



The Welfare State Evolves: German *Knappschaften*, 1854-1923

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This essay reviews the German miners' model of mutual insurance from its introduction in 1854 to its basic reformation in 1923. The core feature of this insurance was the provision of cash benefits for compensation of income losses resulting from temporary sickness, permanent disability, or death of the breadwinner. This essay aims to give a condensed overview of how the welfare state evolved from the perspective of miners' insurance. On the one hand, evidence of increasing generosity adds to the organizational analysis; on the other hand, evidence on increasing financial distress sheds some light on the problems of a maturing pay-as-you-go-based scheme.

This essay reviews the German miners' social insurance scheme from its introduction in 1854 to its basic reformation in 1923.¹ Underwritten by the so-called *Knappschaft* funds (*Knappschaft[en]* in the following), the

¹ In 1923, all existing German *Knappschaft* funds located in Prussia and the various other states merged into a single, economy-wide *Knappschaft*, the so-called *Reichsknappschaft*.

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scheme provided cash benefits for compensation of income losses resulting from temporary sickness, permanent invalidity, or death of the breadwinner. Strictly speaking, social security mutualism among miners is much older. *Knappschaften* date back to medieval times, when fraternal associations of miners were formed around 1260 in the Harz region. *Knappschaften* adopted the character of insurers, more specifically, as early as the mid-nineteenth century. They at first resembled charity organizations until absolutism, when they became dependent on the sovereign's patronage and paternalistic social policies. It is noteworthy that the *Knappschaft*, still today, is present as the second pillar of German statutory old-age insurance.² The *Knappschaft* can thus look back on a continuous history of about 750 years.

However, *Knappschaft* history has been neglected for the most part in the English-speaking literature, although *Knappschaften*, being among the few pioneers of social insurance, could provide additional historical information on the evolution of the German welfare state.³ Therefore this essay aims to give a condensed overview of how the welfare state evolved from the perspective of miners' insurance. Three questions are basically addressed: What was the basic structural character of this occupational scheme that evolved since 1854? How did the generosity of the system develop in quantitative terms? With some resemblance to the present, can we observe rising cost pressures while the *Knappschaftens'* pay-as-you-go system matured?

The remaining parts of the essay are structured as follows. Focusing on Prussian *Knappschaften* in particular, I extract their main structural

² Christoph Bartels et al., "Vergangenheit und Zukunft sozialer Sicherungssysteme am Beispiel der Bundesknappschaft und ihrer Nachfolger: Ein Forschungsprojekt der Leibniz-Gemeinschaft," *Jahrbuch für Wirtschaftsgeschichte/Economic History Yearbook* (2009), 2: 195-217; Tanja Klenk, *Innovation und Kontinuität: Die Organisationsreform in der gesetzlichen Rentenversicherung* (Wiesbaden, 2008), 125-26.

³ E. Peter Hennock, *The Origin of the Welfare State in England and Germany, 1850-1914* (Cambridge, England, 2007); Patricia Thane, "The History of Retirement," in *The Oxford Handbook of Pensions and Retirement Income*, ed. Gordon L. Clark, Alicia H. Munnell, and J. Michael Orszag (New York, 2006), 33-51; Camilla Arza and Paul Johnson, "The Development of Public Pensions from 1889 to the 1990s," in *ibid.*, 53-75; Marcel van der Linden, *Social Security Mutualism: The Comparative History of Mutual Benefit Societies* (Bern, 1996). There is some literature explicitly on *Knappschaften*: a recent paper deals with ex post information asymmetries in the *Knappschaftens'* health insurance: Timothy W. Guinnane and Jochen Streb, "Moral hazard in a mutual health-insurance system: German *Knappschaften*, 1867-1914," Economic Growth Center Discussion Paper no. 978 (Yale University, 2009). Another essay briefly describes *Knappschaft* history from the 1850s to the 1960s: Martin H. Geyer, "The Miners' Insurance and the Development of the German Social State," in *Sozialgeschichte des Bergbaus im 19. und 20. Jahrhundert*, ed. Klaus Tenfelde (München, 1992), 1046-65.

characteristics from the seminal *Knappschaft* law of 1854 and the Prussian General Mining Law of 1865, which laid the legal foundations for the following decades. Second, evidence on increasing generosity adds to the organizational analysis. Finally, evidence of increasing financial distress substantiates the downside of a maturing pay-as-you-go scheme, which definitely has a parallel in the problems of German social insurance today.

The *Knappschaft* Law of 1854 and the Prussian General Mining Law of 1865

The *Knappschaft* law of 1854 and the Prussian General Mining Law of 1865—the latter bundling all reform laws enacted during the movement of Prussian mining law toward liberal standards shortly before—formed the basic regulatory framework for the following decades.⁴ In particular, 1854 seems to mark the true moment when the social policy innovation “social insurance” was implemented based on legal claims, though with a strictly profession-specific scope compared to the Bismarckian insurance plans of 1883 to 1889. A review of *Knappschaften* business policy, the result of mine owners’ and employed miners’ interaction in corporatist self-management, offers a direct member preferences–based perspective on the origin of the long-term increase in social security spending in Germany (and every related economy).

In its first paragraph the *Knappschaft* law states that *Knappschaften* had to be refounded in every area where mining and complementary economic activity like metallurgy took place.⁵ Aggregate coverage was thus small in comparison to the economically active population at the time. Moreover, the paragraph highlights the types of organizations to distinguish. The area *Knappschaft* (*Bezirkknappschaft*) in the following years became the predominant type, operating an insurance scheme for a limited number of miners contingent on the number and size of the mining enterprises located within its area. For the miners themselves, insurance was compulsory. The other type of organization was works-related (*Werksknappschaft*), usually situated within the area of another *Knappschaft* and, because of the linkage to a single company, comparatively smaller. The resulting spatial distribution of *Knappschaften* bears a resemblance to assigned territorial monopolies. Indeed, no *Knappschaft* could have branches within the area of another. Further, the law specified life risks against which *Knappschaften* had to provide

⁴ Peter C. Brown, “Mining Legislation, the Consultation Process and the Reform of Mining Law: Their Significance for Company Form in Ruhr Coal Mining in the 19th Century,” in *Vom Bergbau- zum Industrievier*, ed. Ekkehard Westermann (Stuttgart, 1995), 295-316, for an overview of mining legislation at the time.

⁵ For the following passage see *Gesetz, betreffend die Vereinigung der Berg-, Hütten-, Salinen- und Aufbereitungs-Arbeiter in Knappschaften, für den ganzen Umfang der Monarchie, vom 10. April 1854* (Charlottenburg, 1854). I refer to metallurgy as “related industries.”

insurance coverage in the form of group insurance. These were the risks of sickness, invalidity, and survivorship, whereby both dimensions—the occupational and general risk—were covered.⁶ Related benefit categories included 1) non-monetary health care benefits like medical treatment and health resort attendance (usually provided for the family as well), 2) sick pay for every day on leave, 3) an invalidity pension until death, 4) funeral benefits, 5) a widow's pension until death or remarriage, and 6) an orphan's pension until the age of 14. It was a characteristic of *Knappschaften* even before the reforms to distinguish between miners with more rights and those with fewer rights in regard to their *Knappschaft*. The so-called established miners (*Ständige*) could legally claim all categories, whereas the unestablished miners (*Unständige*), usually day-laborers and those who did not qualify for established status although they worked permanently in the mining sector, could at first claim only (1), (2) and (4) (§3). Moreover, paragraph 4 specified that *Knappschaften* could either levy a contribution as a fixed amount per contributor or as a percentage of labor income (both to be deducted at the source by the employer, §11). We know from contemporary writers that most *Knappschaften* levied a fixed amount, either the same for every contributor regardless of seniority or relative income positions, respectively, or graded by classes based on seniority and/or wages. Further receipt and expenditure items (for example, initiation fees, punishment fees, or hospital operation, school education for the miners' children) were to be specified by statutes. Note that insured miners paid only one contribution to cover the various risks. In other words, sickness and pension insurance were not formally separated. Like the discrimination between established and unestablished members, shared financing between miners and mining entrepreneurs also had a long tradition. The law itself prescribed a minimum (maximum) share of one-third (one-half) of total contributions to be paid by employers. Finally, a *Knappschaft's* managing committee had to be filled on equal terms with representatives of miners and entrepreneurs. In the case of a tie, the representative of the mining administration had the decisive vote.

The Prussian general mining law of 1865 added only a few alterations.⁷ Unestablished miners could now claim an invalidity pension as well (§171). Beyond that, the mining law prescribed only a minimum—not an additional maximum—for the entrepreneur's share of one-third of total contributions (hence, 50 percent of the miners' payments). Until 1906-1907, the empirical shares had actually fluctuated between a mere 3 percent and roughly 95 percent of total contributions, while the average

⁶ In fact, it seems rather difficult to attempt to distinguish between the two analytically.

⁷ For the following passage see Rudolf Klostermann, *Das Allgemeine Berggesetz für die preußischen Staaten vom 24. Juni 1865, nebst Einleitung und Kommentar* (Berlin, 1866), 300-309.

share was predominantly around 40 to 45 percent.⁸ Finally, the law allowed a *Knappschaft* to divide its members into several smaller sickness funds while keeping a large pension fund. The idea behind this was to improve cost control and to reduce moral hazard incentives in the sickness insurance, but to profit from the law of numbers regarding long-term liabilities like pensions.⁹

The initial laws of 1854 and 1865 lacked information on some other elements of *Knappschaften* affairs. First, the laws did not establish redistribution of revenues between prospering *Knappschaften* and those that suffered from an eroding contribution base because of demographic ageing and exhaustion of resource deposits. Second, the laws did not prescribe a financing mechanism explicitly. In fact, the mechanism applied could have been either pay-as-you-go, where current contributors directly finance expenditures on current beneficiaries (in particular pensioners) so as to balance the budget ex post at the end of a period, or funding, where each member or a generation of members accumulates contributions plus interest so as to finance retirement from that later on. Contemporaries reported that *Knappschaften* in fact balanced their budgets via the pay-as-you-go mechanism.¹⁰ Third, the laws did not specify monetary levels of benefits, calculation principles, or the relationship to contributions paid. Not even monetary minimum standards or eligibility criteria were prescribed.

Sick pay, for example, was usually paid for the first eight weeks and then transformed into a (temporary) invalidity pension. Invalidity pensions predominantly consisted of a flat rate, varying in its level over *Knappschaften* and interpretable as a minimum pension, plus build-up rates for each contribution week, month, or year during service. These rates depended on the classification of miners according to their length of service and wage or occupation within the mine and varied as well over insurers. In particular, there is no clear hint of dynamic pensions. Rather, once granted, pensions usually were not adjusted to any kind of economic dynamic (productivity, inflation). In addition, each *Knappschaft* could decide about eligibility rules autonomously. However, the widespread

⁸ Ministerium für Handel und Gewerbe, *Statistik der Knappschaftsvereine des preussischen Staates* (Berlin, 1862-1908).

⁹ Guinnane and Streb, "Moral hazard in a mutual health-insurance system," 7; Tobias A. Jopp, "Ein risikoreiches Geschäft? Internes und externes Wachstum als risikopolitische Instrumente im preußischen Knappschaftswesen, 1854-1923," in *Berufliches Risiko und soziale Sicherheit: Beiträge zur Tagung "Vergangenheit und Zukunft sozialer Sicherungssysteme am Beispiel der Bundesknappschaft und ihrer Nachfolger" im Deutschen Bergbau-Museum Bochum, 8. und 9. Oktober 2009* (Bochum, 2010), 189-224.

¹⁰ Albert Caron, *Die Reform des Knappschaftswesens und die allgemeine Arbeiterversicherung* (Berlin, 1882), 7; Ferdinand Bertrams, "Die Sicherstellung der Leistungen der preußischen Knappschaftsvereine durch das Knappschaftsgesetz vom 19. Juni 1906," *Glückauf* 48 (1912): 1417.

criterion to qualify for an invalidity pension was simply the inability to work as a miner, which was given if the miner could no longer earn one half of his actual wage. In contrast, the Bismarckian invalidity insurance granted pensions if the employee was no longer able to earn one-sixth of his average wage of the preceding five years and one-sixth of the average wage in whatever job. The *Knappschaften*'s eligibility criteria can thus be labelled by and large as comparatively less strict.¹¹ Survivors' pensions were usually specified as a proportion of invalidity pensions. Finally, as a result of the discrimination into established and unestablished insureds, *Knappschaften* inevitably set up criteria determining when an unestablished member qualified for established status. These criteria usually were a minimum age of between 16 and 25, a maximum age of between 35 to 45 years, good health, integrity, and a successfully completed waiting period. In practice, even miners permanently working in the mining sector were classified as unestablished if they did not meet the *Knappschaft*-specific criteria.¹²

Although the laws of 1854 and 1865 specified the basic conditions under which *Knappschaften* operated until 1922, these basic conditions were subject to adjustments. Some major adjustments arose, on the one hand, from the introduction of Bismarckian insurance and, on the other hand, from constant critical disputes over the institutional shortcomings of *Knappschaften*.

The Bismarckian laws affected *Knappschaften* as follows. First, the health insurance law of 1883 required *Knappschaften* to raise daily sick pay to the standard set by the other sickness insurance funds, especially the works funds. Second, sick pay had to be granted for thirteen weeks. Both adjustments led to considerable additional spending to be financed. Third, the accident insurance law of 1884 installed employers' liability insurance associations for various occupations, including miners. The newly founded *Knappschafts-Berufsgenossenschaft* was responsible for paying pensions resulting from job-related accidents and was financed entirely by employers. This association, however, had very little to do with the *Knappschaften* dealt with in this essay. Especially with respect to the Bismarckian invalidity and old age insurance, *Knappschaft* insurance and Bismarckian insurance have to be treated as two separate systems. Finally, fourth, a *Knappschaft* could apply to take over the Bismarckian invalidity insurance in addition to its profession-specific scheme. Only a few *Knappschaften* did so.¹³ Since the Bismarckian pension was now a miner's

¹¹ Johannes Frerich and Martin Frey, *Handbuch der Geschichte der Sozialpolitik in Deutschland—Band 1: Von der vorindustriellen Zeit bis zum Ende des Dritten Reichs* (München, 1993), 100.

¹² Bertrams, "Die Sicherstellung der Leistungen der preußischen Knappschaftsvereine," 1411-25, 1459-71, 1499-1513, 1538-54 and 1584-97, 1459-60.

¹³ These were the *Allgemeine Knappschaft* Bochum (Prussia: Dortmund), the *Saarbrücker Knappschaft* (Prussia: Bonn), the *Allgemeine Knappschafts-*

main pension income, many *Knappschaften* reacted by reducing per capita benefits in absolute terms or by slowing down relative benefit growth.

The *Knappschaft* law of 1906 was the result of constant debate among *Knappschaft* officials, state representatives, researchers, and miners themselves on failures and room for improvements. In summary, the key issues discussed from the late 1860s were the appropriate *Knappschaft* size in the light of costs and benefits; the institutional separation of provisions for the risks of invalidity and sickness; the cost and benefits of separating members into established and unestablished miners; reciprocity contracts to ensure free spatial mobility of miners without losing acquired entitlements; and the appropriate financing mechanism to ensure financial sustainability. Consequently, the 1906 law affected all those issues. First, it formally enabled the mining administration to merge small *Knappschaften* into larger ones and financially unsound groups into those seen to be financially stable. Second, it prescribed the formal institutional separation of the two classes of insurance. From now on, each levied its own contribution payment. Third, it removed the unestablished status. Fourth, the practice of bilateral reciprocity contracts was included into the legal framework, and the flat-rate pension was removed to synchronize the calculation basis across all *Knappschaften*. Pensions were thus made of variable build-up rates exclusively. Fifth, the law forced a pay-as-you-go mechanism with intensified reserve-building (*Rentenwertumlageverfahren*) upon *Knappschaften*. Per capita contributions, then, had to be determined such that all pensions newly approved in period t_x were covered over their expected duration until $t_y > t_x$, and all pensions already approved before t_x were covered, with their respective value in t_x . The second point countered *Knappschaften* practices before the amending law; many *Knappschaften* had to raise contributions considerably to meet the requirement. Further adjustments included the installment of shared financing on equal terms and sick pay for twenty-six weeks.¹⁴

The Expansion of *Knappschaften* Generosity

After having briefly discussed the structural development of *Knappschaft* insurance, we now turn to quantitative issues. The main themes here are generosity and increasing cost pressures on a maturing insurance scheme

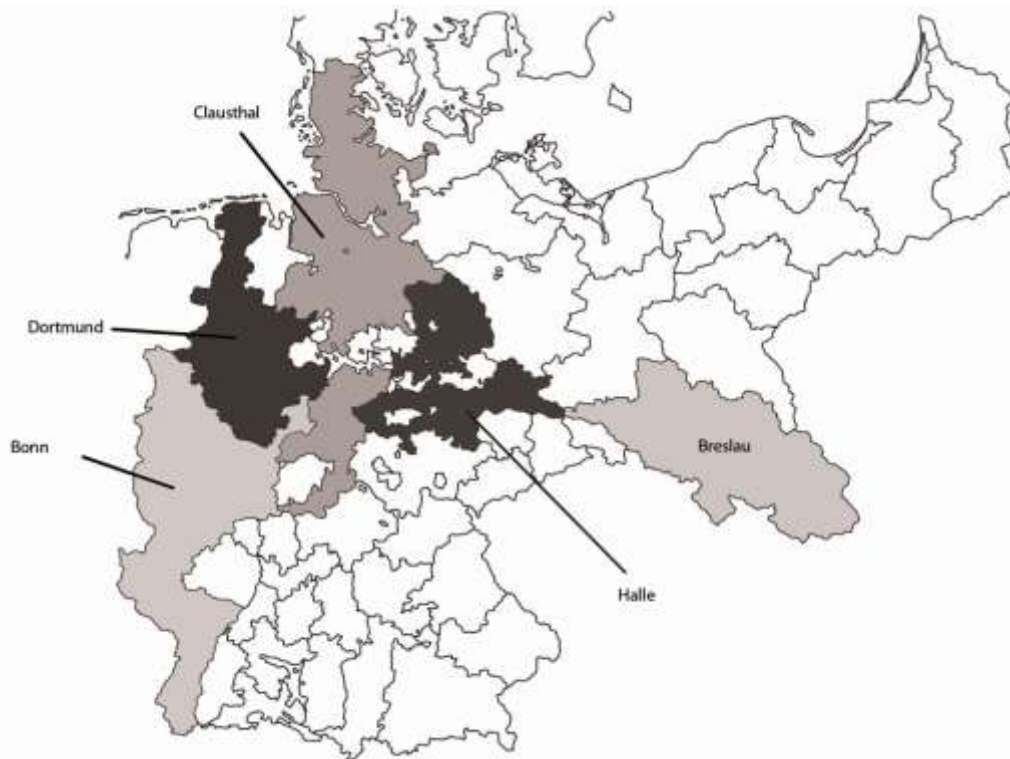
pensionskasse Sachsen (Saxony), and the *Norddeutsche Knappschaftspensionskasse*.

¹⁴ Otto Steinbrink, *Gesetz vom 19. Juni betreffend die Abänderung des Siebenten Titels im Allgemeinen Berggesetz für die preußischen Staaten vom 24. Juni 1865—nebst Kommentar* (Berlin, 1908). In 1912, there was another *Knappschaft* reform accounting for the introduction of white-collar insurance in 1911. However, this essay exclusively deals with workers' insurance, so adjustment processes according to that law are not tackled here.

consisting of a considerable number of pay-as-you-go financed plans (the *Knappschaften*).

Figure 1 locates the Prussian mining administration regions over which the *Knappschaften* in question were distributed. According to the reorganization of the mining administration during the reform of 1851-1865, Prussia was subdivided into four mining regions, each having their own administrative bodies. These were Bonn, Breslau, Dortmund, and Halle. The fifth region, Clausthal, was formed following territorial gains after the Prussian-Austrian war (relating to the province of Hannover).

FIGURE 1
Location of the Prussian Mining Administration Regions within the
German Reich (c. 1871)



Source: Bergamt Halle, *225 Jahre Oberbergämter und Bergbehörden in Halle an der Saale* (Halle, 1998), 29; G. Fürer, "Bergbau und Bergbehörde in Niedersachsen gestern und heute: 120 Jahre Oberbergamt in Clausthal-Zellerfeld," in *Festschrift zur Feierstunde: 200 Jahre vereinigtes Bergamt Clausthal–120 Jahre Oberbergamt Clausthal–434 Jahre Bergamt Clausthal*, ed. Oberbergamt Clausthal (Clausthal, 1988), 17; Oberbergamt Bonn, *150 Jahre Oberbergamt in Bonn* (Bonn, 1966), 22; Helmut Schelter, "200 Jahre Landesoberbergamt Nordrhein-Westfalen," *Glückauf* 128, no. 7 (1992): 505-10; map constructed by Nolan Ritter (RWI).

We can link mining administration regions with the production structure of the mining sector in Prussia. In terms of macroeconomic importance, hard coal stands out. Dortmund contains probably the single most important European coal field at the time, the Ruhr coal fields, always dominated by only a few large *Knappschaften*. The important Lower and Upper Silesian coal fields were situated in the Breslau region. The Saar coal fields were located in the Bonn region, as were the Aachen coal fields. With respect to brown coal, the Halle and Clausthal regions comprised the main areas (Saxonian and Harz fields). Metal ores, iron ore as well as others (copper, lead etc.), were predominantly extracted in the Bonn, Clausthal, and Halle regions. Consequently, *Knappschaften* for related industries were situated there, too. Salt and stone extraction existed especially in Bonn, Dortmund, and Halle.

Table 1 shows the annual number of all German *Knappschaften* from 1861 to 1920. There remains some uncertainty about the number of *Knappschaften* subsumed under the item “other” because official statistics

TABLE 1
Number of German *Knappschaften*, 1861-1920

	Prussia					Bavaria	Other
	Bonn	Breslau	Clausthal	Dortmund	Halle		
1861	39	3	-	11	18	n.a.	n.a.
1866	43	4	-	11	19	n.a.	n.a.
1871	48	4	6	15	18	n.a.	n.a.
1876	46	4	9	15	13	n.a.	n.a.
1881	44	4	9	14	12	n.a.	n.a.
1886	42	3	4	14	12	39	51
1891	43	3	4	11	13	40	24
1896	43	3	4	10	13	41	18
1901	41	3	4	12	13	41	23
1906	41	3	4	11	13	28	26
1911	37	3	4	10	11	28	27
1916	30	3	4	10	9	26	n.a.
1920	20	3	4	9	8	n.a.	n.a.

Note: Shown are mining administration regions; “n.a.” is “not available”; “other” includes the kingdoms of Saxony and Württemberg, the grand duchies of Hesse and Brunswick, the duchies of Anhalt, Sachsen-Altenburg, and Sachsen-Meiningen, and the principalities of Waldeck, Schwarzburg, and Alsace-Lorraine.

Source: Ministerium für Handel und Gewerbe, *Statistik der Knappschaftsvereine des preussischen Staates* (Berlin, 1862-1920); Kingdom of Bavaria, *Statistik der Knappschaftsvereine im bayerischen Staate* (München, 1884-1920); Harry Karwehl, *Die Entwicklung und Reform des deutschen Knappschaftswesens* (Jena, 1907); Peter Simons, *Das deutsche Knappschaftswesen* (Mainz, 1895);

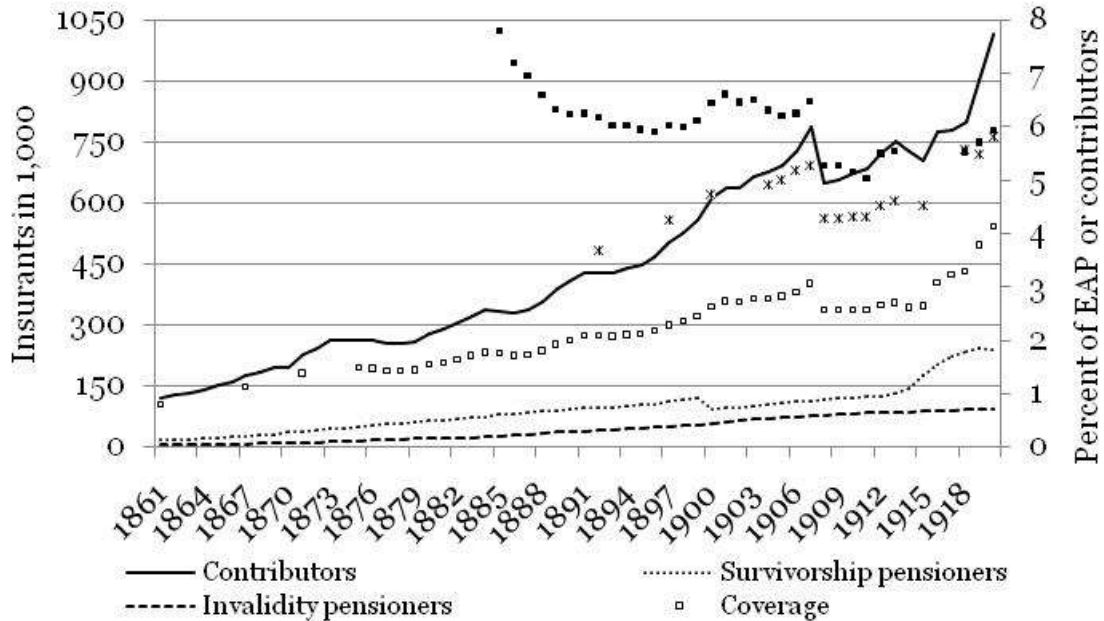
Heinrich Imbusch, *Das deutsche Knappschaftswesen: Eine Darstellung seiner Entwicklung und seines heutigen Standes, unter besonderer Berücksichtigung des Knappschaftsrechts und des Wirkens der Knappschaftsvereine in der Praxis* (Köln, 1910); August Köhne, *Die deutschen Knappschaftsvereine, ihre Einrichtung und ihre Bedeutung* (Hannover, 1915); Georg Pietsch, *Das Knappschaftswesen in Elsass-Lothringen* (Köln, 1911).

are not available for the remaining German states as they are for Prussia, Bavaria, and Saxony. Rather, we have to rely on fairly scarce information from secondary nineteenth-century sources. Prussia constantly accounted for about half of the organizations and for about 90 percent of all miners. Prussian *Knappschaften* themselves were relatively unequally distributed among mining administration regions. While the Bonn region was highly fragmented, miners in the Breslau region were distributed across few *Knappschaften*. In 1861, seven years after the enactment of the path-breaking *Knappschaft* law, 71 *Knappschaften* were in operation. This number increased to a remarkable 91 in 1870-1871. Insurers consolidated thereafter in several phases.

Against the background of a 52 percent decrease (1871 to 1920) in the number of operating Prussian *Knappschaften*, Figure 2 highlights the point that the number of insureds as a whole—that is, contributors and pensioners together—increased by 387.6 percent from 275,143 to 1,341,567 (contributors by 347 percent, pensioners by 577.6 percent). This important trend points directly to the fact that the average *Knappschaft* had grown larger and larger. Furthermore, Figure 2 compares the coverage of *Knappschaften* to the coverage of Bismarckian social insurance. While the *Knappschaften*'s coverage in terms of economically active population rose from about 1 to 4 percent, the coverage of Bismarckian health insurance rose from about 21 percent after implementation in 1883 to 44 percent in 1913, clearly a faster pace. Coverage of Bismarckian invalidity insurance initially was about 49 percent and remained quite stable towards 1913.

As is commonly known, public spending on social security in general—not only for Germany—increased from the mid-nineteenth century on. Definitely on a smaller scale than Bismarckian insurance regarding coverage, *Knappschaften* were the forerunners in expanding generosity of insurance benefits, reflecting thereby members' preferences for a certain income replacement standard above the economy's average. I briefly compare data from the Prussian *Knappschaft* statistics—not individual statutes—with the younger but more extensive Bismarckian scheme. Using data from the *Knappschaft* statistics inevitably allows only for statements “on average.” Clearly, the analysis thus cannot capture all peculiarities among *Knappschaften*.

FIGURE 2
Aggregate Membership and Coverage of Prussian *Knappschaften*,
1861-1920



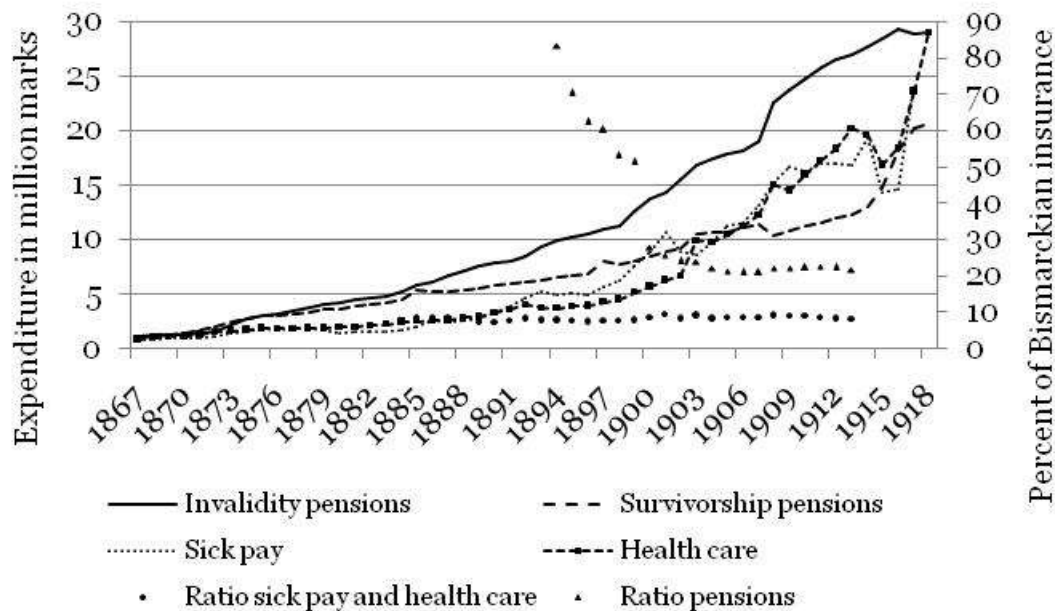
Note: Contributors include established (*ständig*) and unestablished (*unständig*) members; survivorship pensioners include widows and orphans. Coverage is contributors plus invalidity pensioners divided by the economically active population (EAP). Ratio invalidity (ratio health) is contributing miners divided by contributors of Bismarckian invalidity and old age insurance (health insurance).

Source: Figure compiled by author, based on *Statistik der Knappschaftsvereine des preussischen Staates*; Walther G. Hoffmann, *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts* (Berlin, 1965), 172-74, for the economically active population of 1861 to 1913; Andrea Sommariva and Guiseppa Tullio, *German Macroeconomic History, 1880-1979: A Study of the Effects of Economic Policy on Inflation, Currency Depreciation and Growth* (New York, 1987), 235, for the economically active population of 1914 to 1920; David Khoudour-Castéras, "Welfare State and Labor Mobility: The Impact of Bismarck's Social Legislation on German Emigration before World War I," *Journal of Economic History* 68 (March 2008): 211-43; Johannes Frerich and Martin Frey, *Handbuch der Geschichte der Sozialpolitik in Deutschland—Band 1: Von der vorindustriellen Zeit bis zum Ende des Dritten Reichs* (München, 1993), 102.

Figure 3 illustrates the development of aggregate nominal expenditures of the *Knappschaften* on benefit categories (for all monetary data, I dropped the years of open inflation). Other expenditures—for example, for administrative purposes—are neglected here because their

magnitude was uniformly relatively low. As can be seen, aggregate expenditures on invalidity pensions increased from about 2 million marks in 1867 to nearly 29 million marks in 1918, and were thus the single most important benefit item. The ratio of expenditures on sick pay and health care of *Knappschaften* to those of Bismarckian insurance constantly amounted to between 7 and 8.5 percent, while the ratio of pension expenditure decreased from more than 1,000 percent at the start of public pension insurance to a still remarkable 20 percent in 1913. This point is worth noting, as Figure 2 indicates that *Knappschaften* disposed of only 5 to 8 percent of the Bismarckian invalidity insurance's contributors. This implies in general an over-proportionally higher financing burden on one contributing miner than on the average Bismarckian insurance's member. This burden still remains if we take into account that miners' average wages were higher than workers' average wages on the whole.

FIGURE 3
Aggregate Nominal Expenditure of Prussian *Knappschaften* for Pensions,
Sick Pay and Health Care, 1867-1918

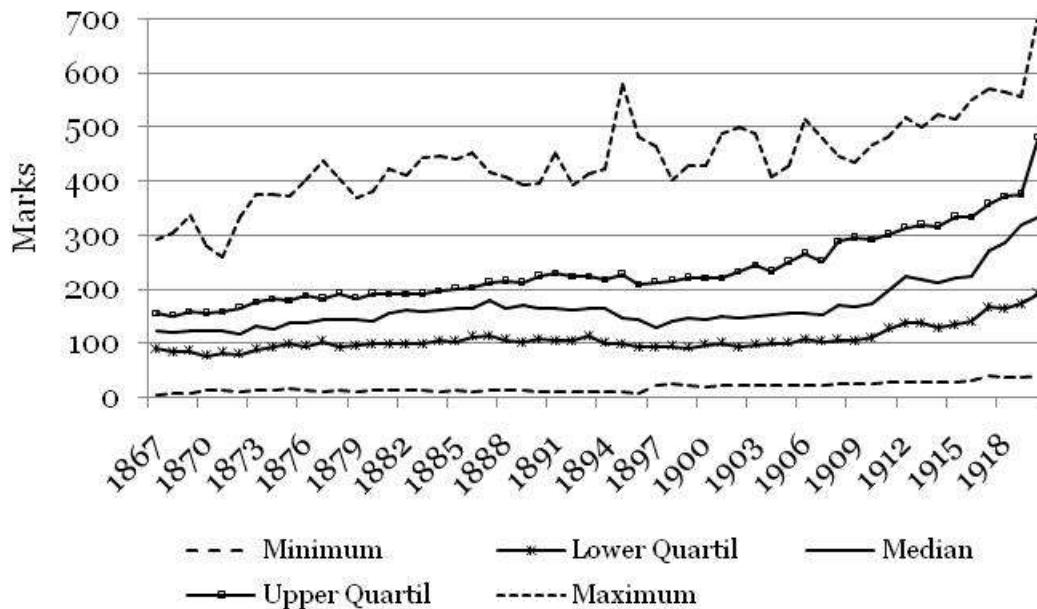


Note: “Ratio pensions” is the sum of invalidity and survivorship pension expenditure of *Knappschaften* divided by the sum of invalidity and old age pension expenditure of Bismarckian social insurance; “ratio sick pay and health care” is the sum of sick pay and health care expenditures of *Knappschaften* divided by health expenditures of Bismarckian health insurance; the value of sick pay expenditure for 1918 (52 million) is dropped, as are the first three values of ratio pensions, because of their magnitude (1891: 1,076, 1892:562, 1893: 381).

Source: Figure compiled by author based on *Statistik der Knappschaftsvereine des preussischen Staates*; Khoudour-Castéras, “Welfare State and Labor Mobility,” 211-43, for Bismarckian health, invalidity, and old age insurance expenditures.

Figures 4 and 5 add details to the picture by providing descriptive statistics on the two single most important *Knappschaft* insurance benefits, the average invalidity pension and daily sick pay. Data on all 103 Prussian *Knappschaften* operating in the observation period highlight the heterogeneity among them with respect to monetary levels. The range between minimum and maximum average invalidity pension increased from about 280 to more than 500 marks. Hence, some *Knappschaften* increased their nominal generosity much more than others. Furthermore, the median pension, which does not deviate much from the arithmetic mean, initially amounted to 120 marks and rose to over 300 marks. Moreover, the mean daily sick pay increased from 0.60 marks to more than 2 marks. On the whole, however, the descriptive statistics imply that both average benefits were raised significantly only since the early twentieth century.¹⁵

FIGURE 4
Per Capita Invalidity Pension of Prussian *Knappschaften*, 1867-1920



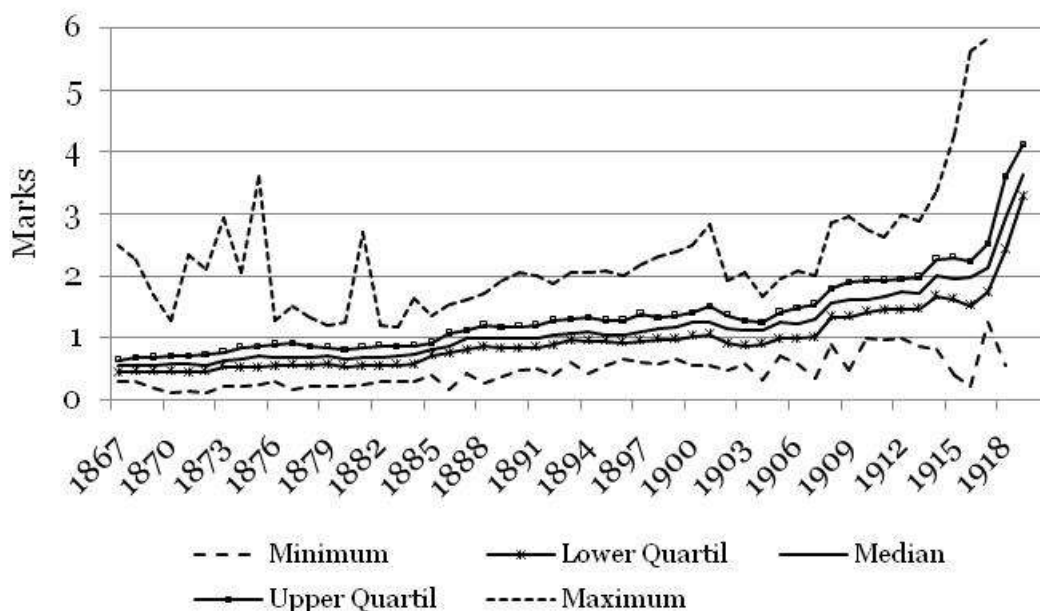
Note: Per capita invalidity pension is the unweighted arithmetic mean per *Knappschaft* and year.

Source: Figure based on *Statistik der Knappschaftsvereine des preussischen Staates*.

¹⁵ Average widows' and orphans' pensions can be expressed as a percentage of average invalidity pensions. Empirical evidence suggests that those items lay predominantly between 50 to 60% and 10 to 15%, respectively. A public survivors' provision was introduced in 1911 empire-wide, along with white-collar insurance. *Knappschaften* evidently put this welfare-enhancing activity on their agenda much earlier.

Data on Bismarckian health insurance expenditures reported by Johannes Frerich and Martin Frey suggest a sick pay per sick day of about 1.04 marks in 1885 and of 1.44 marks in 1910, which initially is more than the upper quartile of the *Knappschaften* sick pay, but later less than the median sick pay. It was mentioned above that the introduction of state health insurance forced almost all *Knappschaften* to adjust their sick pay benefits upward to meet legal requirements. Looking at the data, we can confirm there was indeed a gap in favor of Bismarckian insurance in 1885. However, while state daily sick pay was raised by 38.5 percent when mean sick days per insurant increased by 36.4 percent (from 5.96 in 1885 to 8.13 in 1910), *Knappschaft* daily sick pay on Prussian average doubled when mean sick days per miner increased as well, but at a lower rate (from 6.7 in 1885 to 7.3 in 1910).¹⁶ The ability of *Knappschaften* to expand their generosity comparatively more may have been the result of successful efforts to keep moral hazard–induced sick days as low as possible.¹⁷

FIGURE 5
Sick Pay per Sick Day of Prussian *Knappschaften*, 1867-1920



Note: Sick pay per sick day is the unweighted arithmetic mean per *Knappschaft* and year.

Source: Figure compiled by author based on *Statistik der Knappschaftsvereine des preussischen Staates*.

¹⁶ Frerich and Frey, *Handbuch der Geschichte der Sozialpolitik in Deutschland*, 102.

¹⁷ Guinnane and Streb, “Moral hazard in a mutual health-insurance system.”

What does a comparison of average invalidity pensions reveal? If we compute the ratio of mining administration region-specific average pensions to the Bismarckian pension—which makes sense insofar as wage data on administration regions point to spatial wage differentials across regions—we can observe that *Knappschaft* average nominal invalidity pensions were much higher than the Bismarckian average pensions in three administration regions (Breslau, Clausthal, and Halle): about 50 percent at least (and up to more than 100 percent, Clausthal and Halle, 1891-1896). For Bonn and Dortmund, the ratio predominantly fluctuated around 1. The ratio exceeded 1.2 only for 1891-1894 and 1919-1920. In terms of long-term growth, however, the Bismarckian pension grew relatively faster. The absolute value of the Bismarckian pension amounted to about 115 marks initially and to about 210 marks toward 1920.¹⁸

Probably more informative than absolute pensions or sick pay in marks is the income replacement rate. Regarding pensions, I simply computed the ratio of the average pension in period *t* to the average annual wage for the respective region in *t* in which the *Knappschaft* was situated and for the subsector in which most insurants were employed. We can carefully interpret this ratio, formally the “net pension level in year *t*,” as the income replacement rate of the first received pension payment to the last earned net wage.

In fact, the data, summarized in Table 2, show that pensions usually replaced 20 or more percent of net wage and that replacement increased toward 1891. After public invalidity insurance was introduced, *Knappschaften* obviously used their room for maneuver to cut replacement. From a cross-sectional view, the data also suggest that replacement increased with size. Sick pay replacement is rather low compared to what contemporary writers usually stated, 50 or more percent on average. A comparison of income replacement with the average invalidity pension leads to the conclusion that *Knappschaften* guaranteed a higher replacement on average, even after 1891. Following Frey and Frerich, we learn that the Bismarckian pension replaced about 16 to 17 percent of gross labor income. In fact, net replacement rates do not decrease by more than 2 to 3 percent, if we take social insurance contributions into account. This does not change the picture much. Especially, the pension income replacement of the three largest *Knappschaften* per year—always the same: the *Allgemeine Knappschaft Bochum* and its direct predecessors, the *Oberschlesische Knappschaft* and the *Saarbrücker Knappschaft*—

¹⁸ Average contribution payments by members of Prussian provident funds (*Gewerbliche Unterstützungskassen*) for 1864-1874 suggest that average support pay fell far short of the magnitude of the *Knappschaften* average benefits. For 1864, Frerich and Frey report an average contribution over nearly 3,000 funds of 7.64 marks, raised to 11.25 marks in 1874 (4,877 funds). These figures include a persistent 20-22% share from employers. Comparatively, the corresponding average contribution payments with respect to the entire *Knappschaft* population were 25.3 and 37.3 marks.

usually exceeded 28 percent. These *Knappschaften* alone covered between 54 percent (113,000) and 67 percent (886,000) of all insured individuals (active miners, invalids, and survivors) between 1867 and 1920.

TABLE 2
Estimates of Invalidity Pension and Sick Pay Replacement Rates by Size Class, 1867-1918

	1-199		200-999		1,000-4,999		5,000-9,999		10,000-49,999		50,000+	
	IP	SP	IP	SP	IP	SP	IP	SP	IP	SP	IP	SP
1867-1871	21	28	21	30	19	26	21	29	23	32	-	-
1872-1876	17	22	19	26	18	25	18	26	25	32	25	31
1877-1881	19	25	24	32	25	36	23	39	35	45	30	41
1882-1886	21	28	22	31	28	36	23	35	32	40	31	39
1887-1891	21	32	22	39	27	45	22	40	31	47	28	38
1892-1896	21	37	22	42	25	49	22	42	34	47	24	45
1897-1901	17	35	17	36	21	40	13	37	31	45	21	44
1902-1906	20	29	17	33	24	35	18	40	28	42	26	32
1908-1913	26	44	14	39	23	43	19	49	27	52	25	44
1914-1918	-	-	12	34	20	41	16	42	19	45	18	38

Note: IP denotes per capita invalidity pension, SP sick pay per sick day. Net pension replacement in period t is per capita pension divided by mean annual net wage. Net sick pay replacement in period t is sick pay per sick day divided by mean annual net shift earnings. Annual wages and shift earnings refer to the mining administration region in which the respective *Knappschaft* is located and the subsector in which a *Knappschaft's* insurants were mainly employed. Wages were extrapolated backward from 1883 for all mining administration regions except Dortmund using the arithmetic mean of the ratio of a mining administration regions' wages to wages in Dortmund for 1884 to 1913. Figures displayed are rounded to the nearest integer.

Source: Author's calculation based on *Statistik der Knappschaftsvereine des preussischen Staates*; Ministerium für Handel und Gewerbe (1885-1922), *Zeitschrift für das Berg-, Hütten- und Salinenwesen im preussischen Staate*, Berlin, statistical part, for wage data of 1884 to 1920; Carl-Ludwig Holtfrerich, *Quantitative Wirtschaftsgeschichte des Ruhrkohlenbergbaus im 19. Jahrhundert: Eine Führungssektoranalyse* (Dortmund, 1973), 54-56, for wage data on hard coal mining in the administration region of Dortmund, 1867 to 1883.

Demographic Challenges and Fiscal Reaction

This subsection establishes three conclusions on the problems of a maturing—we may alternatively say ageing—pay-as-you-go—financed pension scheme. Here, I focus especially on pensions. The first fact

concerns a variable significant for every such scheme—namely, the pensioners-to-contributors ratio (PCR). Recall that in a pay-as-you-go system current contributors finance expenditures on current beneficiaries and that the budget is formally balanced at the end of each period. Mechanically, the contribution rate depends on three factors: the PCR, the gross pension level (ratio of average pensions to average wage), and the fraction of state subsidies expanding the receipt base.¹⁹ We may treat a rising PCR as an exogenous demographic or a structural shock, respectively, to a *Knappschaft*.²⁰ Since *Knappschaften* neither received state subsidies nor supported each other with financial aid in the case of crisis, they could react to rising PCRs primarily by adjusting contributions per capita upward or average pension benefits downward.²¹ A third possibility was to draw on reserves created in the past in order to keep contributions and benefit levels constant. In fact, per capita reserves were for most *Knappschaften* rather small; they could have possibly smoothed out seasonal or cyclical fluctuations, but they did not represent funds sufficient to cover entitlements of contributors and pensioners over expected average pension durations, at least not before 1906.

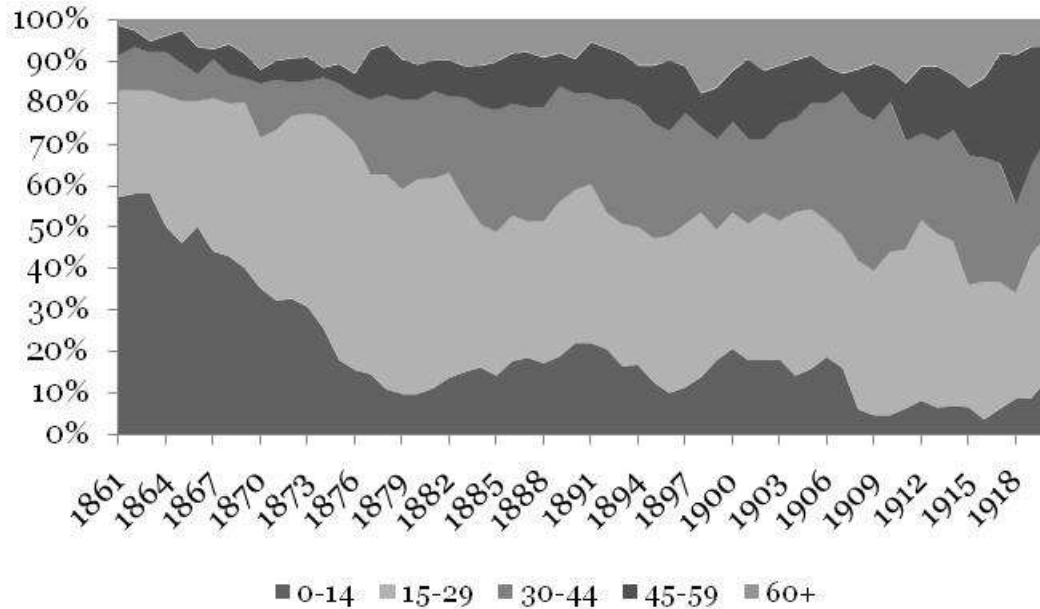
Figure 6 illustrates the great demographic-structural challenge *Knappschaften* faced while maturing. We can observe that the frequency of *Knappschaften* that experienced a PCR of 14 or fewer pensioners per 100 contributors impressively decreased from about 58 percent in 1861 to between 10 and 25 percent during 1879 to 1907, and 5 to 10 percent thereafter. Further on, the proportion of *Knappschaften* facing a PCR above 30 was initially 18 percent and finally about 50 to 55 percent. Note that, for example, the German system today faces a PCR of about 25 to 35, and it is expected to rise further in the future. In particular, the range of PCR values is much higher than today: some *Knappschaften* experienced 80 or more pensioners per 100 contributors. In fact, PCRs of more than 50 were especially likely among the smallest *Knappschaften* and definitely put them under financial pressure. However, not only the smallest *Knappschaften* had to deal with an increasing PCR, but also the rest.

¹⁹ Winfried Schmähl, “Umlagefinanzierte Rentenversicherung in Deutschland: Optionen und Konzepte sowie politische Entscheidungen als Einstieg in einen grundlegenden Transformationsprozeß,” in *Soziale Sicherungssysteme und demographische Herausforderungen*, ed. Winfried Schmähl and Volker Ulrich (Tübingen, 2001), 123-204.

²⁰ Strictly speaking, a *Knappschaft* could—as can a social insurer today—have an impact on the entry of pensioners by tightening eligibility rules. This is to say, the PCR is at least in part endogenous, or homemade.

²¹ Strictly speaking, wages are in part endogenous, too, because employers participated in self-management and at the same time set wages. However, there is no kind of anecdotal literature to suggest that employers adjusted mining wages with the intent of cutting the gross pension level. So, we may refer to wages in this setting as exogenous as well.

FIGURE 6
Relative Frequency of Pensioners-to-Contributors Ratios of Prussian
Knappschaften, 1861-1920



Note: Contributors include established and unestablished members. Pensioners include invalids, widows, and orphans.

Source: Author's calculation based on *Statistik der Knappschaftsvereine des preussischen Staates*.

The pensioners-to-contributors ratio as a measure of the (potential) economic implications of demographic and structural ageing is especially important in connection with pay-as-you-go financing. On the micro level, many *Knappschaften* experienced ageing, while on the macro level, it was not a severe problem for the German Reich toward World War I.²² We can identify two factors that explain this divergence. *Knappschaften* were profession-specific, and thus the local or regional inflow of new contributors was limited to the expansion of the mining sector. *Knappschaften* were inevitably tied to the extraction of non-renewable natural resources; or in other words, the spatial distribution of resource deposits of different quality and the local or regional expansion or contraction of mining activities in turn determined the long-term growth paths of *Knappschaften*.

²² Franz Rothenbacher, *The European Population, 1850-1945* (Basingstoke, England, 2002), 299-300.

The second conclusion refers to the average duration of invalidity pensions. Data taken from the annual records of the *Saarbrücker Knappschaft*, persistently the third-largest *Knappschaft* in Prussia, illustrates the trend.²³ The average invalidity pension duration with respect to the pensioners who died during the course of an observed year increased from 5.0 years in 1876 to a remarkable 14.9 years in 1920.²⁴ So, it should hold that, on average, a *Knappschaft* had to finance more pensioners, each of them for an ever-increasing period, with fewer contributors over time. Data from the Prussian *Knappschaft* statistics confirm rising average pension durations since 1900 (8.8 years in that year, 11.5 in 1920), although the effective entry age into invalidity stayed by and large constant at around 50, though variation among *Knappschaften* can be observed.

Finally, Table 3 shows periodic averages of the ratio of claims costs to be financed by one contributor to the mean annual net wage. Claims costs per contributor include all claims cost categories. The ratio indicates the extent to which claims costs to be financed drove a wedge between net labor income and gross labor income. For all mining administration regions and subsectors depicted, the median ratio increased from 1867-1876 to 1877-1886. Even the average maximum ratio did so predominantly. We may carefully say that claims costs—in part endogenous, since *Knappschaften* specified monetary levels themselves—generally consumed an increased rather than decreasing fraction of gross wages toward World War I. Thus, rising cost pressure is evident.

Conclusion

This essay highlights the main structural characteristics of Prussian *Knappschaften* within the period 1854-1923, when miners' risk provisions adopted a (social) insurance character, and it approaches the issues of generosity and demographic pressure from a quantitative perspective. The essay is descriptive in nature, and seeks to provide an information base from which to start comparative research on social security mutualism and the evolution of the welfare state.

Data identify trends by and large common to all Prussian *Knappschaften*. First, miners had a preference for sickness and invalidity benefits exceeding the generosity of related institutional or insurance arrangements, respectively. This holds definitely true if we compare them to the more extensive Bismarckian scheme after 1883. Second, over time, increasing pensioners-to-contributors ratios resulting from structural and demographic changes and increasing average pension durations resulting primarily from gains in life expectancy became serious issues that made

²³ Unfortunately, *Knappschaft* statistics on average pension duration have been published only since 1900.

²⁴ Saarbrücker Knappschaftsverein, *Jahresbericht des Saarbrücker Knappschaftsvereins* (Saarbrücken, 1879-1920).

TABLE 3
Ratio of Claims Costs per Contributor to Mean Annual Net Wage
by Mining Administration Region, 1867-1918

	Hard Coal				Brown Coal				Iron Ore			
	Bonn		Breslau		Dortmund		Halle		Bonn		Halle	
	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max
1867-1876	4.1	10.4	3.9	4.0	3.8	4.3	-	-	2.4	7.6	5.1	10.5
1877-1886	8.0	13.3	6.4	7.1	7.1	10.3	4.6	5.5	4.3	13.2	5.5	8.6
1887-1896	6.8	11.7	6.0	7.2	10.4	16.0	5.2	7.0	5.3	10.3	6.0	8.1
1897-1906	7.3	17.5	5.9	6.6	7.3	8.7	5.1	7.1	4.5	10.4	5.6	7.5
1908-1913	6.3	8.0	8.1	11.2	7.1	7.8	11.5	16.7	6.2	12.5	8.7	15.6
1914-1918	3.9	3.9	6.9	8.0	5.2	5.6	6.8	7.4	5.0	7.2	7.0	9.6

Source: Author's calculation based on *Statistik der Knappschaftsvereine des preussischen Staates*; Ministerium für Handel und Gewerbe, *Zeitschrift für das Berg-, Hütten- und Salinenwesen im preussischen Staate* (Berlin, 1885-1920), statistical part, for wage data of 1884 to 1920; Carl-Ludwig Holtfrerich, *Quantitative Wirtschaftsgeschichte des Ruhrkohlenbergbaus im 19. Jahrhundert: Eine Führungssektoranalyse* (Dortmund, 1973), 54-56, for wage data on hard coal mining in the mining administration region of Dortmund from 1867 to 1883.

adjustments necessary and caused the proportion of a miner's labor income dedicated to the coverage of social security costs, overall, to increase.

It should be emphasized, however, that the income replacement rate estimates presented here are definitely not comparable to the rates many present-day schemes, especially in the developed countries, provide for their insureds. With respect to pensions in particular, this is explainable by the fact that the concept of an individual's lifetime as split into three stages—youth, employment, and retirement—had not yet taken hold, not even really with Bismarckian old age insurance. So, nineteenth- and early twentieth-century contemporaries may not have identified a pension as self-standing retirement income.