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Skill Premium in Sweden, 1900–1950

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Abstract: This paper documents the evolution of wage differentials between skilled and unskilled workers in Sweden throughout the first half of the twentieth century. Using newly digitized data on income taxes, this paper demonstrates that the skill premium decreased throughout 1900–1950, and most rapidly from 1930 onward. This is similar to the fall in skill premium documented by Goldin and Katz for the United States. However, unlike in the United States, the fall in skill premia in Sweden cannot be attributed to a supply shock of high school graduates. Rather, this paper shows that incomes of the low- and unskilled increased faster than those for more-skilled. Despite of similar technological change and rapid economic development, Sweden did not exhibit a comparable rise in high school education as the United States. The paper suggests other mechanisms for the falling skill premium in Sweden, such as informal schooling, emigration, and trade union activity.

JEL: N34, J24, J3

Keywords: Skill premium, industrialization, Sweden, income inequality

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1. Introduction

This paper constructs a long-run series for skill premium in Sweden during the first half of the twentieth century using newly digitized income tax returns. Skill premium is the excess income paid to skilled over unskilled workers. It is typically used to measure the return on education and human capital (Federico et al. 2021, Goldin and Katz 2008) as well as inequality and wage integration (Anderson 2001, Betrán and Pons 2004). The basic premise behind the concept is that greater demand for skills raises wages for skilled workers relative to unskilled, which results in a greater gap between skilled and unskilled workers (Katz & Autor, 1999). This has been documented in the United States and most European countries in the late twentieth century (Berman & Machin, 2000; Katz & Murphy, 1992). Earlier in the century, there was a fall in income inequality and skill premium (Betrán & Pons, 2004, 2013), which in this framework would suggest that the demand for skills was decreasing. However, this was challenged by Goldin and Katz (2008), who argue that technological change throughout the century was skill-biased and the decrease in skill premium is explained by the increase in the supply of skills, particularly the surges in high school education in the early decades and college education in the middle of the century.

In this paper, I examine skill premium during the first half of the twentieth century. I focus specifically on Sweden, where technological change was particularly rapid. Prado (2014) shows that in a short time span from 1906 to 1912, electrification of motive power increased from 25 to 51 percent. In contrast, in the United States, it reached 21 percent by 1909 and 49 percent by 1919 (Jerome 1934, p. 251). This technological change undoubtedly explains some of the rapid industrial development that took place. Industrial composition shifted from the old wood and sawmill industries toward more modern industries that relied on purchased electricity and new chemical innovations, such as pulp and paper, and engineering (Schön 1990). These industries are also known for their greater demand for skilled workers relative to unskilled workers (Goldin and Katz 1998). Industrialization also raised employment within services (Ostermeyer 2023), particularly telecommunications, banking and insurance, and transport (Schön 2012, p. 143). This change was further associated with skill upgrading from unskilled to more-skilled occupations (Heikkuri 2024).

Sweden offers an interesting context for studying skill premium, as it is known as one of the most egalitarian countries and from the solidaristic labor market institutions (Bengtsson et al. 2019, Lundh 2004, Prado and Waara 2018), but had relatively low secondary

schooling years until 1950s (Ljungberg and Nilsson 2009). In other words, we would expect skill premium to decline, despite the presence of skill-biased technological change and a lack of a surge in the supply of high school educated workers.

Previous studies have put Swedish skill premium at a moderate level, comparable to those at other European countries (Betrán and Pons 2013). Anderson (2001) estimates the skill premium to have been practically eliminated by 1960, as it fell from around 1.5 in 1900 to one in 1960. This premium was calculated using municipal worker wages from Bagge et al. (1935) and construction worker wages from ILO. Prado (2010a) shows that the ratio between skilled and unskilled hovered around 120 and 130 percent between 1860 and 1910. He uses different manufacturing industry wages and the same municipal worker wage as (Anderson 2001). Bengtsson and Prado (2020) show that the ratio between white-collar and working-class incomes remained at around four throughout 1850 and 1930, though with a significant variation depending on which white-collar salaries are used. For example, higher civil servants earned as much as 11.5 times more than unskilled workers. The authors include several salaried occupations, such as teachers, professors, civil servants, police officers, and clerks. However, their data comes largely from the Stockholm region, where income differentials were larger.

I take advantage of newly digitized data on incomes from tax returns, in which individuals reported their income and occupation (Bengtsson et al. 2021). Compared to previous studies on Swedish skill premium, the dataset used in this paper is much more comprehensive. The occupational titles are standardized and then coded into HISCO, which gives us four different skill-levels: high, medium, low, and unskilled. In total, there are 849 unique occupational titles covering each sector of the economy and both men and women. I adopt a regression model from Federico et al. (2021) to estimate incomes for different skills and calculate the ratios between them. This model accounts for several confounding factors, such as gender, urban, and industry effects on incomes.

The result shows a robust decline in skill premium at least from 1930 onwards. The decline is largely driven by the faster income growth at the lower-tail of the skill distribution compared to the high-skilled incomes. For urban male workers, the compression of skill premium started already in 1900. Changing gender composition had a small positive impact on unskilled incomes, as women left both farm work and domestic services for higher-skilled occupations. Feminization had a small negative effect on low-

skilled incomes, as women increased their share within occupations such as office clerks and shop assistants. In general, non-agrarian production workers exhibited the strongest income growth, and the shift away from agriculture contributed to the income growth at the aggregate level.

2. Data and methodology

The main data for the study is a sample from national tax registers (Bengtsson et al. 2021). These registers cover the population earning high enough of an income to pay income taxes. The coverage in Sweden has been judged comparatively good (Bengtsson and Molinder 2024, Bengtsson and Molinder forthcoming), though for the purposes of this study, there are some limitations discussed here in detail. In addition to the taxed income, tax authorities collected information about the occupations of tax filers. This paper takes advantage of this information in constructing a sample of occupational incomes throughout 1900 to 1950. The tax registry data covers the years 1900, 1910, 1920, 1940, and 1950. For 1930, the census collected information on income and occupation, which is used here to complement the dataset.

Since there is no direct evidence of educational level, the skill-level of a given occupation follows the classification from the HISCO/HISCLASS scheme. The first step in this process is to standardize the occupations from the tax registry. This involves using a more common spelling and correcting for transcription errors. In the next step, occupations are matched with HISCO and further to HISCLASS, from which they can be readily assigned into skills. Both men and women are included in the analysis, with women making up some 29 percent of all observations. Men are overrepresented in the sample particularly in the earlier years, as they were more likely to earn large enough of an income to pay taxes. Similarly, urban observations make up 61 percent of the data, and for the same reason: urban incomes were higher and therefore the probability of appearing in the tax registry was greater.

There are four skill-levels in the HISCO/HISCLASS scheme: high, medium, low, and unskilled. Unskilled workers largely consist of workers without any further specialization, such as factory workers, farm workers, or day-laborers. Low-skilled workers are more specialized, but often in tasks that require little to no schooling or specific training. They include both manual workers and lower clerical and sales personnel. Medium-skilled occupations consist of many artisan and crafts occupations, or occupations that require

education or training, and most white-collar and supervisory occupations. High-skilled occupations require an advanced degree, and these include higher managers and professionals only. In total, 849 unique HISCO occupations are included in the final data set. The composition of the work force by skill is presented in Table 1.

TABLE 1 *Shares of observations by skill and year*

Skill	1900	1910	1920	1930	1940	1950
High	7.9%	5.5%	4.3%	2.6%	5.6%	7.1%
Medium	52.0%	40.9%	33.3%	40.7%	33.7%	36.1%
Low	18.8%	27.0%	27.9%	30.6%	38.6%	37.6%
Unskilled	21.4%	26.6%	34.4%	26.0%	22.1%	19.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Sources: Bengtsson et al. (2021), author's own calculations

The occupational structure in the dataset used here differs from the occupational structure in the census. This is because of the positive selection into the sample posed by the income threshold. This threshold was 500 SEK until 1903, after which it was raised to 600 SEK where it remained until 1958 (Gustafsson and Johansson 2003). This threshold excludes many low-income occupations, especially before 1920. One of the most common occupations at the time was farm worker. In 1900, average annual cash wage of an agrarian worker was 228 SEK for men and 114 SEK for women (HILD).[1] Even with the value of food and lodging added, the total income of male farm workers would have barely met the threshold. However, because of the stagnant nominal income threshold since 1903, the representativeness of the sample improves over time, and by 1920, the occupational structure is closer to what would be expected based on the census.

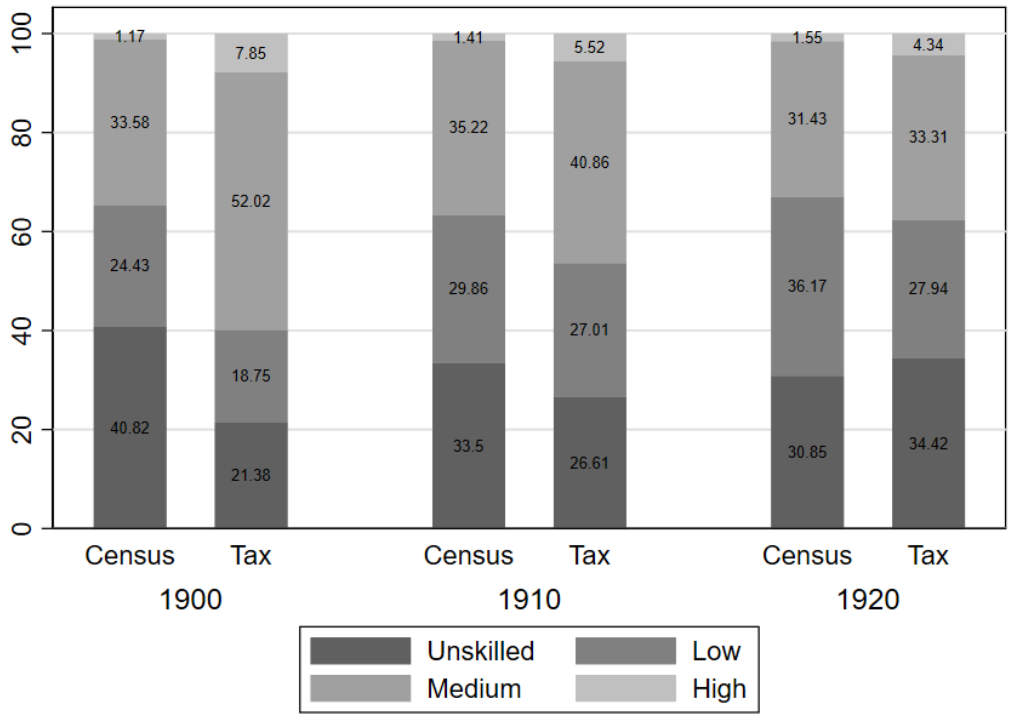
Graph 1 compares the skill composition of the tax sample to that of the census. The skill composition of the census is estimated in Heikkuri (2024) using the HISCO/HISCLASS scheme to assign skills to occupations in the tabulated censuses from 1870 to 1930. This allows a comparison between the two datasets in terms of skill composition until 1920.[2] The tax sample excludes many low- and unskilled occupations,

[1] These wages are reported in HILD, which is based on surveys by Agricultural Societies that were aggregated by Statistics Sweden.

[2] The 1930 data in this study comes from the census, which makes comparisons with Heikkuri (2023) redundant. The 1940 and 1950 published censuses no longer distinguish population by occupation, which makes inferences of skill unfeasible. Individualized data for 1940 and 1950 is currently not

and thus medium- and high-skilled individuals are overrepresented at least in 1900 and 1910. By 1920, the representation improves such that the employment shares in unskilled occupations are almost identical. There is further a difference in the share of high-skilled employment, though this could result in issues capturing high-skilled individuals from tabulated censuses correctly.[3]

GRAPH 1. *Skill composition between the tax sample and census*



Sources: Bengtsson et al. (2021), author's own calculations

The nominal occupational incomes by skill group are presented in Table 2.[4] The reported average incomes are weighted by the number of observations per HISCO occupation. That is, the nominal income for each skill is a product of occupational wages and the number of individuals within a given occupation, divided by the sum of all people in each skill group.

available. However, the samples for 1940 and 1950 are deemed representative of the occupational structure of the population, as typical wages have by then increased to well above the tax threshold.

[3] The censuses list occupations more broadly than the tax registry, as the tabulated censuses do not include individualized data. Many high-skilled individuals, such as engineers, were often combined with medium-skilled occupations, and thus, the high-skilled share in the census is likely an underestimate in 1920 and 1930 (see further discussion in Heikkuri (2024)).

[4] This study uses nominal incomes, as the main measure of the study is a ratio between incomes rather than its level. There are no separate cost of living indices for different skills, and therefore converting incomes to real incomes does not provide any additional insight to the analysis.

This procedure adjusts the incomes based on the most popular occupations within the skill group instead of giving equal weights to each occupation. The nominal incomes surged between 1910 and 1920 due to inflation and economic boom after WWI, only to plummet later in the 1920s due to deflation (Prado 2010b). Annual incomes are influenced by other factors than skills. In addition to the mentioned economic conditions, the annual income depends on the hours and weeks worked, capital-per-worker, type of wage (hourly or piece-rate), other compensations and bonuses, unobserved individual characteristics, and even discrimination. Because of this and the issues with representativeness, the skill premium calculated in this paper is based on a regression model discussed further below.

TABLE 2 *Weighted average nominal incomes in Swedish krona by skill and year*

Skill	1900	1910[1]	1920	1930	1940	1950
High	3335.8	4712.5	11223.6	6906.4	9068.9	14206.4
Medium	1191.3	1522.6	3807.2	2031.2	3292.8	5497.3
Low	901.6	1159.5	2867.0	1501.7	2491.4	5151.2
Unskilled	697.8	842.8	2071.9	1196.5	2033.8	4485.4

[1]Digitization ongoing. The data used here excludes northernmost regions in Sweden.

Sources: Bengtsson et al. (2021), author's own calculations

The final dataset is a collection of HISCO titles with average incomes, standard deviation of that income, and the number of observations (individuals). These are summarized by skill in Table A1 and A2 in the Appendix. The average incomes are calculated separately for urban, rural, men, and women. Thus, if there are observations for each of these categories, there are four different average incomes per HISCO.

Skill premium is calculated as the ratio between high-, medium-, or low-skilled income and unskilled income. That is, the paper produces three different skill premia for three different skill groups in relation to unskilled. To estimate the income for each skill group, a regression method similar to that in Federico et al. (2021) and Clark (2005) is used. That is, the incomes are estimated using time, skill, gender, urban, and sector dummies. Because the income for each unit of observation (HISCO) represents an average over n people in a given occupation, the regression is weighted by the number of income observations for each HISCO occupation. The regression model is

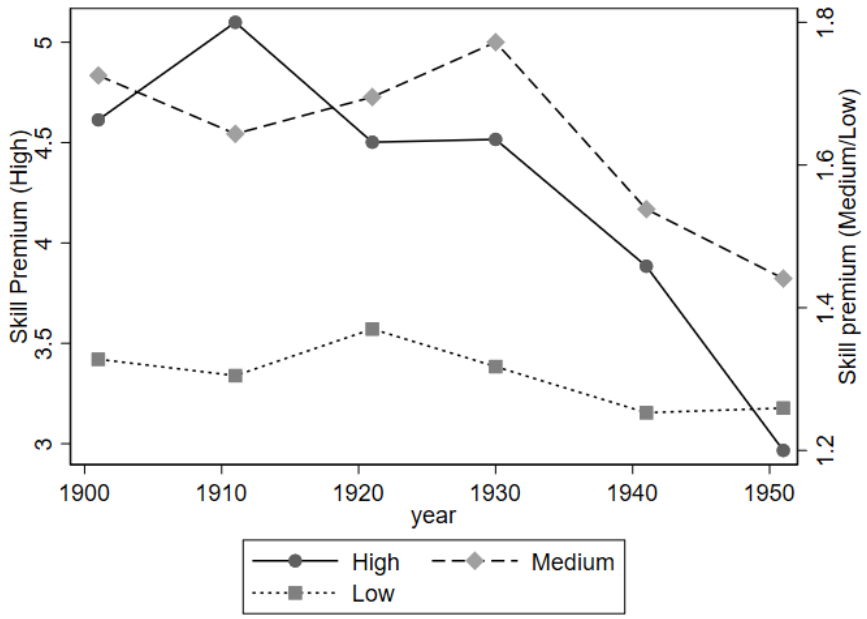
$$\ln(income_p) = \alpha + \sum_{i=1}^{4}\sum_{j=1900}^{1950} \beta_{ij} SKILL_i YEAR_j + \gamma GENDER + \sum_{k=1}^{4} \delta_k SECTOR_k + \theta URBAN + \varepsilon_p$$

where $income_p$ is the mean income for an occupation p, $SKILL$ is a categorical variable for skill (1 = high, 2 = medium, 3 = low, 4 = unskilled), $YEAR$ is a categorical variable for each year in the data (10 year intervals between 1900 and 1950, total 6 years), $GENDER$ is a dummy for which female observations equal to 1, $SECTOR$ is a categorical variable for each sector (1 = primary, 2 = secondary, 3 = tertiary, 4 = other), and $URBAN$ equals 1 for urban observations. A unit of observation i is a HISCO-occupation. The predicted income is the exponent of the sum of $\alpha + \beta_{ij}$, as in Federico et al. (2021). The ratios are calculated using the predicted incomes. The full regression table is available in the Appendix (Table A3).

3. Skill premium in Sweden

This section shows the newly constructed skill premium for Sweden using incomes from as many as 849 occupations. Graph 2 represents the skill premiums constructed using the weighted regression model detailed in the previous section. It reveals that high-skilled occupations were on another level compared to other skills. High-skilled earned more than 4.5 times the unskilled income in 1900, rising to five times higher in 1910, after which their relative incomes decreased. By 1950, high-skilled earned less than three times as much as unskilled. In comparison, medium- and low-skilled workers earn a small premium compared to unskilled workers. For medium-skilled, the premium remains around 1.7 until 1930, after which it falls to 1.4. For low-skilled, the premium remains quite stable, falling only from 1.3 to 1.25 in the span of 1900–1950. The relatively low premium for medium- and low-skilled workers corresponds to the premium estimated by Prado (2010a). The premium for high-skilled is somewhat higher in earlier decades than that estimated in Bengtsson and Prado (2020), though it decreases more rapidly, reaching a lower level by 1950. The skill premium for 1900–1920 here should be considered as a lower bound, as the incomes for low- and unskilled workers are positively selected due to the tax threshold.

GRAPH 2. *Skill premiums in Sweden, 1900–1950.*



Notes: The skill premium for high-skilled on the left axis, and skill premium for medium- and low-skilled on the right axis. All premiums are calculated as the ratio of income for skilled (high, medium, or low) and unskilled.

Sources: Bengtsson et al. (2021), author's own calculations

The decrease in income inequality was largely due to low incomes catching up to high incomes in Sweden (cf. Bengtsson and Molinder 2024). Table 3 shows that skill premium fell for a similar reason. Unskilled incomes increased almost twice as fast as high-skilled incomes over the course of half a century. The incomes of unskilled workers were catching up to those of more-skilled workers. This growth was particularly strong in 1910–1920 and again in 1940–1950. The first period, from 1910 to 1920 is partly explained by the post-WWI economic boom and consequent inflation (Prado 2010b, Schön 2012). All incomes increased but for the high-skilled, income growth was the slowest. Another important period was 1940 to 1950, when nominal incomes for medium-, low-, and unskilled workers more than doubled. Like the previous period of catch-up, this era coincided with a major war (WWII) and another wage increase due to consumer price increases (Prado 2010b). Furthermore, the 1938 Saltsjöbad agreement started a process of wage compression in Sweden, which significantly lowered the gaps between workers and salaried employees (Bengtsson and Prado 2020, Prado and Waara 2018). Once again, high-skilled faced the slowest income growth in this period. Only in the first subperiod of 1900 to 1910 did the high-skilled incomes grew fastest. This does not fit the expectations based on current

evidence of Swedish wages and wage ratios, which all point to decreasing gaps (Bengtsson and Prado 2020, Lundh and Prado 2015, Prado 2010b). That is, the rise in skill premium observed here for the first decade of the twentieth century could be explained by sampling bias. I will return to this in the next section.

TABLE 3 *Income growth by skill, 1900–1950.*

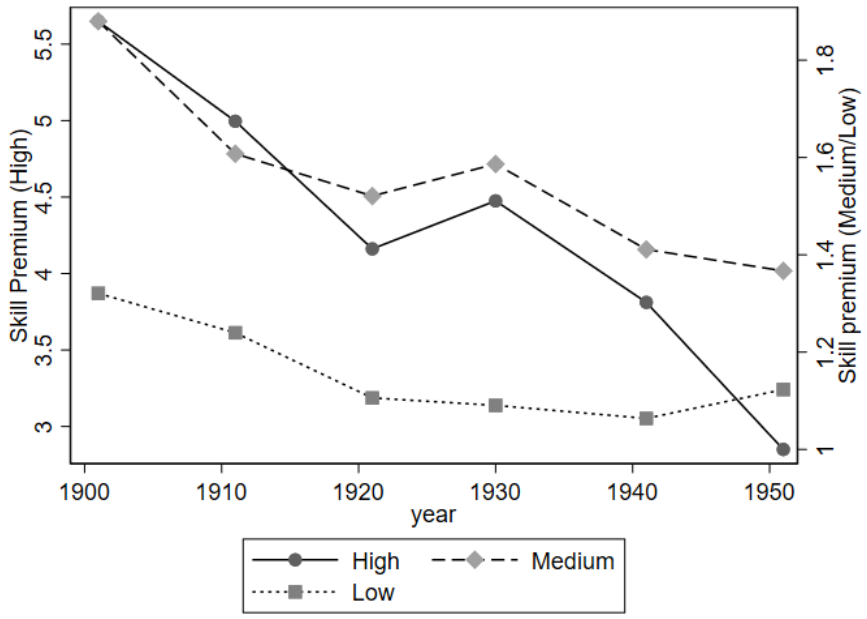
Growth rates	High	Medium	Low	Unskilled
1900-1910	39.5%	19.9%	23.6%	25.9%
1910-1920	116.1%	153.2%	158.0%	145.4%
1920-1930	-35.8%	-33.1%	-38.5%	-36.0%
1930-1940	22.2%	23.3%	35.1%	42.1%
1940-1950	64.9%	102.2%	117.0%	115.9%
1900-1950	289.9%	406.4%	475.1%	506.4%

Sources: Bengtsson et al. (2021), author's own calculations

Due to the inherent issues with the representativeness of women and rural male workers, I estimate the same skill premiums separately for urban male workers in Graph 3. The skill premium for the high-skilled starts from a higher level than for the full sample, but decreases almost continuously from 1900 onward, except for 1920–1930. Medium-skilled earn a greater premium in the early years but lose more in the subsequent years compared to the full sample. The premium for low-skilled is comparable to the full sample in 1900, but again, it falls to a lower level than in the full sample. The sample is less representative for rural men, largely because farm workers were less likely to earn high enough of an income to pay income taxes, and because farmers were not in general covered by the income taxes.[5] **Error! Reference source not found.** 4 shows skill premiums for rural non-farm workers, which still show a great volatility as opposed to urban men.

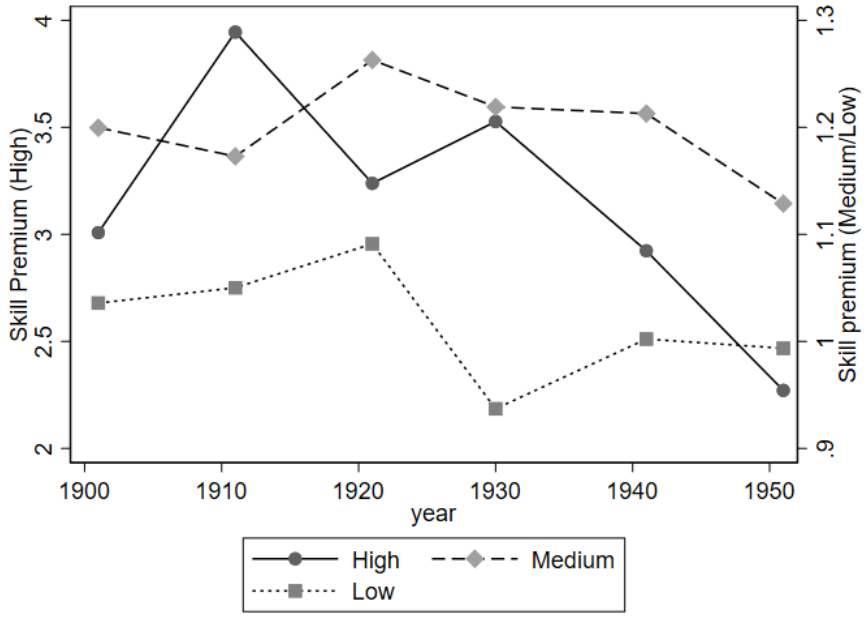
[5] Farmers paid a property tax rather than income tax. The income tax data does include some farmers who have reported an income, but their share does not correspond to that reported in the censuses.

GRAPH 3. *Skill premiums in Sweden, 1900–1950, for urban men.*



Notes: The skill premium for high-skilled on the left axis, and skill premium for medium- and low-skilled on the right axis. All premiums are calculated as the ratio of income for skilled (high, medium, or low) and unskilled.
Sources: Bengtsson et al. (2021), author's own calculations

GRAPH 4. *Skill premiums in Sweden, 1900–1950, for rural men.*



Notes: The skill premium for high-skilled on the left axis, and skill premium for medium- and low-skilled on the right axis. All premiums are calculated as the ratio of income for skilled (high, medium, or low) and unskilled.
Sources: Bengtsson et al. (2021), author's own calculations

Table 4 represents the income growth by skills separately for urban and rural male workers. It reveals again that the income growth was greatest for unskilled workers. However, the small recovery observed for high- and medium-skilled premiums from 1920 to 1930 is largely because their incomes decreased the least during the economic downturn of the late 1920s. During the 1930s and 1940s, low- and unskilled workers enjoyed greater income growth, which resulted in lowering gap between more- and less-skilled workers. For rural men, the growth rates reveal that the first hike in high-skilled premium is due to their stronger income growth. However, low- and unskilled catch up in the next period. After 1920, incomes decrease the most for low- and unskilled, explaining the recurrent increase in the skill premium. Once the economic turbulence is replaced by the post-WWII stable economic growth, the incomes of low- and unskilled begin to catch up to those above them. Medium-skilled workers, who in rural areas were often farmers, faced a relatively low post-WWII growth in incomes (Lundh and Prado 2015), explaining why they fall behind low- and unskilled workers, who often work within industry.

TABLE 4 *Income growth for urban and rural men by skill and decade.*

	Urban male				Rural male			
Growth rates	High	Medium	Low	Unskilled	High	Medium	Low	Unskilled
1900-1910	15%	11%	22%	30%	81%	35%	35%	36%
1910-1920	154%	188%	173%	205%	116%	144%	163%	160%
1920-1930	-31%	-33%	-37%	-36%	-28%	-24%	-40%	-39%
1930-1940	12%	16%	28%	31%	15%	10%	40%	44%
1940-1950	60%	108%	126%	114%	67%	86%	116%	139%
1900-1950	260%	419%	507%	614%	438%	412%	550%	645%

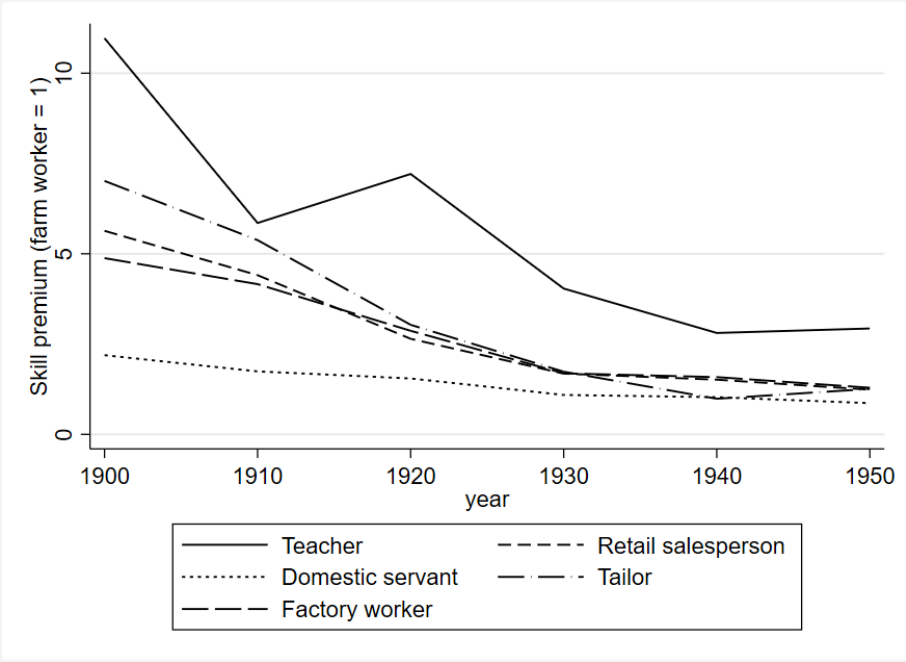
Sources: Bengtsson et al. (2021), author's own calculations

Since urban workers were more likely to be working in manufacturing, whereas rural workers had greater concentration of farm workers, it is important to note that reductions in working hours may explain some of the wage growth. In 1920, daily working hours were reduced to 8 hours, which meant that regular weekly hours were limited to 48 hours (Bengtsson and Molinder 2017). This regulation did not cover agrarian workers, who worked on average 11 hours per day, and as much as 14 hours during summer. Only in 1936 were the hours for agricultural workers reduced by regulation to 52 hours per week, and by 148, it was further reduced to 48 hours. Lundh and Prado (2015) estimate that the differences in working time reduction explain as much as 10 percent of the gap between manufacturing and agrarian workers around 1911–1950.

The sample size for women is much smaller than that for men, which makes income ratios very sensitive to selection bias, especially before 1920. From the censuses we know that the most typical occupations for women in 1900 were farm workers, domestic servants, day-laborers, tailors, teachers, and factory workers. By 1930, the top occupations include retail trade salespersons, but no day-laborers. Using incomes for these occupations, but imputing incomes for unskilled farm workers for 1900–1920 (HILD), and for domestic servants for 1900–1910 Bengtsson and Molinder (2022, Table A4), I calculate skill premium for female workers in Graph 5. Unlike the incomes in Graphs 3 and 4, these are simple averages. The ratio is calculated using the incomes for a given occupation and a farm worker. The results show a considerable decrease in the income differentials between the occupations. High-skilled incomes here correspond to teacher incomes, which are as high as 10 times greater than farm worker incomes in 1900. Tailors represent medium-skilled female workers, and they too earn a significant seven times the income of a farm worker. Retail trade salespersons represent low-skilled female workers, and even they earn more than 5 times the wage of a farm worker. Finally, other unskilled occupations, such as factory workers and domestic servants earn more than farm workers, though some of this difference could be explained by the greater urbanization within these occupations.

Because the representativeness of women improves in 1930, the skill premiums comparable to those in Graphs 3 and 4 can only be calculated for women for 1930–1950. Graph B1 in the Appendix B shows that the skill premiums for women were decreasing from 1930 to 1950 at all levels, and from a comparatively low level.

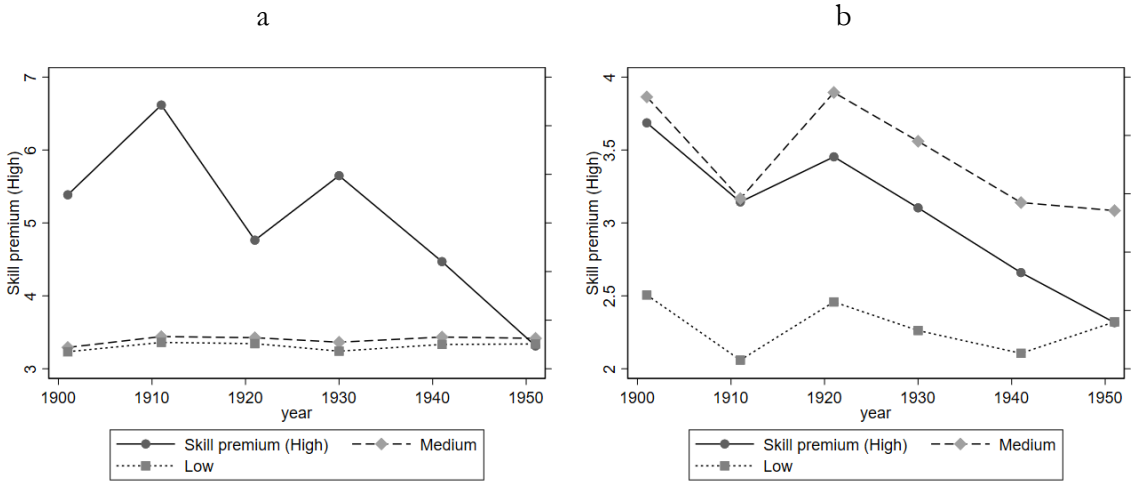
GRAPH 5. *Skill premiums for typical female occupations in Sweden, 1900–1950.*



Notes: Skill premiums are calculated using simple average incomes. The reference is agricultural workers, whose incomes are imputed for 1900–1920 using wages from HILD. Incomes for domestic servants are imputed using estimated wages from Bengtsson and Molinder (2022). All other incomes from Bengtsson et al. (2021).

Graph 6 shows the skill premiums separately for secondary sector (a) and tertiary sector (b). The notable differences between the two sectors are the level of high-skill premium at the beginning of the twentieth century and the variation in the rest of the workers. In the secondary sector, the high-skilled earn a significant premium in the early century, whereas within tertiary sector this premium is less pronounced. However, medium-skilled workers earn a larger premium within the tertiary sector, whereas within the secondary sector, medium- and low-skilled earn very similar incomes. One potential reason is that within industry, there are collective agreements that dictate wages for all workers, and small differences in skills are not accounted for. For example, in the metal and engineering sector, high-skilled urban men earned 9.2 times the low-skilled income, but this premium was only 1.12 for medium-skilled workers. In comparison, within the tertiary sector, the differences between medium- and low-skilled are more pronounced but the high-skilled earn smaller premium than in secondary sector.

GRAPH 6. *Skill premiums for (a) secondary and (b) tertiary sectors in Sweden, 1900 – 1950.*



Notes: The skill premium for high-skilled on the left axis, and skill premium for medium- and low-skilled on the right axis. All premiums are calculated as the ratio of income for skilled (high, medium, or low) and unskilled.

Sources: Bengtsson et al. (2021), author's own calculations

In summary, this section reveals a decline in the skill premiums at least from 1930 onward, which is line with the existing evidence of wage compression due to collective bargaining system. However, for urban male workers, the onset of the decline was much earlier, at least as far back as 1900. For typical female occupations, this appears to be the case as well, though on the aggregate, it is difficult to confirm this pattern, as women are underrepresented in the data. Economic conditions around WWI introduce volatility to wage levels. In general, low- and unskilled benefitted more from the inflation in 1920s, catching up to the high-skilled workers, but then lost more in the immediate post-war decade. In the next section, I dive deeper into the explanation of these patterns.

4. Counterfactual analysis and occupational composition

The decrease in skill premium is driven by the faster income growth at the lower end of the skill distribution. In this section, I consider the composition of the labor force and how changes in it could explain the trends in skill premium. The extent to which compositional changes affect incomes for specific skills are addressed through counterfactual incomes. In this exercise, the composition of the workers at a given level of skill is held constant to re-calculate incomes had there been no changes in gender or sectoral composition. Lastly, this section shows how incomes for different occupational groups have developed over the decades to further explain the shrinking gap between skilled and unskilled incomes.

4.1. Feminization

The trends in skill premium look different for men and women, though largely because men are in general better represented than women. Only 5 percent of the sample in 1900 consists of women, improving to about 20 percent by 1910, and further to 28 percent by 1950 (Table B1 in the Appendix). In particular, low- and unskilled women are poorly captured by the income taxes, as their earnings were too low to meet the threshold. In the census, the share of women in the working population remains stable at around one-third throughout 1900 to 1930. The labor force participation rate fluctuates between 45 and 55 percent in 1900–1950 (Molinder 2022). To account for the undercounting of women, I re-weigh the incomes using the weights from the census for 1900–1920 (Table B2 in the Appendix).

Assuming that the income for any skill is $e_w Income_w + e_m Income_m$, that is, the sum of female and male incomes, weighted by their proportions (e). Thus, if the share of women increases from one year to another, their income has more weight in determining the average income for any skill. For this exercise, I calculate counterfactual average incomes using the weights from Table B2 (Appendix B). The counterfactual incomes are calculated as a relative income compared to incomes calculated using actual shares and fixed 1900 shares. That is, a counterfactual income of 100 means that income for a given skill would not have changed had the sectoral composition remained at 1900 level.

TABLE 5 *Counterfactual incomes using 1900 gender composition.*

Skill	1900	1910	1920	1930	1940	1950
High	100	103	110	104	99	99
Medium	100	103	104	102	105	104
Low	100	101	106	103	109	112
Unskilled	100	92	93	89	96	92

Sources: Bengtsson et al. (2021), gender composition from Heikkuri (2024), author's own calculations

These counterfactual incomes in Table 5 show that had the gender composition remained the same as in 1900, unskilled incomes would have been 92 percent of the actual income in 1950. In contrast, the low-skilled incomes would have been 112 percent of the actual income in 1950, had the female share remained low. For high- and medium-skilled, the counterfactuals would have been slightly changed: 99 percent for high-skilled and 104 percent for medium-skilled. To conclude, the exercise here suggests that some of the

increase in unskilled incomes may have resulted from masculinization, whereas the growth in low-skilled incomes could have been hindered by greater feminization. In the beginning of the twentieth century, many young women left countryside and farm work for better opportunities in towns, and especially in service sector (Carlsson 1968, Morell 2011).

4.2. Sectoral composition

Sectoral shifts in employment may influence the skill premium if workers shift from a relatively low-pay sector into a high-pay sector without occupational upgrading. For example, shifting from agriculture to industry without upgrading skills can result in higher incomes, even if there is no rural-urban migration involved. In 1950, rural male factory worker earned as much as 1.7 times as much as rural male farm worker. Even between different industries, there were large differences in average wages (Prado 2010b). The sectoral shares for each skill can be obtained from the censuses for 1900–1930 (Table C1 in the Appendix). Among the highly skilled, the sectoral composition shifts from services (which include most white-collar jobs) to secondary sector. Medium-skilled workers shift from agriculture to manufacturing and services. For low-skilled workers, the majority remains within manufacturing, but the shares in agriculture decline in favor of services. Finally, unskilled employment likewise shifts away from agriculture to both manufacturing and services. In fact, the service sector becomes the most important sector for unskilled workers, though the employment within manufacturing exhibits the fastest relative growth. It should be noted that in 1900, one-quarter of the unskilled workers were day-laborers without specialization, for whom sector cannot be determined. Their share falls to just 2.7 percent by 1930.

The counterfactual exercise from the previous section is repeated here for the sectoral composition. Using employment shares for the censuses for 1900, I calculate the counterfactual incomes by skill had there not been sectoral shifts described above. Again, I assume that the income for any skill is determined by $\sum_{j=4} e_i Income_j$, that is, for each skill j, the income is the sum of all sectoral incomes, weighted by their employment share e_i. The incomes by skill and sector are listed in Table C2 (Appendix C).

TABLE 6 *Counterfactual incomes using 1900 sectoral composition.*

Skill	1900	1910	1920	1930
High	100	100	97	83
Medium	100	96	90	94
Low	100	97	96	95
Unskilled	100	99	97	94

Sources: Bengtsson et al. (2021), sectoral composition from Heikkuri (2024), author's own calculations

For 1940 and 1950, sectoral composition by skill is not available. The income tax data does not reflect the actual sectoral composition, as agricultural workers and farmers are poorly represented. However, the sectoral composition between manufacturing and services can be addressed. Table C3 (Appendix C) shows that high-skilled were first concentrated in the service sector but by 1950 the split was more even. Medium- and low-skilled were quite evenly distributed between manufacturing and services in 1900, but by 1950, most medium-skilled were in manufacturing while low-skilled were concentrated in services. Unskilled workers were in all years more concentrated in services. The counterfactual incomes in Table C4 show that the incomes for medium-, low-, and unskilled were virtually unchanged had the sectoral composition been fixed. High-skilled incomes are the most affected by the counterfactual scenario, as the result suggests they would have been 92 percent of the actual level.

4.3. Occupational composition

A change from low- to high-paying occupations within skill-level can explain changes in skill premium. For example, if managers earn more than professionals, but the share of professionals increases within high-skilled employment, the average income may consequently decrease. This section explores changes in occupational composition using the HISCLASS scheme, in which occupations are grouped into 12 categories. Among the highly skilled, there are two HISCLASS-groups: higher managers and higher professionals. The composition of high-skilled workers shifts more from managers to professionals such that the share of managers decreases from 38 to 29 percent (Table D1). The medium-skilled group consists of five HISCLASS groups and is thus the most heterogeneous group. The composition away from lower managers and lower professionals (which include higher clerical and sales workers) toward foremen and medium-skilled non-farm workers, while the share of farmers remains relatively stable (Table D2). Among low-skilled workers, there are three groups: (lower) clerical and sales, low-skilled non-agrarian workers, and low-

skilled farm workers. The composition within this group shifts away from low-skilled workers to clerical and sales (Table D3). Finally, the group of unskilled can be divided into unskilled non-agrarian and unskilled agrarian workers. Interestingly, the composition here shifts away from non-agrarian to agrarian workers (Table D4). This is likely due to the farm incomes increasing over time to meet the income tax threshold, which improves the representation of farm workers in the income tax data.

TABLE 7 *Income growth by occupational group and decade.*

	High-skilled			**Medium-skilled**			
Year	Higher man.	Higher prof.	Lower man.	Lower prof.	Foremen	Medium-skilled	Farmers
1900-1910	39.6%	29.8%	30.0%	20.7%	32.4%	23.8%	56.9%
1910-1920	116.8%	118.8%	169.2%	166.8%	44.0%	188.2%	25.3%
1920-1930	-26.2%	-34.2%	-36.3%	-34.3%	-25.4%	-37.1%	12.5%
1930-1940	20.4%	15.2%	29.9%	11.7%	29.8%	38.1%	-38.5%
1940-1950	62.4%	64.6%	86.1%	100.8%	77.8%	108.2%	109.4%
1900-1950	336.5%	254.3%	439.2%	375.1%	228.3%	544.9%	185.0%
	Low-skilled				**Unskilled**		
Year	Clerical and sales	Low-skilled	Low farm	Unskilled non-farm		Unskilled farm	
1900-1910	30.6%	21.4%	9.5%	24.6%		6.3%	
1910-1920	139.5%	173.3%	131.3%	148.4%		118.3%	
1920-1930	-37.8%	-38.1%	-29.2%	-30.0%		-40.5%	
1930-1940	31.6%	35.7%	22.6%	36.8%		45.3%	
1940-1950	105.1%	122.1%	135.5%	109.7%		141.3%	
1900-1950	425.3%	518.6%	418.1%	521.3%		384.1%	

Sources: Bengtsson et al. (2021), author's own calculations

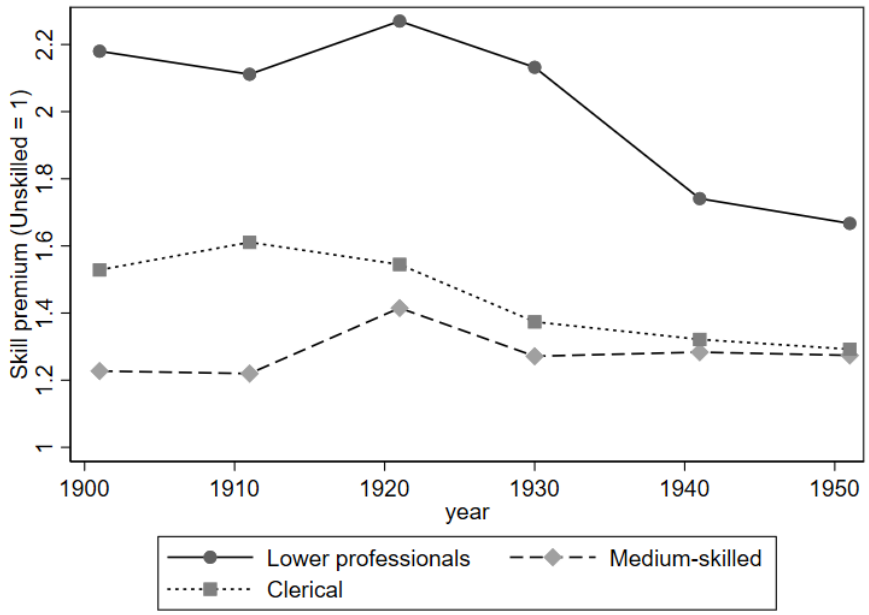
Table 7 reports the income growth by HISCLASS, revealing that in general, production workers gained most in terms of income growth. The three fastest growing occupational groups were medium-skilled, low-skilled, and unskilled non-agrarian workers. Farmers had the slowest income growth, but this could be a result from the differential tax coverage, as most farmers paid property tax instead of income tax. Other groups facing relatively slow income growth were foremen and higher professionals. Foremen made up a tiny portion of the dataset, and therefore they could be more sensitive to selection into the sample. Higher professionals include many public sector administrators, whose employment share increased particularly from 1930s to 1950s (Schön, 2012).

5. Discussion

The skill premium in Sweden was on a downward trajectory most of the early twentieth century. To summarize the findings from the previous section, we observe a faster income increase among low- and unskilled workers, and this translates to a diminishing gap between high-skilled and unskilled, or in other words, a decreasing skill premium. These results are in line with the general picture of decreasing income inequality at the time (Bengtsson and Molinder 2024, Bengtsson and Molinder forthcoming, Roine and Waldenström 2008, Svensson and Bengtsson 2023), and that wage compression likely started before the post-WWII era of the Swedish model (Prado and Waara 2018). In this section, I return to the potential drivers of skill premium, namely technological change, education, migration, and trade union activity.

A typical explanation for the increase in income inequality and the college premium in more recent decades is skill-biased technological change (Autor et al. 1998, Katz and Murphy 1992, Krueger 1993). However, even if skill-biased technological change did raise the demand for skills, skill premiums may decrease if the supply of skills exceed its demand (Goldin and Katz 2008). In the United States, skill premium, calculated as the excess wage paid to high school graduates over less-educated workers, decreased by almost 50 percent from the early twentieth century until 1950 (Goldin and Katz 2008, Figure 8.1.). While not entirely comparable, the skill premium in Sweden shows a similar development. High school graduates were likely to work in white-collar office jobs or as skilled blue-collar workers, which in terms of HISCO/HISCLASS should correspond to the medium-skilled professional, clerical, and sales workers, and the medium-skilled non-agrarian workers groups. Graph 7 compares the skill premiums for the two groups, and lower-skilled clerical workers against unskilled non-agrarian workers. It reveals that lower professionals earned a higher premium against unskilled workers than medium-skilled production workers. Other clerical workers earned only a small premium. If lower professionals represent high school graduates as a group, one could detect a decline in the high school premium, though not as impressive as in the United States. Blue-collar workers in general were not particularly likely to hold a high school diploma in Sweden, as illustrated in Table E1 in Appendix E.

GRAPH 7. *Skill premium by selected HISCLASS.*



Sources: Bengtsson et al. (2021), author's own calculations

The Swedish schooling system differed from that in the United States, and as in many other European countries, high school was not very popular until after 1950s. However, schooling years did increase over time. Lee and Lee (2016) show that average schooling years were 4.5 in 1910, which increased to almost 7 years by 1950. This compares favorably to the rest of Europe, with only Norway and Switzerland having higher schooling years in 1910. In comparison, average schooling years in the United States were 6.7 in 1910, and almost 9 years in 1950. In secondary schooling, Sweden was admittedly lagging the United States. Ljungberg and Nilsson (2009) show that average years of upper secondary schooling were only 0.03 in 1900, growing to 0.09 by 1950. However, this comparison may neglect the differences in the schooling systems.

Goldin (1998) describes high school system in the United States as unique, as they offered curriculum in subjects that were directly useful in the labour market. That is, in addition to the more classic subjects in the Latin-curriculum, high schools started to offer courses in more practical subjects. In Sweden, secondary schools were established around 1849, and technical upper secondary schools emerged in 1853 (Ljungberg and Nilsson 2009). Vocational training was often organized in part-time as evening and Sunday schools (ibid.). Like the United States, Sweden began to offer high school education in more

practical subjects than Latin. A report by SCB (1977) shows more than half of the high school students choosing the more practical education within high schools between 1909 and 1927. Vocational training was further offered by technical schools, in which students could take courses in trade, household work, and in different industry-specific skills, such as machinery, forestry, textiles, and construction (SCB 1984). Ljungberg and Nilsson (2009) argue that the expansion in primary education made Swedish population well equipped for the second industrial revolution in the beginning of the twentieth century. However, there was less interest for upper secondary schooling.

Technological change is difficult to measure, as there is no generally accepted definition for it. Goldin and Katz (1998) use purchased electricity to measure technological advances within an industry. They note that industries that used more purchased electricity were more capital-intensive and employed more high school educated workers than other industries, both production (blue-collar) and nonproduction (white-collar) workers. Prado and Theodoridis (2017) conduct a similar experiment for Sweden but find a weak effect from electricity on white-collar employment. Rather, electrification increased the demand for low- and medium-skilled manufacturing workers relative to unskilled farm workers in areas close to the electricity grid (Molinder et al. 2021). Indeed, while Sweden reached levels of electrification twice as high as the United States already by 1912 (Prado 2014), there is little evidence of increase in the supply of skills beyond primary schooling. In fact, within manufacturing nationwide, employment shifted from medium-skilled to low- and unskilled occupations during the early twentieth century (Heikkuri 2024). If technological change was skill-biased in Sweden, it was not manifesting itself in increased secondary schooling or in widespread occupational upgrading. However, skill upgrading within occupations remains a possibility, but this is difficult to detect.

There are other factors that could explain the similar decrease in skill premium between Sweden and the United States during the early twentieth century. In Sweden, the decrease in skill premium was a result of less-skilled catching up to more-skilled, suggesting that there was either a lower supply of less-skilled workers, or that there was greater demand for them, or both. A lower supply of less-skilled workers could be a result of emigration. In Sweden, there is some evidence of both. During the late nineteenth and early twentieth centuries, as many as one million Swedes emigrated, and as much as two percent of those between ages 20 and 24 left in each year (Bohlin and Eurenius 2010). This mass emigration has been argued to have had a positive impact on wages prior to 1914 (Ljungberg 1997,

O'Rourke and Williamson 1995). As to whether emigration resulted in a short supply of unskilled workers relative to other skills depends on who migrated. Bohlin and Eurenius (2010) show that most of the emigrants were from the countryside. However, this does not necessarily mean they were unskilled. Dribe et al. (2023) show that emigrants were often from middle-class origins, with fathers in artisan and crafts occupations, or farmers. Eurenius (2020) shows that emigrants from Halland county were slightly more likely to have father's occupation as worker than those who stayed. In contrast, stayers were slightly more likely to have father in a skilled occupation than emigrants. Ongoing research by Castillo (2024) suggests that the male migrants were often listed as laborers (*arbetare*), farm workers, textile workers, and other blue-collar workers in the 1900 census. For women, overwhelming majority were domestic servants.

By 1920s, the emigration slowed down significantly, and in the 1930s, there were more immigrants arriving than there were emigrants leaving Sweden (Lundh and Olsson 1994). The decline in emigration was both a response to tighter regulations in the United States and to improved living standards in Sweden (Bohlin and Eurenius 2010). The economic incentives were no longer as strong as before, as Swedish real wages approached to those in the United States (O'Rourke and Williamson 1995). [6] Apart from the economic downturn in the late 1920s and early 1930s, Swedish economy was growing rapidly, and employment within industry increased by almost eight percentage points between 1930 and 1950 (Schön and Krantz 2012). In addition, service sector growth provided more labor demand. Ostermeyer (2023) shows that for every two industrial jobs, one job within services was created in Sweden around 1880–1910. Given that growth in services picked up in 1930s, this multiplier was probably higher later in the twentieth century. In contrast to the growing demand for workers within industry and services, fertility had been declining sharply since 1900s (Bengtsson and Ohlsson 1994), which together with emigration of young adults in their reproductive ages reduced the supply of new labor market entrants. That is, there are reasons to believe the supply of labor declined during the first half of the twentieth century in Sweden. By the end of WWII, labor shortage was severe enough for the labor unions to agree on pro-immigration policies to increase the supply of migrant workers (Bengtsson et al. 2005).

[6] Though see Prado (2010a) for criticism against the wage convergence between US and Sweden.

Wage growth accelerated after the sluggish 1930s, but it required an active role by the labor unions. The early decades of the century saw thousands of strikes, and especially in 1920s (Enflo and Karlsson 2019). Collective agreements were set up locally starting already in 1860s, though it took until the early twentieth century to reach agreements with wider scope (Lundh 2004). In 1928, legislation was set up to regulate agreements, negotiations, and conflicts (ibid.). The 1938 Saltsjöbad agreement finally established mutual trust between trade unions and employer organizations (ibid.). After this agreement, there was a considerable compression in the wages across different industries (Prado and Waara 2018). While there is no evidence of this benefiting the unskilled disproportionately over skilled workers, evidence from ongoing work suggests that the unions did benefit low-wage workers more than high-wage workers (Skoglund 2023).

Finally, another explanation for the increased incomes for low- and unskilled workers comes from the demand side. That is, technological change in the early twentieth century may have not been skill biased, but rather deskilling. During the first half of the twentieth century, Taylorism and the Fordist production system were adopted in Sweden, which resulted in the replacement of craftsmen by unskilled workers (Lundh 2004). The United States faced this transition already in the late nineteenth century when skilled blue-collar share decreased relative to unskilled operatives and other laborers (Katz and Margo 2014). In Sweden, the absolute number of artisans was in fact increasing, though in relative terms, their share of the manufacturing employment decreased from above 40 percent to just 25 percent (Heikkuri 2024). Lundh (2004) makes an interesting proposition as to how deskilling may have resulted in increasing the bargaining power, and therefore wages. Because tasks were more standardized throughout an industry, workers had more opportunities to leave their current job for better pay. Furthermore, Lundh argues that because there were no benefits to firm-specific knowledge, the incentive to stay under the same employer was reduced. Under conditions where labor demand is sufficiently high, deskilling may increase incomes through making workers more mobile.

To summarize, while the United States and Sweden exhibited similar declines in skill premium, the drivers were different. According to Goldin and Katz (2008), the massive increase in the supply of skills in a form of high school graduates depressed the wages for skilled workers relative to unskilled. In Sweden, the decrease in skill premium was bottom-led in that the incomes of low- and unskilled increased relatively faster than high- and medium-skilled incomes. In particular, production workers were benefitting from strong

income growth relative to agrarian or white-collar workers, which is likely a result of trade union activity. Unlike the United States, where trade union activity remained limited and its peak short-lived, trade unions reached long-term agreements together with the employer unions. These agreements formed the basis of the collective bargaining model, known as "the Swedish model", that prevailed throughout 1930s until 1970s.

6. Conclusion

Supply and demand for skills can result in a widening gap between different worker groups. During the early twentieth century, industrial countries saw great technological advances but at the same time, wage compression and general improvements in working conditions (Frey 2019). For Goldin and Katz (2008), the answer to the decrease in skill premium in the presence of accelerating skill-biased technological change is increased supply of skills. But as they make their case of the American exceptionality, they downplay the supply of skills in Europe. This raises the question: if the supply of skills was lower in Europe, why was there no increase in skill premium? In this paper, I have highlighted other explanations as to why the skill premium could decline, using Sweden as the context. I show that rather than a relative decrease in skilled incomes, it was rather a relative increase of the unskilled incomes that explain the fall in skill premium in Sweden. While there are a number of potential explanations as to why this occurred, I gravitate toward emigration and labor unions. Emigration reduced the number of young adults in Sweden, which reduced the labor supply. Existing evidence suggests that many of them were from working class or farmer origins, and many had described themselves as laborers or domestic servants. In the 1920s, after emigration had slowed down significantly, the labor unions made important achievements toward collective bargaining and solidaristic wage policies. Future research should investigate quantifying the roles of labor supply and institutions on incomes.

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Appendix A. Summary tables and regression output

TABLE A1 *Number of observations by year, skill-level, urban-rural status, and gender.*

	1900	1910	1920	1930*	1940	1950	Total
High	1075	587	1416	16601	1841	3804	25324
Rural	559	124	367	8926	213	267	10456
Male	549	119	335	6975	190	231	8399
Female	10	5	32	1951	23	36	2057
Urban	516	463	1049	7675	1628	3537	14868
Male	491	447	959	6208	1413	3090	12608
Female	25	16	90	1467	215	447	2260
Medium	7119	4346	10877	258179	12738	19438	312697
Rural	4153	1201	4133	199525	2289	3026	214327
Male	4011	1072	3513	173145	1885	2519	186145
Female	142	129	620	26380	404	507	28182
Urban	2966	3145	6744	58654	10449	16412	98370
Male	2603	2594	5307	46706	8073	13180	78463
Female	363	551	1437	11948	2376	3232	19907
Low	2570	3111	10515	194175	14473	20213	245057
Rural	1126	458	3539	132181	2718	2985	143007
Male	1096	413	2496	103824	2136	2274	112239
Female	30	45	1043	28357	582	711	30768
Urban	1444	2653	6976	61994	11755	17228	102050
Male	1288	1699	3856	34101	6754	9614	57312
Female	156	954	3120	27893	5001	7614	44738
Unskilled	2923	2592	9849	164720	8582	10298	198964
Rural	1728	973	5144	134828	2283	2153	147109
Male	1720	938	4608	116781	1779	1697	127523
Female	8	35	536	18047	504	456	19586
Urban	1195	1619	4705	29892	6299	8145	51855
Male	1164	1246	3287	20154	3739	5545	35135
Female	31	373	1418	9738	2560	2600	16720
Total	13687	10636	32657	633675	37634	53753	782042

*) 1930 data from census, Sources: Bengtsson et al. (2021), author's own calculations

TABLE A2 *Arithmetic means of nominal incomes by year, skill-level, urban-rural status, and gender.*

	1900	1910	1920	1930*	1940	1950	Total
High	3365	3744	8933	5787	7288	11018	7068
Rural	2547	3184	7142	5145	5330	10216	5856
Male	2766	3555	8701	6430	6523	11834	6897
Female	960	709	2466	2604	2433	6778	3151
Urban	3773	3978	10069	6361	8238	11344	7778
Male	4188	4290	12473	7691	8638	13733	8836
Female	1453	2142	4587	3642	7538	7055	5300
Medium	1417	1692	4154	2681	3359	6422	3566
Rural	935	1471	3724	2340	2985	5789	3022
Male	987	1500	4147	2703	3326	6339	3343
Female	531	1363	2128	1555	1851	4080	2034
Urban	1728	1837	4433	3004	3575	6744	3932
Male	1847	2042	5050	3441	4011	7682	4336
Female	1039	1081	3041	2146	2713	4997	3010
Low	986	1358	3067	1893	2516	5129	2706
Rural	838	1147	2786	1630	2395	4615	2321
Male	855	1211	3191	1831	2588	5157	2529
Female	610	791	1673	1164	1942	3209	1729
Urban	1099	1486	3240	2153	2590	5409	2978
Male	1167	1675	3767	2437	2959	6276	3349
Female	823	934	2144	1634	1845	3858	2203
Unskilled	808	972	2257	1656	2122	4057	2158
Rural	651	873	2213	1593	1987	3611	1956
Male	672	928	2510	1529	2293	4098	2071
Female	493	654	1550	1709	1285	2695	1693
Urban	927	1041	2287	1727	2229	4352	2322
Male	968	1207	2821	2007	2590	5230	2678
Female	740	709	1637	1280	1642	2990	1722
Total	1505	1756	4129	2692	3359	6292	3551

*) 1930 data from census, Sources: Bengtsson et al. (2021), author's own calculations

TABLE A3 *Full regression output.*

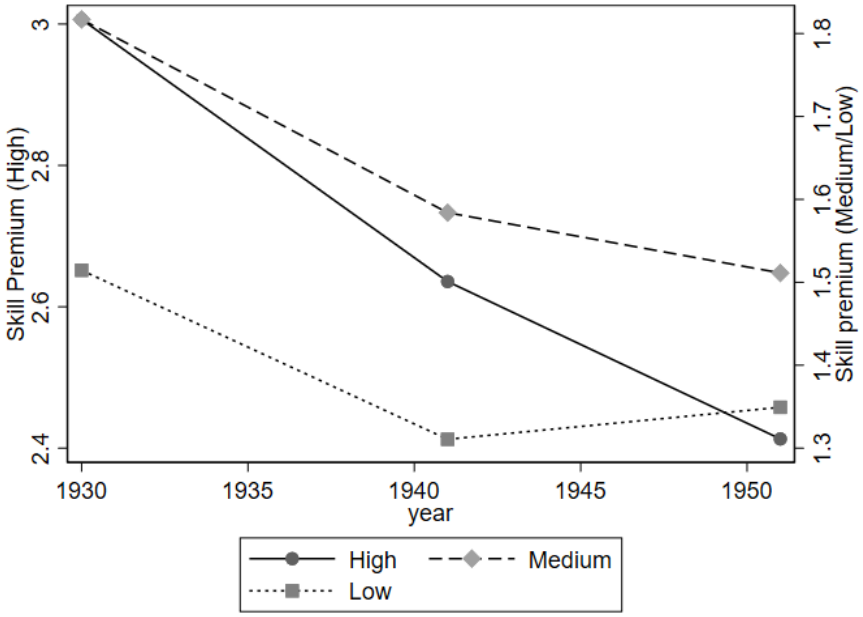
VARIABLES	All	Men	Women	Urban	Rural
Dependent variable	Log income	Log income	Log income	Log income	Log income
High-skilled					
1900	1.415***	1.365***	0.653***	1.679***	1.204***
	(0.0155)	(0.0159)	(0.0808)	(0.0225)	(0.0193)
1910	1.733***	1.714***	0.563***	1.822***	1.716***
	(0.0222)	(0.0219)	(0.114)	(0.0252)	(0.0513)
1920	2.601***	2.616***	1.550***	2.729***	2.461***
	(0.0144)	(0.0139)	(0.0536)	(0.0164)	(0.0331)
1930	2.211***	2.257***	1.459***	2.327***	2.133***
	(0.00558)	(0.00563)	(0.0281)	(0.00910)	(0.00677)
1940	2.372***	2.379***	1.674***	2.473***	2.315***
	(0.0128)	(0.0130)	(0.0474)	(0.0147)	(0.0413)
1950	2.863***	2.852***	2.299***	2.962***	2.851***
	(0.00756)	(0.00767)	(0.0341)	(0.00975)	(0.0285)
Medium-skilled					
1900	0.498***	0.440***	0.323***	0.678***	0.379***
	(0.00611)	(0.00607)	(0.0293)	(0.0114)	(0.00611)
1910	0.708***	0.651***	0.473***	0.799***	0.674***
	(0.00730)	(0.00773)	(0.0293)	(0.0104)	(0.0101)
1920	1.673***	1.648***	1.275***	1.806***	1.556***
	(0.00544)	(0.00535)	(0.0290)	(0.00848)	(0.00739)
1930	1.327***	1.291***	0.979***	1.437***	1.259***
	(0.00391)	(0.00361)	(0.0273)	(0.00721)	(0.00383)
1940	1.484***	1.435***	1.181***	1.593***	1.391***
	(0.00501)	(0.00494)	(0.0282)	(0.00770)	(0.0109)
1950	2.186***	2.149***	1.846***	2.315***	1.988***
	(0.00454)	(0.00430)	(0.0281)	(0.00739)	(0.00963)
Low-skilled					
1900	0.261***	0.201***	0.134***	0.349***	0.211***
	(0.00651)	(0.00648)	(0.0315)	(0.0104)	(0.00770)
1910	0.490***	0.409***	0.246***	0.573***	0.517***
	(0.00700)	(0.00789)	(0.0286)	(0.00945)	(0.0150)
1920	1.480***	1.434***	1.136***	1.556***	1.460***
	(0.00504)	(0.00533)	(0.0278)	(0.00818)	(0.00622)
1930	1.047***	0.974***	0.804***	1.152***	0.977***
	(0.00391)	(0.00362)	(0.0272)	(0.00717)	(0.00384)
1940	1.307***	1.221***	1.026***	1.385***	1.339***
	(0.00454)	(0.00483)	(0.0274)	(0.00752)	(0.00655)
1950	2.078***	2.020***	1.755***	2.167***	2.074***
	(0.00412)	(0.00404)	(0.0273)	(0.00722)	(0.00543)
Unskilled					
1900	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*
1910	0.283***	0.264***	0.00711	0.329***	0.305***
	(0.00493)	(0.00468)	(0.0276)	(0.00813)	(0.00515)
1920	1.231***	1.305***	0.663***	1.275***	1.214***
	(0.00447)	(0.00414)	(0.0275)	(0.00782)	(0.00475)
1930	0.844***	0.865***	0.368***	0.913***	0.786***
	(0.00385)	(0.00354)	(0.0272)	(0.00704)	(0.00376)
1940	1.141***	1.164***	0.723***	1.206***	1.142***
	(0.00433)	(0.00418)	(0.0274)	(0.00728)	(0.00611)
1950	1.910***	1.940***	1.439***	1.975***	1.936***
	(0.00420)	(0.00391)	(0.0274)	(0.00717)	(0.00616)
Female	-0.549***			-0.550***	-0.539***
	(0.00104)			(0.00138)	(0.00156)
Urban	0.321***	0.307***	0.308***		
	(0.000898)	(0.00102)	(0.00167)		
Secondary	0.344***	0.370***	-0.0525***	0.238***	0.361***
	(0.000847)	(0.000860)	(0.00307)	(0.00312)	(0.000987)
Tertiary	0.466***	0.541***	0.0164***	0.387***	0.459***
	(0.000995)	(0.00108)	(0.00281)	(0.00317)	(0.00129)

Other	0.492***	0.454***	0.258***	0.434***	0.482***
	(0.00115)	(0.00114)	(0.00514)	(0.00319)	(0.00146)
Constant	5.970***	5.978***	6.211***	6.280***	6.030***
	(0.00388)	(0.00358)	(0.0273)	(0.00758)	(0.00379)
Observations	782,237	618,108	164,129	267,264	514,973
R-squared	0.804	0.832	0.726	0.791	0.701

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Incomes from Bengtsson et al. (2021), author's own calculations, based on regression model by Federico et al. (2021). See discussion in Section 3 for the model specification.

Appendix B. Gender composition and female skill premium

GRAPH B1. *Female skill premiums in Sweden, 1930–1950.*



Sources: The skill premium for high-skilled on the left axis, and skill premium for medium- and low-skilled on the right axis. All premiums are calculated as the ratio of income for skilled (high, medium, or low) and unskilled income. Source: Bengtsson et al. (2021), author's own calculations.

TABLE B1 *Gender composition in the tax sample.*

	1900	1910	1920	1930	1940	1950
Male	94.4%	80.2%	74.6%	80.1%	60.3%	70.4%
Female	5.6%	19.8%	25.4%	19.8%	27.1%	28.8%
Total	100%	100%	100%	100%	100%	100%

Sources: Bengtsson et al. (2021), author's own calculations.

TABLE B2 *Weights for women by skill*

Skill	1900*	1910*	1920*	1930	1940	1950
High	0.15	0.18	0.27	0.21	0.10	0.13
Medium	0.11	0.18	0.18	0.15	0.19	0.19
Low	0.14	0.17	0.27	0.23	0.33	0.41
Unskilled	0.44	0.36	0.33	0.24	0.32	0.29

Sources: *) Weights from Heikkuri (2024), Bengtsson et al. (2021), author's own calculations.

TABLE B3 *Nominal incomes by skill and gender*

Women						
Skill	1900	1910	1920	1930	1940	1950
High	1209.7	1109.7	2940.1	2586.6	3371.2	6331.6
Medium	861.32	996.57	2210.9	1566.2	2027.3	3968.1
Low	725.56	810.15	1896.4	1303.3	1677.7	3543.4
Unskilled	169.22	241.49	1229.9	858.85	1277.5	2617.6
Men						
Skill	1900	1910	1920	1930	1940	1950
High	3054.5	4177.8	9885.6	6989.5	7813.2	12606
Medium	1167.2	1529.5	4226.4	2701.2	3296.3	6767.9
Low	867.95	1121.3	3111.4	1860.6	2501.8	5656.6
Unskilled	736.83	921.94	2608.6	1674.7	2219.3	4867

Sources: Incomes estimated by regression model specified in Section 3 in the paper. Regression is run separately for women and men, and thus, the dummy-variable for gender is omitted. Data from Bengtsson et al. (2021), author's own calculations.

The incomes by skill are calculated using the incomes reported in Table B3 and employment weights reported in Table B2. The formula for this calculation is specified in Section 5.1 in the paper, and it assumes that the income for any skill is determined by the weighted sum of men and women's incomes. The counterfactual incomes by skill are calculated the same way, except for holding the employment weights constant at the 1900 levels. That is, women's income for any given year is multiplied by 5.6% and men's income by 94.4%. In other words, while incomes are allowed to change, the gender composition is held fixed in the case of counterfactual incomes. The figures reported in Table 5 in the paper are the ratios between the calculated and the counterfactual incomes.

Appendix C. Sectoral composition

TABLE C1 *Sectoral composition by skill.*

	1900	1910	1920	1930	1900	1910	1920	1930
	High-skilled				Medium-skilled			
Primary	0.0%	3.7%	0.0%	0.0%	56.0%	50.2%	43.7%	40.2%
Secondary	12.4%	18.8%	19.2%	37.6%	24.4%	22.4%	28.8%	31.3%
Tertiary	87.6%	77.4%	80.8%	62.4%	19.6%	27.4%	27.5%	28.4%
	Low-skilled				Unskilled			
Primary	22.1%	14.4%	14.0%	10.3%	45.8%	49.8%	49.4%	37.1%
Secondary	53.6%	60.8%	54.1%	52.0%	8.4%	16.2%	23.3%	21.9%
Tertiary	24.3%	24.8%	32.0%	37.7%	21.3%	23.9%	23.1%	38.4%

Notes: "Other" refers to workers without a specified occupation, such as day-laborers. These are likely workers in a rural setting and likely to work occasionally within agriculture. However, the censuses have not classified them under any specific sector. They are all considered unskilled. Data from Heikkuri (2024).

TABLE C2 *Incomes by sector and skill*

				High-skilled		
	1900	1910	1920	1930	1940	1950
Primary	2148.79		16480	8018.34		16872
Secondary	4114.14	5374.89	11643.5	9401.03	8762.69	13297.5
Tertiary	2661.84	3348.38	7537.99	4845.82	5683.98	9815.48
Other			11360	7854.87	25335.6	18581.8
				Medium-skilled		
	1900	1910	1920	1930	1940	1950
Primary	771.874	1051.24	1633.92	1543.36	1213.53	2404.31
Secondary	865.568	1080.35	3051.97	1941.94	2576.29	5437.04
Tertiary	1441.24	1693.24	4165.85	2609.96	3252.64	6362.69
Other	917.263	2249.81	3697.9	2567.55	3629.29	6491.28
				Low-skilled		
	1900	1910	1920	1930	1940	1950
Primary	611.593	667.938	1544.31	1094.51	1342.01	3157.69
Secondary	821.213	1003.42	2793.77	1668.89	2279.47	4918.86
Tertiary	903.849	1124.99	2785.88	1773.82	2342.63	5077.7
				Unskilled		
	1900	1910	1920	1930	1940	1950
Primary	654.407	694.852	1513.69	900.041	1307.48	3150.73
Secondary	749.905	838.907	2540.22	1762.95	2157.2	4473.94
Tertiary	747.002	934.917	1830.41	1310.13	1876.16	3888.17
Other	625.372	776.226	1982.79	1416.01	1845.92	4213.93

Sources: Bengtsson et al. (2021), author's own calculations.

TABLE C3 *Sectoral composition between secondary (manufacturing) and tertiary (service) sectors.*

	'00	'10	'20	'30	'40	'50	'00	'10	'20	'30	'40	'50
	High-skilled						Medium-skilled					
Secondary	22.8	40.7	38.1	24.9	44.4	47.6	50.3	55.9	55.5	56.7	58.6	59.4
Tertiary	77.2	59.3	61.9	75.1	55.6	52.4	49.7	44.1	44.5	43.3	41.4	40.6
	Low-skilled						Unskilled					
Secondary	58.2	44.7	46.4	59.5	42.0	38.4	34.1	43.9	33.5	26.3	29.3	34.4
Tertiary	41.8	55.3	53.6	40.5	58.0	61.6	65.9	56.1	66.5	73.7	70.7	65.6

Sources: Bengtsson et al. (2021), author's own calculations.

TABLE C4 *Counterfactual incomes with fixed sectoral composition (1900)*

	1900	1910	1920	1930	1940	1950
High	100	91	93	98	91	92
Medium	100	103	102	102	102	101
Low	100	98	100	100	100	99
Unskilled	100	101	100	102	101	100

Sources: Bengtsson et al. (2021), author's own calculations. Incomes reflect relative income (1900 = 100) had sectoral composition remained fixed at the 1900 level.

Appendix D. Occupational composition

TABLE D1 *Occupation composition among high-skilled workers.*

Year	Higher managers	Higher professionals
1900	38%	62%
1910	39%	61%
1920	41%	59%
1930	30%	70%
1940	31%	69%
1950	29%	71%

Sources: Bengtsson et al. (2021), author's own calculations.

TABLE D2 *Occupational composition among medium-skilled workers.*

	Relative frequency				
Year	Lower managers	Lower professionals	Foremen	Medium-skilled workers	Farmers
1900	18%	35%	1%	41%	6%
1910	14%	31%	2%	48%	5%
1920	14%	26%	4%	47%	9%
1930	9%	16%	5%	30%	40%
1940	11%	27%	4%	53%	4%
1950	14%	26%	4%	50%	6%

Sources: Bengtsson et al. (2021), author's own calculations. Note: Lower professionals include some sales and clerical workers.

TABLE D3 *Occupational composition among low-skilled workers.*

	Relative frequency		
Year	Clerical and sales	Low-skilled	Low farm
1900	22%	72%	6%
1910	31%	67%	2%
1920	30%	62%	8%
1930	16%	62%	22%
1940	33%	63%	3%
1950	37%	59%	4%

Sources: Bengtsson et al. (2021), author's own calculations.

TABLE D4 *Occupational composition among unskilled workers.*

	Relative frequencies	
Year	Unskilled	Unskilled farm
1900	93%	7%
1910	84%	16%
1920	77%	23%
1930	52%	48%
1940	85%	15%
1950	86%	14%

Sources: Bengtsson et al. (2021), author's own calculations.

Appendix E. Education by broader occupational groups

TABLE E1 *Educational attainment among broader blue-collar occupations in Sweden, 1930*

Broad HISCO category	N	Only Primary	Some secondary
Broadcasting and Sound-Equipment Operators and Cinema Projectionists	26	80.8%	15.38%
Jewellers and Precious Metal Workers	360	82.5%	12.50%
Electrical Fitters and Related Electrical and Electronics Workers	3790	86.5%	5.54%
Stationary Engine and Related Equipment Operators	5464	89.1%	4.83%
Printers and Related Workers	3269	90.4%	4.77%
Machinery Fitters, Machine Assemblers and Precision-Instrument Makers	6887	89.4%	4.52%
Rubber and Plastics Product Makers	156	91.0%	3.21%
Food and Beverage Processors	15933	91.9%	2.87%
Transport Equipment Operators	24124	91.8%	2.73%
Tanners, Fellmongers and Pelt Dressers	1114	95.6%	2.51%
Painters	7403	93.3%	2.26%
Material Handling and Related Equipment Operators, Dockers, and Freight Handlers	17430	94.6%	2.24%
Production and Related Workers Not Elsewhere Classified	932	93.5%	2.04%
Tailors, Dressmakers, Sewers, Upholsterers and Related Workers	26685	94.9%	1.69%
Plumbers, Welders, Sheet-Metal, and Structural Metal Preparers and Erectors	5942	95.7%	1.53%
Cabinetmakers and Related Woodworkers	4478	95.2%	1.25%
Blacksmiths, Toolmakers and Machine-Tool Operators	14054	95.7%	1.07%
Spinners, Weavers, Knitters, Dyers, and Related Workers	19871	96.6%	1.07%
Workers Not Elsewhere Classified	41142	96.1%	0.99%
Bricklayers, Carpenters, and Other Construction Workers	30284	95.9%	0.83%
Metal Processors	8704	97.3%	0.76%
Shoemakers and Leather Goods Makers	8645	95.9%	0.74%
Glass Formers, Potters, and Related Workers	4201	96.8%	0.74%
Wood Preparation Workers and Paper Makers	16033	97.2%	0.56%
Chemical Processors and Related Workers	752	96.8%	0.40%
Miners, Quarrymen, Well-Drillers, and Related Workers	2474	97.9%	0.36%
Stone Cutters and Carvers	10144	97.3%	0.35%
Tobacco Preparers and Tobacco Product Makers	299	97.7%	0.00%

Sources: Census 1930

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