How to Get Tenured

(in Germany, in Economics)

Michael Graber[(a)], Andrey Launov[(a,b)], and Klaus Wälde[(a,b,c)] [1]
[(a)] University of Würzburg, [(b)] UCL Louvain la Neuve and [(c)] CESifo

www.HowToGetTenured.de

August 2007

Getting a tenured position in economics in Germany is viewed as a random outcome where the probability of tenure depends on the quantity and quality of publications, age and years since PhD. We measure publications both in units of Top 5 journals and in units of the European Economic Review (EER). We find that the average age of a professor in the year of his first appointment in Germany in the period of 1970 to 2005 is 38. This is approximately 8 years after the PhD. He has 1.5 "standardized" Top 5 papers or 2.2 "standardized" EER papers, i.e. written with one coauthor and of 20 pages length. Results vary across subfields and over time. Someone aiming for a tenured job after 2010 should by then (average over all fields) have 3.3 standardized Top 5 papers or 5 standardized EER papers.

1 Introduction

A university career is an attractive option for many successful PhDs. One question that arises for each post-doc at some point in time is "what does it take to get a tenured job?". Obviously, the number and quality of publications play a role. In addition, the post-doc should have developed certain "soft-skills" and he or she should not be too old. It is the objective of this paper to quantify as much as possible what is required to obtain a tenured job at a university in Germany. Our goal is to provide results which help post-docs in their career decisions.

In October 2006, there were 453 tenured professors of economics (including econometricians and excluding statisticians) at 73 German universities.[2] For 86% of these professors we have information on e.g. date of birth or date and location of PhD from

[1] All authors are at the Department of Economics, University of Würzburg, Sanderring 2, 97070 Würzburg, Germany. Phone + 49.931.31-2951, Fax + 49.931.888-7025. Michael.Graber@uni-wuerzburg.de, Andrey.Launov@uni-wuerzburg.de, Klaus@Waelde.com, http://www.waelde.com. We are grateful to Pierre-Philippe Combes for having provided us with the Combes and Linnemer (2003) weighting scheme for journals and to Heinrich Ursprung for comments on an earlier draft.

[2] According to the "Hochschulverband" there are 86 German universities. At 73 of them at least one tenured professor in economics is active. For a complete list of all German universities see Hochschulverband (2007).

the CVs they make available through the internet. For 72% of them, we also know the date of their first tenured appointment. 89% of all professors have published in journals which are covered by EconLit, the database provided by the American Economic Association.

Where the date of the first appointment is known, for professors who received their PhD in 1970 or later and had their first tenured position in Germany (giving a coverage of 62% of 453, i.e. 280 individuals), we look at their list of publications in the year of appointment. By aggregating these publications in various ways, we are able to identify average quantity and quality levels which are fulfilled by those having obtained a first time appointment in Germany. Any current post-doc can then think about whether he or she believes that these levels, which we extrapolate into the future further below, can be reached within some reasonable time limit. To this end, we provide an internet site - www.HowToGetTenured.de - where one can easily compute one's own quality index by filling in own publications.

The average age of a first-time appointed professor in Germany is 37.5 years. This average is basically constant since the 1980s. Appointment takes place roughly 8 years after receiving the PhD. The youngest new professor since 1970 is 29 years old, the oldest is 58. In terms of publications, we find a significant increase in quantity and quality over time. While the average new-appointed professor in 1990 had 1.3 standardized EER papers, this rises to 3.6 papers in 2005. According to our preferred regression illustrated in and discussed after figure 8, this is expected to reach 5 in 2010. With our weighting schemes presented below in equation (1), 3 standardized EER papers corresponds to 2 standardized Top 5 papers. This means, instead of publishing 5 standardized EER papers, it is enough to publish 3.3 standardized papers in a Top 5 journal (or, say, 7 to 8 lower quality papers). If a post-doc mainly publishes alone, all numbers can be divided by $\sqrt{2} \approx 1.4$. Keeping the number of authors and quality of journal constant, a paper (half) twice as long counts (half) twice as much.

It should be taken into account, however, that these results vary across fields. Competition is higher in international trade, economic theory and public finance, compared to econometrics or economic policy. When 3 papers are required in the first-mentioned fields, 2 or 1.5 are required in econometrics or economic policy (see, however, our discussion on econometrics below). We also find that there are much more tenured positions in the low-competition than in the high-competition fields.

The analysis of publication activities of economists already has some traditions. Bommer and Ursprung (1998) had a first ranking of departments in Germany being based on publications. This study received a lot of attention both within and also outside of the profession. Lists of journals taking quality differences into account at least date back to Diamond (1989) and there was a wave of comparisons of departments at the European level around 2003 (for more references, see footnote 6). Recently, Rauber and Ursprung (2007) and Ursprung and Zimmer (2007) extend this analysis for cohort effects. The paper which is closest to ours is by Heining, Jerger and Lingens (2007). They run various Cox regressions to identify determinants of university success.

In terms of results, we are more comprehensive as we provide e.g. information on differences across fields and recommendations on how much to publish in order to get tenured in 3 to 5 years. We also hope that our results are of more practical use given our website www.HowToGetTenured.de where individuals can easily position themselves in our ranking.

2 Some first facts

2.1 Data sources

We use three types of data sources: CVs, data from EconLit and weighting schemes. The first was collected by ourselves and contains personal information about 453 professors in economics at German universities. Table 1 provides an overview for the availability of personal data from public CVs.

Table 1: Data coverage

Data	Coverage
CV in internet	86%
Date of birth	72%
Date of PhD	72%
Location of PhD	73%
Date of Tenure	72%
Location of Tenure	69%

It shows that if a CV is available on the net, it almost always contains standard information like date of birth, date and place of PhD and date of tenure.

The second data source is EconLit provided by the American Economic Association. It contains publications in all relevant scientific economic journals. As EconLit starts in 1969, we only take journal publications between 1969 and 2005 into account. We found that around 89 % of the 453 German professors have publications in journals covered by EconLit. As EconLit starts in 1969, the remaining 11% have either published before 1969 or in other outlets. As the average age of the professors whose publications are not registered in EconLit is 59 years, they probably have published in German.[3] The number of individuals without any EconLit publications by the year of their first appointment in Germany is shown in figure 1.

[3] One should also keep in mind that coverage of EconLit expanded over time and not all the journals which are included today were included in early years.

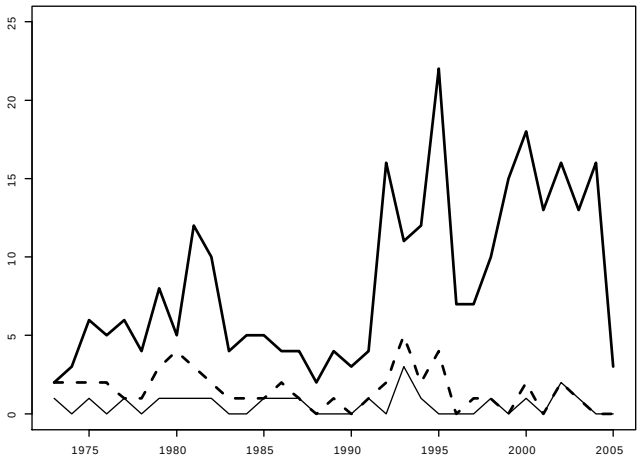

Figure 1 *The number of tenures with and without EconLit publications*

The thick solid line on top presents the total number of new appointed for a certain year. The dashed line shows the number of new appointed without any EconLit publication up to their year of appointment, while the thin solid line presents the number of professors without any publication covered by EconLit from 1969 to 2005, i.e. also subsequent to their appointment.

The interpretation for newly appointed before, say, 1975 is difficult as they might have published before the start of EconLit. For the time afterwards, however, we see that there is still a considerable number of new jobs offered to and accepted by individuals without EconLit publications even though their share clearly goes down. No appointment was made in 2004 and 2005 of a person without EconLit publications.

Our third data source is a weighting scheme for journals. Our aim is to take not only the total number but also the quality of publications into account. We decided to take the weighting scheme proposed by Combes and Linnemer (2003) as a measure for quality of a journal. It provides standardized weights for 798 journals listed in EconLit. The journals are divided into six groups. The first group contains five top journals with a weight equal to one. The second group consists of 16 journals with a weight equal to two third. The next 39 journals are weighted one half, 68 journals one third, 138 journals one sixth and the remaining 532 journals one twelfth. Clearly, there are many more weighting schemes and some references on this topic are listed in subsection 3.3.1. Due to the comprehensive list of Combes and Linnemer, more than 95 % of the publications we work with can be weighted. The weights of the remaining publications are set to zero.

2.2 How lively is the market?

Any applicant for a job would like to know how lively the market is. How many economics positions are there in general in Germany? How many positions are filled per year? There is a well-known study undertaken every 3 years by Borchert and Gülicher. The latest version we could get hold off was published in 2000. They analyze the chance of getting tenured for "Habilitanden" in the German-speaking area by comparing the current number of "Privatdozenten" plus the expected number of "Privatdozenten" for the next 3 or 7 year period with the expected number of vacancies. In 2000 the average number of "Privatdozenten" within the following three years to fill one expected vacancy within the following seven years is 0.71 for the least competitive field Economic Policy and 2.19 for the most competitive field Economic Theory.

We know from our data collection that in October 2006 there were 453 tenured professors in Germany. Table 2 shows how many professors obtained their first tenured position for a given year in our database. The total number is 323.

Table 2: Number of first-time appointed by year

Year	Number	Year	Number	Year	Number	Year	Number
1970	1	1980	6	1990	4	2000	20
1971	3	1981	14	1991	6	2001	15
1972	1	1982	10	1992	17	2002	18
1973	6	1983	5	1993	11	2003	15
1974	4	1984	6	1994	13	2004	17
1975	8	1985	6	1995	24	2005	5
1976	5	1986	5	1996	8		
1977	6	1987	5	1997	7		
1978	7	1988	3	1998	10		
1979	9	1989	7	1999	16		

The market became much more lively after the reunification in 1990 where appointments of young professors more than doubled compared to the 80s. It is to be seen whether the drop in 2005 is of a temporary or permanent nature.

3 Career factors

We focus on three criteria which we believe are informative about the probability of obtaining a job: Age, university background (university which granted the PhD) and publications. We present not only means but also distributional information. We also focus on changes over time and on differences across universities and subjects: Have job

requirements increased over time and is it easier to get a job in some "less technical" fields?

Table 3: Where first-appointees got their PhD

Location.of.PhD	Number	Location.of.PhD	Number
Augsburg	3	Konstanz	13
Bamberg	2	Linz	2
Basel	4	London	2
Bayreuth	3	Mainz	5
Bern	3	Mannheim	17
Bielefeld	3	Marburg	6
Bochum	9	Minnesota	2
Bonn	19	MIT	2
Bremen	2	München	14
Chicago	2	Münster	13
Dortmund	8	New York	2
Duisburg	2	Paderborn	2
Erlangen-Nürnberg	5	Pennsylvania	2
Frankfurt (Main)	5	Princeton	2
Freiburg	8	Regensburg	5
FU Berlin	15	Saarbrücken	8
Göttingen	5	St. Gallen	5
Hamburg	9	Stanford	2
Hannover	5	TU Berlin	11
Harvard	2	TU Hannover	2
Heidelberg	9	Tübingen	7
Hohenheim	2	Wien	5
HU Berlin	3	Würzburg	2
Innsbruck	2	Yale	2
Karlsruhe	6	unknown	124
Kiel	19		
Köln	9		

3.1 University background

How important is the university background for getting a tenured job? A simple measure to answer this would be to compute the ratio of the number of first-appointees from a given university by the number of PhDs granted by that same university. Is the probability of a PhD from Bonn to find a job higher than the probability of a PhD

from some less prominent university? Unfortunately, we do not have the number of granted PhDs by university. Nevertheless, we know how many new-appointees come from which university. This is shown in table 3.

Some universities are obviously outstanding in the education of to-be professors. At the same time, however, there are also many "small" universities from which future (tenured) professors originate.[4]

3.2 Age

How old are professors when they are appointed for the first time? By first time appointment we understand the first tenured appointment in Germany. Therefore all professors who had a first tenured appointment outside Germany are excluded, i.e. 7% of the 453 professors in our data source. Figure 2 gives an impression of the evolution of the difference between the time of first appointment and the year of PhD. This difference is shown on the vertical axis while the horizontal axis shows the year of the corresponding appointment. It shows a fairly stable average difference of around 8 years since the mid 80s.

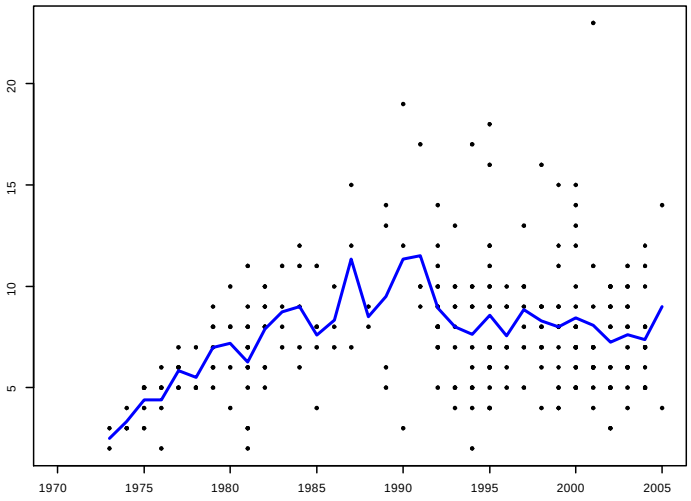

Figure 2 *Difference between the year of first appointment and year of PhD in the year of appointment*

[4]Universities which granted exactly one Ph.D to a German professor are: Alicante, Basel/Cambridge, Berkeley, Cambridge, Columbia, Darmstadt, Paris (Ecole des Hautes Etudes en Sciences Sociales), Eichstaett/Ingolstadt, Essen, Florence (European University Institute), Georgia, Giessen, Kassel, Magdeburg, Rome, Moscow, Northwestern University, Oestrich-Winkel, Oldenburg, Osnabrück, Oxford, Passau, RWTH Aachen, Sussex, State University of New Jersey, Toronto, TU Darmstadt, University of California Santa Cruz, University of North Carolina at Chapell Hill, University of Western Ontario, Uppsala and Warsaw.

The age of the youngest appointees in our sample is 29 in 1990 (i.e. this person became 29 in the year of his appointment); the oldest is 58 in 2005. The latter person had many non-tenured professorships before and habilitation was many years earlier. The increase of the difference during the 1970s might be due to incomplete coverage of careers for this time period in our data set and an expansion of universities at the end of the 1960s and the beginning of the 1970s.

Concerning post-docs, figure 2 provides a deadline at which application for a tenured job should start. Given that the delay between sending an application and being appointed is 1 year and infinity, the average job applicant should start applying 6-7 years after having completed the PhD (i.e. the habilitation should be submitted) or, for those lying in the typical age range, at the age of 35 or 36. As always, exceptions confirm the rule.

3.3 Publications

3.3.1 How important is a publication?

- The number of publications

Any economics professor in Germany would probably agree that publications are the most important criterion for judging the quality of a candidate. Most would also agree that this was less important some 2 or 3 decades ago. To sustain this claim, the following figure looks at the distribution of the number of publications by age groups of currently active professors. To obtain this data, we need the date of PhD and date of birth. This reduces our sample to 229 professors. If publications are more important today than some decades ago, younger professors should publish more than old professors.

Figure 3 focuses on the number of publications per year since the year of PhD, $n_i/\left(2005 - p_i\right)$ where 2005 is the last year covered by our publication data source and p_i the year where the PhD was granted. Hence, whether young or old, we evaluate our claim that the young are (or need to be) more publication-oriented by using a measure of productivity which "filters out" career length. The age of the median professor in 2006 is 52 years, the 33 percentile is 47 years. Hence, we split all professors into 2 groups and define "the young" as the youngest third, i.e. all those who are 47 or younger.

The curves in the figure show which percentage of the groups publish so and so many papers per year. When we take the young group as an example, point A shows that around 40% of the young professors publish 1 paper or less per year. Or, put differently, more than 60% publish one paper or more per year. Only 21% (point B) publish 2 papers or more per year. Concerning the old, less than 20% (point C) publish 1 paper or more and only less than 3% publish 2 or more (point D). What is true for these 4 points also holds generally: The young are always more productive than the

old group. On average the young publish 1.4 articles per year in contrast to 0.48 for the old.[5]

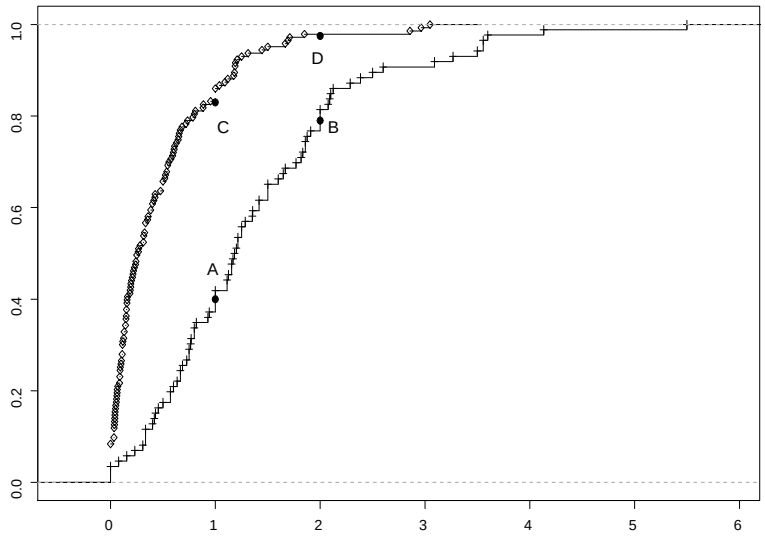

Figure 3 *Annual number of publications of the young (cross) and the old (circle)*

- The quality of publications

Any researcher would probably also agree that a publication is not as good as any other. There are differences in quality. A publication in a frequently cited journal is of higher value than a publication in a journal that does not receive as much attention. Similarly, a publication of 30 pages is worth more than a short note of 4 pages. Accepting these arguments creates many practical problems: How to measure quality and quantity? Should the number of words in a publication be counted, should the number of coauthors be taken into account? What about quality differences within a journal?[6]

[5] We agree that this finding could be entirely driven by life-cycle effects. If an individual is more productive while young, it is obvious that productivity per year falls over time. We believe that the findings in the figure can not entirely be traced back to productivity over the life cycle but are partly driven by differences in publication orientation over time. This conclusion is perfectly in line with with the results presented in Rauber and Ursprung (2007).

[6] All these aspects have been discussed extensively elsewhere and we refer the interested reader to e.g. Diamond (1988), Kalaitzidakis, Mamuneas and Stengos (2003), Bauwens, Lubrano, Kirman and Protopopescu (2003) and Combes and Linnemer (2003). All these studies have in common that they are all based more or less on a journal weighting scheme on the basis of citation analysis. A completely different approach to evaluate the quality of journals was applied by Bräuninger and Haucap (2001,2003). Their journal weighting scheme was developed on the basis of a survey among the members of the Verein für Socialpolitik - the German association of academic economists.

We solve these problems (or cut the Gordian knot) by adjusting publications both with respect to quality (which type of journal) and quantity (number of pages and coauthors). We will therefore not talk about number of publications of a person but quality index of a person. Our equation defining the quality index q_i is

$$q_i \equiv \Sigma_{k=1}^{n_i} \frac{p_k}{\sqrt{a_k}} w^k. \tag{1}$$

The quality index sums over all the n_i articles published by individual i in and before a certain year. An article k has p_k pages, is written by a_k authors (including the author under consideration) and is published in a journal with quality weight w^k. This weight w^k is taken from Combes and Linnemer (2003), see section 2.1.

As the index q_i will give some number but the number per se does not provide a lot of information, we construct standardized quality indexes. We use two standards, the Top 5 standard and the European Economic Review (EER) standard. The idea is to obtain a number that says how many (standardized) articles (20 pages of length and one coauthor[7]) an author needs to have published in Top 5 journals or in the EER such that these hypothetical publications corresponds in quality to his actual publications.[8] We believe the standardized indexes are more informative than the ones usually used and propose

$$q_i^{Top5} = q_i / \left(\frac{20}{\sqrt{2}} w^{Top5} \right),$$

$$q_i^{EER} = q_i / \left(\frac{20}{\sqrt{2}} w^{EER} \right) = \frac{3}{2} q_i^{Top5}. \tag{2}$$

An author having a quality index q_i from (1) would have the same quality index if he had published q_i^{Top5} articles (with 20 pages and one coauthor) in Top 5 journals or q_i^{EER} articles in the EER (or journals of similar quality). An article in a Top 5 journal is ceteris paribus worth 50% more than an article in the EER. An index of e.g. $q_i^{EER} = 4$ means that individual i has published papers with a quality equivalent to 4 standardized EER publications or 2.67 standardized Top 5 publications. Her quality index on the Top 5 scale would be $q_i^{Top5} = 2.67$. It is lower than on the EER scale as the requirements of the Top 5 scale (the weights) are higher.

[7] The average number of pages in journals with EER quality weight over our sample length is 17.3 pages written by 1.7 authors.

[8] Given the journal weights we use, Top 5 journals are the American Economic Review, Econometrica, Journal of Political Economy, Quarterly Journal of Economics and Review of Economic Studies. Journals which have the same weight as the EER are Econometric Theory, Games and Economic Behavior, International Economic Review, Journal of Business and Economic Statistics, Journal of Econometrics, Journal of Economic Theory, Journal of Finance, Journal of International Economics, Journal of Labor Economics, Journal of Monetary Economics, Journal of Money, Credit and Banking, Journal of Public Economics, Journal of the American Statistical Association, RAND Journal of Economics and Review of Economics and Statistics.

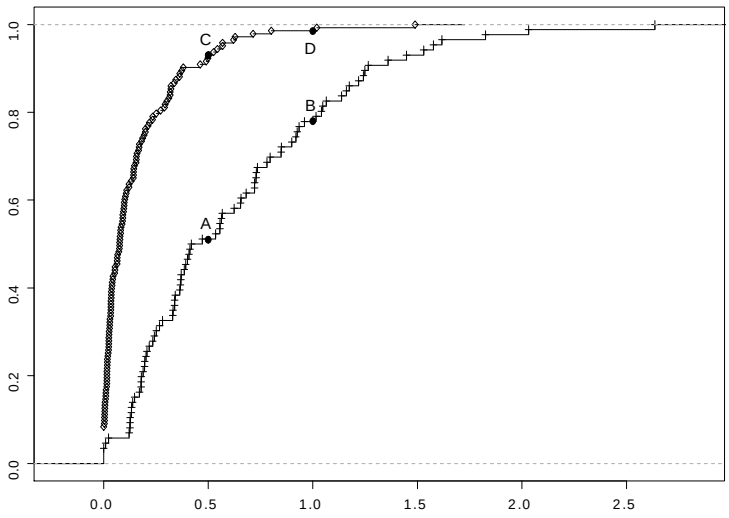

Figure 4 *EER standard article- productivity of the young (cross) and the old (circle)*

Let us now analyze publication habits of the young and the old by employing the EER measure. The vertical axis in figure 4 now plots our productivity measure π_i, the number of EER articles published since the year p_i of the PhD up to 2005,

$$\pi_i \equiv q_i^{EER} / (2005 - p_i) \tag{3}$$

The curves show again the empirical cumulative distribution functions for both age groups.

Our quality measure confirms the findings of figure 3; the young are always more productive than the old. Considering that approx. 50% of the young age group publish more than half an EER standard article per year (point A) in contrast to less than 10% of the old (point C). Moreover, more than 20 % of the young group publish more than one EER standard article per year (point B), but only less than 3% of the old age group publish the same amount per year (point D). On average, a young professor publishes 0.63 EER standard articles per year in contrast to 0.15 EER standard articles for an average old professor.

Comparing figure 4 with figure 3 shows two things: First, the variation in quality is higher than the variation in quantity. Taking the coefficient of variation (CoV) as a measure of inequality, we see that taking quality differences into account, there are larger differences across professors than when we just look at the productivity in view of the total number of publications. The CoV for quality-productivity for the old group is 1.4 in contrast to 1.19 for the same group for quantity-productivity. For the young, we obtain the same pattern: the CoV for quality-productivity is 0.82 in contrast to

0.73 for quantity. Second, the difference across age groups increases. While the average productivity in terms of number of publications of the young group was about 193% higher than the productivity of the old, the average EER standard article productivity is 306% higher.

We conclude from this that publications became more important over time and that quality adjustment allows for a better distinction across individuals. The latter makes a selection procedure easier and more transparent.

3.3.2 Publications of newly appointed professors

We now turn to our main group of interest, the just-appointed professors. The following figure plots the year of appointment on the horizontal axis and - to start with - simply the (unweighted) number of publications on the vertical axis. Each dot corresponds therefore to one appointment.

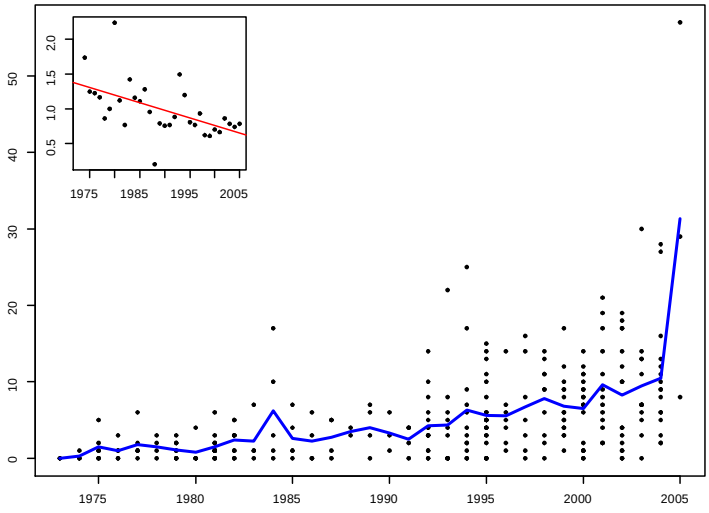

Figure 5 *Number of publications in year of appointment*

Taking into account individuals with a PhD after 1970 and without previous appointments abroad, our sample reduces from 323 in table 2 to 275 professors. When we look at all newly-appointed over all years in our sample, there are 170 professors (more than 60%) who had 5 or less publications; almost 8 % had 15 publications or more. When we ask whether there is a time trend, the solid line indicates a steady increase over time. The upper left figure in figure 5 shows that the CoV fell over time. Hence, in terms of number of publications, heterogeneity falls but the average number rises.

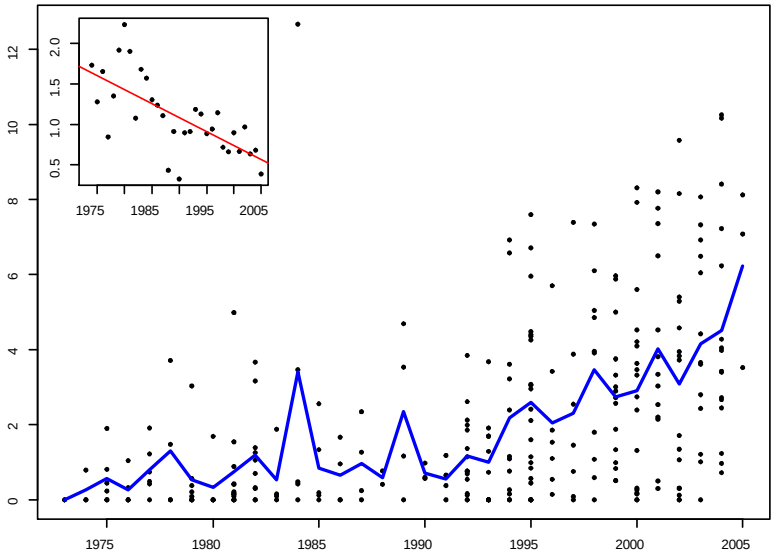

Figure 6 *Number of EER standard articles in year of appointment*

Following our belief that the quality index is more important, figure 6 shows the distribution of our standardized quality index q_i^{EER} for the just-appointed. Comparing figure 6 with figure 5 shows that there is an increase in average quality over time as well. While before the 1990s the typical newly-appointed had around 0.93 EER papers, afterwards, the average number of standardized EER papers is 2.8.

Given the relatively large differences within a year with respect to quality-adjusted output, one might want to know what the strategies of "the stars" are. If we look at appointments in 2004 and compare the top two appointments in this year (both over 10 standard EER papers) we find heterogeneity there as well. At the risk of overstating the differences, there seem to be clear differences in strategy: One person had a lot of articles with average quality and thereby obtained a quality index of over 10 mainly through quantity. The other person had relatively few papers but many of them in EER-type or Top 5 journals.

The increase in average quality came along with a decrease in heterogeneity among the just-appointed (but not among all professors as figure 4 above has shown). The upper left figure in figure 6 shows that the CoV fell over time. The rise in average quality is therefore not the result of one or two individuals who are outstanding in each year but the result of an upward shift of the entire distribution.

4 Robustness and the future

4.1 Does it matter which field you are in?

How informative are results which are computed across all fields of economics? Can one compare subdisciplines like econometrics, public finance and economic policy? We now differentiate between 7 subdisciplines, namely microeconomics (10.6% of all non-vacant chairs in 2006), macroeconomics (13.7%), international trade (8.7%), public finance (15.4%), economic theory (12%) economic policy (including economic history) (22.1%) and econometrics (including applied econometrics) (17.6%). In our sample, 88.6% of the chairs could be classified into these subgroups.[9]

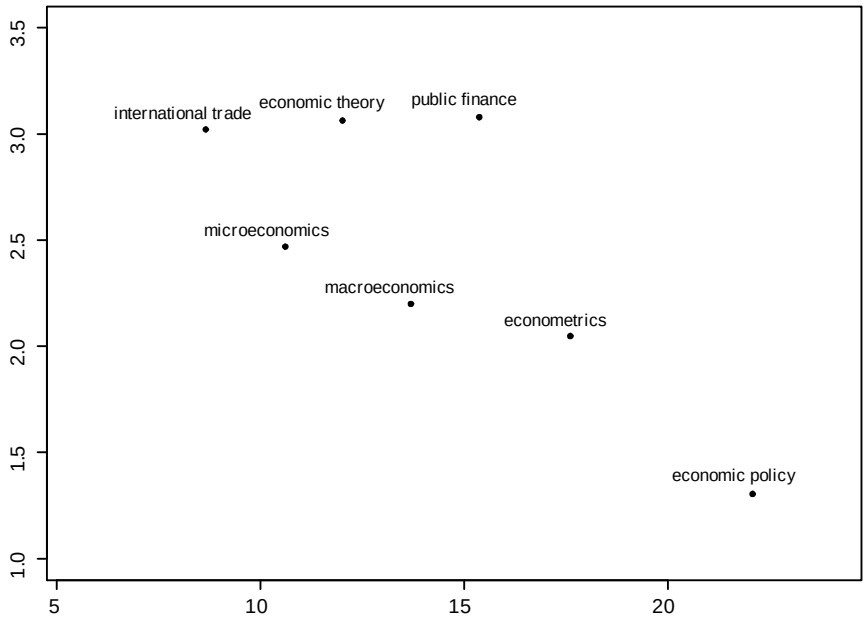

Figure 7 *Competition in various fields*

The difference in the average number of EER standard articles, as defined above in (2), for first appointments across these disciplines is striking. Figure 7 plots the percentage of chairs in a certain field on the horizontal axis. The vertical axis plots the average number (over the entire sample period) of EER standard articles q_i^{EER} from (2) of newcomers by fields. In the top left corner, there are the highly competitive fields: low percentage (rare openings) and high quality (strong competitors).

[9] This classification was made by looking at the official names of the chairs. Clearly, some ambiguities had to be taken into account.

As one can see, the most competitive fields are international trade, economic theory and public finance. Obviously, the least competitive field is economic policy. In public finance, newcomers are very strong (the average over 1969 to 2005 are 3.1 EER standard articles), in contrary to newcomers in the field of economic policy (1.3 EER standard articles). The number for econometrics needs to be looked at with some caution. Some econometricians publish in journals which are highly regarded in these fields but are simply not covered in standard economic rankings. An extension of the Combes and Linnemer list would be useful for this purpose. Nevertheless, the advice for all post-docs seems obvious - work on economic policy and publish well.

4.2 What will be in some years from now?

We have focused so far mainly on averages over the entire period of observation or on quantities in certain years. What is more important for a post-doc today is to know how the world will look like in 2, 5 or 10 years from now. Below we go over several econometric models capable of providing the answer.

4.2.1 Linear regression analysis

The easiest way to predict future values of the quality index is to consider a linear regression equation

$$q_i = \mathbf{x}_i'\beta + \varepsilon_i \tag{4}$$

that formalizes the index as a function of a year of appointment and of the rest of personal characteristics of a newly appointed professor. From Figure 6 we see that there exists a clear non-linear dependence between the quality index and the time the tenure track starts. Two different specifications can be immediately suggested. First, the year of appointment can enter equation (4) as a polynomial of order two. This will lead us to a regression equation

$$q_i^{EER} = \beta_0 + \beta_1 Year_i + \beta_2 Year_i^2 + \mathbf{z}_i'\gamma + \varepsilon_i, \tag{5}$$

where $Year_i$ stands for the year of appointment of the i-th individual and $\mathbf{z}_i$ contains the rest of the characteristics of this individual. The second way to formalize the dependence observed in Figure 6 is to suggest that the development of the quality index features a structural break. Figure 6 further tells that year 1990 can be easily taken as a break point. Assuming that the coefficients after the break do change we can write down the following specification

$$q_i^{EER} = \begin{cases} \beta_0^{(b)} + \beta_1^{(b)} Year_i + \mathbf{z}_i'\gamma^{(b)} + \varepsilon_i, & \text{if } Year_i \leq 1990 \\ \beta_0^{(a)} + \beta_1^{(a)} Year_i + \mathbf{z}_i'\gamma^{(a)} + \epsilon_i, & \text{if } Year_i > 1990 \end{cases} \tag{6}$$

where superscript (b) refers to coefficients before the break and superscript (a) refers to coefficients after the break.

Estimation results for both of these specifications are presented in Table A.1 of the Appendix. The vector of additional characteristics $\mathbf{z}_i$ includes such variables as age of a newly appointed professor, difference between the year of appointment and the year of graduation and the set dummies that indicate the field of affiliation.[10] Considering the results for specification (5) reported in the first two columns of Table A.1 we see that indeed there exists a positive significant dependence between the year of appointment and the magnitude of the index. However, adding the quadratic term for the year of appointment does not improve the fit of the model and makes both $Year_i$ and $Year_i^2$ insignificant. This implies that non-linearity of time dependence of the index should be considered in the framework different from that of (5). Analysis of the estimation results for the alternative specification (6) confirms this implication. From the last two columns of Table A.1 we see that before 1990 the coefficient for the "year of appointment" variable was not significantly different from zero. After 1990, however, we already observe a positive significant relationship.

To show the existence of a break formally we may consider the hypothesis of a joint pairwise equality of the coefficients estimated before and after the break. Wald test statistic for this hypothesis is 22.91; with 11 degrees of freedom and critical value of 19.68 we reject the hypothesis of the pairwise equality and indeed establish the existence of a structural break. Nevertheless, the specification with a break still does not provide a satisfactory enough fit to the data, which can be seen from the R^2 measures for the "before 1990" and "after 1990" parts of the sample (0.14 and 0.33 respectively). The reason for such low values of R^2 is the excessive number of zero outcomes of the index. This is especially true for the earlier times, when pursuit of EconLit enlisted publications was not a top priority. To formulate a model that suits the data better then the one in (6) we need to address the modelling of the zero outcomes of the index explicitly.

4.2.2 Nonlinear regression analysis

Considering the distribution of the quality index, we see that the index permits both zero and non-zero outcomes. In addition to that the zero count is substantial, making about 20% of the entire sample. This fact suggests a hurdle model as a natural alternative candidate for the accurate econometric specification.[11] Within the framework of a hurdle model, zero outcomes of the index can be viewed as a strategic decision of a post-doc not to pursue publication exclusively in the range of EconLit journals. Observing $q_i = 0$ means that a post-doc rather concentrates on the rest of academic and policy-oriented journals, investing more time in other relevant for the prospective

[10] As we need several personal data, our sample of originally 280 individuals for which we had (some) information from CVs, reduces to 220 individuals for which we have all information we need for our regressions.

[11] The model was originally introduced by Cragg (1971) and has got a widespread application in many fields thereafter. As it will be demonstrated below, our final specification is nothing but the model shown in Equations (7) and (11) in Cragg (1971), p.831-832.

tenure activities (e.g., enhancing the quality of own teaching). Otherwise, in case the decision to concentrate on EconLit publications is made, the zero-hurdle is crossed and we observe a positive value of the index.

To write down the likelihood function for this model let us define the indicator function d_i which takes value "1" if the quality index q_i is positive and value "0" otherwise. Assuming that the decision to pursue EconLit publications and the distribution of the positive outcomes of the quality index q_i are governed by two independent processes, we get the following individual contribution to the likelihood

$$\ell_i = \left[F\left(q_i = 0|\mathbf{x}_i, \theta_1\right)\right]^{1-d_i} \left[\left[1 - F\left(q_i = 0|\mathbf{x}_i, \theta_1\right)\right] g\left(q_i|q_i > 0, \mathbf{x}_i, \theta_2\right)\right]^{d_i}. \tag{7}$$

In the individual contribution above, $F\left(q_i = 0\right)$ is a probability of being absent from publishing in EconLit range and $g\left(q_i|q_i > 0\right)$ is a probability density of positive outcomes of the index. Without loss of generality, the publication decision can be described by a simple Probit. For the distribution of the values of q_i, any distribution defined on $\mathbb{R}^+$ can be taken. In the present application, we will experiment with lognormal and gamma distributions.

As before, we use q_i^{EER} as a dependent variable. For the above described set of explanatory variables $\mathbf{x}_i$ plus an additional dummy variable that shows appointment after 1990, we estimate the model (7) assuming gamma and lognormal distributions for $g\left(q_i\right)$. To decide which of the distributions provides the best fit to the data, we apply a chi-square goodness of fit test developed by Andrews (1988).[12] Table 4 shows the test results. It turns out that the lognormal specification is more accurate in fitting the values on the upper and lower ends of q_i^{EER}. Consequently, it passes the goodness of fit test which underlines a very high explanatory power of the hurdle model with lognormal positive part. Gamma specification, to the contrary, is rejected by the test.

Table 4: Model selection

Specification	χ^2 Test Stat.	DF	p-Value
Lognormal	10.445	8	0.235
Gamma	22.458	8	0.004

With these results our final specification is

$$\ell_i = \left[1 - \Phi\left(\mathbf{x}_i'\beta_1\right)\right]^{1-d_i} \left[\Phi\left(\mathbf{x}_i'\beta_1\right) \lambda\left(q_i^{EER}|\mathbf{x}_i'\beta_2, \sigma_2^2\right)\right]^{d_i}, \tag{8}$$

[12] To perform the test we partition the data according to quintiles of the distribution of q_i^{EER} and the time of appointment (before and after 1990). The relevant test statistic is given in the Equation 3.18 in Andrews (1988), p.1435.

Table 5: Estimation results for the EER standardized quality index

	Parameters					
	θ_1	Std.Error	p-Value	θ_2	Std.Error	p-Value
year of appointment [a)]	0.109	0.029	0.000	0.071	0.015	0.000
appoint. after 1990	−0.988	0.503	0.049	−0.011	0.264	0.967
age	−0.038	0.040	0.343	−0.001	0.032	0.982
difference	0.043	0.055	0.442	−0.088	0.037	0.018
Public Finance	1.134	0.437	0.009	0.923	0.339	0.006
Macroeconomics	0.582	0.410	0.155	0.407	0.336	0.226
Microeconomics	0.614	0.468	0.189	0.681	0.383	0.075
International Trade	1.321	0.554	0.017	0.932	0.365	0.011
Economic Theory	1.745	0.658	0.008	0.729	0.350	0.037
Econometrics	0.803	0.462	0.082	0.494	0.353	0.162
Economic Policy	0.716	0.415	0.084	0.317	0.333	0.341
intercept	−0.382	1.159	0.742	−1.120	1.011	0.268
σ				0.968	0.049	0.000
			Observations:	220		
			log-Likelihood:	−407.44		

[a)] *Year of appointment is the actual year minus 1970.*

where $\Phi(\cdot)$ stands for the c.d.f. of the standard normal distribution, $\lambda(\cdot)$ is the p.d.f. of the lognormal distribution; $\theta_1 = \beta_1$ and $\theta_2 = [\beta_2, \sigma_2]$. It is also easy to see that the conditional mean of the hurdle model with lognormal positive part is expressed by

$$E(q_i^{EER}|\mathbf{x}_i) = \Phi(\mathbf{x}_i'\beta_1) \exp\left\{\mathbf{x}_i'\beta_2 + \sigma_2^2/2\right\}. \tag{9}$$

Knowing the estimated values of β_1, β_2 and σ_2 we can use (9) to track the evolution of the expected value of the index in the near future.

Estimation results for the model (8) are presented in Table 5. The results are perfectly in line with the earlier discussion of the behaviour of the quality index. First of all, for the year of appointment we see that the estimates of both β_1 and β_2 are positive and significant at 5% level. This means that the expected value of the index increases with time and one needs to be prepared to publish more in future. In addition, there will be more and more people in the future who will opt for pursuing publication in journals encompassed by EconLit. Interesting enough, if we consider the effect of the

difference between the year of graduation and the year of appointment, the estimated value of β_2 is negative significant, but the estimated value of β_1 is not significantly different from zero. Insignificance of β_1 implies that the duration of the spell between the graduation and the appointment has no impact on the decision of pursuing EconLit publication strategy. This result is quite logical because in the framework of the model the individuals do not revise their decisions. At the same time, considering the expected value (9) of the q_i^{EER}-index we see that insignificance of β_1 still does not imply that marginal effect of the difference between graduation and appointment on $E(q_i^{EER})$ is zero. With negative significant value of β_2 we see that among any two applicants in one and the same year and one and the same field the applicant who has graduated earlier is expected to have a lower value of the EER standardized index. Finally, addressing the dummies for the fields we see that for Public Finance, International Trade and Economic Theory both β_1 and β_2 are positive and significant at 5% level. This implies that in these fields more applicants put a significantly higher value on publishing. As a result, the expected value of the quality index for these disciplines is higher than in the rest of the fields.

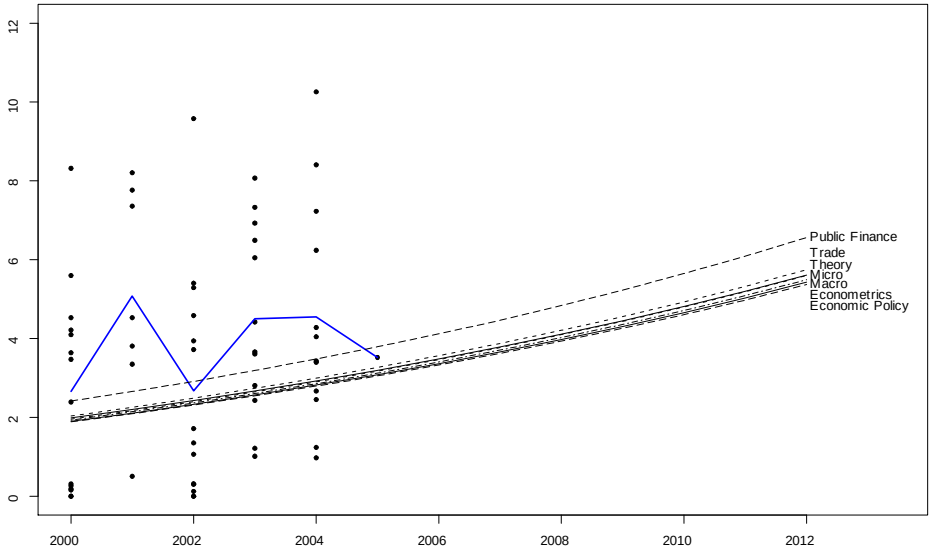

Figure 8 *Future requirements expressed in EER-standard articles*

Lest us now use the results in Table 5 and the expression for the conditional mean in (9) to predict the number of EER standard articles $\widehat{q}^{EER}$ for every field in any year of appointment. In particular, we would like to know how large the expected value of the index will be in every field in the near future. Figure 8 shows the results of such prediction for the period from 2000 to 2012. As one can see, the requirements

for getting tenured increase and can be expected to continue to differ across the fields. On average, by 2010 a appointed professor in any field other than Public Finance is expected to have 4.75 EER standard articles. In Public Finance this value goes up to 5.6 articles. In 2012, which is exactly five years since now and seven years from the date of the last observation, an applicant in any field should be well equipped with above 5 EER standard articles. In Public Finance this amount rises to more than 6 articles.

As time goes by, the model becomes less accurate in prediction. The reason is that positive significant coefficients for the year of appointment will always imply an increasing convex dependence between the time and the expected value of the index. Reevaluation of the model in the next five to seven years may discover the reverse trend and show at which value the quality index levels off. Nevertheless, the benchmark of at least 5 EER standard articles for the near future, which corresponds to 3.6 single-authored EER articles or 2.4 single-authored Top 5 articles, is unlikely to be reverted and is to be taken seriously.

Any post-doc who would like to check whether he or she exceeds the average or how much is missing can go to our website www.HowToGetTenured.de. It allows to easily compute the individual quality index q_i^{EER} from (2) by typing in individual publications. This allows each post-doc to position his or herself in figure 8.

5 Conclusion

The objective of this article is to describe characteristics of tenured professors in economics in Germany in the year of their first appointment. We provide information on the average age and age distribution of newly appointed professors as well as on years since their PhD, their educational background and the number of their publications along with the impact factor (quality adjusted number of publications). We also differentiate characteristics across fields and universities where they were hired.

We find that publishing five EER standard articles is a reasonable benchmark for an ambitious post-doc. A good advise is to start applying by the age of 34 - 35 (or 4-5 years after the PhD) with a quality index 1 or 2 points below the average valid in her field in the year she wants to get appointed. It should be taken into account, however, that we look at papers which are published in the year of appointment. As there is often a delay between application and the year of appointment, the numbers given here are higher than the numbers at which we would expect the applications to start (or the "Habilitation" to hand in). Papers that are accepted for publication should be counted like publications as they will in most cases be published by the time of the appointment.

If one mostly works alone, the numbers given so far can all be divided by $\sqrt{2}$. Longer papers count more. Needles to say, however, that this is only a rough indication. In the end, it is the general view of the appointing committee that counts. Those interested

to know exactly where they stand, how far are they away or by how much do they exceed the average can go to the internet site www.HowToGetTenured.de. By typing in the name of the journal, year of publication, number of coauthors and number of pages, the personal quality index q_i and individual productivity will be computed. This might encourage post-docs to do good work and potentially also individuals who are abroad to apply for jobs in Germany.

References

Andrews, D. W. K. (1988): "Chi-Square Diagnostic Tests for Econometric Models: Theory," *Econometrica*, 56, 1419–1453.

Bauwens, L., M. Lubrano, A. Kirman, and C. Protopopescu (2003): "Ranking Economics Departments in Europe: A Statistical Approach," *Journal of the European Economic Association*, 1(6), 1367–1401.

Bommer, R., and H. W. Ursprung (1998): "Spieglein, Spieglein an der Wand. Eine publikationsanalytische Erfassung der Forschungsleistungen volkswirtschaftlicher Fachbereiche in Deutschland, Österreich und der Schweiz," *Zeitschrift für Wirtschafts- und Sozialwissenschaften*, 118(1), 1–28.

Borchert, M., and H. Gülicher (2000): "Berufungschancen künftiger Habilitanden im Fach Wirtschaftswissenschaften," *Wirtschaftswissenschaftliches Studium WiSt*, ?, 414 ff.

Bräuninger, M., and J. Haucap (2001): "Was Ökonomen lesen und schätzen: Ergebnisse einer Umfrage," *Perspektiven der Wirtschaftspolitik*, 2(2), 185–210.

——— (2003): "Reputation and Relevance of Economics Journals," *Kyklos*, 56, 175–198.

Combes, P.-P., and L. Linnemer (2003): "Where are the economists who publish?- Publication Concentration and Rankings in Europe Based on Cumulative Publications," *Journal of the European Economic Association*, 1(6), 1250–1308.

Cragg, J. G. (1971): "Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods," *Econometrica*, 39, 829–844.

Diamond, A. M. (1989): "The Core Journals in Economics," *Current Contents*, 21, 4–11.

Heining, J., J. Jerger, and J. Lingens (2007): "Success in the Academic Labour Market for Economists - The German Experience," *Mimeo University of Regensburg*.

Hochschulverband (2007): "Universitäten in Deutschland," *http://www.hochschulverband.de/cms/index.php?id=102 (download on 27.3.2007).*

Kalaitzidakis, P., T. P. Mamuneas, and T. Stengos (2003): "Rankings of Academic Journals and Institutions in Economics," *Journal of the European Economic Association*, 1(6), 1346–1366.

Rauber, M., and H. W. Ursprung (2007): "Life Cycle and Cohort Productivity in Economic Research: The Continental European Experience as Exemplified by the Case of Germany," *Mimeo University of Konstanz.*

Ursprung, H. W., and M. Zimmer (2007): "Who is the "Platz-Hirsch" of the German Economics Profession? A Citation Analysis," *Mimeo University of Konstanz.*

Appendix

Table 6: Estimation results for linear regressions[a)]

	Model (5)		Model (6)	
	Coeff.	Coeff.	before '90	after '90
year of appointment[b)]	0.141	0.059	0.108	0.222
	(8.95)	(0.68)	(1.87)	(4.92)
year of appointment squared		0.002		
		(0.98)		
age	−0.054	−0.052	0.047	−.083
	(−0.80)	(−0.77)	(0.49)	(−0.89)
difference	−0.130	−0.117	−0.111	−.130
	(−1.59)	(−1.41)	(−0.84)	(−1.12)
Public Finance	1.889	1.901	1.407	2.117
	(3.26)	(3.28)	(1.95)	(2.40)
Macroeconomics	0.850	0.867	0.177	1.140
	(1.45)	(1.48)	(0.23)	(1.31)
Microeconomics	0.820	0.809	1.239	0.260
	(1.27)	(1.25)	(1.52)	(0.27)
International Trade	1.755	1.709	1.456	1.766
	(2.68)	(2.61)	(1.57)	(1.92)
Economic Theory	1.590	1.586	0.776	1.999
	(2.41)	(2.40)	(0.89)	(2.08)
Econometrics	0.626	0.635	0.234	0..701
	(1.01)	(1.02)	(0.25)	(0.79)
Economic Policy	0.443	0.468	0.690	0.216
	(0.77)	(0.81)	(0.89)	(0.25)
intercept	1.027	1.511	−2.009	−.245
	(0.51)	(0.72)	(−0.68)	(−0.08)
R^2	0.344	0.347	0.143	0.326
Observations:	220	220	76	144

[a)] t-Statistic in parenthesis

[b)] Year of Appointment is the actual year minus 1970