Technologies of trust: actuarial theory, insurance sciences, and the establishment of the welfare state in Germany and Switzerland around 1900

Martin Lengwiler

Center for Social and Economic History, University of Zurich, Raemistrasse 64, CH-8001 Zurich, Switzerland

Abstract

The article analyzes the relation between transformations in information systems and changing forms of organization. Drawing on a historical case study, it examines the rise of actuarial theory in Germany and Switzerland around 1900 and its significance for the emergence of the first modern social insurances. So far, the history of actuarial theory has been written as the social history of the actuarial profession or the epistemic history of probability calculus. By examining the political and economic contexts of the history of actuarial theory, the article also discusses the notion of an "insurance society". The argument concludes that Foucauldian interpretations of actuarial theory as a technology of power and a condition of modern governmentality are too monistic and should be specified. The article suggests to use the concept of a "technology of trust" to interpret the integrative power of actuarial theory in a political field marked by deep antagonisms.

© 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Actuarial theory; Social insurance; Welfare state; Germany; Switzerland; Insurance society; Governmentality; Technology of trust; Actuarial theory; Insurance sciences; and the establishment of the Welfare state in Germany and Switzerland around 1900

I. Introduction

The article examines the relation between transformations in information systems and changing forms of organization. My historical case study draws on the establishment of a new scientific discipline, actuarial theory, in Germany and Switzerland around 1900, and its significance for the emergence of the first modern social
insurances. The relation between new forms of information, in this case the discipline of actuarial theory, and changes in organizations, like the establishment of social insurances, is understood as a reciprocal, co-emergent phenomenon: the first social insurances depended on new scientific disciplines while at the same time helping actuarial theory to institutionalize itself within the academic system.

Similar interactions between informational and organizational change have been highlighted by other historical research. Business history in particular has recently started to examine the rise of information technologies in organizational contexts, a process lying at the heart of the transformation of industrial into information or knowledge societies (Chandler, 2000). Following Alfred D. Chandler's classic study on the changing forms of 19th century business practices in the US, JoAnne Yates examined how the adoption and use of new information techniques and technologies shaped the development of American businesses, offices, and markets around 1900 (Yates, 1989; Chandler, 1977). Cautioning against any technological determinism, Yates interprets management technologies and information systems as part of a contingent process of increasing control over subordinates, based upon the rise of what she calls a "systematic managerial ideology" (Yates, 1994). To interpret information systems and their organizational and social impacts as infrastructural mechanisms to increase social control, is a classic criticism since the work of James Beniger on the social meaning of information technologies (Beniger, 1986).

Yates' work offers an interesting comparison between two organizational contexts. Like other works in contemporary business history (Temin, 1991), Yates deals with organizations of the private economy while the cases of this article are public institutions. This distinction between private and public organizations, as will be argued below, plays a crucial part in the development of actuarial science as an academic discipline. Also, the difference between private and public bears on the role that information systems can play in organizations. In Yates' case, the systematic managerial ideology is used to enforce organizational control. Actuarial theory however had a much more integrating and even conciliatory effect within social insurances.

The article begins by discussing two theoretical approaches that specifically deal with the history of insurance and actuarial theory: a Foucauldian approach interpreting insurance as a disciplinary social practice, and a history of science approach focusing on the role of scientific knowledge in insurance practice. Then, the article examines the emergence of actuarial science at the end of the 19th century, when actuarial science was established as an independent academic discipline in several European countries. As Desrosières (1991, pp. 195–197) and Lenoir (1992, pp. 209–225) argued, scientific and non-scientific institutions are a crucial pre-condition for the success of scientific knowledge in society. In the case of actuarial science the relevant institutions were private insurance companies, early welfare insurances, and the late 19th century universities and polytechnics. The analysis will focus on the interplay between informational and organizational change: In what institutional contexts did the professional knowledge of actuaries become academic, scientific knowledge? What was the role of scientific quantification both for private insurance and social insurance? Why were the early institutions of the Welfare state particularly interested in an actuarial science as an academic discipline?
The article compares the cases of Germany and Switzerland, partly also reflecting the British model. Germany represents an exceptional case. The German actuaries, unlike their other European colleagues, did not content themselves with an merely actuarial discipline and took a different path. At the turn of the century German academics created a new interdisciplinary insurance science, called “Versicherungswissenschaften”, integrating actuarial mathematics and other insurance-related disciplines such as insurance medicine, insurance law, and insurance economy. However, the attempt to create a new science partly failed. The model of German insurance sciences was adopted nowhere else in Europe, not even in Switzerland, otherwise closely related to Germany. Eventually, in 1928 the German actuaries abandoned the interdisciplinary project and set up their own journal. In this sense, the German case also illustrates the potential of analyzing failures in the history and sociology of science.1

However, the failure was limited to the epistemic level where disciplinary traditions remained stronger than the interdisciplinary impetus. Institutionally, insurance sciences was quite successful and still remains effective in Germany, with several institutes and chairs at universities and with a still existing interdisciplinary journal (the “Zeitschrift fuer die gesamte Versicherungswissenschaft”, quoted as ZVW).

The Swiss case makes an interesting comparison because it is both closely related to Germany and still different. Academically, the German part of Switzerland, where the leading figures in actuarial theory came from, shared the same university system with Germany, and both academic communities cooperated closely. The differences, as will be explained below, came from the political system. Therefore, the history of insurance sciences in Switzerland serves as an contrasting example to investigate the institutional and political conditions of the establishment of actuarial science in different national contexts. The comparison to Germany helps to analyze the impact of different organizational contexts on the development of scientific knowledge.

The article argues that actuarial science arose as an academic discipline mostly with respect to welfare institutions and not to private insurance. Although both sectors of insurance, private and social insurance, expanded significantly around the turn of the century, only public institutions were actively and supportively involved in the establishment of actuarial science. The first part of the article examines the professional prehistory of actuarial science before the end of the 19th century, particularly focusing on the attitude of private insurance companies towards scientific methods. The second part analyzes the emergence of insurance sciences as an academic discipline in Germany. In the third part, I will sketch the establishment of actuarial science in Switzerland, comparing it institutionally and politically to Germany.

1 Wagner’s (1991) account of the early history of German sociology, with its failure to establish a lasting institutional platform before the Second World War, is good example for a counter-factual study.
2. Two approaches to the history of insurance

Insurance has become an important form of organization in modern societies. With his notion of a “provident state”, François Ewald has critically assessed this secular rise of insurance. For Ewald, insurance practices, namely by institutions of the Welfare state, changed modern society fundamentally into an “insurance society” (“société assurantielle”), with the welfare policy as a new “disciplinary” technique and the insurance policy as a new “contrat sociale” (Ewald, 1986, pp. 1–15, 381–384). Ewald’s study is only the most prominent example of a group of works that apply Foucault’s concept of “governmentality” to the topic of insurance, displacing thus a state-focused concept of power with the idea of a plurality of governing institutions and with their respective technologies of power (Foucault, 1982, 1991; Doran, 1994; Dean, 1999; Knights & Vurdubakis, 1993; Clark, 1999).

These critical studies in the history of insurance are paralleled by a recent interest in the history of insurance as a specific information system, an interest notably in the history of calculation, accounting, classification, and probabilism (Krueger et al., 1987; Power, 1994; Poovey, 1998). Considering scientific disciplines as a particular system of information, we can trace the history of insurance-related sciences, like actuarial science, insurance medicine, or insurance economy, to examine its consequences on the organization of insurance in modern societies. The interactions between these insurance sciences and the emergence of the Welfare state was indeed multifarious. Already in the latter decades of the 19th century, actuaries co-operated with the statistical experts of public administrations in working out the methodological foundations of modern social statistics (Porter, 1995, pp. 98–115). In the 20th century, private insurance companies were successful in influencing some of the definitions of the International Classification of Diseases, the standard reference of diagnostic practice in modern medicine (Bowker & Star, 1999, p. 147). Also, we partly owe the conception of risk in medicine and social sciences, so pervasive in contemporary political debates, to actuarial science. Actuaries of welfare institutions, with their risk assessments, were crucial to introduce the concept of risk into occupational medicine and to epidemiology in the 1930s (Sellers, 1997, pp. 2–12). After the Second World War, the risk conceptions in epidemiology and occupational medicine formed the methodological nucleus of the rising social and preventive medicine, a discipline that built its diagnostic models around the risk factor approach (Aronowitz, 1998, pp. 119–125.). Thus, an actuarial notion of risk became the center point of public campaigns for health prevention in the post-war era, for instance against risk factors like tobacco, alcohol, or cholesterol, providing the foundations of contemporary debates on food and health risks (Porter, 1997; Green, 1999). In recent years actuarial science has embarked on another new trajectory. The so-called financial mathematics, partly an offspring of actuarial science, aims at the mathematical modelling of financial markets like the stock exchange (Bernstein, 1996).2

An example for an introduction to financial mathematics: Pliska (1997).
Historically, actuarial science, or actuarial theory as it was called around 1900, is at the scientific center of insurance practice (Alborn, 1994). Actuarial science was the earliest and most influential of several insurance-related scientific disciplines. However, our knowledge on the emergence of actuarial science as an academic discipline in the 19th century, in the context of the expansion of private insurance companies as well as of the constitution of the modern Welfare state, is rather vague and sketchy. This article investigates the social and institutional conditions of the establishment of actuarial science by bridging the two approaches mentioned above: the history of insurance as a form of organization (studies in the aftermath of Foucault and Ewald), and the history of insurance as a system of information (studies following a history of science approach).

In the following paragraphs, I will bridge these approaches to make up for their respective shortcomings. The problem of the studies in the tradition of Foucault and Ewald is that they focus on political, institutional and social contexts, namely on the application of actuarial knowledge in insurance practice, without referring to the momentum of the epistemic history (Ewald, 1986; Knights & Vurdubakis, 1993; Power, 1994). Thus, they tend to underrate the perspective of actuaries as scientists. Also, they hardly ever include the universities into their analysis. This is a substantial omission as the universities are a crucial factor for the rise of actuarial science. Studies on insurance as a form of organization tell a lot on the political, institutional and social impacts of actuarial knowledge, but they cannot explain why that knowledge had to be a science and not, say, a mere professional knowledge.

On the other hand, studies in the history of science dealing with actuarial science also have their deficiencies. They tend to focus on the epistemic level, examining the history of actuarial theory as part of a larger trend in science from deterministic to probabilistic models, without integrating the social and institutional conditions of this process. Take the influential works in the history of probability calculus, the main theoretical characteristic of actuarial theory. Against this background, actuarial theory can be seen as one element of what has been called "the probabilistic revolution" (Krueger et al., 1987). The notion of a probabilistic revolution goes back to an interdisciplinary project in the history of science, initiated by the "Zentrum fuer interdisziplinaere Forschung" at the University of Bielefeld in 1982. With an allusion to Thomas Kuhn's concept of scientific revolutions, some 20 participants of the project all pursued one common question: How did the mathematical theory of probability find a domain of application in other sciences and thus add up to the so called "probabilistic revolution" (Krueger, Daston, & Heidelberger, 1987, p. 1)? The project led to a vast series of publications, from the work of Lorraine Daston on the classical theory of probability (1988), Theodore Porter's book on the history of statistics (1986), Ian Hacking's study on "the taming of chance" by different sciences, like philosophy, sociology, or mathematics in the 19th century (1990) to the synthesis of the whole project edited by Gerd Gigerenzer et al. (1989). However, these works have been more concerned with the cognitive than with the social or institutional side of science. Although "big revolutions in science", as Hacking (1987, p. 49) put it, always come with "new kinds of institution that epitomize the new directions created by the revolution", the institutions of the Welfare state for example were not
part of the Bielefeld project. Thus, the relation between the history of welfare institutions and of academic disciplines during the late 19th and the 20th century, of which the social and institutional history of actuarial science is an important part, remains still largely unknown.3

3. The paradox prehistory of insurance sciences

The history of insurance sciences consists of three separate but interrelated processes: the epistemic history of the theoretical models, mainly probability theory, the professional history of actuaries, and the institutional history of actuarial theory as an academic discipline. The epistemic origins of actuarial theory go back to 18th century probability theory. Until the mid-19th century actuarial theory was more an application of mathematics than an independent discipline. It combined the theory of mathematical probability, going back to the works of Jakob Bernoulli, Pierre Simon de Laplace and Carl Friedrich Gauss, with the more practical than theoretical tradition of the mortality tables, for example the famous table of Northampton calculated in the 1780s by Richard Price, the actuary of one of the first life insurance companies, the “Equitable” in London (Daston, 1987, pp. 240–241, 251–252).4

The history of actuary as a profession is part of the history of the market for private insurance companies, originating in the 17th and 18th century (Daston, 1988; Clark, 1999; Knights & Vurdubakis, 1993; Rosenhaft, 2001). The actuarial profession was first institutionalized in Great Britain, with the “Institute of Actuaries” in London, founded in 1848, as its professional think-tank (Porter, 1995, pp. 89–90). Still around 1900, actuarial theory was predominantly a professional knowledge. One of the leading German “Versicherungswissenschafter” around 1900, Gerhard Woerner (1878–1943), defined it as the science of the rules to calculate the insurance risks, the premiums and payments of the insurance, and the use of the companies’ profits (Woerner, 1910, p. 11; ZVW, 2, p. 203).

When confronting the question how actuarial science became an academic discipline, every historical study has to face a fundamental paradox. During the 19th century there was hardly an institution more anti-scientific than the private insurance

---

3 The history of science still lacks a thorough study of the history of the actuarial knowledge and theories, at least in Germany. For the British case, see: Clark (1999). The best introductions for Germany still are: Loewy (1924), and the article of Boehmer in the German journal for insurance sciences, the 1900 founded “Zeitschrift fuer die gesamte Versicherungswissenschaft” (cited as ZVW; ZVW, 25, pp. 37–46). For actuarial practice in late 18th century Germany, see: Rosenhaft (1999). On the general relation between the history of social sciences and the prehistory of social insurances: Evers and Nowotny (1987, pp. 88–184)

4 For more historical information, especially on Germany, see the far-reaching study of Braun (1925).
companies themselves. One contemporary observer mentioned in an article in 1910 that the major part of the insurance companies considered the scientific approach to be a “terra incognita” (ZVW, 10, pp. 762–763). This turned out to be a problematic legacy for the Welfare states, too, for the public welfare systems, for example the public health insurance in Germany after the 1880s, delegated the realization of the insurance obligations to the private insurance companies or to the even less reliable small sickness funds (Zoellner, 1981, pp. 88–92). Before we can examine the foundation of insurance sciences, we have to understand the reasons for this anti-scientific tradition in 19th century insurance.

There are mainly two reasons for the anti-scientific tradition of insurance companies. The first has to do with the tradition of insurance as a business. In her brilliant study on the insurance market in 18th-century England, Daston (1987, pp. 244–249) argued that the origins of life insurances had more to do with the spirit of gambling and lottery than with mathematical formulas. On the London insurance market in mid-18th century, insurance policies were preferably issued on the lives of other people, often celebrities, on the outcome of military battles, or even against losing at the lottery. The proper contemporary term for this 18th century business is revealing: in England insurance contracts like these were called “gambling insurances”, in Germany “Wettversicherungen” (Daston, 1987, p. 248; Braun, 1925, p. 108).

An example helps to show how closely insurance and gambling were intertwined, to an extent that betting was fully integrated in the insurance market. One of the most notorious examples was the case of the French diplomat Chevalier d’Eon. He worked in London from 1761, and in his diplomatic missions he often wore women’s clothes. Soon the possible sex of the French diplomat became a matter of speculation at the insurance market, and contracts were offered on the Chevalier d’Eon either being male or female. The market’s observers counted 72 signed contracts, worth the amount of £70,000. To the distress of the companies, the story took an unexpected direction. As the Chevalier was reluctant to reveal his true sex, and as some of the contracts were signed for a limited period, some of the insurance holders, after this time, took legal action against the insurance companies to force them to pay the insured amount of money. In one of those cases the court sentenced the company to pay the contract holder the sum of £700.40, assuming that the Chevalier was female. Only after his death in 1810 it was revealed that the French diplomat in fact was male (Braun, 1925, p. 108).

The effects of this relation between insurance, gambling and lottery were far-reaching. One of it was that until well into the 20th century the insurance business was marked by a culture in which practical experience was everything and theoretical knowledge nothing. The contemporary literature on insurance sciences is full of complaints about the private insurance companies being hostile to scientific theories (ZVW, 1, p. 17; ZVW, 4, p. 2; Woerner, 1910, p. 13). Moreover, the training of the insurance clerks in Germany and Switzerland has traditionally been a non-academic one, and their occupation was hardly professionalized until the First World War (ZVW, 10, pp. 762–763, 781; ZVW, 12, pp. 493–494). Thus the calculating
methods within private insurance companies were based upon business experience and not upon economic or mathematical theory.\textsuperscript{5,6}

The second reason for the lack of an actuarial science in Germany until the end of the 19th century has to do with the mechanisms of the capitalist economy around the turn of the century. Despite their non-academic tradition some German insurance companies tried to promote actuarial theory as part of a professional education. Some of them were inspired by the leading professional society, the “Institute of Actuaries” in London (Braun, 1925, pp. 233–235). Although these attempts all ended with short-lived associations, it is interesting to analyse the fate of these failed projects. The main reason for their failure was that the associations, because they were founded by private companies, had a double character between academic societies and economic trusts. Many of them actually emerged as part of the German “Kartellbewegung” (the cartel movement) after the 1880s (Wehler, 1995, pp. 632–637). Their scientific ambitions were often upset by the market interests of the insurance companies involved. The principle of scientific communication clashed with the trade secret, and the academic discussions were often overshadowed by personal rivalries of market opponents. One of the most promising foundations, the “College of Berlin Actuaries” (“Kollegium der Berliner Lebensversicherungs-Mathematiker”), was ruined in 1871 after a short life of only four years by a personal and political feud between the directors of the “Gothaer Lebensversicherungsbank” and the “Germania” insurance in Stettin (Meltzing, 1911, pp. 47–66). The first lasting scientific societies were only founded at the turn of the century, in Germany in 1899, and in Switzerland in 1905.\textsuperscript{7}

Against the backdrop of the anti-scientific tradition in the 19th century insurance economy, we have to rephrase our problem. We not only need an answer to the question what institutions supported the rise of actuarial science as an academic discipline, but also how academic actuarial theory overcame the resistance from the private insurance economies.

\textsuperscript{5} See also the critical arguments against the probability theory made by the mathematicians Georg Bohlmann and Karl Wagner (ZVW, 2, pp. 203–204; Wagner, 1898; ZVW, 6, pp. 233–248). Whereas other parts of the German economy were actively promoting a scientific-industrial co-operation—most prominently the chemical industry—the private insurance companies were dominated well into the 20th century by this non-academic culture. In 1913 a German insurance scientist wrote in an article that he had recently asked one of the directors of a leading insurance company what professional training he preferred for his senior officers. The director answered sardonically: “We take men with all sorts of training, even if it is an academic diploma.” (ZVW, 13, p. 11)

\textsuperscript{6} It is no surprise that the private insurance sector was soon to be put under governmental supervision, as one of the first breakthroughs for an interventionist economic policy, in Switzerland since 1885, in Germany since 1901, and in Great Britain already since 1774 (Braun, 1925, pp. 109–110, 347–350). For the Swiss case: Maurer (1981, pp. 773–774).

\textsuperscript{7} For the history of the “German Society for Insurance Sciences” (“Deutscher Verein fuer Versicherungswissenschaften”): see ZVW (25, pp. 1–17). For the “Society of Swiss Actuaries” (“Schweizerische Vereinigung der Versicherungsmathematiker”): see Zwinggi (1955).
4. A political technology of trust: the case of “Versicherungswissenschaften” in Germany

Examining the rise of actuarial science in Germany, the argument is that the first institutions of social insurance played a decisive role in the rise of actuarial science in academia, in Germany as part of the interdisciplinary project of insurance sciences. As recent studies on the history of the Welfare state have shown, actuarial science is far from being the only example for the far-reaching effect of the welfare institutions in late 19th and 20th century social sciences (Skocpol & Rueschemeyer, 1996, pp. 3–7; Raphael, 1996, pp. 172–173; Kocka et al., 1994; Nowotny, 1991; Weindling, 1989). Indeed, the emergence of the Welfare state caused a major scientific turn, with the mushrooming of a bunch of new disciplines like social statistics, hygiene, industrial medicine, and later social and preventive medicine. Other sciences like political economy or sociology profited, too, from the data provided by welfare institutions (Nowotny, 1991). The interesting point with actuarial theory is its epistemological ambiguity: it is oscillating between the practical interests of the insurance business and the theoretical purposes of the academics—or as we have seen above: between the anti-scientific position of insurance companies and the scientific interests of social insurance institutions.

4.1. The history of the German insurance science

The history of German insurance sciences (“Versicherungswissenschaften”) depended directly upon the initiatives and the support of the administration of central and regional governments. Indeed, the contribution of German civil servants, especially of academic ones, was essential for the development of the discipline. Some of them worked for the national welfare administration, namely the administration of the national accident, health, and old age insurances, others for the 1891 established “Landesversicherungsanstalten”, the regional administrations of the social insurances (ZVW, 4, p. 4; ZVW, 9, p. 105; Zoellner, 1981, p. 89). An exemplary figure and the most prominent advocate for insurance sciences was Arthur von Posadowsky-Wehner, the substitute of the Reichskanzler and state secretary of the home office (Reichsamt des Innern). He served under the chancellor Buelow between 1897 and 1907 being responsible for the enlargement and consolidation of the social insurances. He personally supported the “German society for insurance sciences” (“Deutscher Verein fuer Versicherungs-Wissenschaften”) on several occasions, and he was co-responsible for the propagation of insurance sciences among the German universities (ZVW, 4, p. 373; ZVW, 5, p. 491; ZVW, 7, p. 734; Wehler, 1995, pp. 1088–1090). Alfred Manes (1877–1963), one of the foundation figures of insurance sciences, mentioned that the initiative for the establishment of university lectures both in Berlin and in Goettingen came from the government (Manes, 1903, pp. 3–4, 11–12, 31–33). Manes knew the field of German insurance sciences like nobody else. After 1902 he was the secretary of the society, edited its journal since 1903, and became a full professor at the commercial college in Berlin in 1906 where he directed the Institute for Insurance. Being Jewish he was forced by the Nazis to resign from
all these posts in 1933 and to emigrate in 1935. For a few years he went to South America, where he taught at the universities of Buenos Aires, Santiago de Chile and Rio de Janeiro, before he eventually settled in the United States in 1946, teaching until 1950 at the universities of Bloomington (Indiana) and Bradley (Illinois).

Why did civil servants sympathize with the academic rather than the professional version of actuarial theory? One reason is the professional kinship between the administration and academia. One of the main characters of the public service in Germany was that the civil servants themselves were academics, mostly lawyers or political economists. Consistently, the education of the civil servants for the administration of the new welfare insurances, especially for the actuaries among them, had to be academic (ZVW, 4, p. 4; ZVW, 9, p. 110; Wehler, 1995, p. 1024–1025).

Another reason was that, different from the British Institute of Actuaries in London, there was hardly any professional education for actuaries in Germany. As we have seen before, German private insurance companies continued to train their actuaries on the job throughout the 19th century, without being able to establish any centralized institutions for professional training. Given the unique system of universities and professional colleges in 19th century Germany, the public service had hardly any alternative than to locate the education of actuaries in academia (Manes, 1925, pp. 1–3; Zacher, 1901, p. 16).

Why did the authorities of government and administration favour the academic over the professional training? The explanation I want to suggest is that actuarial science did not only solve the technical questions of insurance but also the political problem of gaining the necessary support for the centralization of the welfare system by compulsory social insurance. Therefore, the academization of actuarial science is driven by the role of actuarial knowledge as a political technology of trust.

One of the most difficult obstacles for the institution of the first social insurance in Germany in the early 1880s, notably for the accident and health insurance, was the opposition of the sickness insurances and the friendly societies. Not only did the social democratic movement oppose the social insurance legislation for political reasons, the major part of the multitude of local, professional, and company-based insurances, integrating often not only workers but also their employers, was also very sceptical against the project of a centralized, compulsory insurance scheme (Born, 1957, pp. 75–80, 142–177; Rosenstock, 1933, pp. 5–22; Tennstedt, 1981; Zoellner, 1981; Ritter, 1991). The political power of this opposition is reflected by the fact that in the legislation process, Bismarck had eventually to give in and make a compromise. The accident and old age insurance was founded with regionally centralized administrations, whereas the health insurance law only stipulated compulsory membership for the industrial workforce but conceded that the administration of the insurance remained with the variety of existing insurances (Tennstedt, 1981; Zoellner, 1981; Ritter, 1991).

In the course of this conflict, the arguments for the centralizing project were combined with a critique of the nonprofessional actuarial practices of sickness insurance.
and friendly societies. The more profound actuarial knowledge of central administration was said to be an effective advantage over the poor administrative record and lacking adequate knowledge of the local insurances (Rosenstock, 1933, pp. 9–11). Moreover, after the social insurances were established, the reference to actuarial theory remained important, not just for technical but also for political reasons. With a scientific legitimation, the Imperial administration was able to fend off any criticisms that their activities were politically biased. To keep up an apolitical image was crucial for the administration, especially in the politically deeply divided field of social policy (Born, 1957, pp. 166–177).

Against this backdrop, we can interpret the rise of actuarial theory, especially its attraction for political and administrative institutions, with its function as a political technology of trust. Theodore Porter used the notion of a “technology of trust” to point out the political role of expert knowledge. With this notion, Porter interpreted the rise of quantifying engineering and social sciences since the 19th century as an abstract and unpersonal language for societies in a process of increasing differentiation and politification (Porter, 1995, pp. 145–147, 186–189, 217–231). A similar interpretation applies to politicians and bureaucrats in Wilhelmine Germany. They used actuarial theory as a technology of trust to found their policies in a field marked by deep political controversies on a seemingly apolitical, technical ground.

To understand actuarial science as a technology of trust differs significantly from the critical interpretation of information systems in the studies of JoAnne Yates or James Beniger mentioned at the beginning. While Yates stresses the hegemonical and controlling aspects of new information systems, like the operating, recording and archiving practices that businesses introduced around 1900 as “systematic management” based upon written documents, the role of actuarial science in the organizational context of social insurances is much more mediating and integrating (Yates, 1994). The different role of information seems to reflect the different organizational structures. Public administration, and especially social insurances in Germany and Switzerland, have a non-partisan institutional position. Built on the corporatism of European Welfare states, they often involve equal representations of employers and employees. The first social insurances for accident and health insurance in Germany and Switzerland were both directed by boards with equal numbers of delegates for employers’ associations and trade unions (Maurer, 1981; Zoellner, 1981). Mediation by disinterested figures was a crucial condition for the success of social insurances, a role which was often taken by scientific knowledge and experts.

The rise of the “Versicherungswissenschaften” at the German and especially at the Prussian universities is impressive and illustrates how successful actuarial knowledge was both in technical and in political terms. It started in the 1880s with the first lectures on insurance matters at different universities (ZVW, 13, pp. 1–2). The first institution, the Institute for “Versicherungswissenschaften”, was founded 1895 by Wilhelm Lexis who taught political economy and statistics at the University of Goettingen. The institute in Goettingen was the leading academic school for insurance sciences in Germany until the First World War. The Goettingen Institute was organised as an interdisciplinary institution, bringing together mathematicians, political economists, and statisticians (Manes, 1903, pp. 11–18). Although there was
no special chair for insurance sciences until the turn of the century, the universities and professional colleges showed a lot of interest in the new science, above all the only recently established commercial colleges. There was considerable support from related academic disciplines, too, particularly from the political economy ("Nationaloekonomie") and the "Staatswissenschaften", the dominating form of political science in Germany. Adolph Wagner, a political economist and member of the influential "Verein fuer Socialpolitik", was the first German professor to give a special lecture on insurance economy in the 1880s (ZVW, 7, p. 734). And Gustav Schmoller, another founder-member of the "Verein", considered the private and the social insurance as "one of the most important recent social institutions" (ZVW, 4, pp. 6–8; ZVW, 5, pp. 305–306). Within a few years German universities and colleges offered more than 50 lectures on insurance matters (ZVW, 5, pp. 142–144). The first chairs followed after 1901, at the commercial colleges of Frankfurt, Cologne and Leipzig (ZVW, 13, pp. 5–9; ZVW, 7, pp. 505–506). Other institutes for insurance sciences followed after 1908 at the Universities of Dresden, Freiburg, Munich, Erlangen and Wuerzburg (ZVW, 13, pp. 2–3; Manes, 1903, pp. 19–24).

5. Actuarial theory in Switzerland: "social physics" and its universalism and determinism

With the German example, we can understand the collaboration between the administration and actuarial science only from one side: the interest of the bureaucracy in science. The Swiss example now helps to explain the other side of the relationship: the interest of actuarial academics in leaving their ivory tower and in intervening in such profane matters as industrial accidents or old age poverty. We have to anticipate that this is a story of actuarial science and not of actuaries as a profession. In Switzerland as well as in Germany, actuarial science or insurance sciences were rather an achievement of demographers and mathematicians like Wilhelm Lexis, or political economists and statisticians, like the members of the "Verein fuer Socialpolitik", than of actuaries, mainly for reasons, already mentioned, of the anti-scientific tradition of the profession.

Switzerland is a particularly good example to study the practical interests of actuarial theory because the chronology is crucially different from Germany. In Germany, the establishment of actuarial science in academia followed the welfare legislation, offering a case to study how the administration initiated the rise of insurance sciences. Switzerland had a much longer legislation process, mainly because the political system prescribed compulsory referendums. In the Swiss case, the academics were already interested in actuarial theory before the social insurances were founded. Thus since the 1880s, actuarial scientists took an active part in the preliminary works for the national accident and health insurance, providing an example to study the interests of scientists in the practical application of their actuarial knowledge.

The Swiss welfare institutions emanated from the federal constitution of 1874. By establishing the principle of the protection of labor, the constitution prepared the
ground for the employers’ liability legislation (the “Haftpflichtgesetzgebung”) of the late 1870s and the 1880s. The pace of the Swiss legislation was set by Germany and Bismarck’s workers’ insurance laws of the 1880s. Thus, soon after the German accident and health insurance of 1884 and 1885 the Swiss government, the Federal Council, pushed forward the idea of a similar legislation. The delays came with the first referendum that failed due to an unholy coalition of employers and workers fearing the forced winding up of their local sickness funds. The whole legislation process lasted nearly 30 years, and the Swiss accident and health insurance was only set up in 1912 (Degen, 1997; Maurer, 1981, pp. 770–787).

From the beginning, the preparatory works for the Swiss accident and health insurance were accompanied by and even dependent on actuarial research. The establishment of welfare and scientific institutions went hand in hand. The first step of the federal council was to commission several statistical inquiries during the last years of the 1880s, mostly into the numbers of accidents and diseases among the industrial workers. After that, the government asked three experts to write a report on the question how to organise such a welfare insurance. Among them was Hermann Kinkelin, Professor for Mathematics at the University of Basel and a leading academic for actuarial science and statistics (Degen, 1997, p. 141; Kupper, 1998, pp. 38–40).

The third step was to appoint an actuary within the federal administration. The history of this job illustrates the variety of academic and administrative backgrounds interested in actuarial science. The suggestion to appoint an actuary goes back to an internal memo written by Johann Jakob Kummer (1928–1913), the director of the federal insurance office for the supervision of the private insurance market. Kummer was a statistician of the first generation, a former clergyman, then a politician, and in the end a senior officer of the civil service. There he started as the director of the new Federal Statistical Bureau, later to become director of the Federal Insurance Office (Tanner, 1995). In the memo from June, 30, 1890, Kummer reminded the responsible minister that the preparations for accident and health insurance were full of complex, scientific tasks: the calculation of risks, premiums and the costs of the insurance. He therefore suggested appointing an academic trained in mathematics and economics (“Anstellung eines Versicherungsmathematikers”, Swiss Federal Archives, E 46, [-], -/1, vol. 2). Eventually, this memo was the reason for the government to create the job for an actuary.

The person who got the job, Christian Moser, was until then a senior lecturer (a “Privat-Dozent”) for mathematics at the University of Bern. He is a good example to explain the specific interests of academics to get involved in administrative projects like accident and health insurance legislation. Moser in fact pursued a double career, both at the university and in administration. In his new administrative position he became one of the most influential voices during the works for the accident and health insurance. 1904 he seized the opportunity of becoming the director of the federal private insurance office, and thus the successor to his patron, Johann Jakob Kummer. During his civil service he followed up his academic career. The federal council supported Moser’s double role realizing that his administrative work would only profit from his academic career. Moser eventually became, after his resignation
from the civil service in 1914, the most influential academic figure in Swiss actuarial science of the 20th century (Kupper, 1998, pp. 40–42; “Anstellung eines Versicherungsmathematikers”, Swiss Federal Archives, E 46 [-], -/1, vol. 2).

At the same time, Moser founded the most influential actuarial school in 20th century Switzerland. It is not an exaggeration to argue that his work as the federal mathematician produced the necessary spin-off for the establishment of actuarial science as an academic discipline. As a representative of the federal administration, Moser regularly participated at the international congresses for social insurances and at the actuarial congresses. After a few years, the University of Bern acknowledged the scientific efforts of Moser. 1901 the university established an appointed professorship for actuarial science for Moser. With this chair Switzerland was among the leading European countries for the establishment of the insurance sciences. As far as I can see, only three specialized actuarial chairs were established before Berne, all of them in Germany (ZVW, 7, p. 505; ZVW, 5, pp. 142–145, 302). In 1906, Moser took the initiative, together with three other insurance experts, to found the “Society of Swiss Actuaries” (the “Vereinigung schweizerischer Versicherungsmathematiker”). With this society and its journal, actuarial theory definitely became an established science in Switzerland. Apart from Moser’s commitment, the contribution of the federal administration was essential to the establishment of the society. A quarter of the 36 founder-members were civil servants, another quarter were professors and senior lecturers at different universities (Mitteilungen, 1 (1906), pp. 3–10).

Scientifically, Moser represents the transition from the merely theoretical approach to actuarial issues to the still academic but more practical, insurance-related understanding of actuarial theory, as part of the new discipline of insurance sciences. Moser’s academic background still stands for the pre-disciplinary period of actuarial theory. Moser studied mathematics and astronomy and was a disciple of Ludwig Schlaefli, a mathematician and theologian. The theological connotations of 19th century mathematics are still echoing in the letter of application, Moser sent to the federal authorities on 20 November 1890 to apply for the actuary’s job in 1890 and in which he described actuarial theory as a “calculating charity”: “But the desire for knowledge of the wonderfully harmonical laws, that are not only revealed by lifeless nature, but that are more and more accepted as valid for social life too—this desire was repeatedly a stimulus for me and arose my passion for the studies of mathematics as the most exact of all languages. I would find profound inner satisfaction in working for the country’s future if the knowledge of these general laws could be used in social life to ease a particular misery and would be a tool of a calculating charity, as it is the case with the technical works for the accident and health insurance.” (“Anstellung eines Versicherungsmathematikers”, Swiss Federal Archives, E 46 [-], -/1, vol. 2).

This sentence also offers a key to explain the interests of academics in the social insurance projects of the administration. In his letter, Moser alludes to an influential tradition in early social sciences, including actuarial theory, that understood social sciences as part of a “social physics”. The “wonderfully harmonic laws of the social life” were indeed a characteristic expression of the central paradigm of “social phys-
ics”. The responsible figure for the concept of “social physics” was Adolphe Quetelet (1796–1874). Quetelet is part of the history of sociology in the 19th century and the main antipode to Auguste Comte. With his notion of a “physique sociale” he drafted a sociological program that was founded on the methods of natural sciences, mainly on mathematics, to study the laws of social life from the marriage rates to the average size of the human body, Quetelet’s famous “homme moyen” (Actualité, 1997). One can hardly overrate the influence of Quetelet’s “social physics” on the following generation of demographers, social statisticians and actuarial scientists. The universalistic and deterministic paradigms of his theory exerted a lasting influence on the first empirical branches of modern social sciences, including actuarial theory (Porter, 1986, pp. 188–190, 240). The hope to repeat the successes of natural sciences in early social sciences, and to discover the deterministic laws of social life, also provides the reason why actuarial scientists were keen on collaborating with the institutions of the political system. In this collaboration, actuarial scientists were motivated not only by the goal of practical application but also, if not principally, by their theoretical interest in the laws of society. These interests fit well to the integrative mechanisms of social insurances as argued above. The more universalistic and deterministic the paradigms of the actuarial experts, the better for the administration, for universalism and determinism, as the pure opposition to the variety of political interests, is exactly what was needed from actuarial science as a technology of trust. The integrative role of actuarial science not only depended on the corporatist models, after which social insurances were built. It was also supported by the theoretical paradigms of actuaries themselves.

6. Actuarial or insurance sciences

Before coming to the conclusions, I would like to get back to the different disciplinary shapings of the insurance sciences, either as “actuarial science”—as it was the normal way—or as the German “insurance sciences”. This conceptual question was indeed a fundamental issue at the time, and some of the most passionate disputes at the congress for insurance sciences were about the range and the limits of the discipline. At the meeting of 1904 in New York for example, a trans-atlantic alliance between the German deputies and some American insurance scientists (most of them from the east coast) who studied in Germany argued for their interdisciplinary insurance sciences project and clashed against the rest of the insurance world, led by the British actuaries (ZVW, 4, pp. 82–83). To examine the conditions for the different ways, in which actuarial theory became an academic discipline, will help to specify the social and institutional interests in actuarial theory on a more general, European level.

What are the reasons for this German peculiarity of the “Versicherungswissenschaften”? The answer has two parts, an economic and a political one, and the best way to explain it is to compare Germany with Britain, its main opponent, and with Switzerland. Economically, the differences between the disciplinary concepts mirror the different national insurance markets. The British market with a big trading econ-
onomy was traditionally strong in the insurance of goods. Their risk calculations were essentially statistical. There was no need for a wider scientific approach than actuarial theory. Germany with its early social insurance institutions was fundamentally different. The country was dominated by the public welfare institutions and the life insurance companies that profited from the insurance boom. Welfare institutions were dealing with mathematics but as well with other sciences, like insurance medicine and insurance law. At the constitution of the German society for insurance sciences it was the coalition between the life insurance companies and the social insurance administration that turned the balance in favour of the broad concept of “Versicherungswissenschaften” and against actuarial theory (ZVW, 1, pp. 95–97).

The form of insurance sciences depended as well on the political attitude of the scientists themselves. The British position reflected the policy of British liberalism and the Anglo-Saxon tradition of private welfare organisations. According to the British actuaries, the private insurance companies, and not the state’s administration, were the legitimate representatives of actuarial science (ZVW, 4, pp. 82–83). The position of German insurance scientists favoured the policy of public interventionism. Together with the conservative and the liberal parties, the German representatives of insurance sciences supported the early establishment of the social security system in Germany under Bismarck. This interventionist policy is one of the driving forces behind the lasting co-operation between academics and the administration, and thus partly responsible for the emergence of insurance sciences as an interdisciplinary project (ZVW, 7, pp. 331–333; ZVW, 9, pp. 749–751).

The comparison between the two countries, Germany and Switzerland, shows that the institutional context can make a decisive difference for the development of academic disciplines and for the subsequent implementation of new information systems as actuarial theory. The balance between private and social insurances—only the other way around—helps to explain, too, why Switzerland, unlike the German model, did not succeed in establishing insurance sciences. It was indeed Christian Moser, who was the only person at the first meeting of the Society of Swiss Actuaries arguing for a trajectory similar to the German insurance sciences. But the project failed, for Moser did not find the support his fellow mathematicians from the universities and the private insurance companies (Mitteilungen, 1 (1906), p. 10). Unlike in Germany, the representative of private insurance companies had a much more critical stand on the social insurance legislation. Also, there is no evidence that the other representatives of the federal administration supported Moser’s project. This is no surprise, as until the First World War the interventionist position was still very weak in Switzerland, mostly because of the predominance of regional interests in the federal political system (Degen, 1997). Swiss social statistics suffered a similar fate. Only after the First World War did the federal administration and its statistical office introduce a modern social and consumers’ statistics (Tanner, 1995).

---

9 In Britain, only the London School of Economics took a more interventionist position. France, too held the liberalist view (ZVW, 7, pp. 331–335).
7. Conclusions

The purpose of this article was to examine the history of actuarial theory in order to understand historically the relation between transformations in information systems, like actuarial theory, and changing organizational contexts, notably German and Swiss social insurances around 1900. These transformations should be seen as co-dependent. As JoAnne Yates cautioned against a technological determinism when examining the rise of information systems, we should also beware of any epistemological determinisms. The rise of actuarial theory is not driven by its scientific progress, it has to be understood in a wider social and institutional context. The institutional rise and significance of actuarial theory is based upon organizational needs, particularly the need for a seemingly objective, disinterested and independent knowledge in the politically highly disputed field of welfare policy and social insurances. Thus, organizational conditions, like the centralized bureaucracy of Wilhelmine Germany, with its large university system, shaped the emergence of new informational practices, like the rise of actuarial theory as an academic discipline and its subsequent implementation in social insurances.

The article also cautions against an exclusive focus on the hegemonic and controlling aspects of information systems, stressed for example in the critical histories of information technologies (Yates, 1989; Beniger, 1986) or by the studies using the Foucauldian concept of governmentality to interpret accounting or insurance practices (Foucault, 1991; Ewald, 1986; Power, 1994). We should refrain from monistic concepts of power, especially of the Foucauldian tradition, and specify them by a heterogeneous multiplicity of interests. Given the variety of strategical policies of insurance companies, government authorities, academics, employers and employees, it is inappropriate to reduce them to one technology of power or one form of government. The history of actuarial theory in Germany and Switzerland for example shows, that information, particularly scientific knowledge, can be used to integrate different parties on a seemingly disinterested and objective point of view. In the institutional context of social insurances, the universalistic approach of scientific experts provided a common reference point for employers and trade unionists when dealing with controversial issues. Thus, in social insurances around 1900, actuarial knowledge is less a coercive power instrument but rather a mediating and integrating conceptual platform within organizations marked by deep antagonisms. Actuarial science was not a pure instrument of power but rather a subtle technology of trust (Porter, 1995).

The final conclusion relates to methodology. The traditional focus of studies in the history of science is still on the academic, disciplinary context of scientific knowledge, lacking the wider organizational and social implications. Therefore, the case study of this article also shows that history of science and business history can learn a lot from each other. The traditional explanations for the emergence of actuarial science (as part of the "probabilistic revolution") must be enlarged with an analysis of the role of different organizations for the rise of academic disciplines. The first generation representing actuarial science in Swiss and German universities did not come from an exclusively academic but also from a civil service background, although not from the professional domain of insurance companies. Academic actu-
Actuarial science, or in Germany the interdisciplinary model of insurance sciences, was not founded by actuaries but by civil servants, social statisticians, demographers, and mathematicians. The academics got involved into social policy not just for practical but also for theoretical reasons. Actuarial science represents their hopes to adapt the model of 18th and 19th century natural sciences, especially of physics, to the social life and to found "social physics", an empirically grounded, deterministic and universalistic science of the social. Thus, the history of actuarial science illustrates the importance of social insurances as an organizational context for the emergence of modern social sciences. The institutions of the Welfare state were not just the field of application for an otherwise purely academic knowledge. Disciplines like actuarial science and insurance sciences only became possible by the collaboration between two separate institutions, universities and the government administration, and by a combination of their specific interests.

Acknowledgments

I would like to thank Dick Boland, Jakob Tanner, Leigh Star, Paul Johnson and an anonymous reviewer for their helpful comments. This paper has originally been presented at the Spring School for Science and Technology Studies in March 1999 in Zurich, Switzerland. I am also indebted to the participants of the Spring School for their most useful suggestions.

References


Mitteilungen der Vereinigung schweizerischer Versicherungsmathematiker, 1 (1906).


