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No longer top of the class: Professorial salaries in the 20th century

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No longer top of the class: Professorial salaries in the 20th century in Germany

Alexander Sohn

Abstract

Using individual income data from university archives, we look at the development of professorial salaries over a time-span covering the *Kaiserreich*, the Weimar Republic, the Third Reich as well as the Federal Republic of Germany. We find that relative salaries have fallen dramatically, both with respect to other highly qualified labour and to the average income of labour. We also find that inter-discipline dispersion among professorial salaries has decreased and that conversely to today it was professors in the social sciences rather than the natural sciences who earned the most.

JEL-Classification: J24, J31, J42, J45, N 34

1 Introduction

The 20th century is often acclaimed to be the "century of human capital" (see Goldin, 2001, p.256). However, very few comprehensive long-run empirical studies concerning the remuneration of a vital contributor to the formation of human capital, the professor, have been undertaken for Germany. Given the great importance that science has had for Germany's economic development during that century this is surprising. The only study which has attempted such a long-run empirical analysis from an economic perspective is by the Hungarian born, American economist Scitovsky (1966), who finds that professorial together with other professionals' salaries have declined relatively to the per capita income. Very recently Maus (2013) has published an extensive account of professorial income which only covers the salaries of law professors up to the first half of the century though. Our study tries to both broaden and deepen the analysis of professorial salaries over the duration of the 20th century.[1]

Using individual income data from university archives, we are able to shed some light on the income distribution of professors at various points in time. Especially we focus on the development of professorial salaries in comparison with the development of top incomes in Germany. This allows us to compare the incomes of highly skilled professionals both within and outside the academic

We thank the German Research Foundation for the funding of our project and the visited university archives for their friendly support. Moreover, I want to thank Jan-Otmar Hesse and Kerstin Hoffmann for their helpful comments.

[1] As the definition of what constitutes a professor is somewhat unclear and has varied over time (see Lehrich, 2006), we solely concentrate on the highest rank of the professor, the *Ordinarius*, *ordentlicher Professor* or full university professor receiving a salary of the C4 or W3 classification.

labour market. Our results show a sharp decline of professors' salaries relative to other incomes over the century, which is even sharper than the decline put forward by Scitovsky (1966).

We thus add to the literature on economics of education in general and the analysis of academic labour markets in specific (e.g. Belfield and Levin, 2003). Most of that literature has concentrated on the American academic labour market (see among others Tuckman et al., 1977; Ransom, 1993; Ehrenberg, 2003; Pherson and Schapiro, 2006). These studies agree that in general the market mechanism of supply and demand plays a significant role in the determination of the salary, although they vary in the degree that they assign to market imperfections. However, Ben-David and Zloczower (1961, p.309) note that the European institutions are much more bureaucratic than the rather market based American system. Unfortunately, much less research has been dedicated to looking at the European academic labour markets in specific. The most comprehensive study of a European academic labour market was undertaken by Williams et al. (1974), who looked at the British academic labour market. In our analysis we pay tribute to the specificities of the German academic labour market which evolved in arguably the most tumultuous century yet experienced in central Europe, while also drawing on the existent literature on academic labour markets. Especially the notion of universities exercising monopsony power will be employed in our analysis of the German academic labour market (Manning, 2003; Hirsch et al., 2010; Falch, 2010, see among others).

The structure of this paper is as follows: First, we discuss our data on professorial salaries. Subsequently, we portray results from our data and discuss the reasons for the decline of professorial salaries which we observe. Additionally we discuss the inter-discipline differences in pay. In the last section we conclude.

2 The database for professorial salaries

The yearly income of German professors can be divided into five components. The basic salary of professors was generally within the boundaries of the remuneration classification of German higher civil servants. Secondly, the state paid allowances to professors and other state employees which depended on the regional price level and family situation. The third component, the so called *Kolleggelder* (KG)[2], were individual tuition fees paid until the nineteen-sixties by the students to the professor whose classes they would attend[3]. In addition to these, professors could also receive payment for different additional administrative tasks at the university, like the dean's office, or up to the nineteen-thirties for taking Ph.D.-examination. Lastly, the professor can of course pursue additional income sources outside university like writing reports, sitting on supervisory boards or registering patents. For the last component our data only yields very sketchy information, so that

[2]The name of these fees changed over time. They were frequently also called *Unterrichtsgelder*.

[3]Although we only consider gross incomes here it is worthwhile to note that the *Kolleggelder* were tax-exempted revenues until 1897 (Maus, 2013, p.185).

our study concentrates on professorial income received from the primary employer. Likewise, our information on the fourth component is equally scarce, but since this source of income generally was rather negligible in comparison to the others (at most a few per cent of annual income) we can disregard it, keeping in mind the slight downward bias that this imposes on our results. For further information on these income components see Hesse (forthcoming). In the following, we will thus investigate the development of annual gross salary received by the professor for his primary occupation at university.[4]

For the construction of our database containing these professorial incomes, we have visited 15 university archives. For each of these universities we originally tried to obtain information about the income on two professors for each of six discipline groups for seven selected time periods spanning nearly the whole century. These subject groups are Law, Economics, Engineering, Medicine and Chemistry and a mixture of subjects representing the humanities, including Philosophy, History and Modern Philology and thus abbreviated PHP in the following. The time periods are are 1908-10, 1926-28, 1933-36, 1953-55, 1963-65, 1976-78 and 1985-87. The professors for which the information was to be obtained were selected randomly from the relevant faculties in the staff-listings using a random numbers generator in `R` (R Core Team, 2012), thus ensuring random selection of a professor at a given university and a given discipline group. We then looked at the personal files, the remuneration files as well as the cash registers of the university for each professor. If all three were existent and accessible we obtained a complete set of income components.

Unfortunately the data basis is rather scarce. Of the over 1200 observations we would have obtained in an ideal world[5] many files were not existent or didn't contain any information on the income for the relevant time periods. Especially from the late sixties onwards we encountered severe difficulties as German legal restrictions prohibited us from looking at the files of some of the professors active at the time. For the eighties the problems were even so severe, that we have to omit this period from our analysis. For the restricted time period up to the eighties we found files for 443 professors. Despite the fact that for some professors we could reconstruct the basic salary and the living allowance if we knew the seniority and the number of children, the number of observations melts down to 234 if we only take the observations into account for which complete income information, i.e. observations for which all four university-related components are available. The chief culprit in this regard is the relative difficulty to obtain the individual tuition fees, which for some universities and periods are no longer existent.[6] We thus have to note that data cannot strictly speaking be considered random. While within a given university or rather a given faculty one could argue that missing files result from a more or less random process with no apparent

[4]We thus ignore differences to in the social security and pension structure of the professor. Especially in comparison to other occupations this implies a downward bias with respect to net- and lifetime incomes respectively.

[5]No. of Observations = Universities * Time periods * discipline groups * 2 = 15 * 7 * 6 * 2 = 1260

[6]For a tabulation of the available observations with regard to university, time period and discipline group, see the Appendix.

structural selection this cannot be said for professors across various universities. In general the files of professors for a given time period are clustered at some specific universities, so that observations are not independent of one another leading to problems with selection bias. Nonetheless, as with any sparse data we must make assumptions which may stretch the true nature of the past just as the nature of the past has stretched our data basis to be as thin as it is. For more discussion on the nature of the data see the appendix.

3 Professorial salaries in Germany

In Table 1 we give the weighted arithmetic mean for each subject from 1908-10 to 1963-65 from our sample.[7] Each mean is denoted in the currency of the time and rounded to the nearest 100 units of that currency. In addition, we also provide the relation of the salaries to the average income of an employee (RAY) [8] as well as the relation to the threshold to the top 1% of incomes as estimated by Dell (R99)[9].

Table 1: Discipline-dependent mean salaries

Time Period	Chem	Eng	Med	Law	Econ	PHP
1908-1910	9,200 M	7,500 M	8,700 M	13,000 M	N.A.	9,300 M
RAY						
R99	117%	95%	109%	164%		117%
1926-1928	18,100 RM	18,900 RM	12,900 RM	24,400 RM	22,300 RM	13,900 RM
RAY	866%	904%	616%	1169%	1069%	664%
R99	171%	179%	122%	232%	212%	131%
1933-1936	14,000 RM	12,600 RM	12,200 RM	13,200 RM	12,900 RM	11,000 RM
RAY	810%	728%	703%	764%	747%	638%
R99	154%	139%	134%	145%	142%	121%
1953-1955	22,300 DM	N.A.	21,400 DM	22,700 DM	24,200 DM	20,200 DM
RAY	554%		543%	568%	590%	538%
R99						
1963-1965	38,400 DM	37,800 DM	29,900 DM	45,900 DM	42,700 DM	43,200 DM
RAY	449%	442%	349%	536%	499%	505%
R99	75%	74%	59%	90%	84%	72%

Table 1 shows the decline of professors' salaries with respect to average incomes as well as with respect to their old economic peers. At the beginning of the century the average salary of a professor was normally found in the top 1% of incomes. One professor's income in our sample reached 16,000

[7] For further information see the appendix.

[8] From Bruttolohn-& Gehaltssume pro Unselbstständiger Beschäftigter *Statistische Jahrbücher für das Deutsche Reich und für die Bundesrepublik*. The population was interpolated linearly where necessary.

[9] The value for 1978 was obtained by linear interpolation. It should also be noted that Dell (2007) uses the incomes without capital gains for 1910 and for the time after WWII. For the inter-war period they include capital gains, such that especially the upper income brackets are likely to be higher.

M positioning him well into the top 0.5% of the income distribution.[10]
Somewhat surprisingly the highest relative standing of the professor is found in the years after the Hyperinflation and Alfred Weber (1923) decrying the diminishing income of academia at the annual meeting of the *Verein für Socialpolitik*. All subject-mean salaries are now well within the top 1% of the income distribution. Top incomes in our sample stand at 29,000 RM which was fourteenfold the average income and within the top 0.2% of the income distribution.[11] Thus professors not only had a high social standing (Ben-David and Zloczower, 1961, p.305) they also were among the top earners. Indeed one could argue that the critique by the American economist Laurence Laughlin about his colleagues wishing to "compete with the idle rich" (cf. Stricker, 1988) could also apply for Germany, where professors' salaries were high enough to possibly tempt them into doing just that. Certainly professorial salaries sufficed to put them among the top of their own class, i.e. those people who draw their income mostly from their own labour.
Following the Great Depression the Brüning government imposed deductions on most salaries of state employees of around 20% and were taken over by the Nazis. These reductions also applied to professorial salaries with basic salary and allowances cut. In addition revenues from the KG slumped as the percentage of enrolled students per inhabitant halved (Edding, 1957, p.43) offsetting the 'positive' effect by the racially and politically motivated expulsion of many academics at the time (see Maus, 2013, p.234).
In the first years after WWII, the legislation from 1939 concerning professorial salaries was largely retained. Similarly the numbers of professors hardly moved (cf. Ben-David and Zloczower, 1961, p.305). In 1953 new legislation increasing the basic salaries by around 40% in two steps was introduced. The average professorial salaries in our sample surpassed 20,000 DM, such that we can assume that the average professorial income was still found in the top percentile of the income distribution. However, even the top incomes in our sample of nearly 30,000 DM were only close above the 0.5% threshold, which was still easily surpassed 25 years earlier.
Despite the sharply rising student numbers in the early sixties (Jarausch, 1989) and the induced rise of KG, average professorial salaries had now surely fallen out of the top 1%. While the top incomes in our sample between 55,000 DM and 60,000 DM were still found in the top 1%, they were now no longer members of the illustrious group of the top 0.5%. Thus as the *Kolleggeldreform* ended Professors had already seen a considerable erosion of their salary level. Yet while they had fallen out of the top 0.5%, the KG still allowed some to count themselves among the top 1%.

Unfortunately, we could until now find no information on the remuneration of professors for the 1970s and 1980s, as the personal files were not accessible. We are however confident to find summary information on the matter. But for now we will have to confine ourselves to one point of comparison in the year 2000.
At the beginning of the new millennium the threshold of the most well-off percentile stood at

[10] Findings from Maus (2013) and Hesse (forthcoming) indicate that the absolute income of professors including incomes from sources outside university could substantially raise the professors' income.
[11] For details and the interpolation method use see the appendix.

240,000 DM (Alvaredo et al., 2012)[12]. By contrast the average income of a professor was 141,000 DM (Hofmann, 2001) still putting him in the top 5% of the income distribution. The picture becomes even more drastic, when However, even with the highest possible remuneration of 233,000 DM (Hofmann, 2001) the professor would no longer surpass the threshold to the top 1%.
Similarly in comparison with average incomes we observe a relative decline to the average income (see below). These findings are in line with the findings of Scitovsky (1966); Maus (2013) and others. In the following we will look at each period individually before we return to the greater scheme of things and discuss possible reasons for the overall decline.

4 Reasons for the decline

As pointed out above, the demise of professorial salaries, both with respect to average incomes and top incomes, was a prolonged process. Consequently, it was not one single economic shock or political decision which caused this decline but rather a continuous shift of economic and political circumstances. We will therefore refrain from discussing the individual changes in the legislation which may have affected the salaries in the various time periods which we consider.[13] Rather we will try to give an economic explanation for the long-term demise of professorial salaries. The standard economic explanation brought forward by Scitovsky (1966) and Johnson (1966) is that the salaries of professors fell with respect to average incomes as the supply of human capital outstripped demand. While there certainly seems to be some truth to this story, this does not explain why professorial incomes fell with respect to the salaries of other professionals found in the top 1% of the income distribution, most of who like the professor owe most of their income to their human capital (Dell, 2007, p.383).[14] In the following we will therefore try to point to the main differences in the developments in demand and supply for professors to that of their old economic peers.

4.1 Demand, politics and the professor

Following the ideas of Wilhelm von Humboldt university should unite education and research. In contrast, during his time and thereafter the remuneration of professors was formally divided up into a basic salary and a component distinctly attached to the professor's teaching commitment. The most evident and in terms of magnitude probably most important reason for the decline of the professorial salaries is the decline of the KG, culminating in their abolition in the 1960s.

[12] We used the price index provided in the database to obtain the nominal thresholds and used linear interpolation to obtain the value for the year 2000.

[13] A comprehensive review of the legal changes up to 1945 is given by Maus (2013). A relatively short overview on the second half of the century is found in Blomeyer (2007).

[14] It must be noted that we use a rather undifferentiated concept of human capital here. An attempt to differentiate between academic and non-academic human capital may provide interesting insights into some factor driven pay-differences. But since we do not have much data on this matter, we will have to leave this aspect to the side.

Table 2: Discipline-dependent KG revenues

Time Period	Chem	Eng	Med	Law	Econ	PHP
1908-1910	2,600 M	1,300 M	2,300 M	6,100 M	N.A.	2,200 M
PoS	27%	18%	24%	47%		24%
1926-1928	3,600 RM	5,000 RM	1,400 RM	7,500 RM	6,100 RM	1,800 RM
PoS	18%	25%	10%	31%	27%	13%
1933-1936	3,500 RM	1,800 RM	2,500 RM	2,900 RM	2,300 RM	1,900 RM
PoS	22%	15%	17%	21%	17%	16%
1953-1955	3,200 DM	N.A.	3,000 DM	4,100 DM	4,800 DM	3,000 DM
PoS	13%		13%	17%	20%	13%
1963-1965	8,100 DM	6,400 DM	3,000 DM	9,600 DM	10,600 DM	8,100 DM
PoS	20%	17%	10%	21%	23%	18%

Table 2 display the average KG received by a professor and its corresponding percentage of the professorial salary (PoS) for all six subject groups.[15] The table shows that Scitovsky (1966) underestimates the importance of KG for the salary which in general contribute well above 10% to the professorial income.[16] Over the period under consideration the importance of KG varied, hovering between 15-30% for the six subject groups with peak values of 47% at the beginning of the century. While there is a slight decline in the importance of the KG from 1908 to 1965, the ratio stayed more or less constant over the 50-year period. Next to the inter-temporal variance, the table also portrays the importance of the KG for the inter-subject pay hierarchy. Especially those subjects which were among the top-earners, most notably law, we find that an elevated percentage of the income was generated from the tuition fees. More generally it was those subjects with high student numbers which were economically the most rewarding.[17] The rise and fall of professorial earnings in a certain subject was thus closely linked to the number of students that this subject attracted[18]. For example, the extraordinary high incomes of law professors in the late twenties can thus be explained by the *Juristenschwemme* (Jarausch, 1989, p.178) at the time[19], while the sharp fall in their income in the following decade coincides with the rapid fall in student numbers[20]. By contrast, KG revenues increased in this period, since medicine was one of the few subject where student numbers actually increased (cf. Statistische Jahrbücher).

The reason for the fall in KG revenues somewhat ironically lies in the expansion of the German university system. The rapid expansion of the university system in Germany led to a boom and the

[15] Again we use weighted averages and weight in the same manner as for the overall salaries.

[16] In fact, he himself already points out his suspicion that this may be the case(Scitovsky, 1966, p.37).

[17] However, it must be noted that this comparison negates the non-university revenues of professors, where it is likely that the natural sciences and technical sciences outstripped those subjects with high student numbers, like law or economics.

[18] Strictly speaking it should be the ratio of lectors to students which determines the KG, but if we have short term booms or busts in student numbers we can assume the number of lectors to stay relatively stable.

[19] Student numbers increased from 15800 in 1926 to 20400 in 1928 (cf. Statistische Jahrbücher).

[20] Student numbers decreased to 8026 in 1936 (cf. Statistische Jahrbücher). Whether this was a reaction to the oversupply in the previous decade or a falling demand for lawyers in fascist Germany shall be left open to debate here.

bust of the *Kolleggeld* revenues. As student numbers increased the price for education per student fell with respect to the level of earnings. At the beginning of the century the nominal lecture fee ranged between 2.50 and 4.00 Marks[21]. Prior to their abolition in the 1960s the nominal amount charged per lecture was 2.50 DM. This stagnation in nominal terms meant that the relative price of a lecture and thus the revenue of professors per student taught declined from around 6-10% of the weekly income of an employee in the 1920s to 1-2% in the 1960s.[22] This reduction of relative revenue per student coupled with the only a slight increase of students per professor ratio[23] meant a fall in monetary demand for professorial services from the private sector.[24]

The public sector did not fully compensate for this decline in relative demand. Although state-funded research institutions have seen an ever increasing allocation of resources[25] much of this expansion was achieved through the expansion of positions of the lower rugs on the university-hierarchy. While in 1928 around 36% members of the academic staff were still professors (1898 out of 3392), this ratio had decreased to 14% (3794 out of 22860) by 1966[27]. In other words, while education at large expanded the composition of the staff at university changed. This substitution meant that the demand for professors did not expand in line with state expenditure, which against the backdrop of rising supply (see below) is thus likely to have contributed to falling salaries. As a results there was relatively less demand for professorial services from the state. Moreover, there were political factor restraining the demand from the state.

In the Germany prior to WWI and the Weimar Republic with its haphazard politics it was still possible to dish out extraordinary salaries to certain employees of the state. In other words, demand for professors was in practice not strongly limited by public opinion. By contrast the political environment after WWII was geared towards and equitable society making it politically no longer feasible to pay a professor five- or ten times that of the average worker (see Abelshauser, 1983, pp.10-14).[28] While top incomes were also curbed to some extent (Dell, 2007), they were not

[21] As taken from the schedule of lectures of the universities we considered

[22] Calculated of the basis of Bruttolohn-& Gehaltssume pro Unselbstständiger Beschäftigter *Statistische Jahrbücher für das Deutsche Reich und für die Bundesrepublik*.

[23] While the ratio of students per professor increased from about 1:50 to 1:70 from 1926 to 1966. The ratio of student per lecturer, i.e. all teaching personel, decreased from 1:20 to 1:10 in the same time period (see below).

[24] This development in contrast to the developments in America, where at least some select private higher education institutions have engaged in an "arms race of spending" fuelled mostly by staggering tuition fees (Ehrenberg, 2003, p.269). In the year 2000 the average salary of a full-professor at Harvard was $128,900 (Wehr, 2013) which equates to around 276,000 DM if we use the average nominal exchange rate for that year (Federal Reserve Bank, 2013). Not only does this exceed the highest possible remuneration possible in Germany at the time, this payment would also be situated in the top 1% of the income distribution.

[25] In 1908 only around 0.2% of GDP was channelled towards research (*Wissenschaftsausgaben*) by the the Reich and the States[26]. In the years 1928, 1936, 1955, 1965 and 1975 this number increased to 0.4%, 0.5%, 0.7%, 1.4% and 2.6% (c.f. Pfetsch, 1982, pp.67-83).

[27] See Statistische Jahrbücher. Again we only count *ordentliche Professoren* but include the retired university professors. As the share of these ought to be higher in the 60s, the decline in the share is probably even more drastic than portrayed here.

[28] The fact that the setting of a professorial salary is not solely determined by market forces but also by political aspects and institutional practices was already pointed out by Picht (1965) and Niskanen (1975).

as visible as those of public servants. Thus as political forces pulled down professorial salaries, the salaries of comparable occupations in the private sector were affected to a lesser extend an thus were able to pull away or overtake.

4.2 Supply, monopsony and the professor

This relative fall in demand first and foremost implied a fall in the relative salary rather than a mass-exodus of graduates from the university career track[29]. Hence, we now turn to the key aspects of the supply side and the question why the falling price due to the demand shock did was not severely counteracted by a fall in supply.

First, one may argue that those pursuing a scientific career are not necessarily those who are first and foremost interested in making as much money as they possibly can (see Greenwood, 1957), so that salaries might be considered irrelevant. And if one only took the statement from Weber (1923) that science "must not to be directed to money" and that "materialism must only to be an emergency chair (Schemel), on which [science] can rest, when it is tired", we may be inclined to agree. Similarly Williams et al. (1974, pp.237-241) shows that professors in the UK state that income is not their primary incentive but their interest in research, a finding that is echoed for the US by Becker (1975). While non-pecuniary aspects certainly play a large role for professors, pecuniary aspects shouldn't be negated (cf. Clark, 2001, p.224), as the recent dispute about professorial pay in Germany has highlighted again (Müller, 2012). Especially a decline of the magnitude which we observe over the decades can hardly be explained solely by the advantages of higher job-security, the agreeable nature of the professorial job and the like.

Moreover, the ever increasing university system meant that other university professors now became the point of reference for a professor's salary and not the economic elites of the private sector. This was supported by the fact that ever more professors no longer came out of affluent circles of society, who would have a higher payment expectation (Jarausch, 1989, p.230). In other words, as university became a universe of its own, professorial salaries no longer revolved around the incomes economic elites but around their own salaries and thus lowered their demands for a 'fair' salary.[30] Following Fligstein and Fernandez (1988) this implies a separation of the labour market which allows the price structures to diverge.

Lastly, the the professorial labour market is highly oligopsonistic. Ransom (1993) showed for the case of the US that seniority actually had a negative impact on professorial salaries which he

[29] Although we do not know whether there was a brain-drain in the form that rather than staying at university the best graduates opted to leave academia as relative salaries fell. While there may well be some truth to this story, casual observation indicates that changes were not of tectonic magnitude.

[30] Consequently, the self-consciousness and with it the salary demands of the professor changed as he was surrounded by other professors to an ever larger extent Akerlof (1982, pp.551-555). Although the scarcity of our data makes the robust estimation of spread difficult, our findings indicate that the fall of the relative salary coincided with a narrowing of salary differentials among professors.

ascribes to higher monopsonistic power in later age. He ascribes this observation to monopsonistic wage discrimination, as more senior staff a less likely to leave their current institution. Manning (2003) defines the degree of monopsony by the utilisation of worker-recruitment and -quit rates. With graduates already being in an academic environment, their recruitment was and is naturally comparatively simple for academia. Similarly the very specific nature of academic work (and arguably the very specific nature of academic human capital accrued there) mean that quit rates are comparatively low to those one would expect in the private sector.[31] The sole widespread form of economic pressure for higher salaries available for professors was the threat and/or the execution of a change of university. [32] However, this relative individual power was by and large dwarfed by the power exercised by the state as employer. So due to the institutional set-up of education the academic labour market in 20^{th} century Germany naturally always held a considerable degree of monopsonistic power. Yet, in 1965 this monopsonistic power claimed new heights as the ministers of education of the various states agreed to a limit the competition for professors among universities (Blomeyer, 2007, p.5). This increased monopsonistic power drastically and with it the scope for lowering professorial salaries further.

With hindsight the fears of Borchardt (1960) that without a substantial raise in the salary level academia would fail to attract qualified personal in the future prove ungrounded. As we showed above relative salaries declined further. However, due to the factors outlined in this section, the elasticity of supply was relatively low for professors meaning that even the drastic fall in relative salaries seen in the years before and after Borchardt voiced his concern did not lead to a mass exodus of all qualified personal from university. Rather than voicing their discontent by exercising an economically effective form of foot voting, i.e. by going elsewhere, the social and economic conditions of the professors were such that they grudgingly accepted their declining economic status.

5 Conclusion and Outlook

Using individual data we have found that professorial incomes have declined in respect to average income. This echoes the line of argument from Scitovsky (1966), we find that the fall was steeper than his estimates. We also find that professorial incomes have fallen behind those from similarly skilled lines of work in the non-academic sector. While professors were generally still found among the top 1% and with some breaking well within the top 0.5% at the beginning of the century, this was no longer the case at the end. Thus professors ceased to be among at the top of the class of people earning their income from their own work over the course of the century. The cause for this decline is found in a number of reasons: political shifts in Germany, the falling importance of the

[31] Manning (2011, p.990) points to the high costs of switching jobs with different skill portfolios.

[32] Our data indicates that throughout the time periods at our disposal the exercising of this power (measured by the number of offers of a professorship) increased the professor's salary.

Kolleggelder culminating in their abolition in the nineteen-sixties as well as the changing structure of universities.

Concerning the level of individual subjects, we find that in terms of subject specific average incomes of professors that it is the natural sciences and technical sciences which have gained relatively to the philosophical and social sciences which started out as the better paid ones at the beginning of the century and ceased that position with the abolition of the *Kolleggelder*. We also have to concede that the availability of data on the matter is problematic. Personal files even for professors were not available to the extent to allow for comprehensive statistical analysis. Especially for the period from the 1970s onwards the personal files remain an inadequate data source as data protection legislation prohibits the access of the relevant files. In time when the legal problems of insight into the personal files abate a better data foundation concerning the effect of the *Kolleggeldreform* will be possible as incomes from the seventies and eighties can be readily accessed. Especially the question, when the inter-disciplinary payment hierarchy reversed in favour of the MINT subjects remains unsolved.

With regard to present developments it remains to be seen whether the relative decline of the professorial remuneration continues in the 21st century.

A Appendix

A.1 Complete Observations

Table 3 and 4 show the number of professors for which we could reconstruct the full set of the first four income components, i.e. all the payments by the university-related activities, split up by time period and discipline group respectively.

	1908-10	1926-28	1933-36	1953-55	1963-65	**Σ**
Aachen	0	7	0	0	1	8
Darmstadt	1	5	2	1	7	16
Duesseldorf	0	0	0	0	1	1
Erlangen	0	4	2	3	2	11
Frankfurt	0	10	1	1	4	16
Freiburg	0	0	1	10	8	19
Goettingen	1	0	2	0	1	4
Hannover	0	5	1	0	13	19
Heidelberg	2	8	8	2	3	23
Karlsruhe	0	0	1	0	13	14
Mainz	0	0	0	1	0	1
Marburg	2	8	9	9	2	30
Muenster	0	0	0	2	0	2
Stuttgart	10	0	0	0	14	24
Tuebingen	0	2	11	11	9	33
Σ	16	49	38	40	78	221

Table 3: Number of observations for selected years

	Human.	Law	Econ.	Engin.	Med.	Chem.	**Σ**
Aachen	0	0	2	1	0	5	8
Darmstadt	3	0	0	9	0	4	16
Duesseldorf	0	0	0	0	0	1	1
Erlangen	1	1	2	0	2	5	11
Frankfurt	2	5	3	0	1	5	16
Freiburg	6	4	2	0	3	4	19
Goettingen	0	1	2	0	0	1	4
Hannover	2	0	1	9	0	7	19
Heidelberg	3	7	4	0	5	4	23
Karlsruhe	2	1	2	4	0	5	14
Mainz	0	0	0	0	1	0	1
Marburg	8	7	4	0	6	5	30
Muenster	0	2	0	0	0	0	2
Stuttgart	2	0	1	12	0	9	24
Tuebingen	6	9	7	0	3	8	33
Σ	35	37	30	35	21	63	221

Table 4: Number of observations for selected disciplines

A.2 Discussion of the data

As can be seen above, the data is not equally distributed and for each periods clustered at certain universities. Hence, in the following we will assume that our observations are randomly sampled from the underlying population for a certain faculty and university. For the compilation of a representative salary structure of a given discipline group for the whole of Germany, we will moreover assume that the universities for which we obtained information are representative for the whole country. This is particularly problematic as due to the nature of archives they tend to cluster at traditional, prestigious universities.

Using these assumptions, we are able to calculate weighted means (see below). Again it must be noted that the nature of the data restricts our capabilities of analysis. The small sample-size implies that we have high standard-errors, which combine with possible biases, to yield a possibly considerable MSE.

Moreover, the nature of the data as well as the small sample size forced us to use rather wide time periods of up to four years with an observation lying somewhere in this time period. The reason for this is that we obtained salary information mostly at time-points when there was a legislative change about which the professors were informed by the ministries thus leaving traces for us in the personal files. Due to the federal structure of Germany, with its many states both prior and after the Second World War, these changes were implemented at different times by different states. However, since inflation(Hoffmann, 1965, p.610) and thus salary adjustment was rather small within the periods which we consider, at least up to the sixties, we shall neglect the deviation caused by these inter-temporal differences of the observations.

Lastly, it should be noted that the nature of the data does not allow us to construct life-time incomes. We simply do not have sufficient information to track the life-time income of a representative number of professors for the different points in time. Thus the relative generous pensions of professors are not considered, when comparison with other occupations is made. For inter-temporal comparisons this is problematic insofar as the pension schemes changed with the various reforms of the professorial remuneration. Under the remuneration schemes prior to the abolition of the *Kolleggelder* only the basic salaries were *ruhegehaltsfähig* (i.e. considered for the calculation of the pension). However, as professors frequently continued to teach even after their retirement and consequently still received *Kolleggelder* their incomes are likely to have been higher than their pension. As a result pensions were raised to 100% of the last pre-retirement level (instead of 75% before) income under the new remuneration scheme, the *H-Besoldung*. For the professors employed in the period from 1964 to 1974, when the new *C-Besoldung* with 75% pension benefits was introduced, this meant relatively high pension payments and therefore lifetime income in comparison to the later generations. Additionally the life expectancy varies across time and across professions. As professors generally have a high life-expectancy the high pensions generally raise their lifetime income in comparison to other occupations. Similarly the increasing life-expectancy over time favours the later generations over the earlier ones.

Neither can we consider other benefits of university employment like mortgage subsidies which were sometimes provided by universities. While such an analysis would surely provide further interesting insights, it must be left to further research in this field.
Thus as we proceed to the analysis of professorial salaries, we must bear the scarcity of data that is underlying most quantitative historical analysis and the uncertainty that is therefore attached to our estimators.

A.3 Estimation of the weighted average income for the subjects

In order to obtain an average we estimate the selection probability as follows: Firstly we calculate the selection probability within a certain university, that is we divide the number of professors in our sample by the total number of professors at that university for a given subject. This probability is then multiplied by the probability of finding a professor of that subject in a traditional/non-traditional[33] university in the North/South[34]. As we cannot assume independence between the two probabilities, we calculate this university-probability for all four possible combinations by using the number of professors entailed in all the lecture schedules available to us. The selection probability given a university is then multiplied by this university-probability for all subjects to obtain an overall selection probability for every professor in our sample.

One aspect, which we also looked at was the impact of age on the income of the professor, as a changing age distribution may severely affect the average income. For this purpose we estimated the two parametric and one semi-parametric model:

$$\begin{aligned}\log Y_i =& \theta_0 + f(age_i) + \theta_3 Chem_i + \theta_4 Eng_i + \theta_5 Med_i + \theta_6 Law_i + \theta_7 Econ_i \\ &+ \theta_8 TradUni_i + \theta_9 South_i + \varepsilon_i,\end{aligned}$$

where Y_i denotes the $i-th$ professors income. For the parametric models we estimated a linear, as well as a quadratic effect for age, while for the semi-parametric model $f(age_i)$ is a smooth function of the impact of age estimated by P-splines (see Eilers and Marx, 1996), which is estimated using the `mgcv` package in `R`. The age-term is followed by the discipline dummies for chemistry, engineering, medicine, law and economics respectively. $TradUni_i$ is a dummy denoting whether the professor teaches at a traditional university that was founded before the revolutions across Europe in 1848 and the subsequent political shifts in Germany. The last dummy $South_i$ denotes whether the university of the professor is below the *Mainlinie* and thus in the South of Germany. We thus assume that income is influenced by the explanatory variables individually with no interaction terms present.

[33] A traditional university is defined as a university founded before the revolutions across Europe in 1848 and the subsequent political shifts in Germany. It should be noted that most of the non-traditional universities were technical universities most of which were founded after 1848. Thus we have strong correlation with technical and non-traditional universities.

[34] The border between North and South Germany is defined by the *Mainlinie*. This line though by no means a formal North-South divide can be seen as such for historical reasons as it was the border for the *Norddeutscher Bund*, which was dominated by Prussia, and the independent Southern German states (see Historisch-geographisches Informationssystem, 2012).

While there is certainly some ground for economic criticism, the scarcity of data forces us to use a model which is simple enough to obtain relatively stable estimators.

For this model we found that the effect of age was negligible and non-significant in most periods. While it is likely that the insignificance largely stems from the small sample size, the small magnitude of the effect is closely connected to the importance of the Kolleggelder, which tended to lessen age effects. This finding is in line with Maus (2013, p.292), who finds that many young professors could upon appointment as professor be very well paid thanks to well filled lecture halls.

We therefore exclude age for the calculation of the mean. Nonetheless, it must be pointed out though that both age differences across subjects as well as across time can (and probably do) distort our estimates to some extent.

A.4 Interpolation of the income distribution

For 1928 we calculate the quantile of the top income within the income distribution as follows: We follow Atkinson (2007) in assuming that the top incomes follow a Pareto-distribution. It follows that cumulative density function is given by $F(y) = 1 - (k/y)^a$, where k and a are constants such that $k < 0$ and $a > 1$. This equation can be rearranged in the following form $H_i(y) = (k/y_i)^a$, to yield the top percentile, i.e. the proportion of people with an income greater or equal to y_i. To determine the top percentile of a given income x, we proceed as follows:

We use the two adjacent nominal thresholds from Dell (2007) to calculate values for k and a.[35] These values are then used to determine the top percentile of a given income x. For 1928, we use the threshold for the top 0.5% and 0.1%. From these values we get $a = 1.78$ and $k = 792$, such that the percentile of the top income in 1928 of 29467 RM is 0.00161. Thus this income is within the top 0.2% of the income distribution.

[35] It should be noted that these values are not constant across the various income groups but stable enough to generally provide us with a reliable if not 100% accurate interpolation.

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