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# The Quantitative Development of Academic Careers in Germany 1850-1940: Growth, Exams and Age Structure

*Volker Müller-Benedict\**

**Abstract:** »Der quantitative Verlauf akademischer Karrieren in Deutschland 1850-1940. Wachstum, Examen und Altersstruktur«. The term career is generally defined as a sequence of positions. During the time period in question, 1850-1940, the sequence and level of the steps for the different academic careers in Germany align more and more. With the help of the new data presented in this article it is now possible to draw quantitative comparisons between the academic careers over longer periods of time, which until now could not be presented universally. The data are presented in a way which shows the manifold of its usefulness.

First the various factors influencing differences in growth will be analyzed: demographic, secular and career factors. Then the available graduates of these careers will be explored in terms of how the final examinations, the failure ratio and the final marks developed. Finally the development of another important factor, namely the age structure will be described. Supply and demand are interdependent and lead to periodic fluctuations, which in addition to the other growth factors have an influence on career development.

**Keywords:** career, growth, grades, professions, age structure, examinations, failure ratio, (academic) labor market.

The term career is generally defined as a sequence of positions, which build upon each other and develop gradually. The same can be said for academic careers, where a position can only be attained by going through a succession of steps on the career ladder, starting with a university-entrance diploma (German Abitur) followed by academic and practice-orientated exams to advancement positions.

Not all careers follow the same sequence of steps, but they always describe a necessary development.

During the time period in question, 1850-1940, the sequence and level of the steps for the different careers in Germany align more and more. They resemble each other in other areas of their development as well, e.g. in growth and differentiation. The aim of this article is a comparative description of these careers

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and some of their steps, as well as the identification of differences and commonalities in their development.

Monographs and essays exist for each career, in which their historic development is depicted richly in detail. Differences between them, if based upon social, cultural, political and regional as well as other conditions developed throughout time have also been researched extensively in professionalism research.

With the help of the data presented here it is now possible to draw quantitative comparisons over longer periods of time. The emphasis of this article is thus on the quantitative comprehensible differences, which until now could not be presented universally. In cases where the sequence of timelines can be explained through a theoretical approach, references are given at their relevant content.

The primary goal of this article is to present the available data in a way which shows the manifold of its usefulness.

The data has been compiled during a four year long research project called “Akademische Karrieren in Preußen und Deutschland 1850-1940” (Müller-Benedict 2008)<sup>1</sup>. The data forms the basis for one of the many available databases of historical data which is available online on [www.histat.gesis.org](http://www.histat.gesis.org). All data presented in the illustrations, including the references, can be found in this database, as well as on [www.zml.uni-flensburg.de/akka](http://www.zml.uni-flensburg.de/akka). The project is one of many which concentrate on the quantitative compilation of the history of education, of which the results have been published in the series “Datenhandbücher zur Deutschen Bildungsgeschichte” by Campus-Verlag Göttingen.

The first chapter describes the quantitative development of careers on the basis of various factors influencing differences in growth: demographic, secular and career factors. In the second chapter the quantitative development of available graduates of these careers will be analyzed in terms of how the final examinations, the failure ratio and the final marks developed. The third chapter will conclude with a description of the quantitative development of another important factor in the demand chain, namely the age structure. Supply and demand are interdependent and lead to periodic fluctuations, which in addition to the other growth factors have an influence on career development.

## 1. Growth

The most conspicuous tendency in the development of academic careers since the 19th century is their growth. This is seen to be an important reason for cross-social movements (Ringer 1969, Perkin 1989). Growth did not always

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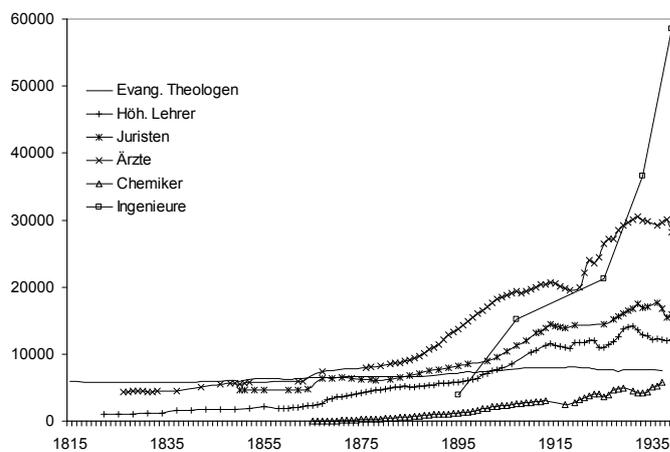
<sup>1</sup> This article is a revised version of parts of the introductory chapter of the book Müller-Benedict 2008.

develop consistently and not all careers developed in the same way. In order to explain variations in the growth of the different careers, the following four main influences will be differentiated: the demographic development and the secular social growth (1.1), the influences of the careers themselves (1.2) and the effect of the professional position (1.3).

### 1.1 Absolute Growth and Growth Relative to the Population

An indication for the growth of an academic career is the number of people educated and working in affiliated professions.

Illustration 1: The Growth of Academic Careers in Prussia (Protestant Theologians Only Old Prussia)<sup>2</sup>.



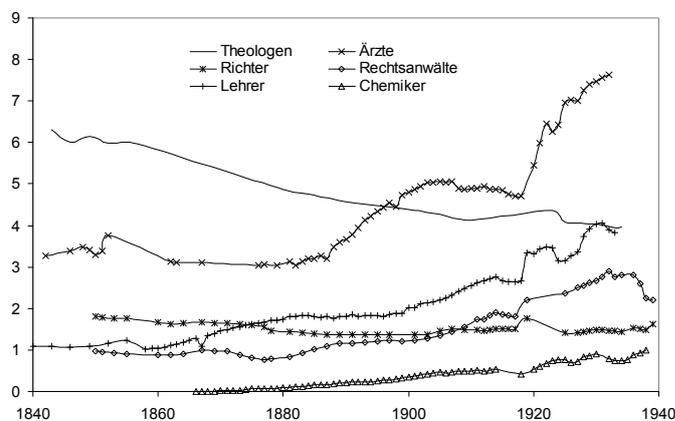
<sup>2</sup> In illustration 1 “chemists” until 1912 means a projection in the development of chemists at BASF, where data is available until 1914, on the total number of chemists for which data for the German Empire is available after 1913. Individual data from other companies show that the chemists at BASF were no exception.

The number of academic engineers in Prussia was estimated on the basis of the data in the unified database of available engineers from Technical Universities and secondary respectively technical schools in the “Statistisches Reichsam”. It was estimated with the help of two factors: factor 5/13 for the average number of students at Technical Universities on students of both institutions with the consideration of the varying length of the course of studies, and factor 0.4 for the average number of students at Prussian and non-Prussian Technical Universities (DHB I/1=Titze 1987, S.46-49), combined a factor of 0.15 on the number from the occupation census. Hereby it is assumed that the subdivision of students approximately amounts to the subdivision of working people.

The established regional churches of the Prussian provinces Brandenburg, Pommern, Schlesien, Ost- und Westpreußen, Posen, Westfalen und das Rheinland of the “Altpreußische Union” have since 1817 been unified under a superior administration.

As seen in illustration 1, theology as a profession was the only career which did not have any growth as opposed to the engineers, which experienced an especially strong growth. At first sight the other four professions seemed to have undergone a relatively equal growth. In the chosen period of time the population of Prussia grew considerably. As a big part of the achievements attained by the careers in practice are bound to single persons, e.g. clients, their growth partly depended on increases in population. In illustration 2 depicting the growth of the professions per 1000 inhabitants this part of the increase in population has been neutralized.

Illustration 2: Number of Academics per 10000 Inhabitants, Prussia  
(Protestant Theologians: Old Prussia)



The graph above shows that demographic development only is one part of the dynamics. As a topmost extreme the number of engineers (not shown in the illustration) in 1936 is 18 engineers per 10000 inhabitants. This shows that especially technical careers have grown far more than the increase in population. It is obvious that the lowermost extreme is theology, which has decreased strongly. The number of priests relative to the population has declined nearly by half of the original, while it has increased more than twice the original number for physicians and teachers. The demographically adjusted changes in the supply of academic jobs are often ascribed to the common societal, technical and social development which is called secular growth. It generates a certain necessity of new jobs in academic careers. For theology this meant a big loss of importance as an institution of sense and legitimation, which has been replaced by science and education as well as social institution, which has been replaced by a better health care system. The importance of technical sciences has strongly increased due to the progress in technical sciences. The demographi-

cally adjusted developments show that the secular growth of the careers is influenced differently according to the occupation.

Additionally judges have been differentiated from the lawyers in illustration 2. The obvious diverging developments of these two careers show that different types of growth are possible, even if the population does not change. This means that other determinants of growth exist beyond the different professional developments generated by secular growth.

### 1.2 Growth in Relation to Secular Development – Demand Generated by Professionalization

Besides the increase in population, there is no other cause spanning over all professions contributing to a change in demand, as the academic careers provide for different services. If one wants to try to define the consequences of secular growth in academic professions, the following can be said:

- In certain functional areas in society the number of tasks which only can be executed by academically educated persons has increased (e.g. health protection as a new medical area).
- Tasks previously carried out by non-academics have increasingly been taken over by academics (e.g. legal representation in court).
- Completely new tasks (functional areas) have been created, which primarily are performed by academics (e.g. research and development of chemical fertilizers).

Due to the extreme specialization and complexity of the functions in academic careers a professional self-determination has developed. This allows them to influence the demand in their sector. It has been shown in historical analysis that academic careers have defined their working environment, that they have enlarged, secured and occupied it and to what extent they did that (Huerkamp 1985, Janz 1994, Jarausch 1990, Siegrist 1996, Lundgreen 1990). On one hand this happens via scientific progress and technical inventions and on the other hand by the self-organization in professional associations. In all careers these organizations were established in the course of the second half of the 19th century. Secular growth can be influenced to a certain degree by these organizations. Thus, in the following it will be distinguished between secular growth on one side and growth due to the particulars of different processes in professionalization on the other hand. The latter will be called growth due to professionalization. That growth due to professionalization exists is visible in neighboring careers which developed differently although they have been subject to the same trends in their field. In the case of chemists and engineers, which both have been driven by technical evolution, only the first named could professionalize on a larger scale (Gispen 1989). The number of judges and lawyers grew differently though both have been affected by the increase of legal proceedings.

Both these types of growth will now be compared quantitatively. This way it can be determined, if the growth in the different careers has been influenced more by secularization or by professionalization and how big the influence of a career has been on secular trends. It seems though that it is not possible to completely separate the two types of growth as they are interdependent. In order to differentiate some criteria can be of help. With these criteria it is possible to relate single historical developments to one of the two types of growth, even though the transitions are smooth:

The demand of a career is called secular if it is created by events which are not intended or stipulated by members of a profession. These include:

- 1) Increase in population,
- 2) Scientific inventions in other areas of society (e.g. x-rays, which influenced the health care system),
- 3) Social changes in other (non-academic) sectors (administration, educational demand, distribution of technical equipment),
- 4) Change of functions in the social system (replacement of the poor relief offered by the church by social systems, patronage rights by local courts).
- 5) A demand for a career can be called "due to professionalization" if it is generated by activities related to the profession. This includes:
- 6) Exploitation of new areas of demand which cannot be explained by the change of societal functional areas (youth pastors, invention of new technology),
- 7) Displacement of non-academics from existing working areas (e.g. non-academic medical staff), enforcement of new academic qualifications,
- 8) Strong influence on examinations or accreditations defining the amount of personnel within a profession via strong professional associations, which a majority of professionals within a profession belong to (pharmacists, dentists).

The total growth is a combination of the secular growth and the growth due to professionalization. Thus the growth due to professionalization can be designated as the difference between total growth and secular growth. In accordance with the criteria mentioned above, secular growth can be characterized by an increased demand due to the course of the structural development of society and an increased need of certain services in one area more than in others. Alphabetization, the national health care system, bureaucratization and mechanization are examples of such structural developments. They influence the demand for teachers, physicians, legal practitioners and engineers.

The long-term development of a typical specific service of a career or core institution of a career will be used here as an indication for these kinds of secular trends. It will serve as representative for the generally accepted demand for the services of this career. Due to insufficient data, the choices in this case are limited. The following will be determined as indicators for these secular

changes. They comply in different ways with points 2-4 of the above mentioned criteria:

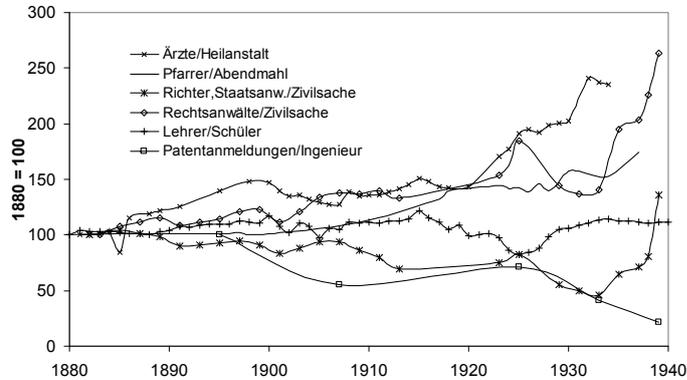
- for the demand of theological services the sacraments offered (point 4),
- for the demand of legal services the civil law cases (point 3),
- for the demand in health care the number of hospitals (points 2 and 4),
- for the demand in the education system the number of students in secondary education (point 3).

In order to neutralize the secular growth, the development of the number of members of a career available per unit for the respective indicator of secular growth will be determined. If this number increases, a career can increase its demand beyond the secular growth.

The specification of an indicator for secular technical development is more complex in the case of engineers. The idea for an indicator could be the growth of the amount of a technical product or a technical resource like energy. This however consists of the combination of components of existing products in mass production and their constant innovation. Only mass production constitutes a secular trend (points 2, 3). Contrary to that there is a direct indicator for the non-secular growth (growth due to professionalization), the innovation: the number of patents filed (Metz / Watteler 2002, S.107). This explicitly constitutes the exploitation of new areas of demand (point 5). If the number of people per unit in the secular trend increases the number of people per unit innovation has to decrease as the amount of both trends constitutes the quantity. In this case the reversed indicator of the number of innovations per person will increase which means an equivalent indicator to the above mentioned indicators of the other careers. For this reason the development of the stake of this achievement (patents per engineer), which is a part of the professionalization process, will be calculated. With these assumptions, the following illustration 3 of the growth adjusted by the secular trend can be developed. In the case of engineers it shows the growth directly related to professionalization processes. A different relationship between the careers can now be seen.

To reveal the differences in trends, all careers in this illustration in 1880 have been set to 100. In the case of engineers it becomes obvious that the secular trend is particularly connected to the strong growth. While engineers have been strongly involved in the creation of patents in the 19th century their working area changed strongly from innovation to production- and process monitoring up until the Second World War. It must be mentioned that the break-down of engineers with academic backgrounds to those from technical secondary schools and technical colleges have only been estimated. Therefore the real rate of academic engineers contributing to patents cannot be determined. Generally though, the academic degree has no influence on the specific activities of the engineers (development of production monitoring), but more, to a small extent, on the opportunity for advancement in the company hierarchy (Sander 2004).

Illustration 3: Growth of the Careers Relative to the Indicators of the Secular Trends<sup>3</sup>



The number of jobs in theology has increased relative to the secular decline of this career since the turn of the century. There is a larger number of theologians to carry out their main service, the sacrament. Their professional importance has increased if the strong secular loss in importance will be held constant. This quantitative development agrees with the research of Oliver Janz, who describes how the loss of importance of theology during the course of the 19th century goes along with the intensification of specific theological activities and the internal church relationships since the end of the 19th century (Janz 1994, S. 267 f.).

It is the same for physicians. At the end of the period twice as many physicians are treating the expected average number of medical conditions of the population which naturally has increased by the achievements in medicine, as opposed to the situation for theologians. Teachers, however, did not increase their professional importance for 130 years. The huge increase in demand for education did not lead to an increased demand for teachers in accordance with the growth. The teacher-pupil ratio in higher education remains remarkable steady, even until today.

In the case of legal practitioners a clear differentiation between the “free part” of the profession and those employed in civil administration is made. Here is a similar situation to that of the teachers in tenured position. Despite a big increase in civil law cases judges cannot turn this increase of importance of the law into more jobs. It is a different situation for lawyers. They achieve that

<sup>3</sup> In the case of civil law cases strong fluctuations between 1915 and 1923 and unexplainable increases of the numbers between 1925 and 1931 have been taken out. “Engineers” as in illustration 1.

twice as many lawyers as before are available at the end of the period for the same amount of cases.

Thus only the physicians and lawyers gained a huge increase in growth beyond the secular trend.

The pastors could also stand their ground against a secular downward trend. The growth for teachers and judges did not extend beyond the societal-structural changes of their working area. In contrast the engineers lose more and more influence on their growth to the general technical-structural changes.

### 1.3 Growth According to the Type of Employment

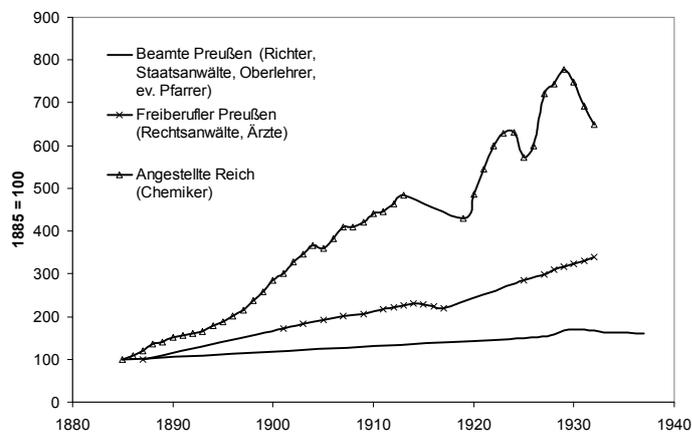
Out of the previous text it becomes clear that the secular growth on the one hand and the influence due to professionalization on the other hand lead to a deviation not only between different careers, but also between different professions within a career depending on the type of employment, e.g. between judges and lawyers. So the differences in the total growth are only partially based on professional contents. Besides secular trends and the influence of professionalization the type of employment is a third important factor. The professionalization theories assume that academic careers ideally are integrated in the job market in three different ways:

- 1) Careers in civil service (civil servants), “unfree professions” (Jarausch 1990): In this case there is a monopsony of the state. There is no flexibility in the income and the numbers of jobs, as both are determined by the state, the federal state and the municipalities. Because of this there is little or no autonomy for a professional and legal restriction and a numerical distribution of the career. The autonomy of the profession only relates to the form of the work content.
- 2) Careers in businesses (employees): Graduates have to search for jobs on the free job market in the economy. As they do not have a monopoly on the job market, they are no professions in the common sense. At least they are in parts similarly organized through academic examinations as entry requirement, protection of titles (or at least the constant efforts to do this), professional ethics or a relative autonomy on the workplace.
- 3) “free professions”: They are self-employed with few or no employees and offer individually requested expert services (the “third way”: Freidson 2001). Their job market is only limited by common trade laws and association agreements, if agreed upon. They are autonomous in securing and spreading of the career, the procedures and the work content.

Out of today’s perspective these three types of employment form the “status of the occupation”. These demarcations show that the members of a career, which have had the same professional education and whose work practices on the job market are the same are spreading over these three types of employment for most careers until today. Teachers and theologians were careers only within

civil service. Law practitioners were civil servants as well as self-employed in the case of lawyers and notary publics. There are even some commercial lawyers working for big companies. To a minor degree physicians are civil servants working in hospitals but otherwise they are mainly self-employed. To a minor degree engineers and chemists can be civil servants, working as government building officers or food chemists. Mainly they are employed in the economy but some are self-employed with their own laboratories or companies. On the basis of this observation it is possible to develop a reclassification of members of an academic career, which runs diagonally to the careers. The members of the different careers can be assigned to one of the three types of employment. A comparison of growth of the three types of employment thus established is shown in illustration 4.

Illustration 4: Growth According to Type of Employment



In this illustration all three types of employment in the year 1885 are set to 100. This way the varying growth can better be identified despite the absolute level difference. A clear difference can be seen. The careers in civil service grow only slightly, the free professions about double until 1940 but the careers in the economy increase even more in numbers. These differences can be explained by the services offered respectively goods generated by the different types of employment. The following services/goods accord for the differences in the dynamics of growth:

- The civil servants have official functions. The goods they “produce” are institutions of infrastructure provided by the state (education facilities, administration, security, court of law). In the statehood of the time period in question, which has to legitimize in front of the population, the scope of the services offered grows according to the increase in population to guarantee

an equal distribution of these services. The scope of the work in the civil service thus increases similarly to the population.

- Self-employed persons provide individual services. They provide single persons, their clients, with goods which can only be used by them, e.g. health and law. Self-employed chemists or engineers can be counted to this group if they offer client based chemical expertise or technical developments in their laboratories or firms – as opposed to bigger companies which produce for the goods market. Although their growth potential is bigger than the increase in population it is limited because it often concerns “negative” goods which are only needed when something is wrong. If all people are healthy or feel in their good right less service is requested of physicians and lawyers. On the other hand it is generally the real services which demand a certain temporary presence of the client. Thus they can increase their growth beyond the increase in population, but only slightly.
- Academics employed in the economic process ultimately produce investment goods and consumer goods only limited by the purchasing power of the market. Their scope can be increased as desired. They have the greatest growth potential because the demand for their services is not limited by the increase in population. Everybody can own three cars. Despite of that they can increase the demand of their services through successful activities by increasing the sales of their products as long as there is no saturation of the market.

According to this analysis the growth in the professions largely depends on the type of employment – civil servants, employees, self-employed. However, there are individual cases in which the “status of the occupation” does not influence the growth according to the pattern described above. These cases show that it is not only the “status of the occupation” which defines the growth but the services offered, including theologians in the second half of the examined period of time, and pharmacists. Both deliver “goods”, which, unlike in the case of other civil servants and self-employed persons, are not provided *ad personam* und thus are restricted by the population.

In the time theologians stood for the religion as a constitutional requirement and provided for national functions for the whole population, their number increased like the number of civil servants. With the growing division of state and religion their service changed from a national service to a freely available service, where the scale and value depended on the demand. Their service – spreading faith – is mainly specified by the number of parishes, not by the number of parishioners. Because of this the service changed only slightly. In combination with a strong secular decline of their services this lead to an enhancement of supply of theological services offered to those who required them (illustration 2: theologians vs. teachers respectively judges). Contrary to the secular trend the number of theologians did not decline after the division from the state as the services offered did not depend on the population.

Like physicians and dentists the pharmacists are self-employed within the healthcare system, but their services also do not depend on a specific client. The goods they produce, the medicament, are eventually sold on the goods market. If the healthcare provision improves and more people go to see their physicians more often, more physicians have to be available as a single physician can only treat a limited number of patients. There has to exist a certain time quota for every patient. If this leads to a growing demand of medicaments, their production can be increased without the need to increase the number of pharmacists according to the increase. It makes no difference if the recipe is used to produce 50 or 500 units, the expenditure of time is the same. If the number of pharmacists would be increased following the increased demand in health, as is the case for physicians, this would lead to the impoverishment of the pharmacists. The market would be overcrowded with pharmacies. In the examined period of time the pharmacists could maintain their privilege of hereditary pharmacy concessions until 1894. After that they still had a significant influence on the concession procedure due to a strong association. So the number of pharmacists did not increase according to the secular trend in the health system, as their services too did not depend on the population.

The growth dynamics is ultimately defined by the type of the good or service produced by a career. This kind of service generally depends on the type of professionalization respectively the type of employment, but in certain cases has to be seen in a different light.

In conclusion it can be said that the dynamics in growth of the careers can be broken down in these three components: the secular trend, the influence due to professionalization and the type of service offered. These three determinants superimpose in different professions of a career to different degrees and each lead to a specific development in growth.

## 2. Academic Examinations

The establishment of a passed academic examination as a prerequisite for applying for a position is in various aspects important for the development and classification of academic careers. A passed examination is equal to a specific set of knowledge and thus partly defines the expectable accomplishments of a certain career. At the same time they open or close the door to a specific job market. The valuations thus given to the student can, if necessary, be used to a rejection of claims and thereby be used to close the path to a career. The development of the amount of examinations taken in addition to the growth of a career reflects the medium term influences of the job market as the differences between careers follow historically evolved examination traditions, which due to their constitutive importance will be in place for a long time.

## 2.1. Development and Role of Academic Examinations

### *2.1.1 The Development of an Authorization System*

Until the mid-19th century an authorization system was enforced for the four academic careers theology, law, medicine and teaching, namely national examinations as a prerequisite for employment in public office. These examinations superseded former assessment criteria for the privileged which depended less on achievements and more of the person in question and the region.

On the one hand the criteria for acceptance at a regular university have been standardized by the introduction of the Abitur as a general prerequisite for a study at university in 1834. On the other hand the final examinations had to be executed by a national and specifically for that matter nominated committee. The introduction of state control can be explained by the increasing range of functions of the modern territorial state during the course of the 18<sup>th</sup> century and the following increasing demand of higher civil servants, as well as other civil servants. State universities became a training facility for higher civil servants. The examinations served as political control of the education as well as the protection of the quality of this education which could no longer be guaranteed by personal connections due to increasing number of examinees and the complexity of the subjects taught.

The French revolution and the reforms following that event lead to the dissolution of the privileges of high society and a growing involvement of the middle-class in civil offices. As part of this process the examination has been detached from a concurrent appointment to a post in all four careers. The examination could be taken by all qualified people and became a necessary prerequisite of a position in the civil service. The combination of examinations evaluated only on the basis of competence and a future post in the civil service laid the foundations for a meritocratic authorization system, which became a pillar in the developing liberal civil achievement-oriented society. Regulation of the final examinations in the four careers did not happen simultaneously and were introduced gradually, each time first for a small and single part of a career. In Prussia this happened for the careers in law first, in 1693, as it seemed to have most importance for the state administration. It was followed by theology in 1709 and medicine in 1725, then secondary education teaching in 1817, which only became a career independent of theology through this act (Titze/Lühns/Müller-Benedict/Nath 1990).

In the second half of the 19th century the academic examinations were further standardized, divided into different main professional topics and completed and expanded by a second practical educational phase. During that time the academic examinations only started to be introduced in the careers of engineers and chemists and thus distanced itself from methods of training on a more middle-class level. The authorization system for all six careers discussed

here, which can be characterized by the following points, had been established until the Second World War.

- a) The examination is temporally and spatially independent of an appointment to a post,
- b) all examinees will be treated equally, for their evaluation only the achievements gained so far are important,
- c) the examinations have the function of a certificate of professional competence as well as the rejection of the incompetent (there is an explicit possibility of failing),
- d) a “professional model” exists: a specified scope of professional knowledge which can be expected of an examinee,
- e) there is a system of hierarchically structured examinations, which are a successive or reciprocal prerequisite for each other.

For a): The separation of an examination from an appointment to a post or for obtaining a title is one of the earliest steps of regulation. Until that point an examination “pro loco” was only taken when the aspirant was appointed a post and thus a failure in the examination was not desired. This possibility was still available on rectories in the Eastern provinces of Prussia in the second half of the 19th century (Janz 1994, S. 54). Until the beginning of the 20th century it was still normal to study without a final examination and apply for a position on the job market with only a proof of a proper participation in the studies in the careers of the engineer and chemist.

For b) and c): The equal treatment of candidates is a result of the continuous repression of privileges of the higher class in the first half of the 19th century and was mainly achieved by the introduction of the Abitur as a prerequisite for admittance to a university. In the following longer process all exceptions for a privileged admittance at university, e.g. those for aristocratic students for the studies of horseback riding and fencing or for children with only an education by private tutors were finally excluded. This includes the determination of criteria for the failure of an examination which no longer allows for exceptions.

For d): The development of a “professional model” respectively “single standard” (in the historical term) requires nationwide standardized academic assessment. This excludes the possibility to add amendments to the final result of the examination or to reduce its scope. Any person having passed the exam is thoroughly competent and can in principle apply for all designated positions. A standardized “professional model” can be assumed for the legal profession in Prussia as of 1851, for medics as of 1852 (abolition of the historical surgeons), and for teachers first as of 1898 (abolition of the three respectively two degrees for schoolmasters).

For e): The reciprocal recognition of examinations affects mainly the admittance to university. The Abitur of a “Gymnasium” was challenged by degrees of historical secondary schools, upper girl’s schools, Latin-free secondary schools and other educational facilities (for the development of the higher

school system see Müller / Zymek 1987 = DHB II/1) during the differentiated development of the secondary school system in the second half of the 19th century. Their degrees were first equated in 1900 and then allowed for the admittance to all courses at university. Differing from that in protestant theology only the degree of a “Gymnasium” was accepted until 1917.

### *2.1.2 Causes for the Trend in the Development in an Examination Standard*

The development of standardization of examinations is mainly formed by

- a) the increasing necessity to examine the candidates for the civil service,
- b) the special development of the occupational area of the careers, and
- c) the processes in professionalization of the careers.

For a): In the course of the development of functional social subsystems with increasing autonomy the central control of admittance to civil service positions by members of the government, who knew most candidates, became more difficult. Because of this the state apparatus had an interest in securing the quality of the applicants through an exam which fulfilled certain criteria. For the judiciary the early interest in state control over the quality of its civil servants due to their national sovereign functions was obvious. It is similar for theologians and for teachers as soon as secondary education had developed insofar as that the larger number of pupils were from the upper-class. Also construction safety was already controlled by certified government master builders, educated for Prussia at the Bauakademie in Berlin, in the first half of the 19th century. As the technical development finally had influence on the population another state exam was introduced in 1894 for food chemists to guarantee the quality.

For b): The development of the occupational areas was different for the careers in question. Careers in which natural scientific discoveries had a big influence on the content of the activities of the occupation the differentiation of the examination regulations was partly incorporating the trend of this specialization. Examinations for oculists were introduced in 1869 after the invention of the ophthalmoscope in 1859 advanced the specialization of oculists decisively. Special exams for electrical engineers were introduced after the broad introduction of public power supply, which were the result of ground-breaking inventions such as the light bulb and the electric motor.

Examinations for teachers which until then followed Humboldts idea of a broadly educated scholar as an ideal for the pupils, changed mid-19th century. They increasingly started to emphasize on subjects such as natural sciences and the humanities, later on followed by languages, mathematics, special natural sciences as well as music and art. The examinations in education echoed the differentiation of the courses at the universities, which again partly depended on the development of natural sciences.

In the other careers the differentiation of examination subjects was more initiated by the economic development. The increasing bureaucracy and technoc-

racy gave reason for the introduction of the degree course “engineer in administration” (Verwaltungsingenieur) in 1908 in Berlin though this occupation could never establish itself against the “monopoly of law practitioners”. In companies these tasks were carried out by the newly developed business sciences. Therefore in 1913 law practitioners introduced economics as compulsory subject in the first exam.

For c): The standardization of examinations was welcomed by professional associations. On one hand it was seen as a central signal of the expected performance and professionalism. On the other hand it offered the associations the possibility to influence the examination subjects and thus define the general knowledge of the profession. Undesired and competing approaches of performance delivery could be eliminated. This affected especially theologians and physicians. Theologians had to deal with lay preachers while medics during the 19th century could subordinate medical laymen, last being the midwives in 1899, to certified physicians. Equally the role of laymen at court was taken over by professional lawyers at the end of the 19th century. In the regular employee career of engineers and chemists contradictory interests existed between the employers’ associations on one side and associations of employed academics on the other side, especially regarding the content of the education. The focus of the companies lies on a practice-orientated education while professionals wanted to strengthen their exclusiveness by emphasizing on the academic-theoretical factor.

In the case of careers within civil service the influence of the professionals on the exam regulations concerning the admittance to their profession was relatively small. The training of law practitioners, judges and prosecutors as well as lawyer is regulated by national decrees from an early stage on. The association of teachers in secondary education had difficulties to implement didactic and pedagogic criteria in the exams as the Department of Education looked at the degree course of teachers in secondary education under the aspect of loyalty and costs. In contrast medical associations had more influence on the shaping of the exams, e.g. with the differentiation of exams for medical specialists. In the area of economy the state has only little interest in regulation as the activities of engineers and chemists do not interfere with national activities, except in the areas of military, health and construction supervision. Employed engineers found themselves on the other side of the industrial associations, which had no interest in engineers with an academic degree and the possibility of them being more expensive to hire as a consequence. For this reason the general introduction of exams for academic engineers and chemists, who did not strive for a position in civil services, and their standardization, scope and definition of practical education did only develop slowly until the Second World War.

### *2.1.3 Steps in the Development of the Academic Examination Standardization*

For all careers similarities can be named over the historical process, which are important for the development of the examination standardization:

- a) the enforcement of exams with respect to space, the total number of candidates and the increments between higher and lower examination performances,
- b) the integration of exams into a system of prerequisites for admission to examinations,
- c) standardization and unification of the examination content,
- d) national guarantees for the recognition of the exams in an occupational area.

For a): The complete implementation of exams for all members of a career has always been a long historic process. Initially the academic final exams were introduced exclusively for the well educated elite of a career and could only be taken at certain locations. The exams *pro facultate docendi* in secondary education was initially only available in Berlin and only a few teachers could take them at high schools. The better part of teachers still had a theological exam. As a successfully taken exam was seen as a quality criterion, which was seen as desirable by candidates as well as employers, it became mandatory after a while. If a mandatory exam exists for a higher qualification level the internal consequence would be further standardization of the preceding levels, e.g. the prerequisites for admission to examinations.

For b): By differentiating occupations within and between careers the exams differentiate as well. Thus a system of exams is created which is characterized by the availability of several options of further education on one exam level. The Abitur became a prerequisite for all degree courses little by little. However, until 1897 chemistry could still be studied without the graduation of a secondary school even though this course offered no possibility of a doctorate. A passed exam *pro facultate docendi* meant that a limited permission to teach certain courses at the upper school could be extended to additional courses with an extended coverage test since 1887. This system can extend beyond career demarcations. Since 1894 students with a very good state examination in pharmacy and a major in chemistry in the degree course secondary education teaching could take a state examination in food chemistry which enhanced their chances on the job market.

For c): The development of a standard type of a professional expert over a longer period of time eliminates all qualitative gradations of a degree which defines a career. A single universal quality standard for a degree is in the interest of the candidates as well as their future clientele. For the candidates this means that they can expand their potential job market to a maximum and the clientele can be guaranteed better quality. The adjustment of former variations in quality is thus carried out on a higher level. The abolishment of the different

levels for teachers of secondary education for instance in favor of one single schoolmaster in 1898 lead to an intensification of the exams. Equally the abolishment of the education of historical surgeons in 1851 had the effect that all doctors had to take a medical state examination. Admittance to the priest seminary, of which only two existed in the beginning (Wittenberg, Berlin), was only given to candidates with the best certificates in the first exam. First in 1927 the priest seminaries became obligatory for all students in the second educational phase.

For d): State exams mean that the national occupational area of a career is secured by the academic exam. Only those careers, in which the occupational area is under state supervision, achieved this aim of professionalization. That is the reason why state exams have only been introduced for food chemists and civil engineers in the technical and scientific field. All other areas could until the mid-1960s be carried out by autodidacts.

## 2.2. The Quantitative Development of Examinations Taken

The number of examinations of a certain year theoretically follows the number of first-year students of a previous average length of study. In practice it is altered by the drop-out rate and students changing to another degree course. The number of first-year students, the length of studies as well as the drop-out rate and change of a degree course are subject to singular and systematic fluctuations, which depend especially on the job market situation (Müller-Benedict 1991, Titze 1990). These fluctuations are visible in the development of the number of exams taken. The singular influence of the First World War had the effect that the number of exams taken in the years during the war decreased extensively. In contrast an above-average number of exams were taken within a length of study after the First World War as students wanted to catch up on their exams. In 1914 exams in the protestant theology and law (first exam) were moved to an earlier date so that an above-average number of exams were taken in that year.

From the beginning of the German empire when secondary education teaching (first state exam), law (second state exam) and medicine (first state exam) had about 300 successfully taken exams per area until the end of the Weimar Republic, where about 1500 exams per area were taken successfully these careers developed in the long-term average on the same level (illustration 5 and 6). The counterpart was the protestant theology, which started in 1875 on a level of 200 exams passed and whose level stayed constant until the Second World War. The exams of the chemists (diploma degree at technical universities and "Verbandsexamen" at the universities) too stayed at approximately the same level before and after the First World War (illustration 5 and 7). In the field of chemistry these exams, which were introduced in 1897/99, only slowly prevailed against the hitherto common doctorate.

In the medium-term cyclic variation of the number of exams taken, which depend on the number of first-year students and these again depending on the developments on the job market, the careers vary notably. The theory of “Akademikerzyklen”, so-called academic cycles (Titze 1990) shows that the choice of a certain degree course is not made arbitrarily but depending on the social background. According to that there are more exclusive careers such as law and medicine, which can be considered as neighboring careers and “advancement careers” such as secondary education teaching, which lead to academic educated new social strata.

According to this theory higher social classes would rather choose between the exclusive careers when the job market situation of these courses changes. Illustration 6 shows that the passed national exams for law practitioners and physicians compare surprisingly inverse to each other. They follow the same dynamics in growth but at the same time they substitute each other. In both courses a high inheritance of occupation exists. The similarity in the social background of the students of these two courses was that lawyers and self-employed physicians as free professions belonged to the same intellectual environment. Both share the resources of the educational patent and the experience of professional independence. By choosing a degree course in the career with the better market opportunity, the sons guaranteed a general constant dissemination of their intellectual status to the following generations.

The lower social classes however will only begin their studies in an advancement career when the occupational outlook is good, which has been proved for the degree course in teaching at secondary schools (Titze 1990, S. 154f.). A similar trend can be seen for engineers. The social background of the engineers at technical universities was nearly as exclusive as for the law practitioners. With the foundation of technical secondary schools and technical vocational schools in 1890 a new advancement path for the career in engineering was open to the lower social classes (Sander 2009). The number of students at those schools managed to equal the number of students at technical universities by the turn of the century. Illustration 8 shows that the number of students from these schools increased steadily between 1900 and 1914. At the beginning of this time period the job chances on the job market were still quite good but decreased at the beginning of the World War. After 1913 and during the constant overflow of the 1920s the rate of students at technical secondary and vocational schools decreased again. So this proves that in case of the engineers the growth after a deficiency is accompanied by an extension of the social foundation in the lower social classes and reciprocally in an overflow situation the social foundation again becomes more exclusive.

Illustration 5: First Exams Passed, Prussia

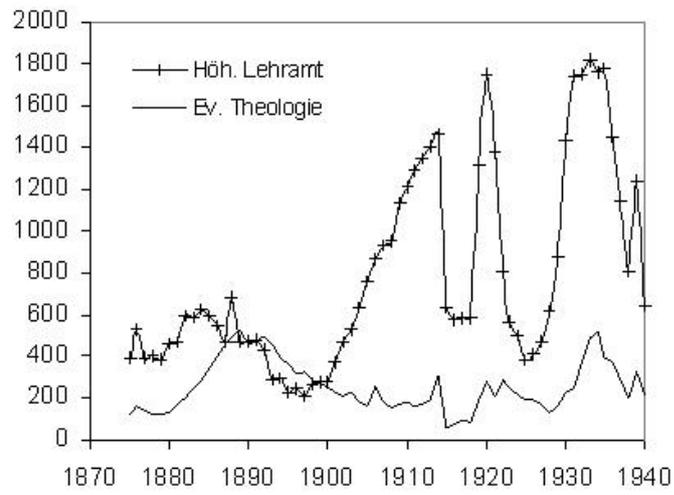


Illustration 6: Passed Exams, Prussia

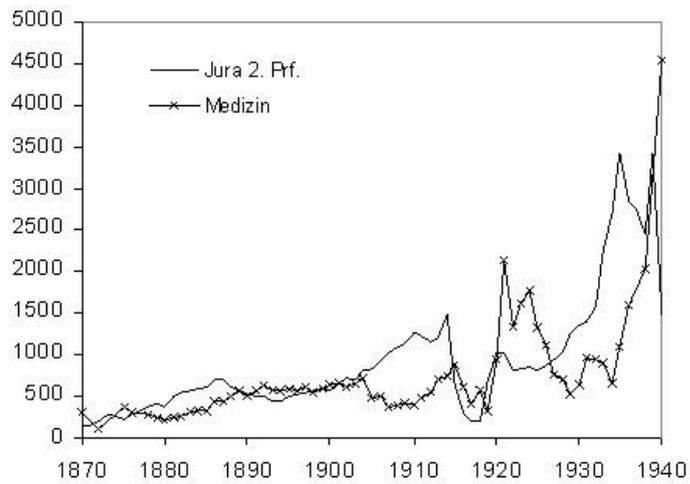


Illustration 7: Exams Passed, Diploma Degree, Respectively Diploma Degree and “Verbandsexamen”, German Empire

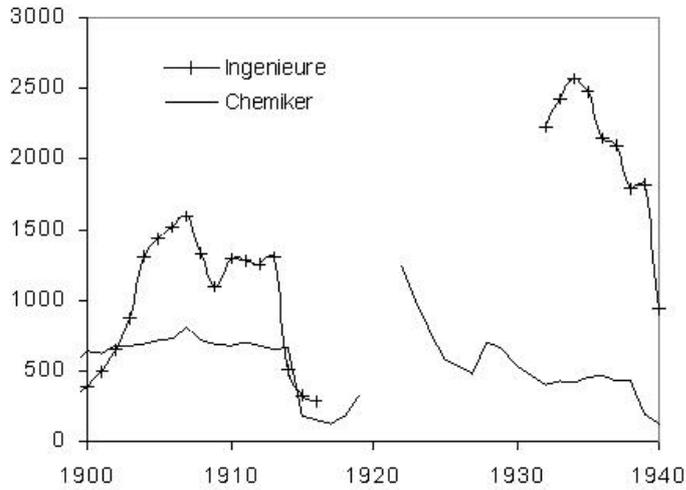
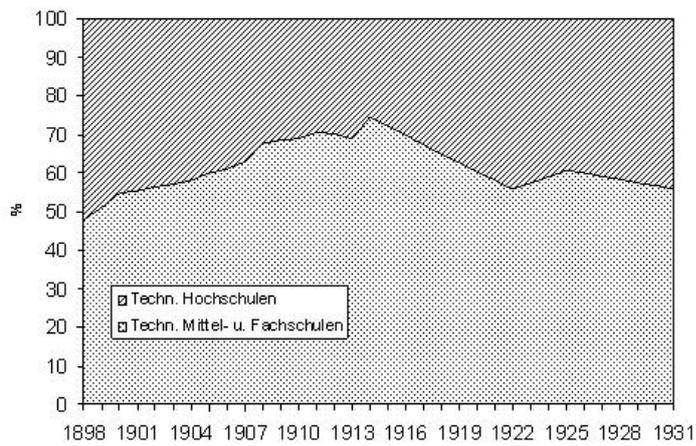


Illustration 8: Distribution of Engineering Students of Technical Universities Respectively Technical Secondary and Vocational Schools



### 2.3 Successful Final Examinations

The different faculties at universities develop their own faculty cultures, which does not only reflect on the styles of discourse and science ideas but can influence the form and the results of the exams as well.

In the following the development of the pass rate, the drop-outs between first and second exam and the average final marks between the different degree courses will be shown.

### 2.3.1 Development of the Pass Rate

A way to determine the differences between the degree courses concerning the chances to pass the academic exams is the pass rate, which is the number of students who passed in percent of the total number of students admitted to the exams. In order to identify stable/constant long-term differences between the degree courses, the pass rates in tables 1 and 2 have been calculated for longer periods of time. The division of the sections follows the societal and political breaks and divides the German empire in the time before and after 1900, as the turn of the century meant changes in exams and admissions for some careers.

Table 1: Long-term Pass Rates in the First Exam

	teaching	theology	law	medicine
1870-1899	91,7	89,3	84,3	75,4
1900-1913	67,8	85,0	72,2	80,3
1920-1932	79,1	86,1	71,4	81,3
1933-1940	73,2		82,3	84,4

Table 2: Long-term Pass Rates in the Second Exam

	teaching	theology	law
1870-1899		95,0	84,4
1900-1913		95,8	80,4
1920-1932	84,4	95,4	79,4
1933-1940	87,4		88,6

Comparing this data the following can be said:

- With regard to the complete time period in question the degree courses have a similar pass rate of about 80%. The pass rate in theology is about 5% higher.
- Within a scope of about 15% law and secondary school teaching temporarily have the highest and theology on average the lowest failure ratio.
- The teaching degree shows the highest, theology and medicine the lowest long-term fluctuations in terms of passing the exam.
- In the second exam the chances to pass are consistently higher than in the first exam.

The degree courses seem to show certain differences concerning the chance to pass the final exams and still in the long-term they seem to be smaller than could be expected of the different faculty cultures.

Illustration 9: First Exam for Protestant Theology: Total Number of Exams (Above) and Pass Rate (in %) (Below)

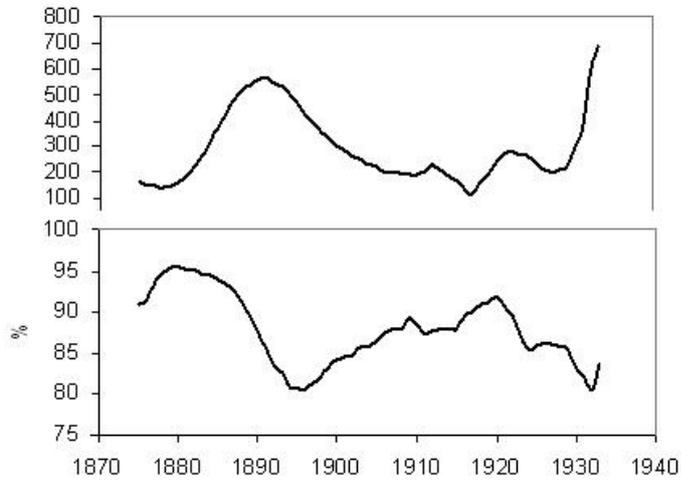
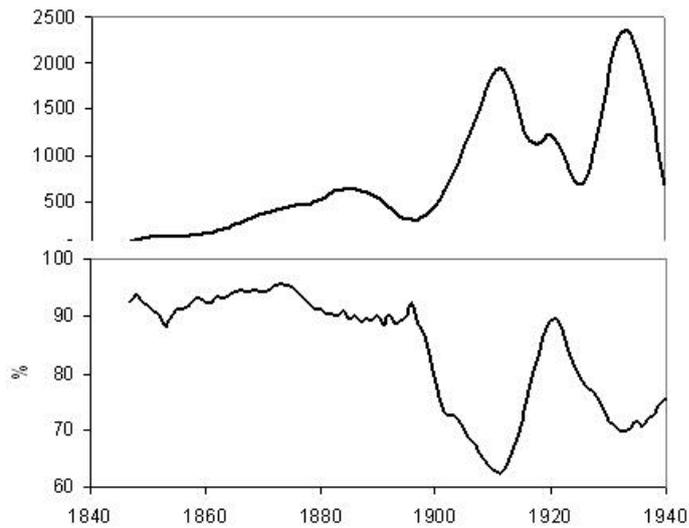


Illustration 10: First State Exam Secondary School Teaching: Total Number of Exams (Above) and Pass Rate (in %) (Below)



In the medium-term the pass rates seem to fluctuate considerably. In that case their size is affiliated with the boom of the degree courses. At times where many people study one degree course and the career is seen as crowded the

failure ratio increases. On the other hand only a few fail the exam at times where a smaller amount of people study a course and the career has a deficiency. This correlation exists for all careers and is well researched. Illustrations 9 and 10 show this correlation for the protestant theology and for teaching. Every time the number of exams is high, the pass rates decrease and vice versa. One explanation for that is that the job market situation, which means bad career prospects in times of overflow and good career prospects in times of deficiency, generates a good climate of selection which reaches as far as to the academic exams (Titze / Lührs / Müller-Benedict / Nath 1990, Müller-Benedict 2005).

### *2.3.2 Decrease of Student Numbers Between First Exam and Second Exam*

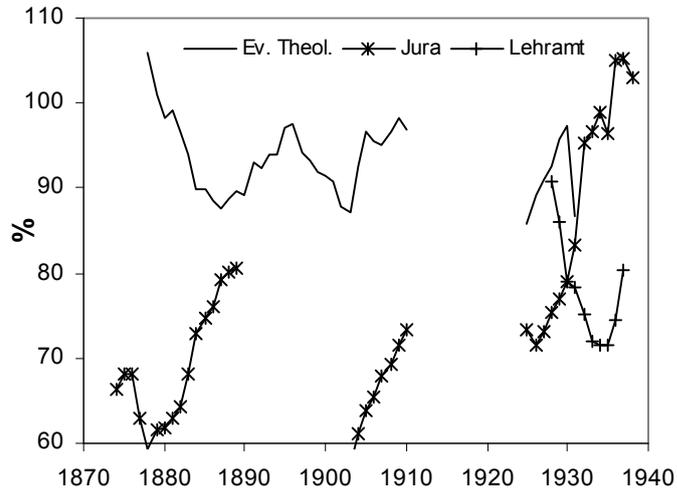
The decrease of student numbers between the first and the second exam is calculated by taking the number of second exams passed in percent to the number of first exams passed, which have been conducted in the average number of precedent years normally passing between the two exams. Since the regulation of the second educational phase (law 1869: four years, Teaching 1898: two years, theology 1898: two years) minimum times have been defined in the examination regulations for this period of time. These minimum times have been used in the following illustration. Additionally it has to be considered that the candidates can extend these interim times because of employment, auxiliary times and shortage of money which means that the actual period of time between the two exams probably showed big dispersions from the scheduled period of time. For this reason 7-year sliding averages have been calculated from the total number. Out of these average numbers the continuation rate has been calculated for the according periods of time (s. illustration 11).

The illustration shows that theology only experienced a small decrease of student numbers compared to those in careers in law and teaching. The numbers exceeding 100 percent in theology can be explained by the big replacement need at that time, which was the result of the restrictive employment policy in the 1850s and 1860s in combination with an increased age structure wave which lead to an increased number of retirements. Thereupon candidates who had been waiting for a longer time were employed.

In the German Empire as well as in the Weimar Republic the fluctuations of the continuation rate by a margin of more than 20 percent are very high in law. This is due to two reasons. On one hand the career within the law was one of the most exclusive ones leading to long unpaid waiting periods in legal clerkships and "assessorats". The national employment policy took advantage of this situation. On the other hand law practitioners had other possibilities than the normal ways to advocacy or the appointment as civil servant. They could get employment in economy and administration after the successful completion of the first exam. The numbers exceeding 100 percent in the 1930s are based on the broad extension of the national judiciary by the National Socialists (NS),

e.g. in the area of tightened family law, criminal law and the so-called racial law. Thereupon many law practitioners who have been on the waiting list since the 1920s got appointed a post in civil service.

Illustration 11: Continuation Rates Between First Exam and Second Exam, Prussia<sup>4</sup>.



The decline to 60 percent in the field of teaching in the mid-1930s showed the bleak prospects for candidates in that area. This was partly due to the high number of traineeships following the big number of students at the end of the 1920s and the beginning of the 1930s and partly to the restrictive employment policy of the NS-government.

### 2.3.3 Comparison of the Development of the Average Grades

The grading system of exams during the period in question developed only slowly and then inconsistent. At first the only grades were “passed” and “failed”. During the second half of the 19th century a gradation starts to establish for the grading of exams in the classical careers, mainly a division in three parts. During the development of a standardized professional model, where its qualification is documented by passing the final exam, it was found more important to eliminate the horizontal differences between the exams first, e.g. the limitation to certain working areas. In the case of teachers the different grades in the exam have long been limiting their permission to teach at different levels

<sup>4</sup> Gaps are due to missing data and the accumulation of sliding averages.

in one school. A “limited” *facultas docendi* did not authorize the teacher to teach upper schools in secondary education. These gradations were first abolished in 1898. The different competencies for the basic surgical and internal medical conditions (*medici puri*) in medicine were abolished with the examination regulations of 1869. Until 1869 a gradation also existed in law in the form of the tripartition of the practical training which led to separate qualifications for high courts and lower courts. A comparison of average marks has to consider these different developments as a predecessor of the particular grading.

To calculate the overall average grade the following procedure was used: if there are three different categories of grading they will be allocated the numbers 1, 2, and 3 according to their ordinal gradation. In the following careers there are discrepancies to this system.

Law practitioners: In law the grade “good” was divided into “good” and “satisfactory” in 1923. For the comparison with other careers the candidates graded “satisfactory” and “sufficient” will from that time on be counted in category 3. Additionally the category “very good” was introduced in the NS era (as of 1934) and was in between “with honors” and “good”. Thus candidates formerly graded “good” are divided into “good” and “very good”. Accordingly the candidates graded “with honors” and “very good” will be allocated category 1 while candidates graded “good” will remain in category 2.

Physicians: until 1884 three grades were used: “with honors”, “very good” and “good”. As of 1887 this changed to “very good”, “good”, and “satisfactory” which have been allocated the categories 1, 2, and 3 accordingly.

Teachers: Between 1868 and 1880 the exam could be passed “without degree”, which meant a permission only to teach the lower levels at secondary schools. The grading “without degree” will therefore not be included. In 1888-1898 a “limited degree” could be awarded to candidates, which is another form of limited permission to teach. Therefore it will also not be included, which means that in these years only the grades “good” and “satisfactory” are available.

These limitations have been considered in the following illustration 12 which shows the long-term development of the overall average grades in the first exam in Prussia.

For the careers the following can be said:

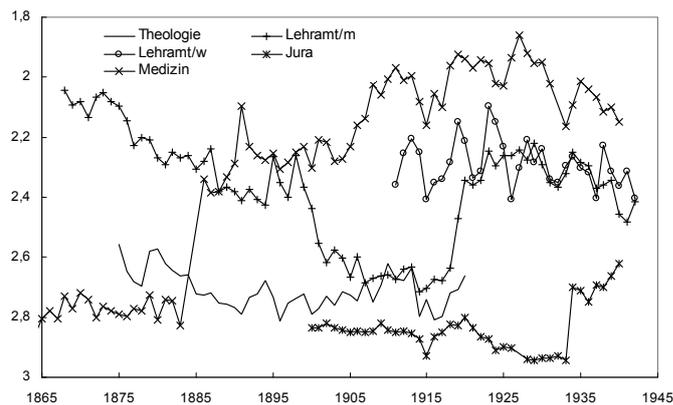
Theology: In the exam in theology a vastly constant overall average grade prevails during the course of time.

Law: The overall average grade in the first exam in law increases in the NS era after a constant performance between 1900 and 1934. This increase can be related to the changes in the grading system at that time, amongst other things.

Medicine: The overall average grade in the medical exam increases slightly until the mid-1920s and then decreases again. The leap of grades between 1884 and 1887 is the result of the changes in the grading system.

Teaching: The overall average grade in the first exam decreased slightly during the analyzed period of time. Female teachers tested in the first years after getting the authorization did on average get better grades than their male counterparts. The grades started to align after a while. The break-down of the overall average grades for men after 1898 has to be attributed to the fact that first as of this time the exam equaled an unlimited permission to teach at secondary school. This meant that candidates which earlier only would have gained a limited permission now passed with a bad grade.

Illustration 12: Overall Average Grades in the First Exam, Prussia



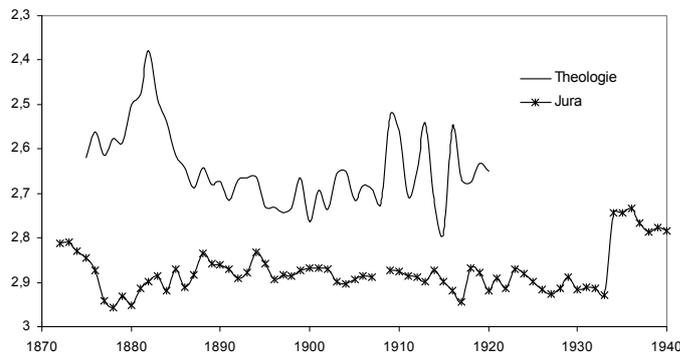
Comparing the different careers it can be noticed, that

- law practitioners and theologians have the lowest grades over the period of time while teachers have average grades and physicians have the highest grades.
- Teachers have the biggest long-term decline in the overall average grade.

Contrary to the pass rates, stable long-term variations in the grading existed. Because of their long-term stability they cannot be explained by different qualifications of the students but have to be seen as the result of the faculty cultures of the academic careers, based on different societal functionality, different historical development paths and the subsequent initial grading and later on the interference in the grading via the examinations regulations in the particular degree courses.

In the second exam, in which grades only are available in theology and law, the general average in law is consistent while the grades in theology increase about 0.1 over the analyzed period of time, as can be seen in illustration 13. Again, in law there are little fluctuations except of the improvements during the NS era due to a changed grading system. In theology it is obvious that the overall average grade was increasing about 0.2 point during the period of deficiency of theologians (before 1885).

Illustration 13: Overall Average Grades in the Second Exam, Prussia



#### 2.4. The Development of the Doctorate

Up until the 18th century a master's degree or a doctorate was the normal degree awarded by universities. The introduction of national exams created a new degree, the state exam, which was necessary for those who wanted to be appointed certain positions within the civil service. The professional training of self-employed physicians and lawyers followed a model similar to that of civil servants and was completed with a state exam as well. Thereby the doctorate became an additional achievement for all careers but it was not necessary to work in their profession.

For a career at universities a doctorate for all professions is necessary up until today but this can only attribute to a small share in doctorates awarded. A motif to get a doctorate degree besides that can be to add an additional proof of qualification as in the case of self-employed professionals. To a certain extent this could explain why only few graduates in theology but a majority of graduates in medicine got an additional doctorate.

The prohibition of the title Councilor of Justice in 1927 led to an increase in doctorates for lawyers organized in the DAV (Deutscher Anwalts – Verein). However, a huge fraction of the doctorates awarded can be explained by the historical traditions of the professions. Especially in the case of physicians a doctorate is to be expected (German expression "Herr Doktor").

In academic careers in the technical and scientific field, which started developing in the mid-19th century, only those needed a state exam aiming for a job in civil service, e.g. food chemists and site supervisors. For all others the diploma degree (as of 1960 the master's degree too) became a protected title, starting with the engineers in 1899. In the career in chemistry, which was the first natural independent scientific specialization long before other specializations followed, the doctorate therefore was the only available university degree. The diploma degree in chemistry started at universities as a "Verbandsexamen"

in 1897 and only since 1939 the chemists can complete their studies with a diploma degree. Because of that the doctorate in chemistry is still the rule (Lundgreen 2006). The introduction of the diploma degree in the new developing degree courses advanced only slowly as well (for graduates in commercial studies in 1923, for graduates in trade in 1924, and for graduates in physics and mathematics at technical universities in 1921 and at universities in 1942). This leads to the assumption, that a doctorate as a university degree had much more importance in these degree courses. Until the establishment of a faculty of economics, mathematics and sciences in the 1920s, a doctorate in the new degree courses awarded the candidates the title of “Dr. phil.” At the same time many of these courses, e.g. biology, physics, geography, and chemistry were also courses of teaching studies so that the studies often had been completed with a state exam earlier on. Which role the doctorate had for candidates not aspiring for a job in secondary education can thus only be estimated by the data available for the faculties and degree courses.

Teachers at secondary schools still saw themselves as scientists until the end of the 19th century. Their scientific papers played a role in their promotion to a professor or director as well as in the rise to a higher income bracket. Salary increases got independent from a doctorate of the teacher by the abolishment of the principle of seniority in 1892. Until that point getting a doctorate was thus also a materiel incentive for teachers in secondary education.

#### *2.4.1 The Quantitative Development of Doctorates*

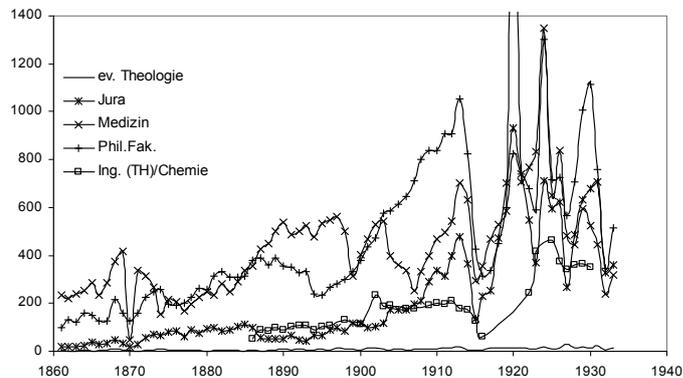
The interpretation of the data of doctorates is difficult due to certain factors:

- Until 1931 all data concerning doctorates are relating to the respective faculty. Data about doctorates in single degree courses of these faculties is only available for the faculty of medicine.
- During the time of the Weimar Republic each term there were doctorates awarded at different universities which were not collected. This leads to strong fluctuations of all times axes in the defined period of time.
- During the time of the Weimar Republic new faculties developed, e.g. the faculty of natural sciences, the faculty of economics, the faculty of political sciences, and hybrids thereof. For universities these divisions happened at different points in time and in different ways whereas single degree courses are assigned to different faculties. As of this time the new faculties have been pooled for the following presentation in an art and philosophical faculty consisting of cultural studies and natural sciences, and in a faculty of law including political sciences and economics.
- The doctorates at the faculty of medicine do in parts include doctorates in dentistry. During and directly after wars unusually many doctorates in medicine are awarded.
- The total share of Prussian doctorates in German doctorates in chemistry and engineering constitutes an estimation based on the number of students in

these courses at Prussian universities in comparison to all German universities and technical universities (s. illustration 1).

Illustration 14 shows the number of doctorates in Prussia in the four classic careers, and in technical sciences.

Illustration 14: Doctorates, Prussia



This illustration comprises all doctorates at Prussian universities and technical universities. The total number of doctorates per year increases from 355 in the year 1861 to 2683 in the year 1930 and thus constitutes for two-thirds of the increase in student numbers from 6512 (winter term 1861/62) to 64166 (winter term 1930/31) (DHB I/1 = Titze 1987, S. 36 und 38).

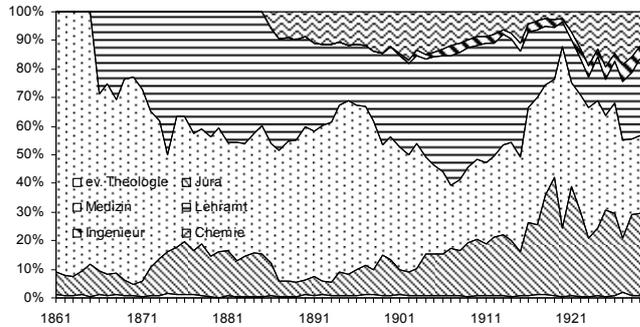
Most doctorates were awarded in medicine and at the faculty of philosophy with about the same amount of doctorates. In absolute numbers law and technical sciences can be found in the middle with about the same number of doctorates while protestant theology only has few doctorates.

#### 2.4.2 The Share of the Careers in the Doctorates

How the share of each career on the number of annual doctorates changes can be seen in the profile (illustration 15). Instead of all doctorates at the faculty of philosophy only doctorates in teaching studies have been used for the illustration. The numbers of doctorates are estimations only. The share of students in teaching studies, which has been subordinated the faculty of philosophy in this illustration, in the total number of doctorates was set equal to the share of students in teaching studies in all courses at the faculty of philosophy and since 1920 the faculty of natural sciences, which too has been estimated. That way the number of doctorates in teaching studies includes doctorates in courses of which graduates rarely actually became a teacher at a school. This is the case for chemistry at universities until 1902 (which therefore has partly been counted double in this illustration) and all other degree courses developing at

the faculties of natural sciences at many universities in the Weimar Republic. Because of this doctorates in teaching studies during that period of time were more likely to be overestimated.

Illustration 15: Profile of the Doctorates, Prussia



It is obvious that the share of doctorates in law and chemistry during the time increased while especially the share of doctorates in teaching studies declined. The doctorates in technical sciences were only to a lesser degree completed by engineers. Mainly they were awarded to chemists for whom this degree was the only possible degree until 1939 due to a long and difficult establishment of the degree course.

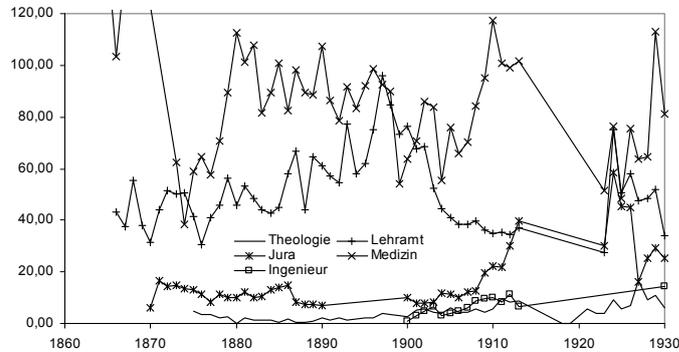
#### 2.4.3 The Importance of Doctorates for Each Degree Course

In order to compare the importance of a doctorate for a career, the ratio of doctorates to exams passed in the same year for all careers during that period will be shown in illustration 16.

The illustration shows that doctorates were the rule at the faculty of medicine (approx. 95%), while they were not common in protestant theology and engineering (less than 10%). Their importance at the faculty of law was also minor (10-20% until 1914). Their number started to increase after that though it cannot be determined to what extent the faculties of economics had a share in that growth. In 1932 the doctorates in economics with a total of 521 doctorates accounted for nearly one-third of all 1497 doctorates in law and political sciences in the German Empire (10 year statistics, S. 138). In teaching studies the doctorates played a medium important role with a share of 40 to 60 percent though their importance at first increased as the title “professor” and affiliated privileges depended on it. Their share declined excessively after 1898 as advancements since that time were treated independently of the scientific endeavors of the teacher. The decline is even more obvious if the fact is considered that degree courses in natural sciences are included in the increasing number of

doctorates at the end of the period of time in question, and graduates of these courses did not aim to become a teacher.

Illustration 16: Doctorates Compared to First Exams Passed, Prussia<sup>5</sup>.



### 3. Age Structure

#### 3.1 The Meaning of Age Structure for the Development of the Careers

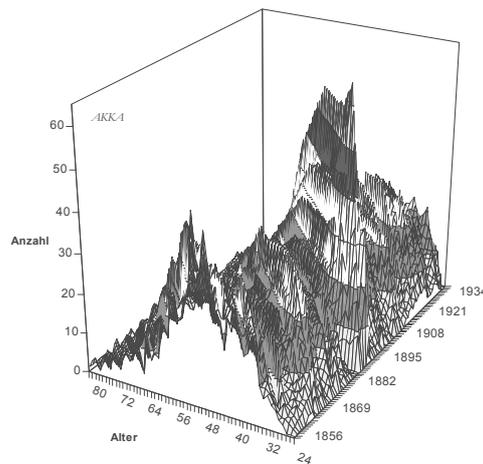
Academics are more rarely unemployed than members of other vocations. Especially jobs in civil service, where the positions are subject to centralized national planning, are guaranteed. For that reason the average length of employment of an academic is an important factor of the job market. In this period of employment he will occupy a position in a career. A person once made a civil servant is blocking a position for the time period of a professional life to young academics.

Does the amount of available positions of a career not change or does it only change slowly thus being mainly determined by the replacement need, the average age of the job holder will become the decisive factor for job openings. Only those jobs will become available where recent job holders have reached the retirement age. An even age distribution of the job holders will lead to a constant number of job openings. An age distribution with concentrations of people of a certain age group will create long waves of replacement needs which have exactly the length of an average length of employment and will reproduce continuously. As long as the dominating age groups will not reach the retirement age there are only few job openings, then within a short amount

<sup>5</sup> Time period 1914-1920 interpolated. Engineers: The number for 1930 represents the number of doctorates in engineering in 1929 in percent of the diploma examinations of 1931.

of time too many job openings will be available. This will lead to a crisis due to the shortage of young professionals. In the illustrations 17, 18, and 19 depicting the age structure of protestant theologians, law practitioners in civil service, and teachers in secondary school the dominant cohorts will extend as waves diagonally from younger professionals respectively earlier years to older professionals respectively later years. Such an unbalanced age structure is created if surges in employment of younger professionals happen within a short periods of time, e.g. if the career starts to constitute itself, if new institutions are created and political reforms are implemented.

Illustration 17: Age Structure of Protestant Theologians in Silesia, 1856-1937<sup>6</sup>



In intervals of the medium length of employment, which is approximately 30-35 years, an excessive aging of the professions of a career is taking place followed subsequently by a generational change. The term generation can be used because a profession within a career is rejuvenated during a very short period of time. The average age falls rapidly within a few years. Thus the average educational standards learned by the members of the career have abruptly become more modern by a whole generation. For this reason these times often coincide with times in which attitude and the value system of a career changes (Nath 1999). The generational change in theology in 1890 (illustration 17) intensified the avoidance of the civil public and the turning to mere church-internal matters. The surge in the generational change in the case of teachers of secondary education at around 1900 (illustration 19) fueled the latent militarism and nationalism of this career (Titze 1991).

<sup>6</sup> Interim periods are interpolated.

Illustration 18: Age Structure of Judges and Attorneys, Prussia 1861-1934.

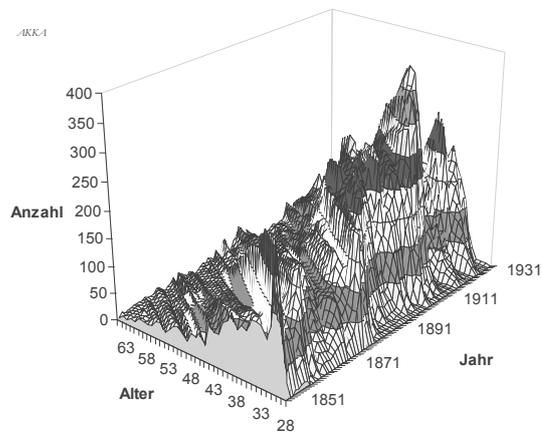
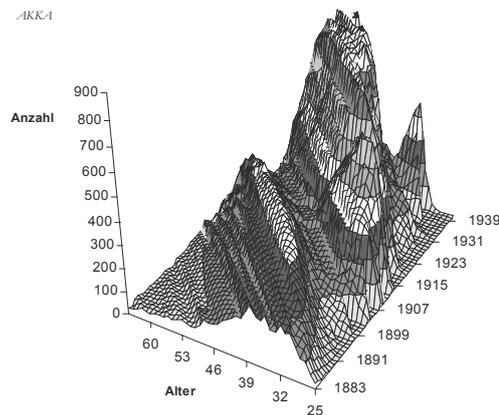


Illustration 19: Age Structure of Teachers in Secondary Education, Prussia 1883-1939<sup>7</sup>.



The effect of an unbalanced age structure is lessened when the need for expansion is bigger than the replacement need. This is especially the case for new fast-growing careers. On the other hand the effect is becoming stronger when the age structure in various academic careers shows an accumulation in the

<sup>7</sup> Interim periods are interpolated.

same birth cohort. At the time of the generational change a general crisis will occur because all careers then will have a huge demand for young professionals during the same period of time (Müller-Benedict 2002). Thus the age structures had a crucial influence on the development of the careers which has been much neglected so far.

### 3.2 The Power of the Influence of the Age Structure

Employment surges leading to long waves keep their influence in the model until the defined cohort is reaching retirement. In reality there is a chain of other historical reasons modifying the effect. During the length of an employment a part of the job holders die in office. The size of this part fluctuates depending on the health care system, plagues and wars, and especially the regulation of the retirement age. In many cases job openings cannot be filled again, maybe for financial reasons (e.g. for the protestant church since the 1920s) or maybe due to a deficit of candidates. If waiting lists apply sometimes people who have been waiting for a longer period of time and thus are older will be the first to be employed. This was the case for teachers. Thus the long waves are getting broader and narrower. In the illustration this can be seen by the broadening and reduction of the waves progressing to the “older part”.

In comparing the careers it is interesting to see how much their respective job market depended on the long waves of the replacement need. Two variables flow into the definition. One is the extent of the concentration of the age structure at the peak showing the strength of the effect of a long wave and thereby the replacement need. The other one is the growth of the amount of current jobs of a career, which defines the ratio of the replacement need to the total demand.

#### *3.2.1 Comparing the Effect of the Age Structure on the Replacement Need*

As a wave can change its form and level itself out due to the historical reasons mentioned before, the effect-size of the age structure can only be compared when the waves of the different careers are in a similar stage of development. For this reason a cross section of the age structure at that point of time, where professionals around the age of 35 form the biggest cohort, is calculated for each career (if possible) in the different time periods of the 1920s and the 1930s. The results are shown in table 4.

If the occupation is even and the working length of employment is 35 years, each 10-years cohort should have a share of about 28.6%. Searching the table for the 10-year cohort of a career holding most jobs it is visible that in the case of theology it is the age group of 35-44 years with a share of 28.8 percent, for law practitioners working in civil service the age group of 35-44 years with a share of 38.6 percent, for medicine the age group of 30-39 years with a share of 39.5 percent, for teaching at secondary schools the age group of 35-44 years with a share of 47.1 percent, for engineering the age group of 30-39 years with

a share of 32.2 percent, and for chemistry the age group of 30-39 years with a share of 32.7 percent. Comparing the careers this means that at this point in time the fluctuations in the replacement need due to the imbalance in the age structure was expected to have been the strongest for teaching studies, followed by medicine and law at about the same level followed again by engineers and chemists. The replacement need was average in theology.

Table 4: Distribution of the Age Cohorts in the Careers Around 1930, Prussia and German Empire.

Career	Age	Below 30	30-34	35-39	0-44	45-49	50-54	55-59	60-64	65-69	70-74
theology 1937	N	17	82	101	98	100	79	81	81	52	13
	%	<b>2,5</b>	<b>11,9</b>	<b>14,6</b>	<b>14,2</b>	<b>14,5</b>	<b>11,4</b>	<b>11,7</b>	<b>11,7</b>	<b>7,5</b>	<b>1,9</b>
law (civ.s.) 1932	N		238	903	869	677	825	658	357	62	0
	%		<b>5,2</b>	<b>19,7</b>	<b>18,9</b>	<b>14,8</b>	<b>18,0</b>	<b>14,3</b>	<b>7,8</b>	<b>1,4</b>	0
medicine 1930	N	4023	19760		10390		8683		3670	2235	1251
	%	<b>8,0</b>	<b>39,5</b>		<b>20,8</b>		<b>17,4</b>		<b>7,3</b>	<b>4,5</b>	<b>2,5</b>
teaching 1921	n	143	1944	3295	2364	1207	805	1030	1188	45	0
	%	<b>1,2</b>	<b>16,2</b>	<b>27,4</b>	<b>19,7</b>	<b>10,0</b>	<b>6,7</b>	<b>8,6</b>	<b>9,9</b>	<b>0,4</b>	0
engeneer. (TH), 1933	n	66791	66998		40557		27693		4378	1529	
	%	<b>32,1</b>	<b>32,2</b>		<b>19,5</b>		<b>13,3</b>		<b>2,1</b>	<b>0,7</b>	
chemistry, 1930	n	4620	3309	2200	1588	1701	1722	1041	659	0	
	%	<b>27,4</b>	<b>19,6</b>	<b>13,1</b>	<b>9,4</b>	<b>10,1</b>	<b>10,23</b>	<b>6,2</b>	<b>3,9</b>	0	

The influence of the career growth, which in the case of a forecast of the actual number of job openings has to be considered, is not included in this comparison. The influence of the age structure will become stronger on the job market of the careers when their growth is becoming smaller. This means that national careers in civil service, such as theology, teaching in secondary schools and the relevant part of law practitioners will be influenced most by the age structure of the job holders.

The cycles thus persist until up to today. In the 1960s there was a shortage of young academics in the FRG. After a temporary occlusion and shifting of the deficiency by a few years through flights and immigration from Eastern Germany, amongst other things, this led to the big educational reform of the 1970s and again to another very unbalanced age structure (Müller-Benedict 2002), which actually today results in a strong shortage of teachers.

With regard to the often researched support of the ideas and measures of the NS-state by academics the age structure can be insightful. In all careers, though especially in the careers in teaching at secondary schools and medicine, in the 1920s the majority of jobs were filled by younger professionals.

If the same analysis is done again for the 1890s, which means a length of employment earlier, the results are as in table 5.

Table 5: Distribution of Age Groups within the Careers Around 1890, Prussia.

Career	Age	bel. 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	über 70
theology 1898	n %	0	19 <b>2,2</b>	209 <b>23,8</b>	205 <b>23,3</b>	104 <b>11,8</b>	58 <b>6,6</b>	63 <b>7,2</b>	93 <b>10,6</b>	71 <b>8,1</b>	28 <b>3,2</b>	28 <b>3,2</b>
law (civ.s.) 1888	n %		0	418 <b>11,5</b>	1036 <b>28,5</b>	632 <b>17,4</b>	389 <b>10,4</b>	400 <b>11,0</b>	389 <b>10,7</b>	213 <b>5,9</b>	109 <b>3,0</b>	49 <b>1,3</b>
teaching 1887	n %	1 <b>0</b>	337 <b>6,6</b>	1029 <b>20,3</b>	1018 <b>20,0</b>	1020 <b>20,1</b>	709 <b>14,0</b>	413 <b>8,1</b>	272 <b>5,4</b>	187 <b>3,7</b>	92 <b>1,8</b>	0

The concentration of the age structure in theology is to be found in the cohort of the 30-39 year old professionals with 47.1 Percent, in the careers of law practitioners in civil service in the cohort of the 35-44 year old professionals with 45.9 percent, and in teaching at secondary schools in the cohort of the 30-39 year old professionals with 40.3 percent. This strong staffing with younger generations was one of the reasons for the first modern academic crisis due to overfilling in the 1880s, shaping the definition of the “educated proletariat” (Titze 1990, S. 234 f.). It was based on the general lack of academics leading to favorable recruitment conditions in the 1870s after the restrictive policies of the 1850s and 1860s.

### 3.2.2 Ratio of Replacement Need to Need for Expansion

The availability of job openings can be increased by the growth of the job market beyond the replacement need. If this need for expansion is high it will exceed the fluctuations in available job openings caused by an unbalanced age structure. Thus the cyclic occurrences of crises due to a lack of professionals will be dampened or averted. If the age structure is evenly distributed and the length of employment is 35 years, 28.6 percent of the jobs have to be newly filled in 10 years due to the replacement need. The more the share of the dominating 10-years cohorts from tables 3 and 4 exceeds the average value, the stronger the fluctuations in the replacement need will be. In order to define the ratio of both influences this value can be compared to the growth of the job market in 10 years. For this, the growth rate of the careers (illustration 1) will be determined for the respective precedent years. The growth rate has to be averaged due to the fluctuations over several years (depending on the data available).

The comparison shows which of the two influences had a stronger effect on the number of job openings (the recent demand). Teaching at secondary schools, careers in law and theology – the three careers in civil service – were subjected to the long waves of the age structure the strongest. In theology this influence got lost at a later point in time, especially due to the non-filling of job openings due to the financial situation of the church. Contrary to that it in-

creased slightly for law and strongly in the field of teaching, where the influence of the age structure was the highest ever. Another thing clearly visible is that the age structure was irrelevant for the job market of the new technical careers. In this area many new jobs were created so that the replacement need was rather small against the growth of the job market, especially for engineers. Accordingly the engineer association shortly after the turn of the century stated a constant overfilling of their job market. Physicians as a self-employed profession are again to be found in the middle position. Their job market was characterized by a total growth three times as strong as the fluctuations of the replacement demand.

Table 1 for chapter 3.2.2: Growth Rates and Effect of the Age Structure

Karriere	Wachstumsrate (%) der 10 Jahre vorher	Stärkste Kohorte ist über dem $\bar{x}$ in %
Theologie 1937	~0	0,2
Jura (Staat) 1932	~8	10
Medizin 1930	~34	10,9
Lehramt 1921	~10	18,5
Ingen., DR, 1933	~72	3,7
Chemie, DR 1930	~15	4,1
Theologie 1898	~8	18,5
Jura (Staat) 1888	~20	17,1
Lehramt 1887	~14	11,7

### 3.2.3 *The Simultaneity of the Peak Level of the Replacement Need*

Though the replacement demand only determines one part of the economic activity of the job market, its influence will increase if the replacement needs for several academic careers reach a peak level at the same time. This will lead to a general lack of young academics. If the dominating cohorts appear at the same time in the same age groups this shows a synchronization of the influences of age structures of the careers. The distribution of the age structure in the year 1925 will be compared in illustration 20.

Engineering and chemistry show the typical structure of careers with increasing growth. The youngest cohorts were the dominating cohorts. In medicine (age 30-40), teaching (age 40-44), law (age 45-49), and theology (age 60-64) the strongest cohort in each case was about 5-10 years older so that reaching the peak of the replacement need could be expected with a delay and fluctuations would not accumulate. The high share of young age cohorts in medicine is also caused by physicians approbated during the war and the growth of

the career. Additionally it is obvious that theology had the most even age structure of all careers.

Illustration 20: Age Structure of the Careers in 1925 in Percent, Prussia or German Empire (Engineering and Chemistry).

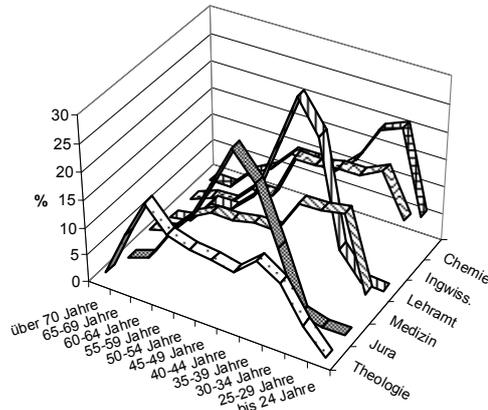
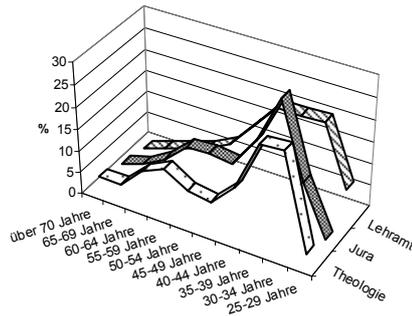


Illustration 21 is the result of the same presentation of date for the year 1890.

Illustration 21: Age Structure of Three Careers in 1890 in Percent, Prussia



In the precedent generation the strongest cohorts of the protestant theologians, law practitioners and teachers at secondary schools were in the same age group (age 35-39) so that an accumulation of the replacement need of all three careers was to be expected after the length of an employment (beginning of the 1920s). Besides growth and the consequences of war it additionally increased the attractiveness of academic professions. In the beginning of the 1930s the next big crisis due to overfilling could be observed. As seen in illustration 20 the peak level of the theologians is at the age group of 65-69 which shows that

only the replacement need for the stationary career of the theologians has increased continuously. In teaching the strong growth of secondary schools since the turn of the century until the beginning of the First World War (illustration 17) led to a constant increase of newly appointed teachers. These appointments form the peak of the distribution of the age structure in teaching in 1925. With this they strengthen the replacement demand following the distribution of 1890, which additionally participates to the young age groups.

#### 4. Conclusion

In the observed period of time the big academic careers have adjusted in terms of important career steps, especially the academic education. Still professional path dependencies prevailed in the grading and the doctorates. The quantitative growth of the careers is the result of a variety of influences. The most important influences are the need of academic achievements as expected by society and the occupational field occupied by members of a specific career.

Two other factors determined the scope for growth. On one hand it is the specific type of professional services offered by a career, which often was identical with the type of employment. On the other hand it is the dynamics of supply and demand in their segment of the labor market, which especially in the field of careers within the civil service was defined by long cycles.

Further questions arising after these results are how these different dynamics, especially a surplus of academics, influences the societal demand via innovation and professional differentiation and thus pushes the own growth.

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