, the size of this effect is open to debate.

The coefficients on s_i and $y_{i,t}$ are highly significant and negative, the coefficient on $y_{i,t}^2$ is positive and significant at the 1% level, suggesting that hypothesis H5 holds: Output declines as researchers grow older, albeit at a diminishing rate. This result is in keeping with previous findings by Backes-Gellner and Schlinghoff (2004). We also find that female researchers tend to publish less.

This baseline, however, is open to one criticism: Newly appointed (tenured) professors face high demands on their time budget to set up their curriculum, to get organised on administrative issues, moving house, and (at least in Germany) to set up their own small outfit (for example, hiring and training assistants). It is likely that this burden diminishes as time progresses in the new job. Therefore, column 3 in table 3 shows the results for a model with $p_{i,(t+3,t+8)}$ as dependent variable; that is, we lag the moving average by an additional two years, leaving out the first two years immediately following the new appointment. The negative coefficient on the appointment dummy grows even smaller and now barely escapes being insignificant. The disincentive effect of an appointment, therefore, almost disappears when we look farther into the future. Also note that the coefficient of the female dummy shrinks to about one tenth, which is consistent with a story that set-up costs in a professorial job are higher for females than for males.

The fourth column shows what happens if we restrict the analysis to the first half of the panel, which loosely corresponds to the time before economics in Germany began to model itself on the Anglo-American example. Only the experience variables remain, and both the appointment and sex dummies become insignificant (and their coefficients even smaller). While we would not place too much reliance on the second non-result – owing to the small number of female appointees in the first half of our sample –, the first is consistent with the hypothesis that extrinsic incentives of the kind modelled in sub-section 2.1 did not become operative until after the reform.

Finally, in the model represented in the fifth column, we take up the distinction between "stars" and (ex-) "hopefuls" outlined in the model. If we restrict the estimation to those individuals who received at least two appointments in distinct periods of time,[6] the coefficient on the appointment dummy becomes very small, statistically indistinguishable from zero. For this group, we cannot reject the null that there is no effect of an appoint-

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[6]See above for a discussion of why we roll multiple job offers in a single year into a single "action".

ment on subsequent research activity, which corresponds to hypothesis (H3) outlined in sub-section 2.2.

5 Conclusion

Economists are increasingly interested in analysing their own labour market. Most of the research focuses on the popular beliefs that tenure decreases the productivity of academics and also that there is a discrimination against women.

Our paper contributes to this literature by analysing the interplay of publications and appointments for German economists. Although there are a lot of studies on the academic market in the USA and the UK only few things are known about the situation in Germany (Backes-Gellner and Schlinghoff 2004; Rauber and Ursprung 2008). In contrast to previous studies, we do not use appointment data from CVs but data that are regularly published in two German magazines. By doing this we address a selection bias.

The results confirm a positive effect of publication activity on the probability to get an appointment. This effect increases by-and-by. So, we find evidence that publication becomes more and more important to get an appointment. Interestingly, we do not find discrimination against women for our whole data datasetset including the years 1981-2006 but for the subsample including the years 1981-1995. Thus, we find some evidence that the anti-discrimination efforts in Germany take effect.

Focusing on the effect of tenure on the publication behaviour our results support a negative, but small, effect of tenure on publications for the whole time spread. However, before 1995 there is no significant decline in publications after tenure. This could mean that in early years publication behaviour was stronger driven by an intrinsic motivation than today. Nevertheless, there is hope because top researchers do not show such a behaviour. There publications do not significantly drop after tenure.

Summing up, institutional changes in the labour market for academics in Germany have markedly reduced discrimination against female postdoctoral academics. However, the number of female researchers is still proportionally low. As an additional result we find an increasing importance of publications on the probability to get an appointment. Our simple model predicts that the increasing efforts in the time period before tenure reduces publication activities afterwards. This is also confirmed by the data.

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