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Workplace accidents and workers' solidarity: mutual health insurance in early twentieth-century Sweden†

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During the industrialization period, the rate of workplace-related accidents increased. Because of the lack of public insurance, mutual health insurance societies became the main providers of workplace accident insurance among workers. Due to large differences in accident risk, health insurance societies were potentially exposed to the risk of adverse selection, since they employed equal pricing for all members regardless of risk profile. This article investigates the impact of workplace accident risk on health insurance selection and outcomes. We employ household budget surveys encompassing urban workers in Sweden during the early twentieth century. We find evidence for a redistribution from low- to high-risk-exposed workers, as workplace accident risk had a significant and positive impact on receiving health insurance benefits, also when controlling for a variety of factors. Workers exposed to greater risks in the workplace were more likely to have health insurance but did not pay higher premiums. The redistribution from low- to high-risk-exposed workers was largely accepted and viewed as an act of solidarity between workers. Given that health insurance societies were aware of this redistribution, we argue for the presence of informed, rather than adverse, selection.

In the wake of industrialization, workplace accidents increased, exposing workers to the risk of injury, invalidity, and death.[1] Mechanization and new factory work practices, such as long hours, limited control of the pace of work, and a lack of skilled workers, were some of the factors underlying the increased rate of workplace accidents in industrializing nations on both sides of the Atlantic during the early twentieth century.[2] As a consequence, protection against workplace accidents turned into a major social policy issue in the late nineteenth century, and

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[1] Fishback, 'Operations'; Lundh, *Spelets regler.*

[2] See Lewchuk, 'Industrialization and occupational mortality'; Aldrich, *Safety first*; Fishback and Kantor, 'Adoption'.

the introduction of statutory workplace accident insurance has been viewed as one of the starting points of the welfare state.[3]

Prior to the introduction of compulsory accident insurance, many working-class households came to rely on health insurance societies to mitigate the risk of workplace accidents.[4] This was especially true for countries such as Sweden, in which public protection for workers developed slowly during the first decades of the twentieth century.[5] Although Sweden is best known for its public welfare arrangements, voluntary mutual societies played a key role as the major provider of health insurance, including insurance for injuries caused by workplace accidents, prior to the enactment of public health insurance in 1955.[6] Although workers in the early twentieth century faced major differences in risk exposure, previous research has not investigated how health insurance societies handled these risks.[7] Swedish official accident statistics by occupation show that on average workers in mining and steelworks lost close to four days of work per annum due to workplace accidents, while workers in retail and postal services only lost 0.05 workdays. The distribution of accident risk was skewed: in 1913, 50 per cent of all workdays lost due to accidents were experienced by only 18 per cent of all workers.[8] Despite this, Swedish health insurance societies, as well as British and American ones, rarely denied membership on the basis of occupation, nor did they abandon the principle of egalitarian pricing of risk by introducing risk-differentiated premiums.[9] Therefore, workers exposed to higher levels of risk had greater incentives to insure themselves than workers in less risky occupations. Workers exposed to high levels of risk were further often offered a higher wage as compensation for accepting a higher risk, which made health insurance more affordable for them.[10] Hence, if the variation in workplace accident risks was unknown to health insurance societies, a higher demand for health insurance among high-risk-exposed workers might cause adverse selection.[11] It is unclear, however, whether differences in risk exposure among workers was unknown or an issue of concern for health insurance societies. Additionally, since the purpose of health insurance societies was jointly to share the risk among industrial workers during a period of limited social protection and social rights, it cannot be ruled out that members of health insurance societies accepted the redistribution of benefits

[3] Moses, *First modern risk*; Fishback and Kantor, *Prelude to the welfare state*; Edebalk, '1916 års olycksfallsförsäkring'.

[4] Emery and Emery, *Young man's benefit*; Benson, 'Thrift'. 'Health insurance societies' refers to mutual aid societies that provide members with financial protection against loss of income due to illness and accident (also funerals before 1910). In Sweden, such societies were called *Sjukkassor*. Members' contributions/payments to health insurance societies are denoted as 'premiums', pay-outs (from society to member) are denoted as 'benefits', and 'days lost due to illness and accident' denotes the reason for receiving insurance benefits.

[5] Edebalk, '1916 års olycksfallsförsäkring', p. 113; Englund, *Arbetarförsäkringsfrågan*.

[6] Andersson and Eriksson, 'Sickness absence'.

[7] See, for example, Murray, 'Asymmetric information'; Emery, 'Rise and fall'; idem, '"Risky business"'; Emery and Emery, 'Young man's benefit'; Murray, *Origins*; Gottlieb, 'Asymmetric information'; Jopp, 'Old times'; Andersson and Eriksson, 'Sickness absence'.

[8] Kungliga socialstyrelsen, *Sveriges officiella statistik* (1915); Kommerskollegii, *Meddelanden från Kungl* (1912).

[9] Gottlieb, 'Asymmetric information', p. 271.

[10] Eriksson, *Gruva och arbete*; Fishback and Kantor, 'Adoption'; Benson, 'Thrift'.

[11] Before Bismarck's social inventions, health insurance membership was compulsory for German mine workers. All miners were insured in special mining associations (*Knappschaften*). This implied that other German health insurance societies avoided risk-sharing with high-risk miners; Jopp, 'Old times'.

to those facing a greater risk of accidents in the workplace and saw it as an act of solidarity.[12]

This article explores how variation in workplace accident risk was related to health insurance coverage, premiums, and benefits. It examines the extent to which health insurance societies redistributed resources by accident risk, and whether any redistribution could be attributed to adverse selection or to a deliberate redistribution among insured members. We make use of household budget surveys encompassing urban workers' households in nine major cities in Sweden in the early twentieth century. By adding information on workplace accident risk from official accident statistics by occupation for each male breadwinner in the household budgets sample, we can address whether or not there was adverse selection with respect to accident risk. Further, we use qualitative evidence from internal discussions in a health insurance society to highlight the importance of considering the specific historical context for understanding the foundations and ideology of pre-welfare-state, mutual cooperative societies. The study focuses on the period before the introduction of compulsory accident insurance in Sweden in 1916, a period when variation in workplace accident risk was high and health insurance societies were the main financial actors involved in protecting workers in the event of workplace accidents. The period of study was further characterized by nationwide societies targeting a wide range of occupations and branches.

Our results show the presence of a redistribution from low- to high-risk-exposed workers, as workplace accident risk had a significant and positive impact on receiving health insurance benefits, when controlling for a variety of factors. Workers exposed to greater risks in their work were more likely to have health insurance. However, this redistribution from low- to high-risk-exposed workers was largely accepted and viewed as an act of solidarity between workers.

The remainder of the article is organized as follows. Section I outlines differences in workplace accident risk; sections II, III, and IV study how health insurance societies handled and viewed occupational risk; section V explains the data and empirical strategy employed; in section VI, we present results from the household budget analysis; and section VII provides extensions and robustness checks. Section VIII concludes the article.

I. Differences in workplace accident risk

In the late nineteenth century, the rising social and economic losses due to workplace accidents increased demand for workers' compensation schemes. Germany introduced a workers' compensation scheme in 1884, and other countries, like Britain, followed and introduced similar schemes.[13] In Sweden, this was echoed in 1889 in the recommendations of a parliamentary committee, the Worker's Insurance Committee, which later led to the Workers' Compensation Act in 1901, which offered limited protections for workers. The 1901 act aimed primarily at protecting workers who had become invalids due to workplace accidents, along with widows of victims of workplace accidents. The amount of compensation provided was, however, not enough to support a family, while

[12] Lindeberg, *Den svenska*.
[13] Huberman and Lewchuk, 'European economic integration'.

Table 1. *Accidents, by number of cases, duration, and work absence for the main industry groups in 1913*

Industry groups	*Accident cases per 100 workers*	*Sick days per accident case*	*Sick days per worker caused by accidents*
Mining and metal industries	7.1	21.7	1.54
Stone, clay, and glass industries	5.5	24.0	1.32
Wood industries	4.0	29.2	1.17
Paper and pulp industries	3.8	26.3	1.00
Food products industries	2.2	22.6	0.50
Textiles and clothing industries	0.8	27.1	0.21
Leather, hair, and rubber industries	1.3	25.4	0.33
Building and construction	1.7	30.2	0.50
Energy, gas, and lighting	1.8	23.3	0.41
Wholesale and retail trade	0.1	33.9	0.02
Transport and communication	3.3	24.4	0.79
Total	2.8	24.4	0.70

Source: Kungliga socialstyrelsen, *Sveriges officiella statistik* (1916).

the long waiting time (60 days) threatened to reduce injured workers and their dependents to destitution before they received benefits, leading the act to be criticized as insufficient by the labour movement.[14] A comprehensive compulsory accident insurance scheme was finally introduced in 1916 and was administered by health insurance societies. Edebalk and Englund both argue that the 1916 scheme put Sweden in a leading position in terms of its public insurance.[15]

The parliamentary Worker's Insurance Committee (1884–9), which had been appointed to investigate public insurance for workers, recognized that there were major differences in risk between occupations. A survey carried out by the Committee in 1884/5 showed that workers in the mining and metal industries faced the most risk exposure. However, the survey was seen as insufficient and incomplete, and from 1906 onwards, employers were legally required to report accidents that led to more than three days of absence for employees.[16]

As a result, workplace accidents were now reported in mining, manufacturing, construction, trade, transport, and other services. Agriculture was omitted, although forestry was included. The National Board of Trade, and later the National Board of Health and Welfare, produced statistics based on the accident reports, supplemented with employee figures from industry statistics. For the sectors outside mining and manufacturing, however, they lacked employee data. In the original statistics, accidents by number of people employed is shown for mining and manufacturing only.

We use the data reported in table 1 to show workplace accidents per 100 workers, work absence per accident, and work absences per worker caused by accidents by main industry group in 1913. It includes not only accidents resulting in claims, but all accidents resulting in three days or more of absence, which employers were

[14] Edebalk, 'Arbetsgivarna', p. 85.
[15] Edebalk, *Välfärdsstaten*; Englund, *Arbetarförsäkringsfrågan*. The act of 1916 encompassed all wage workers and all salaried workers, except household work. The qualifying period was 35 days and the benefits two-thirds of the income. With this act, income loss as the central principle for Swedish social insurance was introduced.
[16] Kommerskollegii, *Arbetsstatistik* (1908).

legally required to report. Short-term leave (less than three days) due to accidents is not included, thus making the estimate somewhat downward-biased.[17]

The diversity of risks is clear. Workers in metal works and mining faced on average 7.1 accidents per 100 workers, while workers in the wholesale and retail trade experienced only 0.1 accidents per 100 workers. In the most hazardous sub-sectors of metal and mining, such as iron ore mining and iron- and steelworks, there were 16 accidents per 100 workers. In such industries, workers faced up to four lost workdays annually due to accidents, while workers in retail, trade, and the postal service sectors faced only 0.05 lost workdays due to accidents.[18] The skewed distribution of risk implied, as previously mentioned, that half of all workdays lost due to accidents were experienced by only 18 per cent of all workers in Sweden. Hence, in some workplaces, accidents were a frequent occurrence and a reality in the everyday lives of workers, while at others, accidents were rare. On average, work absences (three days or longer) due to accidents amounted to close to one working day per worker in 1913.[19] When comparing the accident figure for workdays lost/work absences per worker with the number of days that members of health insurance societies received benefits on average, we find that the workdays lost due to accidents made up approximately 12 per cent of all days for which workers received benefits.[20]

Accident insurance was not entirely absent before the 1901 act. Following the rise in the frequency of workplace accidents, a commercial, employer-based insurance scheme had been created in the late nineteenth century in Sweden. The employers used a risk assessment strategy by offering employees insurance to compensate them for especially severe accidents. This was similar to the approach later taken in the Workers' Compensation Act, introduced in 1901. Few workers purchased this employer-based commercial accident insurance, however. A cost-of-living survey that included Stockholm in 1907/8 and eight other major cities in 1913/14 shows that some 18 per cent of the working-class families surveyed had purchased commercial accident insurance against permanent injuries/invalidity. The average expenditure on accident insurance was 1.5 Swedish krona (SEK), compared to 25.2 SEK on health insurance (see table 3, row 4).[21] As argued by Bergander, commercial accident insurance was largely unknown, and the high premiums limited accident insurance to being a luxury good beyond the reach of many workers.[22]

[17] Data on work absence due to workplace accidents collected from a nation-wide Swedish health insurance society (Sveriges allmänna sjuk- och begravningskassa) show that 4% of all accidents resulted in fewer than three sick days in the year 1916 (the society observed a one-day waiting period before benefits were paid out); Riksarkivet, Arninge, Riksförsäkringsanstalten, 'Sveriges Allmänna sjuk-och begravningskassa' (1916).

[18] Kungliga socialstyrelsen, *Sveriges officiella statistik* (1916).

[19] Ibid. The number of workdays (≥3 days) lost per worker equalled 0.8 days in 1913. The number of workdays compensated by health insurance societies due to accident and illness equalled 6.8 in 1913, on average, per member. If the selection of workers were random, and the waiting time were equal to three days or longer, the share of accident-related workdays compensated by health insurance would equal 12% of the total (workdays compensated/days members receive benefits due to illness and accident).

[20] Kungliga socialstyrelsen, *Sveriges officiella statistik* (1920b).

[21] Stockholms stads statistik, *Statistisk undersökning angående levnadskostnaderna i Stockholm*.

[22] Bergander, *Försäkringsväsendet*. As a contrast to the Swedish case, the commercial accident providers in the Netherlands mimicked the not-for-profit ideology of health insurance societies and their product was viewed less as a luxury good; Vonk, 'In it for the money?'.

We find further evidence that commercial accident insurance was an income-related service when we look at the relationship between buying insurance and labour income. A regression analysis based on the aforementioned cost-of-living surveys shows a positive association between household labour income and the probability of purchasing insurance, and furthermore an association between workplace accident risk and insurance coverage. The estimated coefficient from a linear probability model shows that an increase of accident frequency by one standard deviation increases accident insurance cover by 3.8 percentage points. An increase of labour income by one standard deviation increases demand for accident insurance by 2.9 percentage points (see online appendix S1).

The pre-1901 commercial accident insurance scheme was limited in both coverage and compensation. It was clearly written with an eye towards insuring occupational accident risk, as each industry and occupational class was categorized according to its level of danger. Hence, both commercial insurance and the later national insurance agency (*Riksförsäkringsanstalten*) set up in 1902, whereby the employer could buy insurance to cover claims by the employee, used risk-based pricing to mitigate the redistributive effects that would otherwise occur due to differences in workplace accident risk.[23] The annual premium for insuring a worker with the national insurance agency (for employers insuring against claims, according to the 1901 Workers' Compensation Act) varied between 0.72 SEK (the minimum in the lowest-risk group) and 20.88 SEK (the maximum in the highest-risk group).[24]

II. Towards national health insurance support for industrial workers

In Sweden in the early twentieth century, mutual health insurance societies were the main providers of compensation for loss of income due to accident and illness. These health insurance societies were organized through the collective action of workers, with the purpose of mutually assisting fellow workers with financial protection against loss of income due to illness and accidents.[25]

Swedish historians have regarded the rise of health insurance societies as a vital part of a wider social movement, also encompassing temperance, labour, and revivalist popular movements. The temperance movement came to be especially successful in the establishment of health insurance societies.[26] The first established trade unions in Sweden (the *Typografiska föreningen* and *Bokbinderiarbetarföreningen*, established in the mid-1850s) long functioned primarily as health insurance societies. Some trade unions offered health insurance as a way to attract members, but in contrast to the US, health insurance societies affiliated with trade unions did not attract the masses in Sweden. Instead, Swedish trade unions and health insurance societies became increasingly specialized over time.

[23] Gjallarhornets förlag, *Nordisk försäkringstidskrift*.
[24] Riksförsäkringsanstalten, *Underdåning berättelse för år 1907*.
[25] Lindeberg, *Den svenska*. The Swedish health insurance societies showed many similarities with friendly societies in Britain and fraternal orders in the US. Swedish legislators often followed Britain in regulating health insurance societies. A difference from British and American affiliated orders was that Swedish health insurance societies typically lacked ceremonial elements. For more on the development of Swedish health insurance societies, see Andersson and Eriksson, 'Sickness absence'.
[26] The temperance movement came to establish the largest national health insurance societies in Sweden in the twentieth century.

Table 2. *Descriptive statistics of health insurance societies in major cities[a] in 1913*

Variable	*Unit*	*Mean*	*Std. dev.*	*Min.*	*5th percentile*	*25th percentile*	*75th percentile*	*95th percentile*	*Max.*
Members	No.	929	2,520	41	83	142	594	2,971	25,270
Share of women	%	30.4	32.0	0	0	0	50.2	100	100
Sick days per member	No.	7.4	2.7	0.5	3.3	5.5	9.3	12.4	16.4
Premium per member	SEK	15.8	5.6	1.9	7.5	12.2	19.3	26.6	32.1
Benefit per member	SEK	14.6	6.1	2.0	5.8	10.3	18.3	25.7	35.0
Net benefit per member	SEK	–1.2	3.9	–11.7	–7.6	–3.8	1.2	5.7	11.6

Notes: a Societies situated in Stockholm, Göteborg, Malmö, Gävle, Hälsingborg, Eskilstuna, Jönköping, Uppsala, and Västerås. A pair-wise correlation on the health insurance data shows that (i) the no. of members was not correlated with anything else; (ii) the share of women was negatively correlated* with premiums and benefits; (iii) the days compensated were positively correlated* with premiums and benefits; (iv) the premiums were positively correlated* with benefits; (v) the net benefits were positively correlated* with benefits and negatively correlated* with premiums. Expressed as a ratio, the latter (premium/benefit) becomes uncorrelated with premiums, but positively correlated* with benefits. Number of health societies: 1,276.
* Correlation significant at the 1% level.
Source: Kungliga socialstyrelsen, *Sveriges officiella statistik* (1920b).

The first health insurance societies established were small and local (henceforth 'local societies'). Local societies often targeted workers in a specific occupation, where craftsmanship was a condition for membership, as it had been in the craft guilds. If a member changed his/her occupation or moved to another city, it usually meant leaving the society. Local societies were the common form of organization until the 1890s.[27] From 1891 onwards, health insurance societies increasingly came to be regulated and subsidized. Following the Health Insurance Society Act of 1910, many societies amalgamated, and there was an expansion of nationwide societies without a specific affiliation to a single workplace or occupation (henceforth 'national societies'). The industrialization and mechanization of the Swedish economy made occupation and job title less powerful sources of affiliation, and their place in constructing individual and group identity was replaced by the shared experience of being a wage-worker. The growth of an industrial working class and a more dynamic labour market made membership of national societies a popular option for workers, as their members could change their place of residence and workplace while continuing to belong to the same health insurance society. The national societies experienced rapid growth in membership and came to dominate workers' health insurance.[28] Figures reported by the Welfare Board in 1915 show that 85 per cent of all members were insured through national societies. A few national societies had the largest bulk of members, and 75 per cent of all members were connected to a society with 1,000 or more members. The largest society had over 20,000 members (see table 2). This gradual process of development towards larger, national health insurance societies also occurred in most other countries where mutual cooperative societies had evolved.[29]

[27] Andersson and Eriksson, 'Sickness absence'.
[28] Ibid.
[29] van der Linden, 'Introduction'.

Compared to Britain and the US, Sweden had a relatively large share of the population insured by a health insurance society.[30] In the major urban areas, four out of five working-class households were insured in the early twentieth century (see table 3). In comparison, Beito offers 'a conservative estimate' that one-third of adult males in the US were members of fraternal societies in 1910.[31] In Britain by 1870, approximately 35–40 per cent of the male population were members of a friendly society.[32] One explanation for the high rate of membership of health insurance schemes in Sweden was the large share of women insured. Its national societies all accepted female members, which was not the case in Britain and the US, where women were usually excluded from membership. The state further encouraged societies that offered maternity insurance by granting them additional subsidies, and by 1913 women's membership share was close to 25 per cent on average (see table 2).[33]

The Workers' Compensation Act of 1901 did not provide benefits until 60 days had passed because legislators assumed that injured workers could insure themselves through health insurance societies to cover that period. The Act also only provided a low level of compensation (1 SEK/day), which implied that health insurance continued to be a necessity for workers who had suffered from an accident, even after they began to receive benefits.[34] Indeed, the Health Insurance Society Act of 1910 imposed a legal obligation on health insurance societies to provide benefits for workers suffering from workplace accidents during the first 60 days.[35]

Apart from specifying the obligations of health insurance societies, one of the major ambitions of the Health Insurance Society Act of 1910 was to spread risks and reduce financial instability. Small and local societies—those based on a single occupation or workplace—faced a particular risk of insolvency due to local conditions or specific risks common to the pool, and for this reason the expansion of national societies was encouraged. By having members spread throughout the country, national societies would effectively avoid agglomerated risks. However, one downside associated with national societies targeting a more heterogeneous group of workers was that those exposed to the most risk had a greater incentive to insure than those facing low accident risk.

III. Accepting redistribution due to occupational risk

Health insurance societies employed comprehensive measures to mitigate adverse selection and moral hazard. As stressed by several scholars on cooperative insurance

[30] Lindeberg, *Den svenska*, p. 244.
[31] Beito, 'Advance'.
[32] Cordery, *British friendly societies*. In membership data on cooperative societies from California and Michigan in the late 1800s, the share of women was negligible, at 4.2% and 0.16%, respectively; Gottlieb, 'Asymmetric information', p. 285. Cordery, *British friendly societies*, p. 24, reports that women's membership in London in 1872 was less than 1%.
[33] SOU 1954:4.
[34] Edebalk, '1916 års olycksfallsförsäkring', p. 115. In 1913, the legally required compensation equalled 25% of the average daily wage for a male (>18 years of age) worker in the manufacturing industry (Kungliga socialstyrelsen, *Sociala meddelanden*, 1919). Health insurance benefits were on average twice the size of the legally required compensation, according to the 1901 act (Kungliga socialstyrelsen, *Sveriges officiella statistik*, 1920b).
[35] Berge, *Medborgarrätt och egenansvar.*

Table 3. *Summary statistics of the household sample*

		Panel A: Full sample				*Panel B: Uninsured*				*Panel C: Insured*			
Variable	*Description*	*10th percentile*	*Mean*	*90th percentile*	*Std. dev.*	*10th percentile*	*Mean*	*90th percentile*	*Std. dev.*	*10th percentile*	*Mean*	*90th percentile*	*Std. dev.*
Insured	Share of household insured, %	0	82.1	100	38.3	0	0	0	0	100	100	100	0
Premium	Health insurance premiums, SEK	0	25.2	50.2	19.0	0	0	0	0	11.0	30.7	53.0	16.4
Benefits	Health insurance benefits, SEK	0	20.7	68.0	72.4	0	0	0	0	0	25.3	76.0	79.2
Com-acc-ins	Commercial accident insurance premiums, SEK	0	1.5	5.0	5.2	0	1.5	5.7	3.7	0	1.4	4.9	5.4
Accident risk	Occupational accident risk (accident per 100 workers by occupation)	0.1	2.7	7.9	3.1	0.1	2.3	6.4	2.9	0.1	2.8	7.9	3.1
Age	Age of male breadwinner	29.0	37.2	47.0	7.3	28.0	36.1	48.0	7.4	29.0	37.4	47.0	7.3
Income	Total income	1366	1882	2434	499	1355	1908	2610	583	1368	1876	2408	479
Income per CU	Income, SEK per consumption unit	520	770	1046	234	506	803	1121	293	522	763	1034	219
Women's contribution	Woman's income of total income, %	0	2.8	8.2	7.8	0	2.8	6.9	10.0	0	2.8	8.5	7.3
No. of rooms	No. of rooms	1.0	1.5	2.0	0.6	1.0	1.6	3.0	0.7	1.0	1.4	2.0	0.6
Living space	No. of rooms per consumption unit	0.3	0.6	1.0	0.3	0.4	0.7	1.1	0.3	0.3	0.6	1.0	0.3

Notes: No. of surveyed households equal 1,058. 1 SEK = $3.75 in 1913.
Sources: Stockholms Stads Statistik, *Statistisk undersökning angående levnadskostnaderna i Stockholm*; Kungliga socialstyrelsen, *Sveriges officiella statistik* (1916); Sveriges Officiella Statistik, *Levnadskostnaderna i Sverige 1913–1914*.

societies, social ties and careful selection of members, through instructive and informal control, were seen as vital tools for reducing adverse selection.[36] Swedish records of health insurance societies show that potential members could be denied membership due to chronic illness, alcoholism, and failings of moral character.[37] A prospective member needed to either be known to or affiliated with the society, or know a current member who would guarantee their moral character and good health. In many cases, the member providing the guarantee risked his/her own membership if anything in the application was found to be misleading. To further avoid claims caused by disorderly living, special health insurance visitors checked to see that members receiving health insurance benefits were not malingering or to blame for their health conditions due to, for example, heavy drinking or sexual profligacy.[38]

Besides attracting members with ill-health, another potential cause of adverse selection that needed to be mitigated by health insurance societies was postponing taking up health insurance to old age. In 1908, 92 per cent of the societies had an explicit upper age limit in their charters (the most common age limit was 50 years). Lindeberg argues that age limits were probably employed by the remaining 8 per cent as well.[39] In most cases, the effect of the negative selection of older members into the insurance pool was mitigated by setting an initial age-scaled membership fee.[40] Hence, the chronically ill and those of questionable character were not welcome as members, nor were those who had disloyally postponed joining for too long.

However, risk groups related to workplace accident risk were viewed differently. Workers were not seen as responsible when it came to workplace accidents. The national societies followed the principles of the local societies and kept the custom of not differentiating risk by occupation, and thus they did not exclude members on the basis of occupation. Despite major differences in accident risk by occupation, there were few initiatives to differentiate premiums on an actuarially fair basis.[41]

Health insurance societies registered the occupational status of their members, but occupation was not a reason for being denied membership. One explanation for the lack of attempts to price accident risk may have been information asymmetry on the part of health insurance societies. However, there are a number of reasons to expect that health insurance societies were aware of differences in accident risk. Both figures on workplace accidents and premium tariffs by occupation were readily available in the public statistics from 1906 onward. It is also shown by their records, submitted to the Board of Trade, that health insurance societies were well aware of the causes of benefit claims, including accidents.[42] When reviewing the consultation response to the public inquiry for the Compulsory Accident Act of 1916, we discover how the societies made use of such statistics when criticizing

[36] See Emery, 'Rise and fall'; idem, '"Risky business"'; Emery and Emery, 'Young man's benefit'; Murray, *Origins*; Gottlieb, 'Asymmetric information'.
[37] Lindeberg, *Den Svenska*, pp. 151–3.
[38] Andersson and Eriksson, 'Sickness absence'; Gottlieb, 'Asymmetric information'.
[39] Lindeberg, *Den Svenska*, p. 153.
[40] Gottlieb, 'Asymmetric information'; Lindeberg, *Den Svenska*.
[41] Arbetareförsäkringskomitén, *Sjuk- och begrafningskassor*; Andersson and Eriksson, 'Sickness absence'.
[42] Riksförsäkringsantalten, *Underdåning berättelse för år 1907*; Riksarkivet, Arninge, Riksförsäkringsantalten, *Första och andra sjukförsäkringsbyråerna, statistiska redogörelser, registrerade sjukkassor* (1904).

employers' limited efforts to reduce workplace accident risks.[43] The Swedish Health Insurance Organization (*Sveriges allmänna sjukkasseförbund*) included 60 per cent of societies and existed to ensure they were informed about important issues, including workplace accidents.

Since health insurance societies were in fact well aware of the differences in workplace accident risk between occupations and had readily available tariffs they could have employed to mitigate the pressure from adverse selection, there are few reasons to believe that information asymmetry played a role. Their acceptance of any risk-biased selection due to occupation was an informed choice, rather than an example of unmanaged adverse selection. Since all members were priced equally, this approach meant that more risk-exposed workers would benefit from cross-subsidization from less risk-exposed workers.

To examine whether there was in fact a redistribution from low- to high-risk-exposed workers, we use data on workers and not on societies. As argued by Gottlieb, any analysis of the choices and experiences of workers in certain groups requires access to data on those who did, and did not, belong to a health insurance society.[44] By using data on workers, we also avoid the survival bias that could result if only more efficient societies were sampled.

IV. Data and empirical strategy

To examine empirically the relationship between accident risk and health insurance, we employ household budget surveys and workplace accident statistics. The aim of early twentieth-century household budget surveys was to generate knowledge about the costs and standard of living of a typical urban, working-class family. The participation of households was voluntary and, in the first step, ruled out the working-class poor and rural workers. As with all similar surveys, only households that managed to keep detailed records on consumption for an entire year were included. In our case, 70 per cent completed the surveys. Due to the voluntary nature of participation, the sample cannot be regarded as fully representative of the population of working-class households in Sweden as a whole. The sample differs from the population in two significant ways: the surveyed households had higher wages and single-person households were excluded.[45] For our purpose, the biases in the selection of households actually helps in capturing the consumption habits of the higher-income, urban, non-agricultural working class who faced major differences in workplace accident risk.

The household budget surveys offer a rich source of information, enabling us to investigate historical consumption behaviour at a detailed level. The household data include health insurance benefits and premiums, as well as economic, demographic, and social characteristics. The dataset contains data on 1,058 urban, working-class households collected from two cost-of-living surveys. The first survey was undertaken in Stockholm in 1907/8 (n = 150) and the second in eight major

[43] *Svensk Sjukkassetidning: organ för Sveriges allmänna sjukkasseförbund*, 1 (1914), pp. 148–50.
[44] Gottlieb, 'Asymmetric information', p. 274.
[45] Andersson and Eriksson, 'Compulsory public pension'.

cities (Göteborg, Malmö, Gävle, Hälsingborg, Eskilstuna, Jönköping, Uppsala, and Västerås) in 1913/14 (n = 908).[46]

We use the two sets of household budgets to investigate the relationship between occupation, health insurance coverage, and income. The households kept detailed accounts of their income, consumption, and savings. Income was reported by gender and age of household members, with details on the source of income, including health insurance benefits. Expenditure was divided into 130 categories, including health insurance premiums (henceforth simply referred to as 'premiums'). The surveys also provide information on the age of family members. Here, we focus on the male breadwinner, as the occupation of the male breadwinner is the only one reported in the household budgets.[47]

To consider accident risk by occupation, we use annual workplace accident reports submitted to the Board of Trade from the year 1913. Accident risk by occupation (henceforth 'accident risk') is measured by the average number of accidents per 100 workers by occupation. The accident data cover 95 different industries, which represent rather different working environments with substantial differences in working conditions when considering the variation in accidents per worker. Although some industries consisted of many workers, such as 'other services' (n = 181,967 in 1913), the variation in the number of accidents per worker within industries is small, as reflected in later (1918), more detailed, accounts.[48] In most of the cases, workers returned to work without invalidity.[49] When comparing the number of accidents per 100 workers by occupation before and after 1913, it is clear that only minor changes took place within occupations.

Fatal accidents are excluded from the analysis. The reason for this is that insurance at the time was divided into burial and life insurance, on the one hand, which covered fatal outcomes, and health insurance, on the other, which covered loss of income due to illness or accident. Including fatal accidents would create a mix of insurance forms and incentives for being insured. While insuring against fatal accidents is less likely to invoke an element of moral hazard, there might be scope for moral hazard in the case of non-fatal accidents, as benefits create incentives to report illness or injury. In contrast to reporting on illness, however, incentives to relax safety measures, carelessness at work, or other actions increasing the risk of workplace accidents were reduced by the risk of a permanent loss of capacity to work. Health insurance societies offered no invalidity insurance, and the compulsory accident insurance scheme offered only a low fixed annuity (300 SEK) for total invalidity.[50] When suffering from injuries, workers lost earnings and faced medical expenses that arguably raised the cost of accidents by more than they gained in health insurance benefits.[51] The 1901 Workers' Compensation Act further stipulated that no benefits would be granted if the worker had caused the accident maliciously or through negligence.[52] The expectations of this Act were that

[46] Stockholms stads statistik, *Statistisk undersökning angående levnadskostnaderna i Stockholm*; Sveriges Officiella Statistik, *Levnadskostnaderna i Sverige 1913–1914*.
[47] Kungliga socialstyrelsen, *Sveriges officiella statistik* (1916).
[48] Ibid.; idem, *Sveriges officiella statistik* (1920a); Riksförsäkringsanstalten, *Olycksfall i arbete år 1918*.
[49] Ibid.
[50] Edebalk, '1916 års olycksfallsförsäkring', p. 115.
[51] Fishback and Kantor, 'Adoption'.
[52] *Svensk författningssamling*, 1901:39, § 1.

the workers should show responsibility and carefulness, thus avoiding workplace accidents. This view of workers' responsibility was controversial and was criticized by the Social Democrats, but it decreased the risk of moral hazard further, as a worker might end up without benefits if it could be proven that he had acted maliciously or caused the accident.[53]

The number of days of absence from work due to accidents per worker is highly correlated (0.95) with accident cases per 100 workers, but not correlated with the duration of work absences (–0.19). To capture the average risk of a loss of income due to an accident, we consider the rate of accident cases and number of workdays lost as the most suitable measures for our purposes. Due to their high correlation with each other, we employ only one of the measures in our estimations, and take the number of accidents per (100) worker (accident frequency) as our main indicator for workers' exposure to risk.

To relate the accident risk to households, we match the accident data by occupation with each male breadwinner's occupation, as reported in the household budget surveys. The accident data include details of occupations in manufacturing, mining, and transport. For other kinds of private service work, the accident data are less detailed. We have therefore used broad occupational categories such as building and construction workers; workers in electricity, gas, sanitation, and water supply; and workers in retail trade. We lack data on occupational accidents in clerical work; for this, we assume an accident risk equal to that in retail occupations. When comparing this figure to more detailed data on clerical work available from 1918, we find a similarly low accident frequency (0.1–0.5 accidents per 100 workers). In total, 95 risk classes are identified in the accident data. The occupations represented in the household budget survey include 48 of these.

Figure 1 shows the distribution of accident risk in the household sample. The accident risk varied substantially across occupations, with close to zero accidents in the most common private service occupations, and close to 10 per 100 workers in the metal industry. The figure shows that a large share (40 per cent) of workers faced a fairly low accident risk (fewer than one accident per 100 workers on average), and that most workers (80 per cent) were occupied in industries with fewer than five accidents per 100 workers. Only 12 per cent of workers faced a high accident risk (seven or more accidents per 100 workers).

The accident risk in the matched household budget sample is close (diff = 0.1) to the average of three accidents per 100 workers in the full-count accident data. A t-test shows an insignificant difference between means ($t = 1.02$), and an analysis of variance (ANOVA) gives an insignificant result for the hypothesis that the variance in the household budget sample is different from the full-count accident data ($F = 1.53$).

V. Workplace accident risk and redistribution among the insured

In order to discern the extent to which the health insurance societies redistributed resources because of their approach to workplace accident risks, we start by

[53] Berge, *Medborgarrätt*, pp. 37–8.

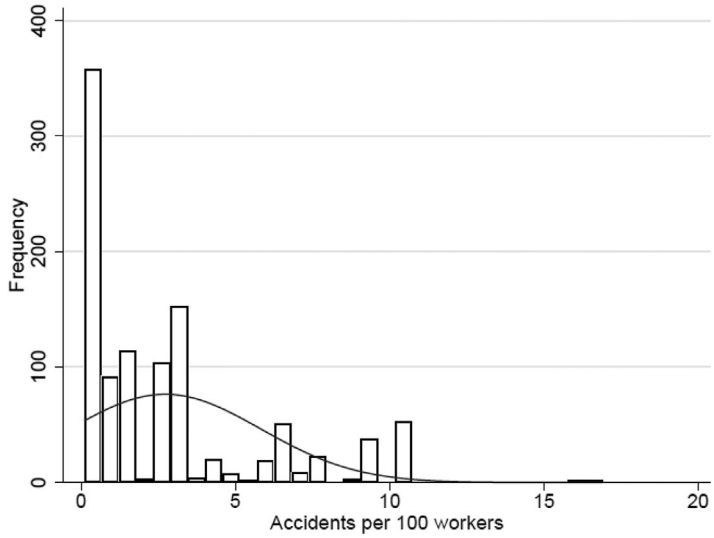

Figure 1. *Distribution of accident risk[a] in household sample*

Note: a Accident risk (occupational accident risk) is measured by the average no. of accidents per 100 workers by occupation.
Source: See tab. 1.

presenting some descriptive statistics. We characterize those who had insurance, how much they paid in premiums, and how much the members of the health insurance societies received in benefits. Later, we target actual redistribution more closely by estimating how net benefits (benefits minus premiums) were related to accident risk among the insured.

Table 3 reports the summary statistics on health insurance (insured, premiums, and benefits), accident risk, age, income (total and women's contribution), housing (number of rooms, living space), and union membership. Out of all 1,058 households surveyed, insurance coverage with health insurance societies was close to 82 per cent (869 households).[54] The average annual premium was 25.2 SEK. Premiums varied from only 1 SEK up to 90 SEK. The average benefits received by the insured households equalled 20.7 SEK.

Data from health insurance societies in 1915 show a similar pricing of risk, measured in terms of the ratio of the premium to the value of benefits paid per day. There was no significant ($t = 0.4381$) difference in pricing when comparing occupational or workplace-specific societies with more heterogeneous and nationwide societies.[55] If we apply the premium and benefit schedule of the health insurance societies to the benefits reported by workers in the household budget sample, we find they imply an average loss of 6.17 workdays (on which benefits were received) per annum. The figure is slightly lower than the aggregated figure

[54] When looking at the working class as a whole, previous studies show that health insurance was primarily demanded by workers in mining, manufacturing, and construction, as well as the urban service sector; Andersson and Eriksson, 'Sickness absence'. These sectors comprised 742,867 employees in 1910, according to the employment figures from accident statistics (Sveriges Officiella Statistik, *Folkräkningen den 31 december 1910*, 1917, supplemented by Jungenfelt, *Löneandelen*; Schön and Krantz, *Historical National Accounts*). Members of registered health insurance societies amounted to 591,315 individuals in the same census-year (1910).

[55] Kungliga socialstyrelsen, *Sveriges officiella statistik* (1920b).

from health insurance statistics operating in the same cities as reported in table 2 (6.32 days), but there is no significant difference (t = –0.2983) between them.

Table 3 shows that the average age of the male breadwinner was 37 years. Most households lived in a small apartment with only one or two rooms, and the number of rooms per consumption unit was 0.6.[56] The average annual income per consumption unit was 770 SEK, and the average total income was 1,882 SEK. Most of the income was the wages of the male breadwinner. On average, women's wages supplied only 2 per cent of total household income.

The majority of households contained union members (59 per cent). In comparison to the economically active population of the cities included, surveyed households had a higher participation rate in both unions and health insurance societies.[57] One reason is that all surveyed households included wage-workers, while many women in the economically active population did not belong to that category.[58] For wage-earners, there was no difference in the health insurance membership rate between men and women, although fewer women were union members.[59] The demand for maternity insurance and/or coverage of medical expenses further led non-wage-working married women to become members of health insurance societies.

The average premium was equal to 30.7 SEK for the insured households (table 3, panel C). That is higher than the individual average of health insurance societies shown in table 2, suggesting that many married women also were members of health insurance societies. The enrolment of some women and young adults in health insurance societies makes the average premium per household (see table 3) higher than the average premium per member (see table 2).

Table 3 shows that the average accident risk was lower for the uninsured (2.3 cases per 100) than for the uninsured (2.8). The differences in mean are statistically significant at the 1 per cent level. The income level was higher and the living space larger among the insured. Women's contributions were also greater among the insured. This is in line with Horrell and Oxley's results on late nineteenth-century British household budget data, which showed that households with multiple earners took out more insurance.[60]

Among the households that did have health insurance, there was a positive (pairwise) correlation between premiums and benefits (0.14). For those facing a higher accident risk, the premium payments were lower (–0.04), but the benefits were higher (0.07). This indicates that workers who were more exposed to risk were subsidized by those who were less exposed. To illustrate the potential redistribution from workers facing low accident risk to workers facing high accident risk, we summarize the premiums and benefits per worker for 10 accident risk groups (see figure 2). Workers in the two groups with the highest risk exposure were on average the only recipients of positive net benefits (benefits minus premiums), while workers facing low accident risk contributed the most. This suggests that a

[56] Consumption units were defined as follows: men aged 19 years and over constituted 1.0 consumption unit, while women aged 19 years and over constituted 0.8 consumption unit. Children constituted from 0.1 at younger ages to 0.9 at the oldest.
[57] Kungliga socialstyrelsen, *Sveriges officiella statistik* (1920b); Andrae and Lundkvist, *Folkrörelsearkivet*.
[58] Stanfors, 'Women in a changing economy'.
[59] Karlsson and Stanfors, 'Risk preferences'.
[60] Horrell and Oxley, 'Work and prudence'.

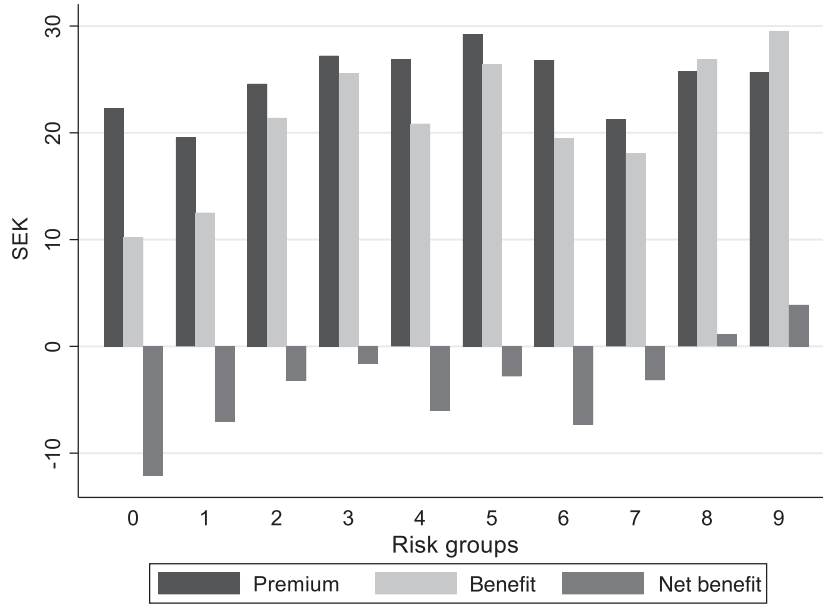

Figure 2. *Average health insurance premiums and benefits (SEK) per worker by 10 accident risk groups*[a] *in the household sample*

Notes: a The risk groups are defined by accident risk, measured as the number of accidents per 100 workers. Accident risk is aggregated into 10 groups; 0=<0.1; 1=≥0.1<0.2; 2=≥0.2<0.4; 3= ≥0.4<1.3; 4=≥1.3<1.9; 5=≥1.9<2.9;6=≥2.9<4.9; 7= ≥4.9<6.9;8=≥.6.9<10; 9= ≥10. The definition based on hazard rate does not give us an equal number of workers in each risk group. Given the distribution of accident risk by workers, a larger number of workers are facing a low risk and a smaller number are facing a high risk. The number of observations by risk group is as follows: 0 (192 cases) lower than 0.1, 1 (40 cases) 0.1–0.2, 2 (45 cases) 0.2–0.4, 3 (76 cases) 0.4–1.3, 4 (92 cases) 1.3–1.9, 5 (105 cases) 1.9–2.9, 6 (150 cases) 2.9–4.9, 7 (63 cases) 4.9–6.9, 8 (53 cases) 6.9–10, 9 (51 cases) ≥10.
Source: See tab. 2.

higher accident risk exposure implied higher benefits rather than higher premiums, resulting in a redistribution from low- to high-risk-exposed workers. It should be noted that this redistribution took place between a large number of workers occupied in industries with fairly low accident risk and a small number of workers occupied in highly risk-exposed industries. The positive net redistribution affected just risk groups 8 and 9, which together included only 12 per cent of the workers.

To conduct an econometric analysis of the impact of accident risk on, first, premiums paid, and second, benefits received, we have to consider that the distribution of both outcomes is skewed to the right with a large mass of zeros consisting of uninsured people, and insurance holders who do not receive any benefits. This type of data structure is common for different household or individual healthcare, financial, and insurance expenditures and benefits. We deal with this by decomposing the density of the outcomes into two parts, one capturing the zeroes via a binary indicator and the other the positive values.[61] In the resulting two-part model for premiums paid, the first part captures the likelihood of being a member of a health insurance society, and the second part the conditional level

[61] See, for example, Deb and Norton, 'Modeling health care'; Mihaylova, Briggs, O'Hagan, and Thompson, 'Review of statistical methods'.

of insurance premiums among members.[62] For the benefits received, we limit the sample under study to insurance holders, simply because people without insurance will not receive any insurance benefits. Here, the first part of the two-part model captures the probability of being a recipient and the second part the conditional level of benefits among recipients. In addition to analysing the influence of the included explanatory variables on the likelihood of having insurance and receiving benefits (the extensive margins), and the level of the insurance premium and the amount of benefits received (the intensive margins), the two-part model enables predictions and estimations of marginal effects based on the combined results from the first and second parts of the model; that is, the predicted premiums and benefits in the respective samples.

A benchmark formulation of the two-part model in healthcare expenditure research is to estimate the first part via logit regression and the second via a generalized linear model (GLM), employing a log link between the expected value of the dependent variable (y_i) and the linear index of covariates ($x_i'\beta$), assuming that the random component of the outcome follows a gamma distribution.[63] Specification of the GLM is highly flexible. In online appendix S2 we examine which structure of the model fits the data in terms of the link and distribution assumptions. Based on this, we present two-part models where the GLM is based on the square root link for premiums, log link for benefits, and the gamma distribution for the random component of both outcomes. In online appendix S2, we briefly discuss results based on alternative assumptions, and the results presented below are highly robust against different model specifications.

Table 4 reports the estimates of how selection into health insurance and the premiums paid relate to accident risk.[64] The first model (A) only includes city dummies alongside our main explanatory variable, and its first logit-based part shows that workers who were more risk-exposed were more likely to obtain insurance (table 4, column 1, panel 1). The estimated relation is virtually unchanged by the inclusion of age and age squared as explanatory variables (model B), with the accident risk coefficient changing from 0.065 to 0.064 (see column 2).[65] When we expand the set of explanatory variables to include socio-economic characteristics in the form of housing, income, women's contribution to household

[62] Belotti, Deb, Manning, and Norton, 'Twopm'.

[63] Blough, Madden, and Hornbrook, 'Modeling risk'; Manning, Basu, and Mullahy, 'Generalized modeling'; Deb, Norton, and Manning, *Health econometrics*. The estimations of tabs. 3 and 4 are made in STATA (ver. 16.0) using the twopm routine with robust (also denoted Huber–White) variance–covariance matrices and standard errors (see Belotti et al., 'Twopm') obtained via the vce(robust) command. This command effectively relaxes the basic assumption that the errors are identically distributed when estimating the variance–covariance matrix. Because our main explanatory variable of interest, the accident rate, operates at a group level, we cannot *a priori* rule out that observations are not clustered within such groups. Therefore, we have also re-estimated the variance–covariance matrix of all two-part models, relaxing the assumption of independence within such clusters yielding cluster-robust error terms (results not shown but available upon request). It turns out that this procedure only mildly affects the estimated standard errors, leaving our interpretations and conclusions intact. For the analysis of net benefits presented in tab. 6 (model B, and fig. 3), replacing the bootstrapped standard errors with cluster-robust errors likewise slightly decreases the precision of the estimated accident risk coefficients for three quantiles and slightly increases it for six of them.

[64] In order to neutralize any structural differences between the included cities, all models presented below include city-specific dummy variables (not shown).

[65] Note that taken together, the magnitude of the estimated age and age square coefficients indicates that the highest probability of being insured and the highest amount paid in premiums occur at about age 50. Only about 5% of our sample is 51 years old or older.

Table 4. *Two-part model estimates on health insurance premiums*

	Panel 1: First part model (extensive margin)		
	Column 1	*Column 2*	*Column 3*
Accident/100 workers	0.065** (0.029)	0.064** (0.029)	0.050* (0.030)
Age		0.148** (0.061)	0.147** (0.063)
Age^2		–14.6e-4** (7.21e-4)	–14.2e-4* (7.34e-4)
Living space			–1.033*** (0.369)
Income per CU (1,000s of SEK)			0.223 (0.490)
Women's contribution			2.954* (1.628)
Union			0.548*** (0.178)
Constant	1.48*** (0.237)	–1.84 (1.287)	–1.810 (1.435)
N		1,056	1,055
	Panel 2: Second part GLM model (intensive margin)		
	Link: square root, family: gamma Coefficient		
	Column 1	*Column 2*	*Column 3*
Accident/100 workers	–0.007 (0.016)	–0.009 (0.015)	–0.011 (0.015)
Age		0.145*** (0.045)	0.166*** (0.0442)
Age^2		–14.7e-4*** (5.43e-4)	–16.4e-4*** (5.31e-4)
Living space			–0.112 (0.211)
Income per CU (1,000s of SEK)			0.975*** (0.302)
Women's contribution			–0.285 (0.862)
Union			0.139 (0.105)
Constant	5.308*** (0.137)	2.02** (0.907)	0.629 (0.994)
N		868	867
	Panel 3: Combined marginal effects from both parts		
	Column 1	*Column 2*	*Column 3*
Accident/100 workers	0.213 (0.191)	0.186 (0.183)	0.103 (0.181)
Age		1.919*** (0.474)	2.097*** (0.473)
Age^2		–0.019*** (0.006)	–0.021*** (0.006)
Living space			–5.159** (2.388)
Income per CU (1,000s of SEK)			9.722*** (3.372)
Women's contribution			9.265 (10.177)
Union			3.505*** (1.197)
N		1,056	1,055
Predicted expenditure	25.206*** (0.554)	25.197*** (0.544)	25.185*** (0.541)

Notes: CU: consumption unit. All models include city dummies as explanatory variables (not reported). Robust mutual errors in parentheses. ***, **, and *denote statistical significance at the 1, 5, and 10% level, respectively.
Source: See tab. 1.

income, and union membership (hereafter denoted a 'full set of controls', model C), the estimated importance of accident risk for selection into having insurance is slightly lower (0.050, table 4, column 3, panel 1). It should be stressed that the main reason for including these variables in the full set of controls is not to address their individual specific relationship to the outcome, but rather to examine more generally the extent to which together they modify the association between accident risk and insurance premiums (and below, benefits and net benefits), regardless of whether it is through either confounding or mediating mechanisms. Further, these variables are also interrelated, as shown by the correlation between income, living space, and age, making it difficult to draw strong conclusions regarding their

respective linkage to the outcomes.[66] That said, it is not surprising that union membership is positively, and living space negatively, related to having insurance.

In the second part of the model, estimated via GLM, the estimated accident risk coefficients are negative and not nearly statistically significant, regardless of which set of explanatory variables are included (see panel 2). Hence, insured people with a higher accident risk did not pay higher premiums overall. Income per consumption unit is positively related to the premiums paid by the insured in this setting (column 3, panel 2).

Taken together, the two parts of the model imply that there is no statistically significant association between accident risk and the premium households paid in the full sample (panel 3). Premiums paid decrease with living space, union members paid 3.5 SEK more, and premiums also increased by about 0.1 per cent (or 9.7) per 1,000 SEK income (column 3, panel 3). The predicted average insurance expenditures from the three models are 25.21 SEK, 25.20 SEK, and 25.18 SEK, respectively, corresponding to the average expenditure of 25.21 SEK in the sample.

The results of the two-part model on benefits are presented in table 5.[67] As expected, insured workers who were more risk-exposed were significantly more likely to receive insurance benefits (model A, column 1, panel 1). This result holds up when we control for age, age squared, and the full set of controls (models B and C, columns 2–3, panel 1), as the estimated accident risk coefficient changes from 0.077 to 0.069 between the model specifications. While these more risk-exposed workers were over-represented in receiving benefits, they did not receive significantly larger payments than other recipients in general (panel 2). Combining the first and second parts of our models, accident risk was overall positively associated with benefits among the insured (panel 3). An increase in risk by one accident per 100 workers translated into 1.60 SEK higher benefit payments controlling only for city dummies, and 1.12 SEK with the full set of controls included, but the positive association is due to a greater propensity to receive benefits, rather than to how much actual recipients received. It should also be noted that these estimates (1.60, 1.12) are not statistically significantly different from each other. None of the socio-economic variables included has a significant relationship to either the probability of receiving or the level of benefits (column 3). The predicted value of benefits amounts to 22.35 SEK with the full set of controls included, which is fairly close to the actual average of 22.19 SEK within the sample.

When examining benefits, we have chosen not to include premiums as an explanatory variable. It is plausible that these are strongly associated, but their relationship may well be governed by, or reflect, linkages between benefits and other included variables such as age and accident risk. Hence, adding premiums risks introducing severe endogeneity bias. That said, it is still useful to illustrate how sensitive the results are to the size of premium. This allows us to provide some indication about whether the positive association between risk and benefits merely

[66] Among the explanatory variables, household income per consumption unit is highly correlated with living space (0.54). Furthermore, the age of the male breadwinner is negatively correlated with income per consumption unit in the household (–0.24). For the other explanatory variables, the correlations are weaker.

[67] For insurance benefits, there is a pronounced skewness in the data, where 65% of the insured do not receive any benefits. The positive values of these benefits have been winsorized at the 1% and 99% levels, respectively (limiting the influence of two outliers receiving 1,728 and 772 SEK, respectively—the average benefits being 65 SEK).

Table 5. *Two-part model estimates on health insurance benefits*

	Panel 1: First part model (extensive margin)			
	Logit Coefficient			
Variable	*Column 1 Model A*	*Column 2 Model B*	*Column 3 Model C*	*Column 4 Model C1*
Accident/100 workers	0.077*** (0.023)	0.076*** (0.023)	0.069*** (0.023)	0.071*** (0.023)
Age		–0.033 (0.066)	–0.047 (0.069)	–0.090 (0.071)
Age^2		3.45e-4 (7.98e-4)	4.89e-4 (8.30e-4)	9.10e-4 (8.57e-4)
Living space			–0.431 (0.390)	–0.387 (0.391)
Income per CU (1,000s of SEK)			–0.166 (0.445)	–0.416 (0.466)
Women's contribution			–0.564 (1.299)	–0.557 (1.292)
Union			0.217 (0.160)	0.197 (0.160)
Insurance premium				0.020*** (0.005)
Constant	–1.170*** (0.211)		–0.124 (1.466)	0.706 (1.505)
N	868		867	
	Panel 2: Second part GLM model (Intensive margin)			
	Link: log Family: gamma Coefficients			
	Column 1	*Column 2*	*Column 3*	*Column 4*
Accident/100 workers	0.023 (0.018)	0.017 (0.017)	0.008 (0.017)	0.008 (0.017)
Age		0.008 (0.042)	0.018 (0.043)	0.010 (0.045)
Age^2		1.16e-4 4.93e-4	0.23e-4 (5.12e-4)	1.07e-4 (5.27e-4)
Living space			–0.031 (0.229)	–0.023 (0.229)
Income per CU (1,000s of SEK)			0.337 (0.303)	0.298 (0.308)
Women's contribution			0.524 (0.954)	0.475 (0.954)
Union			0.154 (0.119)	0.150 (0.119)
Insurance premium				0.003 (0.003)
Constant	4.27*** (0.158)	3.853*** (0.896)	3.252*** (1.009)	3.357*** (1.027)
N	301		300	
	Panel 3: Combined marginal effects from both parts			
	Column 1	*Column 2*	*Column 3*	*Column 4*
Accident/100 workers	1.600*** (0.521)	1.457*** (0.504)	1.122** (0.487)	1.126** (0.481)
Age		–0.288 (1.324)	–0.250 (1.353)	–0.983 (1.378)
Age^2		0.007 (0.016)	0.007 (0.016)	0.015 (0.016)
Living space			–6.648 (7.439)	–5.720 (7.349)
Income per CU (1,000s of SEK)			5.235 (9.194)	1.077 (9.296)
Women's contribution			3.931 (28.168)	3.139 (27.503)
Union			6.205* (3.199)	5.804 (3.182)
Insurance premium				0.335*** (0.096)
N				
Predicted benefits	22.62*** (1.559)	22.60*** (1.583)	22.35*** (1.558)	22.35*** (1.545)

Note: As for tab. 4.
Source: See tab. 1.

results from people in a higher risk class who were subject to injury or ill health having paid more for their insurance. In column 4 of table 5, we report the results of estimations including premiums as an explanatory variable, emphasizing that interpretations of this model should be made with a great deal of caution.

Premiums were strongly linked to the likelihood of receiving benefits in the first part of the model, but not to the sum received among recipients. Combining the two parts of the model, there is a strong significant positive link between premiums and benefits amounting to 0.33 SEK per SEK of insurance paid. This is mainly due to the greater likelihood of receiving benefits, rather than how much was actually received. The inclusion of premiums does not affect the other parameter estimates in any serious way.

The estimated association between accident risk and benefits is highly insensitive to the inclusion of insurance premiums being paid. An increase in the accident risk by one accident per 100 workers is related to an increased expected insurance benefit of 1.12 and 1.13 in the models without and with insurance premiums included, respectively (columns 3–4, panel 3, models C and C1). This suggests that the linkages between accident risks and benefits on the one hand, and accident risks and premiums on the other, run along separate lines.

To summarize, our results show that workers facing higher accident risk were more likely to have insurance, but they did not pay higher premiums. They were (empirically and also by definition) more likely to receive benefits. As recipients, they received as much in benefits as recipients from lower-risk groups. Taken together, these two separate analyses of premiums and benefits indicate that the health insurance societies redistributed resources from low- to high-risk-exposed workers.

We can address redistribution more directly using an analysis of net benefits (whereby premiums have been deducted from benefits received) among insured households. The Spearman rank-order correlation coefficient between net benefits and accident risk amounts to 0.11 (significant at the 0.1 per cent level).[68] Hence, there seems to be a statistically significant positive, but small, association between accident risk and net benefits.

Following the analytical structure we employed above, we present three different ordinary square regression models (A, B, and C) on the relation between the net benefits and the workplace accident risks. The first (A) only includes city dummies, the second (B) adds age and age squared, and the third (C) includes our full set of explanatory variables. The estimated effect of accident risk on net benefits, obtained via OLS, is 1.59 SEK without additional controls and 1.53 SEK when age and age squared are included. When we add the remaining controls, this estimate drops to 1.23 SEK (see last column of table 6). Taken literally, this indicates that, on average, the net benefits of workers facing an accident risk of 12 exceeded the net benefits of employees with an accident risk of only 2 by 12.3 SEK. It also means that a one-standard-deviation increase in accidents per worker (3.1; see table 3) increases net benefits among the insured by about 3.8 SEK (3.1*1.23). While this effect size seems small compared to the standard deviations of benefits and net benefits (79 SEK and 80 SEK, respectively), it is more substantial compared to the means of benefits and net benefits (25 SEK and –5 SEK, respectively). Apart from accident risk, no other variable has a significant relationship to net benefits in the OLS setting.

[68] This correlation is non-parametric and requires no underlying distributional form qualifications. It only requires that the two variables under question can be measured and ranked on at least ordinal scales.

Table 6. *Quantile regression of net benefits on accident risk*

	Quantile regression estimates									
	Quantile									
	0.1	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*OLS estimates*
Model A.										
Accident/100 workers	0.45	0.87***	0.72***	0.77***	0.80***	0.83**	1.32**	2.02**	4.54**	1.59***
	(0.45)	(0.29)	(0.23)	(0.24)	(0.27)	(0.38)	(0.56)	(0.96)	(2.27)	(0.55)
Constant	–43.49***	–35.03***	–27.52***	–25.17***	–22.66***	–16.42***	–12.14***	–5.55	45.55	–10.94**
	(3.54)	3.53	1.84	1.21	2.64	3.05	3.02	8.45	23.49*	(4.63)
Model B.										
Accident/100 workers	0.64	0.80***	0.63***	0.69***	0.68**	0.81**	0.97*	2.02**	4.41**	1.53***
	(0.52)	(0.28)	(0.22)	(0.24)	(0.28)	(0.35)	(0.57)	(0.96)	(2.14)	(0.55)
Age	–1.51	–1.64	–1.29	–1.77**	–1.34	–0.66	–1.65	–0.59	–6.53	–2.66
	(1.55)	(1.13)	(0.83)	(0.82)	(0.92)	(1.16)	(1.80)	(3.80)	(6.06)	(2.08)
Age^2	0.01	0.02	0.01	0.02*	0.01	0.01	0.02	0.01	0.09	0.03
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.05)	(0.08)	(0.03)
Constant	–3.91	2.76	2.32	13.93	8.75	–0.43	22.56)	7.02	160.08	43.36
	(29.54)	(22.59)	(16.65)	{17.01)	(18.78)	(22.58)	(34.15)	(72.69)	(123.02)	(40.43)
Model C.										
Accident/100 workers	0.79*	0.53*	0.73***	0.65***	0.53*	0.44	1.02*	1.77*	3.58*	1.23**
	(0.47)	(0.28)	(0.21)	(.0.22)	(0.29)	(0.35)	(0.52)	(0.93)	(1.98)	(0.52)
Age	–2.09	–2.25**	–2.02***	–1.78**	–1.37	–1.62	–1.06	–0.50	–6.92	–3.06
	(1.49)	(1.03)	(0.77)	(0.79)	(0.91)	(1.11)	(1.73)	(3.68)	(5.94)	(2.09)
Age^2	0.02	0.02*	0.02**	0.02*	0.01	0.02	0.01	0.01	0.10	0.04
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.05)	(0.07)	(0.03)
Living space	–0.27	2.96	4.82	5.37	1.82	–2.52	–5.70	–7.17	–3.25	–0.86
	(6.53)	(5.10)	(3.93)	(3.99)	(4.10)	(5.26)	(6.63)	(10.70)	(25.03)	(7.79)
Income per CU (1,000s of SEK)	–13.28	–21.20***	–19.86***	–17.27***	–13.87**	–5.41	–0.43	2.30	19.73	–8.97
	(8.62)	(5.10)	(5.35)	(6.05)	(7.01)	(7.14)	(8.62)	(12.56)	(29.23)	(8.88)
Women's contribution	12.28	8.52	0.20	3.02**	–10.16	–13.20	–23.91	3.51	85.70	2.34
	(18.22)	(13.95)	(11.77)	(6.05)	(15.30)	(17.97)	(22.20)	(59.07)	(96.60)	(28.55)
Union	–1.22	–0.22	0.75	1.91	1.07	2.98	6.62	9.75	12.49	4.44
	(2.53)	(2.00)	(1.56)	(1.89)	(1.98)	(2.02)	(2.90)	(5.23)	(11.41)	(3.22)
Constant	21.26	34.61	30.86	24.97	21.16	24.68	7.57	–2.20	140.15	58.09
	(29.37)	(22.21)	(30.86)	(17.65)	(19.60)	(22.16)	(33.30)	(69.75)	(123.12)	(39.40)

Notes: All models (A, B, and C) control for city dummies (not reported), model B adds age and age^2, and model C adds living space, income per CU (consumption unit), women's contribution to household income, and union membership as explanatory variables (not reported). N = 868. Bootstrapped (20,000 replications) standard errors in parentheses.
***, **, and *denote statistical significance at the 1, 5, and 10% level, respectively.
Source: See tab. 1.

Table 7. *Accounting of redistribution of health insurance premiums and benefits*

Code	*Variable*	
A	Premium payments to health insurance societies	26,668 SEK
B	Benefits received from health insurance societies	21,953 SEK
C (A–B)	Net benefits	–4,715 SEK
D	Savings accumulated in health insurance societies[a]	–1,333 SEK
E (C–D)	External redistribution from the household sample to the total population of those insured	–3,382 SEK
F	Internal net redistribution payments to households within sample	–298 SEK
G (D+E+F)	Total saving and redistributive payment of contributing households[b]	–5,013 SEK
H (G/HC)	Income share net contributors	0.35%
I ((F+D^{HR}[a])/HR)	Income share net receivers[b]	0.24%

Notes: a The average savings ratio of premiums to reserves was 5% on average in 1915.
b Contributing households (HC) denotes households with negative net benefits, risk groups 0–7 in fig. 2. Receiving households (HR) denotes households with positive net benefits, risk groups 8–9 in fig. 2. The receiving households make no savings, and therefore their part of savings is added to the internal net redistribution.
Source: Tab. 2.

However, a word of caution is warranted as the distribution of net benefits received is characterized by being heavily skewed to the right with a large negative mass (almost two-thirds of the insured individuals did not receive any benefits). Though linear OLS estimation may work well under such circumstances (especially if the sample size is large enough to rely on the asymptotic properties of OLS), in this particular case the resulting error distribution is far from normal.

Because we are reluctant to manipulate the data, and we want to explore how the association between accident risk and net benefits may vary along the distribution of net benefits, we turn to quantile regression. This allows us to estimate the effect of covariates on the conditional median (and the chosen quantiles) rather than the conditional mean of the dependent variable as in OLS. Quantile regression is a semi-parametric approach that is less susceptible to outliers and the skewness of the data at hand.

It should be emphasized that our focus is set on quantifying the relationship between net benefits and accident risk across quantiles conditional on the individuals' other characteristics (such as city, age, and so on) rather than to capture how any hypothetical risk changes would affect the individuals in the population along the unconditional distribution of net benefits. Therefore, we present results based on conditional quantile regressions below, where the accident risk coefficients could be interpreted as showing whether people with higher accident risk have higher or lower net benefits than expected conditional on their other characteristics (such as city and age). That said, in what follows we also refer briefly to estimations based on unconditional quantile regression, which in our case yields highly similar results.[69]

We present three different conditional quantile regression models (A, B, and C), following the same logic as before, on the relation between net benefits and workplace accident risks. Just controlling for city effects, the estimated influence of accident risk is positive throughout the whole conditional distribution of net

[69] For a general discussion of quantile regressions, see Koenker and Hallock, 'Quantile regression'. For a discussion of unconditional quantile regression, see Firpo, Fortin, and Lemieux, 'Unconditional quantile regressions'.

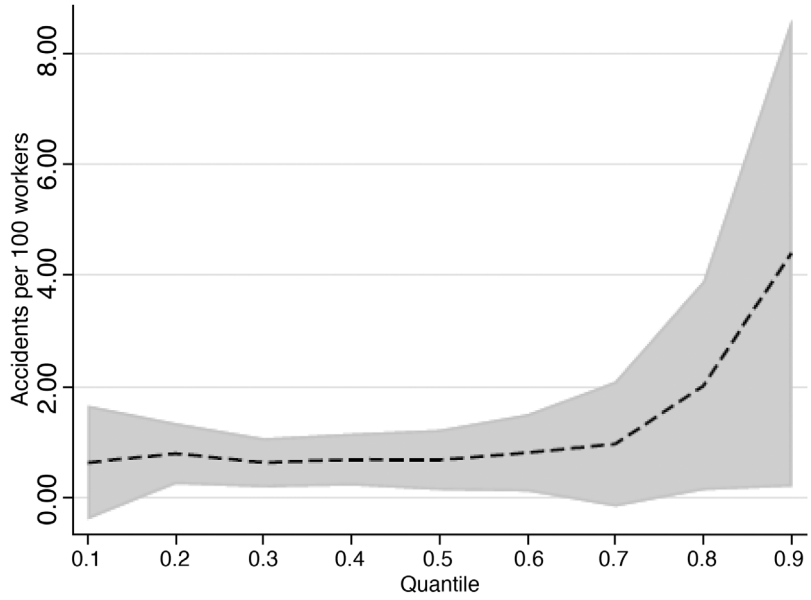

Figure 3. *Quantile coefficient estimates from regression of net benefits on accident risk*
Note: The 95% confidence interval is shaded in grey.
Source: See tab. 5, model B.

benefits (table 6, model A). An increase in the accident risk by 1 per 100 workers shifts the conditional distribution of net benefits for the 20th up to the 60th percentile by about 0.8 SEK and by increasing amounts from the 70th percentile onwards. For the 90th percentile the shift amounts to 4.54 SEK, but the standard errors and confidence intervals also increase, and there are no significant differences between the estimated coefficients for the different quantiles.

When we add age and age squared as explanatory variables, the coefficients are very mildly affected. An increase in the accident risk by 1 per 100 workers now shifts the conditional distribution of net benefits up to the 60th percentile by about 0.6–0.8 SEK, and by 4.41 SEK for the 90th percentile (table 6, model B, figure 3). Hence, the association between net benefits and accident risk does not seem to be governed by age. The results from unconditional quantile regression are similar, the estimated accident risk coefficients ranging from 0.41 SEK to 4.28 SEK for the 10th and the 90th percentile, respectively (see table S4, model B3, in online appendix S3).

Finally, adding the remaining controls (model C) yields similar results, though the accident risk estimates for the two highest quantiles are somewhat smaller. Where the OLS estimate for income per consumption unit showed a negative and insignificant relation to net benefits, the quantile regression reveals a pattern in which an increase in income shifts the conditional distribution of net benefits downward for the lower and mid-quantiles and has no statistically significant effect on the higher ones (table 6, model C). This pattern also emerges when applying unconditional quantile regression (online appendix S3), and is probably the result of people with higher incomes on average paying higher premiums (see table 4), but

not being more likely to receive benefits (though they did receive insignificantly more as insurance holders; see table 5). Because most insurance holders do not receive any benefits, there is a negative association between income and net benefits throughout the largest part of the distribution.

Taken together, the fact that accident risk shifts the conditional distribution (and the unconditional distribution) of net benefits positively for all quantiles in the distribution, and also possibly at a greater magnitude for the highest quantiles, reinforces our contention that the insurance societies redistributed resources from lower to higher accident risk within the pool of the insured.

To give some indication of the scale of redistribution between workers facing a low versus high accident risk, we have accounted for the benefits and premiums among households in the cost-of-living sample (see table 3). We divide insured households into net contributors (risk groups 0–7 in figure 2) and net beneficiaries (risk groups 8–9 in figure 2). When accounting for redistribution within the household budget sample, we find that the net beneficiaries on average receive a contribution equal to 0.24 per cent of their household income (net benefit/household income; see table 7). The net contributors on average experience a loss equal to 0.35 per cent of their household income, which, beyond supporting the net beneficiaries within the household budget sample, contributes to the overheads, savings, and external redistribution in the total pool of health insurance societies. When compared to our OLS estimate of the effect of accident risk on net benefits, this exercise gives a fairly similar result, as the difference in average net benefit is 11 SEK given a difference in accident risk of 8 between contributors and beneficiaries.

VI. Robustness checks and extensions

To address the validity of the results presented in tables 4, 5, and 6, we have executed a number of empirical extensions and robustness checks. The bulk of the results related to these checks are outlined in detail in online appendix S3.

In order to analyse the extent to which selection into insurance societies and premiums paid are linked to the expected outcomes of the investment in health insurance, we have re-estimated the models in table 4 using expected net benefits instead of accident risk as our main explanatory variable (see online appendix S3 for details). The results are similar to the results of table 4. Expected net benefits are positively and significantly (at the 5 per cent level) associated with having insurance when only age, age squared, and city dummies are accounted for, but are only significant at the 10 per cent level when the full set of explanatory variables are included (online appendix table S2, columns 1–2, panel 1). Similar to accident risk, expected net benefits are not significantly related to how much the insurance holder pays, nor to total insurance expenditures in the full sample (panels 2–3).

Of the nine cities in our sample, Stockholm is by far the largest. The information on household consumption from Stockholm also pertains to an earlier year (1907/8 versus 1913/14 for the other cities). In order to investigate whether or not the inclusion of Stockholm affects the results, we reran the analysis of tables 4, 5, and 6 without the observations from this city. Excluding the Stockholm sample leaves the results essentially intact, although the positive association between accident risk and

premiums paid are somewhat less pronounced (online appendix table S2, columns 3–4) and the estimated effect on benefits is slightly elevated (online appendix table S3, columns 1–2). The results of the quantile analysis on net benefits (table 6, figure 3) are also largely unaffected when Stockholm is removed (online appendix table S4, model B1).

It is possible that the development of health insurance societies may have affected accident risks if insured workers became less careful and more inclined to experience work-related accidents, though we believe that this type of moral hazard is of limited importance. To examine a potential moral hazard effect, we have used accident risks from a previous year with lower insurance coverage. However, society and working life were changing rapidly in early twentieth-century Sweden, so there may also be a concern that earlier accident risk measures do not correspond particularly well with later risks. Replacing current risks with previous ones hence involves a trade-off between limiting any influence of reverse causality due to insurance-induced carelessness among employees and the risk measure failing to reflect the current context. We have access to accident risks measured in 1906, four years before the 1910 Act, and have re-estimated all models using this instead of the risk measure from the year 1912 (see online appendix S3 for details of the relation between the two risk measures). The results are presented in online appendix tables S2, S3, and S4. The estimates remain consistent. The associations between risk and having insurance and how much a person pays (online appendix table S2, columns 5–6, panels 1 and 3) are somewhat inflated, though the total effect is still insignificant (panel 3). The estimates on benefits received remain virtually the same (online appendix table S3, columns 3–4), as do the results on net benefits (online appendix table S4, model B2).

Union membership seems to be related to membership in health insurance societies, as shown by the previous analysis of premiums and benefits (see table 4, panel 1, and table 5, panel 3). Our last extension addresses how individual health insurance behaviour varied between cities with high and low degrees of unionization. The fraction of unionized workers varied between 4 and 20 per cent according to city-level membership records, reflecting the different stages that the trade union movement had reached.[70]

We do find significantly higher health insurance rates in the more unionized cities. Households in less unionized cities were about 60 per cent more likely to have no health insurance (21 per cent versus 13 per cent). On average, insurance holders in less unionized cities paid insurance premiums equal to 27.5 SEK, whereas people in more unionized cities paid 32 per cent more (36.2 SEK).[71]

When we subdivide the sample according to whether the head of household was a union member or not, non-unionized workers in the less unionized cities were the least likely to have insurance (74 per cent), and unionized workers in highly unionized cities the most (90 per cent). More interestingly, non-unionized workers in highly unionized cities were almost as likely as unionized workers in less unionized cities to have health insurance (82 per cent versus 84 per cent), and

[70] Andrae and Lundkvist, *Folkrörelsearkivet.*

[71] The distributional differences between the two groups are statistically significant at the 1% level, in terms of nonparametric Mann-Whitney-Wilcoxon rank-sum, and t-testing for means.

as insurance holders they on average spent more (33.8 SEK versus 28.0 SEK).[72] Unionized insurance holders in highly unionized cities paid 37.5 SEK and non-unionized workers in less unionized cities 26.9 SEK. When we turn to net benefits, another picture emerges: non-unionized insurance holders in both types of cities on average faced worse outcomes (–11 and –12 SEK, respectively) than unionized workers (–5 and –8 SEK, respectively), although the differences between unionized and non-unionized workers are not statistically significant, whether taken together or by city type (high or low unionization).

Although circumstantial, these descriptive figures imply that health insurance premiums were more related to city-level unionization than to household-level unionization. This may be a result of a more evolved working-class movement, which first developed in the more industrialized, urban areas. Additionally, the positive relation between membership of health insurance societies and membership of unions implies that many working-class families in the early twentieth century chose to become members of two organizations of collective action, each of which aimed in different ways at improving the conditions of workers. This set of priorities may indicate that these working-class families considered solidarity among workers to be particularly important. To investigate this issue further, we have conducted a qualitative investigation of the registered health insurance societies to discover whether differences in workplace accident risk were a concern.

VII. Solidarity among workers

Only very few societies considered abandoning their egalitarian pricing policy. The only society that abandoned its egalitarian principles due to differences in accident risk was Svenska Folket, the second nationwide health insurance society established in 1903. Behind the decision to impose risk-based tariffs was its weak financial situation, seemingly related to the design of many premium/benefit classes. Before 1910, workers who wanted higher benefits in the case of sickness often took out insurance with more than one health insurance society. Introducing many different premium/benefit classes was a way to fulfil the demand for insurance from this group of workers.[73]

Only three years after its establishment, the board announced at the annual meeting that the society's economic situation was weak, despite a steady influx of members. The explanation for this was that members facing the highest accident risk self-selected into classes offering the largest policies.[74] An investigation showed that the premiums paid by members in such classes did not cover the benefit claims made, and the board suggested introducing accident-risk-based tariffs for 10 different occupational categories. In the subsequent debate at the annual meeting, this suggestion was met with great resistance and viewed as a violation of workers' solidarity, which, it was argued, would result in the dissolution of the society.

[72] The difference between the two groups being significant at the 1% level in terms of Mann-Whitney-Wilcoxon and t-testing.
[73] Toresson, *Svenska folkets sjukkassas.*
[74] *Vårt liv: organ för Svenska folkets sjukkassa*, no. 6–7 (1912).

The problems continued, however, and it was clear that the society had to raise premiums, which made membership less attractive.

At an extraordinary meeting in 1912, the suggestion of risk-based tariffs was made again, now with more urgency, but once more it encountered heavy criticism. F. Franzen from Oxelösund, a small town in southern Sweden, stressed that it was unfair that those who had the misfortune to be engaged in a hazardous occupation had to pay more to protect themselves from hardship and misery than those who were lucky enough to have a less risky occupation. Franzen depicted the risk-class system as unjust and selfish. He also claimed that the majority of workers in the society would end up in the higher risk classes with higher premiums, and he feared there was a great risk that members would leave the society as a result. He concludes: 'we should remember our obligations to assist each other during hardship; as workers, we should primarily show solidarity towards each other'.[75] Many of the representatives taking the floor agreed with Franzen, stressing both the solidarity aspect and the fear of exit from the society; they advocated for 'solidarity classes' as a contrast to health insurance based on the suggested 'risk classes'.

Some of those present, such as A. G. Söderberg from Östersund and J. A. Fagerkrantz from Stockholm, favoured the introduction of risk classes, partly based on arguments related to adverse selection: they stressed that because the statistics showed higher benefit claims for certain occupational groups, these occupational groups should also have higher premiums. This system was not unjust, but fair. They instead predicted an exit of members with a low accident risk, which would still create a need to levy *ex ante* premiums. P. Söderberg from Söråker also supported the introduction of risk classes, adding that the occupational groups facing the highest occupational accidents risks were in many cases also paid more and should, therefore, be able to pay higher premiums. The proposal for risk tariffs based on occupation was ultimately approved by 50 votes to 24.[76]

The experience of Svenska Folket suggests that there was a recognition of the considerable redistribution from low- to high-risk individuals due to differences in workplace accident risk, especially because high-risk workers favoured higher premium classes while low-risk workers turned to lower premium classes. Although the board was well-informed about the differences in accident risk by occupation, solidarity among workers meant that members attending the annual meetings supported cross-subsidization from low- to high-risk-exposed workers. This made it difficult to challenge the idea of redistribution unless the society's solvency was at risk. In the case of Svenska Folket, proponents of accident-risk-adjusted premiums argued that low-risk-exposed workers would begin to exit, due to the selection bias, leading to a rise in the average risk of those remaining. Their argument anticipates the theoretical arguments of Rothschild and Stiglitz, according to which insurance prices would increase in a vicious circle, ending in a so-called 'death spiral' where no one would be covered by insurance.[77]

There is, however, little evidence that this problem materialized in reality. The journal *Svensk Sjukkassetidning* reported in 1914 that some British-affiliated societies had been forced to adjust premiums by occupational risk exposure after

[75] Ibid., no. 3 (1912), pp. 6–8.
[76] Ibid., no. 6–7.
[77] Rothschild and Stiglitz, 'Equlibrium'.

some lodges in mining districts had run into insolvency.[78] However, after surveying the histories of more than 50 Swedish health insurance societies, we did not find any other health insurance society that presented redistribution from low- to high-risk members as a source of concern. A plausible explanation for this is that Svenska Folket was unusual in offering members the option of insurance in many different premium/benefit classes. The high premium/benefit classes might have attracted more high-risk workers to insure who otherwise would have insured in more than one society. Svenska Folket might therefore have been more exposed to the positive correlation between risk and coverage then other health insurance societies.

VIII. Concluding remarks

Health insurance societies played a vital role in protecting the wage-working population by mitigating the financial consequences of workplace accidents in the early twentieth century. Mutual health insurance emerged as the major provider for cover against loss of income due to workplace accidents, covering two out of three workers in manufacturing, transport, and private services. In the major urban areas, four out of five working-class households were insured.

Although workers faced major differences in accident risk, health insurance societies, with few exceptions, applied an egalitarian pricing policy. Our results show that workplace accident risk had a significant, positive impact on individual health insurance benefits. This also holds when we consider age, living conditions, income, and place of residence. Workers exposed to greater risks in their working life also had significantly higher levels of insurance coverage, but faced premium rates that were similar to those facing the less risk-exposed. Health insurance benefits went to the more risk-exposed workers, as shown by our analysis of benefits and net benefits. This highlights the fact that the health insurance societies redistributed resources from low- to high-risk-exposed workers within the pool of the insured.

Previous research has claimed that adverse selection in health insurance societies was mitigated in different ways by careful selection of members. The present article, however, shows that this selection did not consider workplace accident risk. As the very idea of health insurance societies was to support fellow workers who were unfortunate enough to be the victims of workplace accidents, members of health insurance societies accepted a certain level of redistribution in relation to differences in workplace accident risk. Since the health insurance societies were well aware of their own risk pool, the selection of members, regarding accident risk, was informed, rather than being characterized by adverse selection.

We argue that the idea of solidarity among wage-workers helps explain why workers exposed to low accident risk were willing to subsidize more risk-exposed workers. Despite the imbalance in benefits and costs across risk groups, mutual health insurance societies still managed to provide attractive workplace accident insurance for a growing population of wage-workers as long as the redistribution was limited to a small fraction of workers' incomes.

By the late 1930s, the entire labour force was covered by mutual societies, and it was not until 1954—for political rather than economic reasons—that mutualism

[78] *Svensk Sjukkassetidning: organ för Sveriges allmänna sjukkasseförbund*, 1 (1914), p. 148.

was replaced by statutory state provision. The success of mutualism may reflect the perception of a fair and loyal redistribution of resources that persisted as long as financial solvency and solidarity among members prevailed. New rules imposed to maintain financial solvency created debate on loyalty and fairness, as seen in the case of Svenska Folket. The successful adoption of rules that maintained the perception of loyalty and fairness sustained mutualism. From this perspective, the very idea of mutualism studied here may have constituted fertile ground for the rise of the universal welfare state.

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Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

S1. Commercial accident insurance
S2. Model specification of the two-part models on premiums and benefits
S3. Extensions and robustness checks
Data and replication files for this article are deposited with the Inter-university Consortium for Political and Social Research: https://doi.org/10.3886/E137381V1.