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THE LONG WAY TO GENDER EQUALITY: GENDER PAY DIFFERENCES IN GERMANY, 1871-2021

THERESA NEEF

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WORLD
INEQUALITY
..... LAB

The logo for the World Inequality Lab features the text 'WORLD', 'INEQUALITY', and 'LAB' stacked vertically. The word 'WORLD' is followed by a horizontal row of dots. The word 'INEQUALITY' is followed by a grid of dots that forms a staircase pattern, with the number of dots increasing from left to right and bottom to top. The word 'LAB' is preceded by a horizontal row of dots.

The Long Way to Gender Equality: Gender Pay Differences in Germany, 1871-2021*

Theresa Neef[†]

January 15, 2024

Abstract

This paper provides the first time series of the gender earnings ratio for the full-time employed workforce in Germany since the 1870s and compares Germany's path with the Swedish and U.S. cases. The industrialization period yielded slow advances in economic gender relations due to women's delayed inclusion in the industrial workforce. The first half of the 20th century exhibited a marked leap. In Germany, the gender earnings ratio increased from 47% in 1913 to 58% in 1937. Similar increases are visible in Sweden and the United States. In all three countries, the interplay between increased women's education and increased returns to education due to the expanding white-collar sector fueled pay convergence. Yet in Germany, women's educational catch-up was slowed due to the dominance of on-the-job vocational training. German women's migration from low-paid agricultural work to higher-paid white-collar jobs was predominantly increasing the gender pay ratio. The postwar period brought diverging developments between Germany, Sweden and the United States due to different economic conditions and policy action.

JEL Classification: J16, J31, I24, N33, N34

Keywords: Gender; Labor earnings, Wages; Inequality; Education; Labor force participation; Germany; 19th century; 20th century

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1 Introduction

Germany still exhibits one of the highest gender earnings gaps in Europe. While the EU average stands at 13%, gross hourly earnings in Germany show an average unadjusted gender gap of 18% (EUROSTAT, 2023, year 2021). While gender pay¹ differences are currently the focus of intense academic and policy discussion, only few studies take a long-run perspective despite its potential. Long-run time series and their international comparison can help us answer up-to-date pressing questions in a broader historical framework: Which factors and contexts propel and which hinder gender pay equalization? In which institutional and economic conditions do increasing women's education and labor market participation translate into more pay equality? Which pathways have already increased pay equality and where is still space to act?

Despite research efforts in several countries, Claudia Goldin's (1990) work on the long-run development of the gender earnings ratio in the United States is still the benchmark for understanding gender earnings differences since industrialization. Svensson (2003) and Stanfors and Goldscheider (2017) have added accounts on the development of the gender earnings ratio and the female labor force participation for Sweden.²

This paper presents the first comprehensive long-run time series of the gender earnings ratio for Germany since the 1870s. I relate the observed developments with three key influencing factors: 1) educational convergence between men and women, 2) women's occupational migration from lower-paid to better-paid jobs, and 3) changes in female labor force participation. I compare the German evolution of the gender earnings ratio and its influencing factors with the Swedish and U.S. cases. By adding another country-specific account and discussing the effects of prominent

¹I will use the words *earnings* and *pay* as equivalents throughout this article, while I use *wage* for official statistics providing a pay rate.

²Further time series of gender earnings differences exist for other periods, among others for unskilled workers in England between 1260 and 1850 (Humphries and Weisdorf, 2015), and during the industrial revolution from 1720 to 1850 in Britain (Burnette, 2008). Boter (2017) provides a comparable series to Humphries and Weisdorf (2015) for the Netherlands. Pleijt and Zanden (2021) provide evidence on agricultural earnings differences in Europe from 1300 to 1800. Recently, De la Rosa Ramos (2021) built a time series for teachers, unskilled workers and industrial workers in the 20th century in Mexico.

influencing factors in comparison to Sweden and the United States, I can reevaluate the U.S. benchmark conclusions. The comparison between Germany, Sweden and the United States is exceptionally fruitful as these countries diverge substantially in structural factors such as different speeds of industrialization, cyclical events such as booms and busts and institutions such as differences in the education system as well as in policy action and norms towards working wives and mothers.

For Germany, only scattered evidence on the long-run evolution of the gender earnings ratio exists. Relevant studies either focus on specific occupational or sector groups (Bajohr, 1979; Suhr, 1930; Baldauf, 1932; Gärtner, 2014; Maier, 2007; Ziegler, 2010) or explore gender earnings differences for the entire workforce using microdata, which has been available since the 1970s (e.g. Fitzenberger and Wunderlich 2002; Kunze 2005; Gärtner 2014). Gómez León and de Jong (2019), providing a time series for the gender earnings ratio for the employed workforce from 1900 to 1950, is the closest contribution to this paper. My study goes beyond Gómez León and de Jong's study since I have assembled a substantially more granular earnings database and I contextualize the ratio's development by relating it to crucial influencing factors.

The gender earnings ratio is defined as the share of women's average gross hourly earnings in comparison to men's. I have assembled data on gendered gross earnings from a rich variety of sources. For the period before World War I, I draw on surveys commissioned by professional associations and contemporary research works. For the interwar period, I use data by professional white-collar and agricultural organisations and the first official wage statistics for blue-collar industrial workers. Only the postwar period holds more comprehensive official earnings statistics for a large share of the employed workforce in agriculture, industry and services. This paper is supplemented by an extensive data appendix, detailing all used data sources as well as the assumptions and harmonization strategies applied.³

My final dataset comprises men's and women's average gross earnings for three groups: 1) agricultural workers, 2) industrial blue-collar wage receivers and 2) white-collar workers (salaried personnel) in industry, commerce, banking and insurance. To arrive at a representative estimate of the gender earnings ratio for the entire

³The data appendix is available upon request.

employed workforce, I use the social tables method. The main idea is to weight information on the male and female average earnings of each of the three occupational groups by their relative size in the male and female employed workforce.

I trace gender earnings equality throughout five distinct periods which provided very different environments for working women and their work's valuation in Germany: (I) the era of rapid industrialization from 1871 to 1913; (II) World War I (1914-1918), a time of tumultuous change in the industrial workforce, and the Weimar Republic (1918-1933) with its progressive institutions such as compulsory secondary schooling and strong labor unions; (III) the Nazi reign between 1933 and 1945 in which married women were first urged to leave the labor market but soon demanded in the industrial workforce in the context of the rearmament; (IV) the postwar period in the Federal Republic of Germany between 1949 and 1990 characterized by single-earner households during the intensive child-rearing phase and increasing numbers of married women reentering the labor market thereafter; and (V) the post-reunification period since October 1990 which brought together two countries and populations with different wage levels, gender earnings ratios and skill sets.

The industrialization period since the 1870s yielded slow advances in the gender earnings ratio due to women's delayed inclusion in the industrial workforce in Germany. In contrast, the first half of the 20th century exhibited giant leaps towards earnings equality. In Germany, the gender earnings ratio increased from about 47% in 1913 to 58% in 1937. Similar increases were visible in Sweden and the United States. In all three countries, the interplay between increased women's education and increased returns to education due to women's rapid migration into the expanding white-collar sector fueled the increases in the gender earnings ratio. In Germany, women's educational convergence was less successful compared to the United States. Germany's focus on on-the-job apprenticeships may have posed higher entry barriers for young women into secondary schooling compared to the school education centered system of the United States. While educational convergence predominantly pushed the gender earnings ratio upwards in the United States (Goldin, 1990), Germany's similar increase in the earnings ratio is better explained by women's migration from

low-paid agricultural work to higher-paid white-collar jobs in the context of Germany's late industrialization. The postwar period brought about slower growth in the gender earnings ratio, but a growing participation rate due to the reentry of married women into the labor market. The paths of the United States and the European countries diverged substantially. While Sweden and Germany increased their earnings ratios between the late 1950s and 1980, the United States experienced stagnation from 1950 to 1980 and a rapid catch-up in the 1980s. In the United States, the strong reentry of married women with low work experience depressed the female earnings potential (Goldin, 1990), while Germany's postwar recession delayed married women's reentry into the labor market and slow increases in the gender earnings ratio were observable. Sweden took the lead in terms of gender equality in the 1970s due to a set of policies propelling married women's labor supply, absent in Germany and the United States.

To better interpret the results of this study, it is crucial to understand its blind spots and limitations. Specific to German history is the changing extent of the nation. The territory of Germany from the Reich to reunified Germany underwent several changes from ceding territories after World War I, the annexation of territories by the Nazis and the reshaping of the postwar borders as well as the separation and the reunification of the two Germanys. I estimate the earnings ratio for the respective historical territory of Germany. From 1949 to 1990, my sample only includes the Federal Republic of Germany. Further, my sample population comprises only full-time employees in the private sector and outside of the house. Civil servants, self-employed, assisting family members and domestic servants are not included. Overall, constructing a harmonized time series means combining heterogeneous data sources. Despite carefully harmonizing earnings data and taking care that representativeness is given along geographical and occupational dimensions, the stated estimates remain approximations. Still, they can shed light on crucial historical dynamics.

The article is organized as follows: In section 2, the data, its representativeness, the earnings concept and empirical strategy are laid out. Section 3 discusses the main development of the gender earnings ratio since the 1870s in Germany and

in comparison to the Swedish and U.S. time series. The subsections of chapter 4 take a detailed look at influencing factors of the gender earnings ratio's evolution in international comparison, namely increased education of young women (section 4.1), occupational migration into better-paid jobs (section 4.2) and female labor force participation of married women (section 4.3). Section 5 concludes.

2 Data, earnings concept and representativeness

I construct a long-run time series of the gender earnings ratio which is equal to women's gross hourly earnings W_f across all sectors and occupations divided by men's gross hourly earnings W_m :

$$\text{Gender earnings ratio} = \frac{W_f}{W_m} \quad (1)$$

For most of the 150 years since the foundation of the German Reich, wage and earnings statistics in Germany were published separately for three broad occupational groups across different sectors of the German employed workforce: 1) (blue-collar) agricultural workers, 2) blue-collar industrial workers, and 3) white-collar workers (salaried personnel) in industry, commerce, banking and insurance.⁴ To construct the male and female gross hourly earnings across all occupations in the sample population, W_f and W_m , I apply the social tables methodology. This method was previously used to explore consumption and income inequality of the active population in different countries based on budget and earnings surveys or tax records (Lindert and Williamson, 2016; Milanovic et al., 2010; Gómez León and de Jong, 2019). But also Svensson (2003) and Goldin (1990) have applied the key steps of this method to construct male and female earnings and the gender pay ratio of the employed workforce.⁵ The main idea of this method is to compile information on the average earnings of different social or economic groups of the population, in this

⁴Data are available for agricultural workers, (*Industrie-)Arbeiter*, which are blue-collar wage receivers, and *Angestellte* or salaried personnel, which consist mainly of white-collar workers. Throughout the article, I will use white-collar workers and salaried personnel as equivalents. These three main groups had separate insurance schemes and advocacy or labor unions which were the main source of earnings information until the emergence of comprehensive official wage statistics.

⁵See Goldin (1990, p. 64) whose notation I follow.

case, the three occupational groups, and weight these group-specific average earnings by the relative size of each group in the sample population (Gómez León and de Jong, 2019):

$$W_g = \sum_{o=1}^O \phi_{o,g} \cdot w_{o,g} \quad (2)$$

$w_{o,g}$ denotes the gross hourly earnings by gender g of each of the three occupational groups o . $\phi_{o,g}$ indicates the relative share of each occupational group in the female and male sample population, with $\phi_{o,g} = \frac{n_{o,g}}{N_g}$ and $\sum_{o=1}^O \phi_{o,g} = 1$.

To construct the respective weights $\phi_{o,g}$, I use information from the occupational censuses conducted in 1882, 1895, 1907, 1925, 1933, 1939, 1950 and 1961. For 1882, 1895 and 1907, I use corrected census data on the composition of the employed workforce outside of the home provided by Müller et al. (1983).⁶ Since the 1960s, I use comparable information based on the micro census (Statistisches Bundesamt 1964 - 1976 & Statistisches Bundesamt 1977 - 1984). These sources provide gendered information on the labor force by occupation, sector and industry in the main job. I interpolate linearly between census years. From 1984 onwards, I use the Socio-Economic Panel's yearly microdata. This dataset provides individualized earnings information which can be weighted using individual cross-sectional weights (Wagner et al., 2007). The geographical coverage changes with the borders of Germany: The censuses of 1882 to 1907 cover the resident population of the German Reich, the 1925 and 1933 censuses the population of the Weimar Republic excluding Posen, West Prussia, Saarland and Alsace and Lorraine; the census of 1939 comprises the territories of the Saarland again as well as Austria and Sudetenland. The 1950 census comprises the Federal Republic of Germany without Saarland and Berlin, the 1961 one holds the same population but includes the Saarland. The microcensus data since the 1960s represents the resident population of the entire Federal Republic. For more information, see table 4 of the data appendix.

To construct the male and female gross hourly earnings of each occupational group $w_{o,g}$, I compile nominal gross earnings data from a rich variety of sources which

⁶The authors harmonized categories over time and corrected the unsystematic representation of assisting family members in these early years.

range from surveys commissioned by professional associations and for research purposes, contemporaneous academic studies to official wage statistics of the statistical office. For the period before World War I, I mainly draw on surveys commissioned by professional associations and for research purposes. For agricultural workers, I use the detailed data of a survey commissioned by the association of farmers on agricultural workers' earnings across the German Reich in 1873 (von der Goltz, 1875). Later, I can draw on the academic work by Asmis (1919) who assembled agricultural workers' earnings for Prussia in 1849, 1873, 1892 and around 1910 from different previous works. For blue-collar workers' earnings, I rely on the data assembled by (Kuczynski, 1961, 1962, 1963).⁷ In the interwar period, labor unions gained strength or, in the case of agricultural work, were founded. These and occupation-specific associations published detailed wage statistics for agricultural workers (Vorstand des Deutschen Landarbeiter-Verbandes, 1926, 1929) and white-collar workers (Gewerkschaftsbund der Angestellten (GdA), 1931; Glaß and Kische, 1930; Suhr, 1930). Also, the first official wage statistics for blue-collar workers were regularly published during this period (Statistisches Reichsamt, 1930, 1931, 1932, 1929). Only in the post-World-War-II period I can rely on broadly standardized publications by the statistical office of the Federal Republic of Germany (FRG) - foremost the structure of earnings surveys (*Verdienststrukturerhebung*) for blue- and white-collar workers published in the statistical yearbook (Statistisches Bundesamt, 1990) and the salary and wage structure survey in agriculture (Statistisches Bundesamt, 1958a, 1959, 1960, 1961, 1963a,b, 1965, *Gehalts- und Lohnstrukturerhebung*). The structure of earnings survey has not incorporated the newly emerging occupations in the service sector and thus loses in coverage. Therefore, I use SOEP data as soon as it is available. Details on the data sources, coverage and harmonization strategies can be found in the data appendix.

I use actual gross hourly earnings to compute the gender earnings ratio. Gross earnings are defined as all wages and salaries, including the employee's share of social insurance contributions. I exclude overtime supplements in industrial and white-

⁷ Hohls (1991) affirms that "In fact, all [earnings] series for the first years of the German Reich are based on Kuczynski's data", i.e. Desai (1968), Bry (1960) and Hoffmann (1965). Kuczynski assembled his data mainly based on labor unions' data on collectively agreed wages, reports of chambers of commerce and firm data on actual earnings (Hohls, 1991).

collar work which are detailed from the 1920s onwards. The gross earnings concept comprises social supplements such as marriage and child allowances mainly paid by employers to married men because these are usually not separately detailed in publications. I include in-kind payments (mainly board and lodging) to agricultural workers to make their earnings comparable to other occupational groups' earnings. These are often stated in the respective publications and are predominantly based on (stock) market prices (for details, see data appendix table 1).

Before applying the social tables method (equ. 2), several harmonization steps are necessary: 1) a conversion to hourly earnings, 2) in several years, the construction of weighted average female and male earnings across all agricultural or blue-collar industrial workers requires weighting region-specific or industry-specific earnings, and 3) an inflation or deflation when data years for the three occupational groups do not overlap. In the following, I will describe briefly the main steps.

Official wage statistics recorded blue-collar industrial workers' earnings on an hourly basis since 1913.⁸ However, white-collar workers' earnings were presented on a monthly basis and agricultural workers' earnings were paid on a daily basis (free day laborers) or annually based on their yearly contract (agricultural servants). I draw on information on working hours per day and working days per year in the earnings data publications, i.e., for agricultural workers on von der Goltz (1875), Statistisches Bundesamt (1958a), Baldauf (1932) and for white-collar workers on Kaiserliches Statistisches Amte, Abteilung für Arbeiterstatistik (1912), Gewerkschaftsbund der Angestellten (GdA) (1931), Statistisches Reichsamt (1935) and Statistisches Bundesamt (1966-2010). Gender differences in working hours are marginal since my sample only comprises full-time workers.

In the early years of the time series, I have to first construct weighted average earnings $w_{o,g}$ for each of the three occupational groups because the original data source lists earnings for different geographical regions or different industries sepa-

⁸My benchmark concept is average hourly gross earnings. I deviate from this only for the data point of 1873 where I use weekly earnings. Many previous studies discuss collectively agreed wages (Bajohr, 1979; Braunwarth, 1955, for example). Collectively agreed minimum wages can give a good overview of institutionalized differences in pay. However, employers had substantial liberty to go beyond these benchmarks such that the gender pay ratio of actual earnings can draw a different and more precise picture.

rately. For agricultural workers, I construct average gross earnings by weighting earnings information of different provinces and districts (*Regierungsbezirke*) using occupational census data for the strength of the agricultural workforce across districts for 1873, 1913 and the 1920s. Further, agricultural workers comprise different groups. Until 1930 the main groups were day laborers and servants.⁹ I weight their earnings against each other using their share in the agricultural workforce based on data by Baldauf (1932). For blue-collar workers, until the late 1930s, gross hourly earnings are given for different industries respectively. I use the same logic as in equation 2: I construct weighted mean earnings of women (men) in the industrial sector by weighting the industry-specific average female (male) earnings by the share of the female (male) workforce in each industry relative to the entire female (male) industrial blue-collar workforce.

Further, for the early years of the time series, earnings data years for each of the three groups do not necessarily overlap. This is the case for the 1870s where I can draw on agricultural workers' earnings from 1873 but blue-collar workers' earnings of different industries from 1870 to 1880. To construct the gendered earnings for the entire sample, I need to bring together earnings for the same year. Thus, I de- and inflate earnings data to 1873 using the index of living costs by Bry (1960, 325, table A-1). For the years after 1881, I can use the consumer price index provided by Sensch (2008).

My sample population N is restricted to the employed workforce outside the home and in the private sector. I do not include assisting family members, domestic servants outside of agriculture, nor civil servants. I also omit the marginal groups of blue-collar workers in agriculture, commerce and transport due to a lack of earnings information. I only consider full-time employed persons, similar to Goldin (1990) and Blau and Winkler (2018) for the United States. For the postwar period until reunification, the analysis is restricted to the Federal Republic of Germany. Considering the occupational composition of the labor force, my dataset covers about 60% to 80% of the male employed workforce and 50% to 60% of the female employed workforce from 1873 to 1983. From 1984, I draw on SOEP survey data and reach

⁹I omit contracted day laborers as these had to provide labor power of two to three persons of the family and earned a family wage.

a coverage of about 95% for employed men and above 70% for employed women (figure A.1). Before 1900 domestic servants are the blind spot of my sample. Since domestic servants belong to the lowest earnings groups and women were overrepresented in this occupation, my estimate in the late 19th century, when domestic service was an important occupation field for young women, can be seen as an upper bound of the gender pay ratio.¹⁰ Coverage drops in the 1970s, when the structure of earnings survey did not adapt to the newly emerging occupations in the service sector. Therefore, I use SOEP from 1984 onwards.

To ensure robustness, I compare the benchmark time series with alternatives whenever different data sources are available. For the post-WW-II period, I can compare my benchmark series based on the yearly structure of earnings survey (*Verdienststrukturerhebung*) with results from the more comprehensive but irregularly conducted salary and wage structure survey (*Gehalts- und Lohnstrukturerhebung*) for 1951 to 1990. From 1984 to the present day, I compare my benchmark series based on the Socio-Economic Panel with the continuing time series based on the structure of earnings survey. The results are presented in appendix section A.2.

3 The gender pay ratio since the 19th century

This section provides the main results. The first part (subsec. 3.1) presents the German time series of the gender earnings ratio since the 1870s and discusses its evolution in historical context and in light of the gender earnings ratios in the three broad occupational groups. The second part (subsec. 3.2) compares the German series to the Swedish and U.S. cases.

3.1 The German path

Figure 1 shows the gender earnings ratio for full-time employees from the foundation of the German Reich to the present day. I contrast the development of the earnings ratio with the female labor force participation rate as it indicates the selectivity and

¹⁰ Gómez León and de Jong (2019) assume pay in domestic services to be about 30% of average earnings in services.

extent of women actively participating in the labor market.

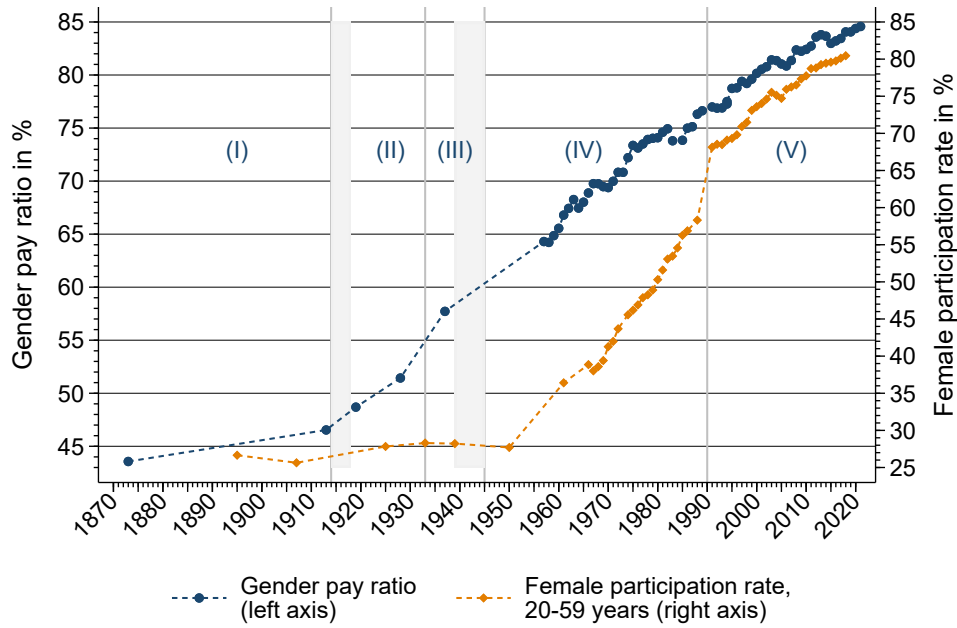
Developments in five periods can be observed: (I) the period of high industrialization, from the 1870s until the onset of World War I, shows stagnation in the female labor force participation and slow increases in the gender earnings ratio. The relative female earnings stood at about 44% in the 1870s and at 47% in 1913. (II) The first half of the 20th century exhibited the most pronounced advances towards earnings equality while female participation in the labor market remained low. The year 1919, in the aftermath of World War I and the November revolution, exhibits an earnings ratio of about 49%, two percentage points higher than in 1913. The Weimar Republic brought about further increases to about 51% in 1928.¹¹ (III) The Nazi period could not stop the upward development of the gender earnings ratio, which reached almost 58% in 1937. (IV) Slower growth characterizes the postwar period in the Federal Republic of Germany. The gender earnings ratio stood at about 64% in 1957, the first year of comprehensive official earnings statistics in agriculture, blue- and white-collar work after the war, and stood at about 76% in 1990. Two more dynamic phases are visible: Between 1958 and 1966¹², and again between 1970 and 1975 the gender earnings ratio increased by approximately five percentage points, respectively. This dynamic slowed down in the 1980s. At the same time, the female participation rate soared in the postwar period. (V) Despite the large economic changes brought about by the political and economic unification of the Federal Republic and the former GDR, the gender earnings ratio continued its longer-term moderate upward trend in the former Federal Republic (West Germany) as well as in reunified Germany since the mid-1990s. Only the participation rate shows a pronounced upward leap after the expansion of the resident population.

The development of the overall gender pay ratio results from developments of gender differences within sectors and the changing valuation of these sectors due to male and female employees' migration across sectors and occupations. Figure 2 shows the gender pay ratio within the three broad occupational groups. While the development of the overall pay ratio shows a relatively persistent upward trend,

¹¹And possibly more until 1932 which cannot be traced here.

¹²This is a period in which Germany just emerged from a severe recession with high unemployment (see figure A.12)

Figure 1: Gender earnings ratio and female labor force participation rate



Source: Own calculations based on sources listed in the data appendix. Female participation rate without assisting family members. Gender earnings ratio of reunified Germany since 1994. Participation rate of reunified Germany since 1991.

the developments within the three broad occupational groups were more volatile. Agricultural workers show the highest gender pay ratio. However, this group also exhibited the lowest average pay, often only about two-thirds of industrial workers' earnings. White-collar workers in services stood at the top of the average earnings hierarchy (see section A.4 in the appendix).¹³

(I) In its **high industrialization period** since the 1870s, the German economy changed its mode of production from small-scale family handcraft businesses to industrial work in many parts of the country. In the first decades, mainly men were drawn to industrial work outside of low-paid agriculture or home-based craftsmanship. Women followed this trend only with a delay around the turn of the century and went from low-paid agriculture into consumption goods industries (Müller et al., 1983). The typical female workers outside of the home were young, single women who withdrew from the labor market and employment outside of the home upon marriage (Willms, 1983a).

¹³I discuss the influence of employees migration between the three occupational groups in detail in subsection 4.2)

(II) Despite the pivotal events of the **first World War** and the November revolution of 1918, the gender pay ratio only increased by about 2 percentage points between 1913 and 1919. World War I brought about temporary increases in the pay ratio in blue-collar industrial work which, however, ceased right after the demobilization (figure 2). While women were overrepresented in low-paid consumption industries (textile, clothing and food) before the war, during wartime the drafting of skilled men to the front decreased the average skill level of male workers, offered opportunities for women to take part in training programs (*Anlernprogramme*) to become skilled workers replacing the drafted men and offered more opportunities for women to transfer to higher-paid, formerly male-dominated heavy industries. Figure 2 shows how the gender pay ratio of blue-collar workers in industry rose from September 1914 to September 1916 and then stabilized. However, as soon as men returned from the front, male workers' skill level rose again and many industrial jobs were reclaimed by them (Bajohr, 1979). The industrial gender pay ratio fell sharply from September 1918 to March 1919 to marginally above the 1914 level. The establishment of the **Weimar Republic** introduced a progressive institutional framework. Labor unions strengthened and established minimum collective wages in agriculture, industrial work and white-collar work. Some scholars highlighted the strong equalization tendencies sparked by the revolution (Karbe, 1928 and Kuczynski, 1963 as described by Bajohr, 1979). However, the collectively agreed minimum wages were still gendered, so that women's minimum collective wages amounted to 60 to 80 % of men's of the same qualification level in industrial work in the 1920s (Bajohr, 1979, 46ff).¹⁴ Also, employers usually went beyond the minimum wages which decreased the pay ratio in effective earnings compared to collective minimum wages. Thus, the November revolution did not provoke instantaneous equalization tendencies. Still, figure 2 shows substantial advances in the gender pay ratio of blue-collar industrial workers and white-collar workers in the 1920s. Overall, the Weimar Republic brought about a higher level of the gender pay ratio within blue- and white-collar work and in the cross-sector gender pay ratio compared to the

¹⁴Gendered pay rates were not only paid under the time wage regime but women also earned less than men under piece rate regimes, thus, for the same work output. Also, Bajohr (1979, 52f.) underlines that qualified women's wage rates (*gelernte und angelehrnte*) did not reach the wage level of unskilled men's in any of the 12 monitored industries in the late 1920s and early 1930s.

prewar period.¹⁵

(III) The **fascist takeover** in the 1930s did not produce substantial changes in the established earnings hierarchies nor did it stop the increase in the overall gender pay ratio. The introduced wage cuts in 1933 applied proportionally to all worker groups and the strict wage controls froze the established pay differences within industries and qualification levels (Bajohr, 1979, 56). “Collective bargaining” minimum wages show a stagnating gender pay ratio from 1933 to 1943 (Bajohr, 1979). Thus, it is likely that the small increase in blue-collar work between 1928 and 1935 that figure 2 suggests happened before 1933. In sections 4.1 and 4.2 I show that an interplay between women’s increased training and migration of young women to higher-paid white-collar jobs are the main drivers of the increase in the gender earnings ratio across occupational groups in the interwar period. This dynamic continued into the Nazi period.

(IV) In the Federal Republic of Germany, the **postwar period** brought about slower increases in the gender pay ratio than before. However, the female labor force participation rate soared. Thus, more and more women participated in the labor market. In this period, Germany introduced several acts that might have propelled gender pay equality, such as the “equal rights act” in the constitution, the “equal pay for equal work” act of 1956 and the inclusion of women’s right to receive equal pay and equal treatment in the workplace into civil law in 1980. However, I share Gärtner’s (2014) conclusion that none of these regulations show a remarkable impact on the development of the gender pay ratio. Also, despite strong labor unions, these did not promote gender pay equality. Gärtner (2014) argues that some legislation was even undermined by employers and labor unions assigning disproportionate importance to physical strength in the construction of collective wage groups. In 1955 so-called *Leichtlohngruppen* were introduced in the industrial sector. These remuneration groups for work that did not require heavy bodywork were at the bottom of the pay scale. More than 80% of female blue-collar workers were assigned to them (Gärtner, 2014).

(V) While **reunification** brought about a marked jump in female labor force

¹⁵This was already pointed out by contemporary scholars based on restricted blue-collar wage data (Karbe, 1928 and Braunwarth, 1955 as cited by Bajohr, 1979, p. 46)

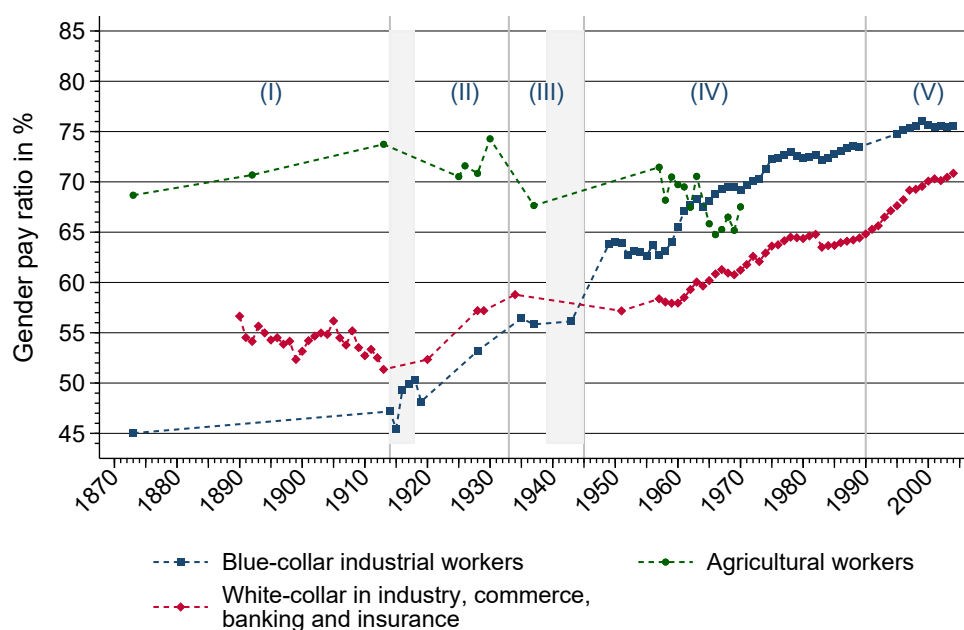
participation, the gender pay ratio does not show a remarkable disruption between the former FRG and reunified Germany as of 1994. This seems counterintuitive given the higher gender pay ratio within East Germany. However, different earnings developments and pay ratios between genders as well as East and West Germans overlap particularly in the early 1990s. Due to the inclusion of lower-paid East Germans in the early 1990s, the reunified earnings distribution widened. Since women are usually overrepresented at the lower end of the earnings distribution, a wider earnings structure decreases the pay ratio (Blau and Kahn, 1996). Hunt (2002) shows how the increase of the gender pay ratio by 10 percentage points in East Germany between 1990 and 1994 is in large part driven by the involuntary exit of low-skilled female workers during the transition that entailed an increasing positive selection into employment for women. This phenomenon is visible in the East German time series in the early 1990s (see figure A.4). From the mid-1990s, we see a stagnating gender pay ratio in East Germany, and only marginally growing pay ratios in the former FRG and reunified Germany. Gallego-Granados and Wrohlich (2020) find a substantial and increasing positive selection bias into full-time employment for women in West Germany between 1990 and 2014¹⁶, which might explain the marginal increases in the pay ratio since the mid-1990s.

All in all, the most dynamic increase in the overall gender pay ratio across occupations and the pay ratios in blue- and white-collar work are seen in the first half of the 20th century. However, only a small number of women participated in the labor market back then. The postwar period brought slower growth of the gender pay ratio, but more and more women (re)entered the labor market and earned a wage or salary.

My results are also in line with gender differences in hourly earnings described by Bry (1960, 12), who finds a gender pay ratio of 58% in 1938 and of 64% in 1958. For the period of 1900 to 1945, Gómez León and de Jong (2019) construct a gender ratio of annual earnings using the social tables method. They find a deterioration of the gender pay ratio from about 59% in 1907 to 53% in 1920. This stands in contrast to my estimate of an increase from about 47% in 1913 to 49% in 1919. For

¹⁶For men, the positive selection bias was smaller but also increased over time.

Figure 2: Gender pay ratios within three broad occupational groups 1873-2004



Note: Own calculations based on data listed in the data appendix. 1950-2004 based on the structure of earnings survey (*Verdienststrukturerhebung*). Reunified Germany from 1995 for blue-collar wage receivers and from 1998 for white-collar salaried personnel. No gendered data available for agricultural workers since 1971 when this group comprised less than 2% of the workforce. Details in the data appendix.

the 1920s and 1930s they estimated a slow but steady increase of the gender pay ratio to 58% in 1937, very similar to my estimate in this year. Given the strong migration of women from low-paid agriculture to higher-paid white-collar work and women's increasing skill levels (see section 4.1 and 4.2), a deterioration of the gender gap seems unlikely for the 1910s. Differences could arise due to the use of yearly vs hourly gross earnings. My estimates on gender earnings differentials are based on more granular data for the different occupational groups, while Gómez León and de Jong include more occupational groups such as domestic servants.¹⁷

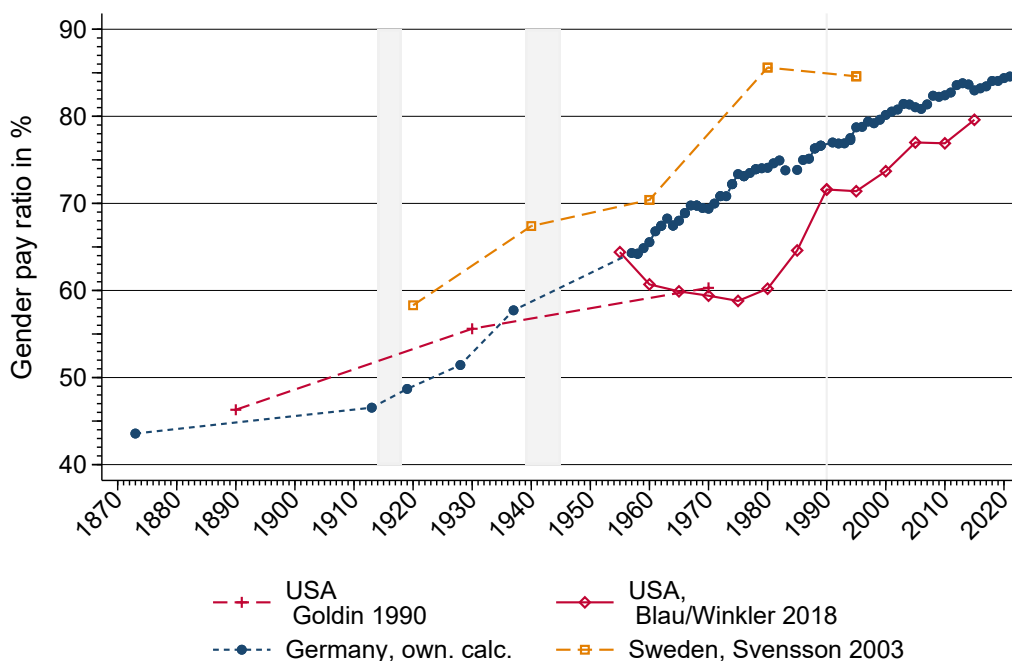
¹⁷Gómez León and de Jong (2019) base their analysis on non-gendered annual earnings from Hohls (1991) and Hoffmann (1965) and weekly earnings from Statistisches Reichsammt (1913-1950). They use gender earnings differentials from Bry (1960). The authors include more occupational groups than those used in this paper. Yet, they use imputations of average earnings levels but also gender differentials for many of these groups. For example, they impute the gender differential in agriculture from industry, while I find a much higher gender pay ratio in agriculture than in industry and a different time trend. The pay ratio in agriculture decreased with the rising mechanization and specialization in the postwar period whereas the pay ratio in industrial work rose.

3.2 International comparison

Comparing the German case to the U.S. (Goldin, 1990; Blau and Winkler, 2018) and the Swedish (Svensson, 2003) experiences uncovers similarities in developments and influencing factors before 1945 and quite substantial divergences in the postwar period.

In all three countries, the gender pay ratio rose substantially between 1890 and 1940. Despite different timings, the benchmark narrative of Goldin (1990) for the United States broadly holds for all countries: the leap towards pay equality can be generally linked to a substantial entry of young women into better-paid white-collar and service jobs propelled by a broader access of young women to secondary education. However, in the German case, vocational on-the-job training instead of general secondary schooling was the main educational channel (see section 4.1).

Figure 3: Germany's gender pay ratio in international comparison



Note: Germany and Sweden (Svensson, 1997) are based on average hourly earnings. Gender earnings ratio of reunified Germany since 1994. Goldin (1990) 1890-1970 constructed the weighted average of annual earnings of six occupational groups. Blau and Winkler (2018) show the median gender pay ratio of annual earnings. Gender pay ratio of full-time employed. More details in data appendix table 5.

The postwar period shows significant dissimilarities between the United States and the European experiences. In the United States, the gender pay ratio stagnated from the 1950s to 1980 and fell substantially behind the European developments.

However, in the 1980s women overtook men in college completion rates, entered the labor market as high-skilled employees, chose the career path and increased the gender pay ratio by over 10 percentage points in just one decade (Goldin et al., 2006).

In Germany and Sweden, the upward trend of the gender pay ratio started in the early 1960s and stagnated after 1980. However, also between the European countries, the gender pay ratios diverged in the postwar period. In 1960, Germany's gender pay ratio stood at almost 66%. Sweden's pay ratio was only marginally higher at 70% in 1960 but quickly took off thereafter so that Sweden became the world leader in gender equality in the labor market by 1980. The narratives about how the Swedish equality miracle happened diverge: The main narrative for Sweden's swift equalization proposes institutions, particularly the strong power of the labor unions, wage policies, and ideological change as the main levers. The 1960s and 1970s were the heyday of the labor unions' solidarity wage policies. Unions and employers agreed upon the abolishment of gender-separated collective wage groups and instituted the "equal pay for equal work" norm in the 1960s. Additionally, Sweden changed to a system of separate taxation for spouses in 1971. Lastly, it massively expanded public affordable childcare in the 1970s and ran a campaign to boost acceptance for working mothers and public childcare (Svensson, 2003; Gärtner, 2014). Gustafsson and Löfström (1991) conclude that about 50% of the observed increase in the gender pay ratio in industrial work can be attributed to policy action. Gärtner (2014) names diverging gender norms concerning the social acceptance towards working mothers as one of the main factors for the observed differences between Sweden and Germany. Svensson (2003) challenges these narratives by pointing out that the upward trend emerged before the introduction of the discussed policies. He claims that the increase in the gender pay ratio already took place between 1960 and the mid-1970s and was fueled by an excess demand for unskilled female labor in the Swedish industry which seized after the structural crisis of the 1970s.¹⁸ He concludes that market forces and not institutions have propelled the equalization process of the postwar period.

¹⁸Svensson (2003) assumes fixed relative earnings throughout this period.

4 Potential drivers

The labor and gender economics literature has highlighted several “traditional” factors influencing the gender earnings ratio over the 20th century, such as differences in education and work experience, female labor force participation, occupational, industry and firm segregation, the gendered division of labor within families and discrimination (Blau and Kahn, 2017).¹⁹ This section discusses three key influencing factors of the gender earnings ratio in the past 150 years in comparison between Germany, Sweden and the United States: 1) educational expansion, 2) occupational and sectoral segregation and how migration between sectors and occupations influenced the relative female earnings, and 3) labor force participation, particularly of married women.

4.1 Education

Educational expansion and women’s catch-up with men’s educational attainment has been discussed as one of the main drivers for the convergence of men’s and women’s earnings from a historical perspective (Goldin, 1990; Blau and Winkler, 2018; Goldin and Polachek, 1987). In the U.S. benchmark case, women benefited from two waves of educational expansion since the late 19th century: First, due to the expansion of high school education in which women swiftly overtook men in the early 20th century (Goldin, 1990) and second, when women overtook men in college graduation in the 1980s (Goldin et al., 2006). While the expansion in women’s secondary schooling coincides with an increase in the gender earnings ratio in all three countries in the early 20th century, the effect of the tertiary education expansion on the pay ratio is only clearly visible in the United States.

During the first decades of the 20th century, women’s increasing secondary schooling was met with the expansion of the white-collar sector in all three countries. This broadened employment opportunities for skilled women and increased returns to education. While Goldin (1990) emphasizes that the rising gender skill

¹⁹In recent years, factors such as gender norms, differences in psychological attributes (e.g., risk aversion) and noncognitive skills are getting more attention to understand the still remaining unexplained part of the gender earnings gap better (Blau and Kahn, 2017).

and earnings ratios within the white-collar sector were the predominant factors increasing the overall earnings ratio across occupational groups, for Germany educational convergence was slower and this channel less potent. Migration between the three broad occupational groups better explains the increasing gender earnings ratio (as I show in subsection 4.2). This might be due to differences in education systems between these countries. While the secondary schooling expansion in the United States and Sweden took the form of school education, in Germany this expansion took place in vocational on-the-job training, i.e., apprenticeships complemented by part-time vocational school attendance. Despite laws obliging youths of all genders to attend a secondary school (incl. vocational schools), the educational convergence was much less pronounced in Germany than in the United States. Based on the human capital model and the theory of statistical discrimination, I argue that the observed difference in educational gender convergence between both countries can be made comprehensible by these differences in the education system.

The secondary schooling expansion happened quite parallelly in Germany, Sweden and the United States in the first decades of the 20th century. In Germany, changes in trade regulations (*Reichsgewerbeordnung*) before World War I extended compulsory vocational training to female industrial workers.²⁰ The Weimar Constitution of 1919 postulated compulsory attendance of a secondary school, including vocational schools, until the age of 18 years. These policy changes had the potential to increase women's education. However, their effectiveness is debated due to a loss of parliamentary majorities in 1920 and the lack of standardization across federal states (Flora, 1975; Herrmann, 2006, 111). In the decades following the reforms, women's numbers and their share in the male-dominated part-time vocational schools and the newly emerging full-time vocational schools increased (figure 4, panel a). The United States were the front-runner in the expansion of generally educating secondary schools in the early 20th century. The so-called high school movement increased the coverage of secondary schools throughout the country. Between 1910 and 1940, the secondary schooling rate of 18-year-olds increased from 9% to 50% (Goldin and Katz, 2009). In 1927 Sweden passed an educational reform

²⁰Novelle der Reichsgewerbeordnung vom 27.12.1911, §111.

opening public secondary schools for young women and thus effectively broadened their educational attainment.²¹

This increase in educational attainment was met in all three countries with a swift expansion of service and white-collar occupations which increased returns to education for these young, trained women,²² while returns to education beyond literacy remained marginal in blue-collar work (Goldin, 1990, 106). In Germany, the share of women in white-collar office and sales jobs tripled from 1895 to 1939 (see section 4.2, figure 8). In the United States, white-collar office work was the single most important occupational group among white women after 1930.²³ In Sweden, new work opportunities for skilled female workers opened not only in the emerging commercial sector but also in the public sector, which only opened for female employees after an administrative reform in 1923 (Svensson, 2003).

While the secondary schooling expansion in the United States and Sweden took the form of school education, in Germany vocational on-the-job training expanded. The most common way of becoming a skilled worker in the late 19th and for most of the 20th century was by obtaining an apprenticeship in a firm, often accompanied by attendance of a part-time vocational school. However, in the early 20th century only very few young women could access this track (Mayer, 1999, 39f.). This observation can be interpreted along the lines of a model of statistical discrimination (Barron et al., 1993) based on the human capital model (Becker, 1964): In school education, which was heavily expanded during the U.S. high school movement, students (and the schooling institution) bear the costs of education. Germany's apprenticeship model is centered around on-the-job training, in which employees and employers

²¹Female graduates increased their share "from 35% to 45% in lower secondary school and from 25% to 32% in upper secondary school" between 1913 and 1940 (Svensson, 2003).

²²Goldin and Polachek (1987) argue that these increased returns to education were crucial for the increase in the gender earnings ratio between 1890 and 1970. Goldin (1984) also shows for the United States that both developments did not solely run parallel but about one-third of the occupational shift in the female labor force from manufacturing jobs to office work was due to increased high school education which provided the necessary skills to enter these jobs.

²³The most affected cohort of U.S. women born between 1900 and 1920, did not only have higher skill levels but entered office jobs in greater numbers often directly after high school and stayed longer on their jobs than previous cohorts, even after marriage, increasing their work experience. These women were also the first cohorts that came back to the booming labor market of the 1950s and 1960s in large numbers and shaped the pattern of increasing labor force participation over the life cycle (discussed in section 4.3).

jointly bear the costs. In such an arrangement high turnover is particularly costly for employers (Becker, 1964). Working women in the first half of the 20th century commonly quit their employment upon marriage, i.e., on average at the age of 25 years (figure A.11). In a model of statistical discrimination, employers who perceive women on average as less stable employees with a higher quit rate than men would rather invest in young men with longer employment horizons to increase the returns to their offered on-the-job training and sort women into jobs that require less training (Barron et al., 1993). This could explain why women had little access to this path in the early 20th century.

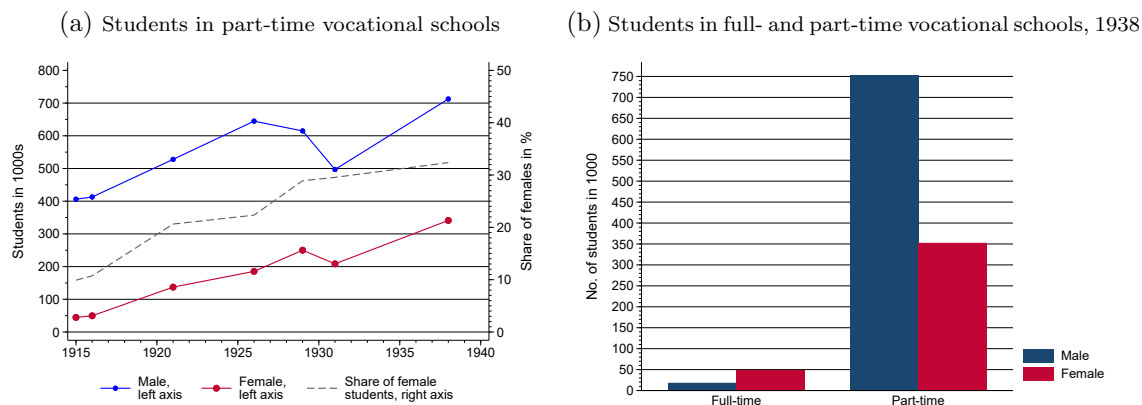
The emergence of new school types and policy changes in the early 20th century had only limited potential to change this. First, the Weimar Constitution of 1919 postulated compulsory attendance of a secondary school for all youths irrespective of their gender but did not change incentives for employers to offer more apprenticeships to women. Still, women's share in the formerly male-dominated part-time vocational schools (which were the complement to apprenticeships) tripled from 10% in 1915 to 31 % in 1938 (figure 4, panel a). Second, as a substitute for the male-dominated path, full-time vocational schools for women, mainly focusing on commercial education or housekeeping tasks, emerged in the first decades of the 20th century (Herrmann, 2006). The rise of these full-time schools may have decreased women's entry barriers to on-the-job training by providing school education for which the costs were entirely borne by students. Young women constituted the majority in this track of full-time vocational training. Nonetheless, these schools were until 1938 still marginal compared to part-time vocational schools (Herrmann, 2006 and figure 4, panel b). General secondary schooling (*Abitur*) levels remained low in the interwar period (fig 6).

This rather sluggish increase in women's secondary education stands in stark contrast to the United States where women outperformed men in high school graduation already in the first decades of the 20th century (National Center for Education Statistics (NCES), 2023)²⁴ The country-specific dominance of firm-centered

²⁴Already in the 19th century, women outperformed men in high school graduation since men usually entered the labor force earlier. Yet, women's advantage only gained relevance with the expansion of secondary schooling, when a substantial fraction of the population could access high school education. (National Center for Education Statistics (NCES), 2023; Goldin and Katz, 2009).

vocational training may have inhibited women’s catch-up with men in secondary schooling in Germany compared to the United States and Sweden.

Figure 4: Female and male students in part-time and full-time vocational schools (Berufsschulen)

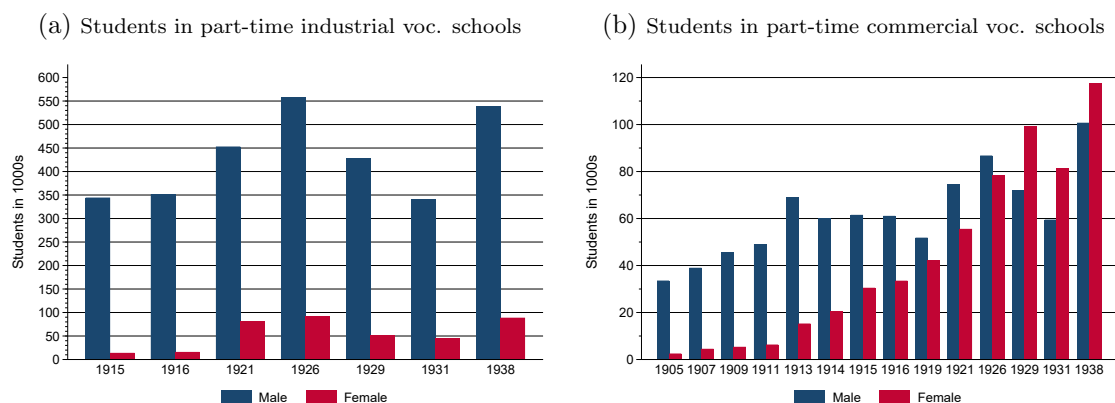


Source: Own visualizations based on Herrmann et al. (2021) and Herrmann (2006).

Also, it may have had long-run implications beyond the interwar period: A strong specialization concerning the schooling content remained in Germany, while high school education in the United States was more general, even though not completely gender-neutral. While women overtook young men in the attendance of commercial schools transmitting training for sales and office personnel or attended vocational household tracks, solely installed for women to become kindergarten teachers, professional housekeepers or housewives, men stayed throughout in the majority in industrial schools, training for specific skilled occupations in blue-collar work (figures 5 and A.5). This may have reinforced the long-term strong gender segregation observed in the German labor market (Müller et al., 1983).²⁵

²⁵Willms (1983b) argues that women have never entered typically male-dominated occupations and industries in larger numbers, but have always entered traditional or newly emerging “womens’ jobs”.

Figure 5: Female and male students in part-time commercial and industrial vocational schools (Berufsschulen)

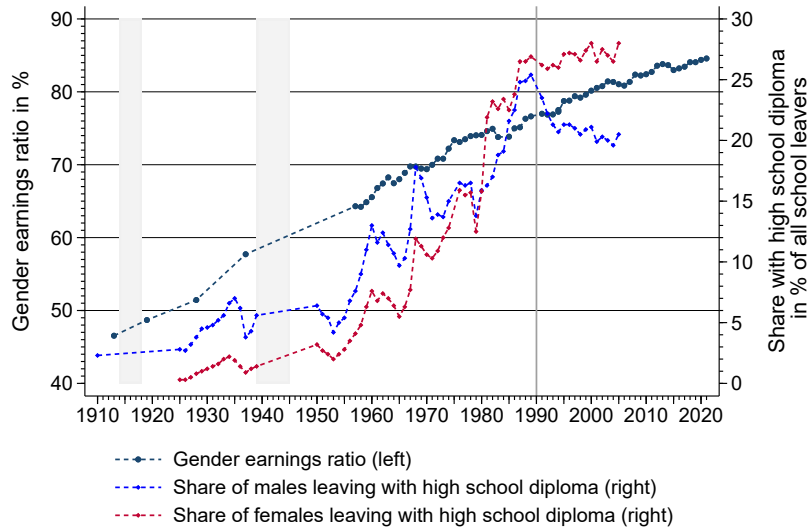


Source: Own calculations based on Herrmann et al. (2021) and Herrmann (2006).

Vocational schools dominated the German schooling system long into the post-war period. General secondary schooling (*Abitur*), allowing for the attendance of universities, only increased late in the postwar decades. In Germany, women overtook men in high school graduation in the early 1980s (see figure 6) and in university enrollment only in the 2010s (figure A.6 and Destatis, 2023). In the United States, the gender pay ratio saw an unprecedented increase of more than 10 percentage points in the 1980s linked to a second wave of women’s educational expansion. Young U.S. women overtook men in college enrollment rates in the 1980s, chose more career-oriented majors and significantly increased their presence in managerial jobs (Goldin et al., 2006; Blau and Kahn, 2017). A second wave of educational expansion and its effect on the gender earnings ratio comparable to the United States is neither visible in Germany nor Sweden in the postwar period. It remains open for further research if this is due to the later expansion of general secondary and tertiary schooling in Germany or different complementary factors.²⁶

²⁶Since the German vocational training system heavily relied on apprenticeships in firms, labor market conditions could influence the training level of the (female) population significantly. In an economic downturn with high unemployment, the availability of apprenticeships decreases. Müller et al. (1983, p. 97ff.) illustrates this by pointing out the declining training level of cohorts entering the market for apprenticeships in the 1940s and early 1950s. These cohorts wanted to enter vocational training in the economic recession of the late 1940s and early 1950s. Due to a lack of apprenticeships, particularly women of these cohorts exhibited a lower average training level.

Figure 6: Female and male school graduates with high school diploma



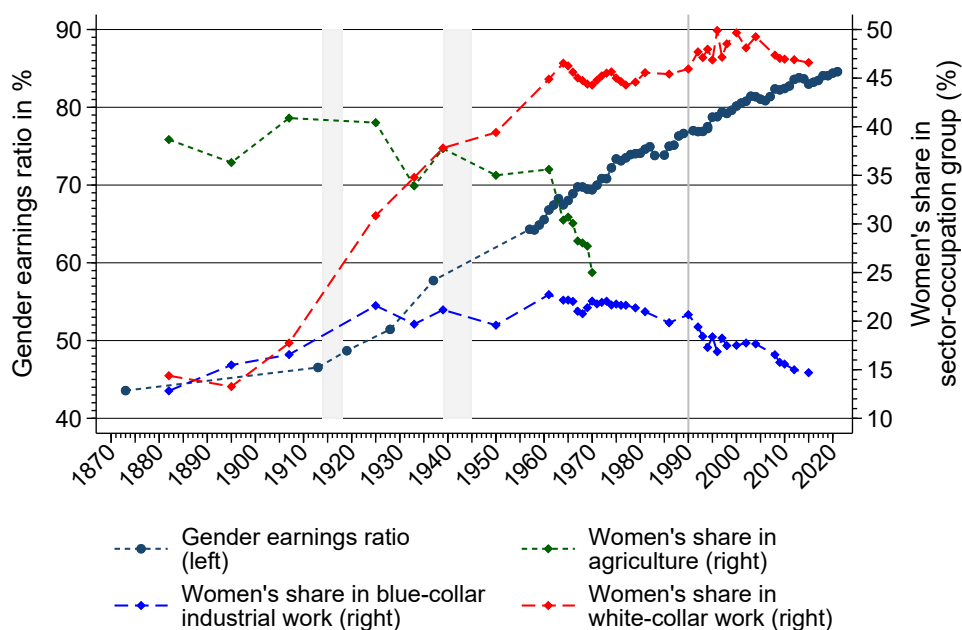
Source: Gender earnings ratio based on own calculations; reunified Germany since 1994. Education series are own visualizations based on data by Rahlf (2015), reunified Germany since 1991.

4.2 Sectoral and occupational migration

While pay ratios within the three broad occupational groups developed differently (figure 2), the trend of the gender pay ratio across occupational groups has been increasing throughout the 20th century. One potent lever for this development was the migration of women workers from low-paid occupations, especially in agriculture, to higher-paid jobs in blue- and white-collar work. Figure 7 contrasts the share of women among all workers within the agricultural sector, blue-collar industrial work and white-collar work in industry, commerce, banking and insurance respectively (right axis) with the development of the gender pay ratio (left axis). Women moved out of agriculture at an increasing pace since the beginning of the 20th century. Women’s share in blue-collar work already peaked in the interwar period and never exceeded more than 23% of the blue-collar industrial workforce. The predominant development is the rapidly increasing share of women in white-collar work from 1895 to the 1960s.

As already touched upon in section 4.1, scholars agree that the strong increases in the gender earnings ratio in the first half of the 20th century were produced by the interplay between increased training in white-collar related tasks and the ex-

Figure 7: Women as share of all agricultural, industrial blue-collar and white-collar workers

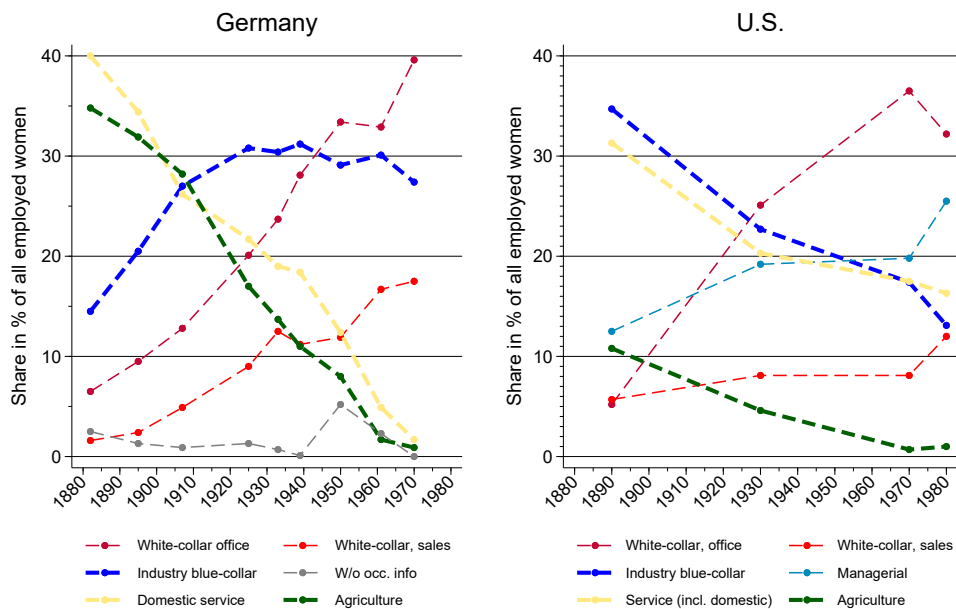


Gender earnings ratio based on own calculations, reunified Germany since 1994. Sector-occupation data based on own calculations using Müller et al. (1983), Statistisches Reichsamts (1926-1943), Statistisches Bundesamt (1960-19), and Statistisches Bundesamt (1976-1997), reunified Germany since 1992.

pansion of the white-collar occupations. Many young women were drawn to these new jobs so the occupational patterns of the female employed workforce changed substantially. The main difference between the United States and Germany is the contribution of the factor education and the factor of migration from low-paid to higher-paid occupations for the observed increases in the gender earnings ratio. For Germany, due to delayed industrialization, women’s migration from low-paid agriculture to higher-paid white-collar work dominated the leap of the gender pay ratio from 1913 to 1928. Only thereafter increasing skill and earnings ratios *within* the three broad occupational groups became more important. For the United States, Goldin (1990, tab 3.2.) describes that the increase in the skill ratio and thus the gender pay ratio within white-collar work predominantly drove the increase in the overall gender pay ratio between 1890 and 1930. The difference arose not only because of the stronger educational convergence in the United States but also due to different migration patterns.

Figure 8 compares the composition of the female employed workforce across occupational groups between Germany and the United States. Due to very different databases, categories are not entirely congruent but several differences are clearly visible. The United States industrialized rapidly in the last decades of the 19th century which profoundly restructured its labor force composition. Already in 1890 only about 10% of employed women worked in agriculture, while the largest share of women, above 30%, were employed in industrial blue-collar work, followed by personal service work (incl. domestic service). Between 1890 and 1930, U.S. women migrated from personal service and blue-collar work into office work and managerial tasks, which made up the majority of the female workforce since 1930.

Figure 8: Share of female employment by occupational group



Source: Own visualisations based on Goldin (1990) & Müller et al. (1983). “White-collar office” comprises salaried personnel in industry, as well as in services like education, transport, banking, administration and hospitality for Germany. Sales employees were not split into blue- and white-collar in German data, but can be assumed to be generally white-collar.

Germany industrialized slower than many European countries and the United States (Ogilvie, 1996). Particularly the female labor force remained longer in the traditional and low-paid sectors while men moved swiftly to industrial work (Müller et al., 1983). In 1895 still about 35% of women worked in agriculture and about 40% in domestic service, the lowest-paid occupations of the economy, while blue-

collar work made up about 15% of the female employed workforce. Between 1895 and 1933 the share of the female employed workforce in low-paid agriculture and domestic work halved, while women took on more and more jobs in blue-collar industrial and white-collar office work, which made up more than 50% of the female workforce in 1933.

These migration patterns influence the overall gender pay ratio because they decrease the relative weight $\phi_{\text{culture},f}^{\text{agri-}}$ attached to the lower average female earnings in agriculture $w_{\text{culture},f}^{\text{agri-}}$ and increase the relative weight $\phi_{\text{collar},f}^{\text{white}}$ of the higher average female earnings in white-collar work $w_{\text{collar},f}^{\text{white}}$. Further, average earnings in the agricultural sector were the lowest while blue-collar industrial workers usually stood the middle ground and white-collar service workers received the highest average earnings.²⁷ Thus, German women bridged a larger earnings differential due to their migration from agricultural work to white-collar work than U.S. women mainly leaving blue-collar industrial work for the new white-collar jobs.

This is also confirmed when contrasting results for the United States by Goldin (1990, tab 3.2) with my tentative results for Germany (appendix section A.4). Goldin’s counterfactual analysis affirms that converging earnings between the genders within occupational groups predominantly pushed the overall gender earnings ratio up between 1890 and 1930 in the United States. For Germany, I find that the migration between the three occupational groups had a stronger impact on the overall gender earnings ratio between 1913 and 1928 (table A4).²⁸

All in all, the strong upward trend in the gender earnings ratio in the United States and Germany in the first half of the 20th century can be linked to first, increases in education and second, occupational migration. However, their importance

²⁷See Goldin (1990, tab 3.2., panel A) for the United States and table A1 for my analysis for Germany. It holds that $w_{\text{agriculture},g} < w_{\text{blue-collar},g} < w_{\text{white-collar},g}$. Also, Gómez León and de Jong (2019, Appendix, figure S1.4 - 1.7) show that agriculture exhibited the lowest average earnings followed by industry wage earners (blue-collar) between 1900-1950 in Germany and Britain. White-collar service workers received the highest average earnings. Further, they find that the earnings differences between these groups were more pronounced in Germany than in Britain which suggests a more potent migration channel on the overall pay ratio.

²⁸Between 1913 and 1937, increases in the overall gender earnings ratio benefit relatively equally from increasing within-occupation gender pay ratios and migration across occupational groups. This analysis should be seen as tentative because the reweighting between three very broad categories, comprising a great variety of occupations, cannot deliver more precise results.

for the gender earnings ratio of the employed workforce differs between the two countries. In Germany, due to its late industrialization, the increase in female average earnings due to migration from the lowest-paid sector, agriculture, to more modern and higher-paid jobs in white-collar work increased women's relative earnings predominantly until 1928. Only thereafter, gender skill and pay ratios within the three occupational groups became more important for the development of the gender pay ratio across occupational groups. This stands in contrast to the United States where the increasing gender pay ratio was predominantly propelled by women's increased education and an increasing gender earnings ratio within white-collar work.

4.3 Labor force participation

In this section, I discuss the different evolutions of female labor force participation in Germany, Sweden and the United States. Developments in female labor force participation influence the gender earnings ratio by changing the average skill and experience level of the female workforce.

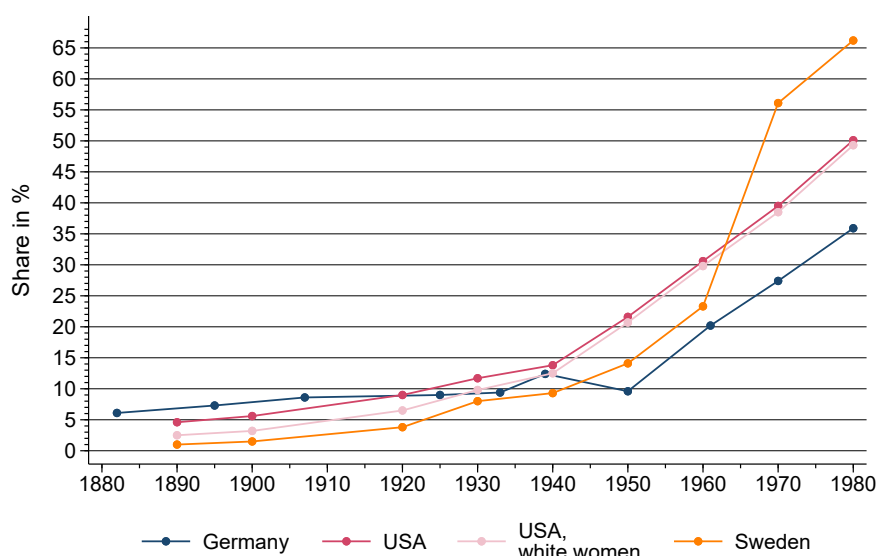
Figure 1 contrasts the development of the gender pay ratio with the labor force participation of working-age women (20 to 59 years). The female labor force participation was relatively stable from 1895 to 1939. This suggests a quite restricted pool of women in the labor market. In the early 20th century, the main female workers outside of the home were young, unmarried women who for the largest part exited the labor market upon marriage in Germany (Willms, 1983a) as well as the United States (Goldin, 1990). The most striking evolution is the strong increase in female labor force participation in the postwar period despite a decrease in marriage age from the early 1950s until the mid-1970s (see figure A.11). The described historical pattern holds true for Germany, the United States and Sweden (figure A.9). But while all three countries exhibited similarly low female labor force participation rates until about 1950, the patterns diverged substantially thereafter.

The most defining event for women's labor force participation was marriage. More than 50% of single women were employed quite stably in Germany between 1882 and 1970 (Willms, 1983a, p. 33).²⁹ The majority of women in the late 19th

²⁹Only with the education expansion in the 1970s, this share dropped due to longer education

and far into the 20th century exited the labor force upon marriage.³⁰ However, married women always constituted the majority of the working-age population. Thus, patterns and changes in their labor market participation had large effects on the overall female labor force participation and the workforce's composition.

Figure 9: Female labor force participation of married women, Germany, Sweden and the United States



Source: Own visualizations based on Müller et al. (1983) and Goldin (1990) and Stanfors and Goldscheider (2017). Without assisting family members. The concept for Germany includes all market based activities including employed blue- and white-collar workers, civil servants, self-employed and service personnel (domestic services & maids).

Figure 9 shows that the labor force participation of married women stood stably below 15% from the late 19th century until about 1940 in all three countries. While many married women worked as assisting family members, work outside of the home was a marginal phenomenon. However, these 10% of married women working outside of the home were likely to have had stable labor market attachments and thus, substantial labor market experience, an important factor increasing the earnings potential (Willms, 1983a). In the postwar period, married women's labor supply increased strongly, but with distinct country patterns. Thus, the gender earnings ratio's evolution in the postwar period was significantly influenced by married women's labor force decisions.

trajectories.

³⁰Goldin (1990, p. 16) emphasizes “marital status, more than any other characteristic save race [...] determined a woman's economic role.” It “provides a clear dividing line for female labor force participation. The majority of women exited the labor force at or just after marriage.”

The postwar period first shows a divergence in labor force participation rates from 1940 to 1950, introducing a wedge of about 10 percentage points between the United States and Germany. The upward trends between the two countries evolve quite in parallel thereafter with increases in the participation rate of around 10 percentage points per decades since 1940 (in the United States) and since 1950 in Germany. Sweden then took the lead in married women's labor force participation in the 1970s. Here, as for the gender pay ratio, discussed in section 3.2, stands the question if this increase was mainly influenced by excess demand for female labor in the industrial sector in the 1960s (Svensson, 2003) or due to policy action (Gustafsson and Löfström, 1991; Svensson, 2003).³¹

What was the crucial difference that created a divide between the labor force participation rates of married women in the United States and Germany and produced very different labor force attachments of parallel cohorts in the two countries? Several explanations for the strong increase in married women's labor force participation are outlined in the literature, mainly focused on the United States: 1) Goldin (1990) shows that rising labor demand in occupations where women were well represented was crucial for the initial shift between 1940 to 1960 and remained important thereafter. 2) Blau and Kahn (2007) show that in later postwar years, when women's average earnings were rising while men's were stagnating, the substitution effect due to increases in female wages outweighed the negative income effect due to increasing husband's earnings on married women's labor supply. 3) Further, labor supply effects due to the expansion of substitutes for home production and better household technology might have made married women's work outside of the home possible. 4) Blau and Kahn (2017) point out that preferences such as a stronger labor market attachment of women and norms might explain the residual part.

For Germany, several scholars argue that gender norms towards mothers reinforced the male breadwinner model in the postwar Federal Republic of Germany (Gärtner, 2014). However, both Willms (1983a) for Germany and Goldin (1990) for the United States find a pattern of increased labor force participation of married women

³¹Policies include the solidaristic labor union policies of the 1960s, the transition to individual taxation of married couples in 1971 and the swift expansion of publicly provided and subsidized childcare for preschool children in the 1970s.

until their first pregnancy in the interwar period. For Germany, Müller (1983, 74f.) argues that married women increased their labor market participation due to the mobilizations of the Nazis. The marriage cohort of 1940 was the first to break the norm of immediate resignation from work upon marriage. For the United States, Goldin (1990) finds prolonged employment beyond the date of marriage emerging with the rise of office work in the 1920s and 1930s. Both authors argue that these cohorts of women, experiencing double-earner households, were the first shaping the newly emerging pattern of married women reentering the labor market after an intense childcare period visible in the postwar period. Thus, the basis for increased acceptance of working wives was set in both countries before 1945. Still, gender norms might have differed between the two countries.

The wedge between German and U.S. married women's labor force participation might be well explored based on Goldin's argument of increased labor demand. For the United States, Goldin (1990, p. 136ff.)³² finds an outward shift in labor demand for occupations in which females were well represented between 1940 and 1960. This happened in the context of an economic boom and a labor squeeze which forced employers to offer more jobs for married women. The increased labor demand was met with an elastic labor supply function of married women. Goldin (1990) concludes that this interplay can explain the largest part of the observed increase in married women's labor market activity.

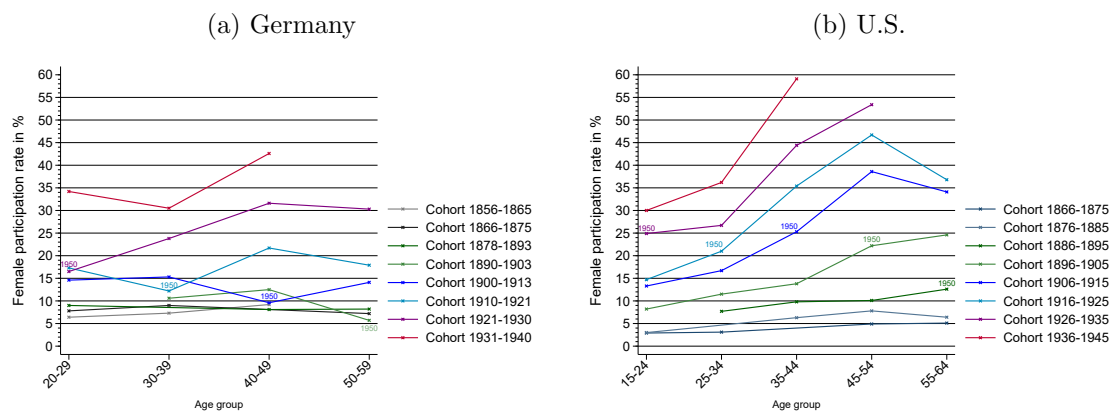
However, the economic conditions diverged fundamentally in Germany in the immediate postwar period. Women of the same birth cohorts in Germany could not reenter the labor market in the early 1950s due to a severe economic crisis with high unemployment of more than 10% (see figure A.12).³³ Thus, the labor demand shift, crucial in Goldin's argument, was substantially delayed in Germany. Only around 1960, the FRG reached full employment and married women reentered more and more the labor market.

To support this argument, figure 10 compares married women's labor force participation over their life cycle between Germany and the United States. A clear difference

³²Goldin builds on Mincer (1962).

³³Willms (1983a) argues that many women who were looking for work were so discouraged by the severe labor market conditions that they declared themselves as housewives despite their ambitions to work outside the home.

Figure 10: Labor force participation rate of married women across the life cycle, Germany and United States



Source: Germany, own calculations based on Willms (1983a). United States based on Goldin (1990, table 2.2). Cohort profiles are constructed from information about certain age groups in different census years. Due to the irregularity of censuses in Germany, cohorts are sometimes broader and slightly overlap.

between the two country patterns centers around the year 1950. While U.S. married women’s labor force participation is higher in 1950 than in their life decade previous to 1950, the opposite is true for all cohorts of German women, whose labor force participation decreases in the life decade around 1950. Thus, the early 1950s have increased labor force participation for U.S. women in all birth cohorts between 1900 to 1935 and may have aided the formation of the distinct pattern of increasing labor force participation over the life cycle in the United States. This means more married women worked in their 30s and 40s than in their 20s - a reversal of the historical stereotype of young working women of the prewar period. Contrary, for Germany, the early 1950s depressed labor force participation of all birth cohorts between 1890 and 1930 in different stages of the life cycle. This suggests that the decreased labor force participation was not entirely due to free choice and norms. It still remains up for further research why this gap between the U.S. and German labor force participation did not close in subsequent decades.

Overall, labor force participation rates of married women increased substantially in Germany, Sweden and the United States since the 1950s. However, the pace and patterns differed. These different patterns may have shaped the average skill and experience level of the female workforce differently and in consequence the evolution of the gender earnings ratio. In the U.S. benchmark narrative, Goldin (1990, p. 24)

argues that due to the strong increase in the labor force participation of married women, who came back to work after a long absence and with low work experience, the average earnings potential of the female workforce was depressed. This translated into a stable gender pay ratio from 1950 to about 1980. Germany similarly shows a strong increase in married women's reentry into the labor market, however, with a delayed onset in the 1960s and a persistent gap compared to the U.S. participation rate of about 10 percentage points since then. If this delayed movement of less experienced women into the labor market exerted less downward pressure on the average experience level of the female workforce and made moderate pay ratio increases possible, is still up for exploration. Sweden's active policy to support married women's labor force participation from the 1970s onwards shortened young mothers' absence from the labor market and thus, the period of skill depreciation. Similar policy action was not visible in Germany or the United States.

5 Conclusion

This article provides the first long-run time series of the gender earnings ratio for the full-time employed workforce from 1871 to 2021, discusses possible drivers of the observed dynamics and compares the German path to the U.S. and Swedish cases. The gender earnings ratio has increased substantially from about 44% in the 1870s to about 85% today. The most prominent leap is observable between 1913 and 1937, while the postwar period was characterized by slower growth.

In international comparison, Germany, Sweden and the United States show similar developments in the first half of the 20th century. In all three countries, strong increases in the gender earnings ratio can be linked to women's educational expansion and higher employment possibilities and returns to education in the expanding office and sales occupations. In the United States, increasing gender skill and earnings ratios in white-collar work were pushing the gender earnings ratio of the entire workforce upwards. German women's convergence in secondary schooling was substantially delayed compared to the United States, likely due to a focus on vocational on-the-job training. While general school education, as in the United

States, posed little entry barriers for women, obtaining an apprenticeship in a firm presented an obstacle for young women often assumed to have a high turnover rate. Thus, education was a less potent lever for the gender earnings ratio in Germany compared to the United States. Due to a delayed emergence of a modern industrial labor market in Germany, young women left the traditional low-paid agricultural sector later than their U.S. peers and directly migrated into higher-paid white-collar work. This was the main lever propelling the gender earnings ratio in the first half of the 20th century in Germany.

The evolution of the gender earnings ratio and labor force participation patterns diverged substantially between Germany, Sweden and the United States in the postwar period. Married women reentered the labor market in greater numbers in all three countries. Due to a severe crisis in the early postwar years in Germany, married women's labor force participation started rising a decade after their U.S. peers. The reentry of married women with little work experience and outdated training has most likely slowed growth of the gender earnings ratio in Germany and brought it to a standstill between 1950 and 1980 in the United States.

It remains open why the United States, despite being the leader in terms of a modern labor market due to a more rapid industrialization and an earlier general secondary schooling expansion, show a similar or lower level of the gender pay ratio than the European countries. One reason might be the higher labor earnings inequality in the United States which mechanically decreases the gender pay ratio (Blau and Kahn, 1996).³⁴ Another explanation may be the overlapping dynamics with the racial earnings gap.

Overall, the German path towards gender earnings equality in the last 150 years was characterized by a delayed emergence of a modern labor market offering higher-paid jobs in blue- and white-collar work for women and a delayed educational convergence between women and men compared to the United States. In comparison to Sweden, the absence of effective policy action to support women's labor supply stands out in Germany.

³⁴The authors argue that the dispersion of the earnings distribution is one crucial factor for international differences in gender pay differences.

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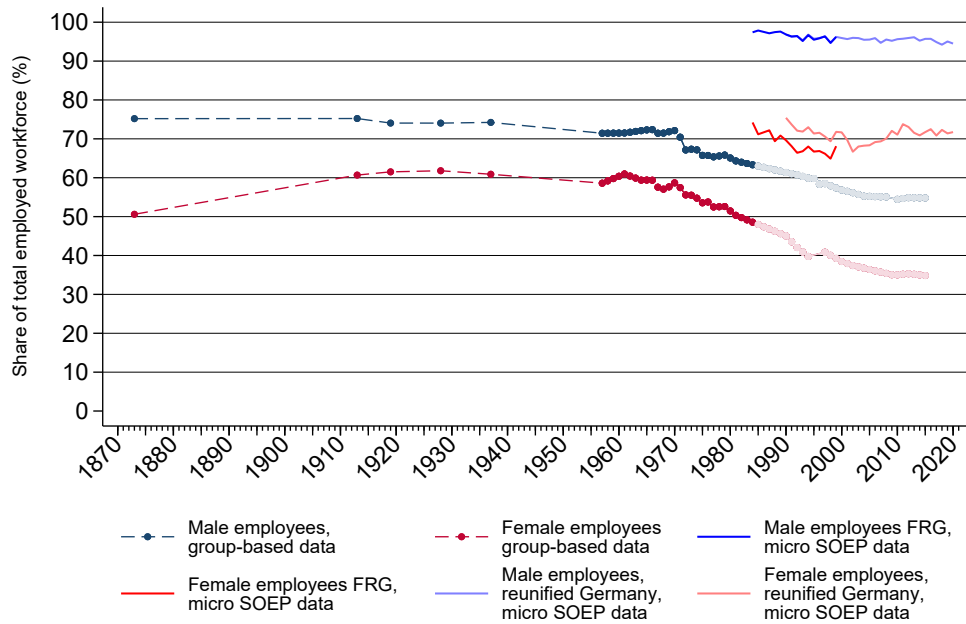
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A Appendix figures & tables

A.1 Data & Method

Figure A.1: Coverage of male and female employees in the assembled earnings dataset.



Note: This graph shows the coverage of the assembled earnings dataset in the employed male/female workforce. It is based on occupational censuses, which are linearly interpolated, and the comparison between the entire employed male/female workforce and the workers groups represented in earnings data, i.e., excluding blue-collar workers in commerce, transport and services, domestic services and agricultural workers after 1970 for published (group-based) data sources due to lack of gendered earnings data. The 1873 data point is estimated using the 1882 census. For the earnings dataset group-based average earnings published in the statistical yearbooks and other publications are used until 1983. SOEP microdata is used thereafter due to its more contemporary scope and comprehensiveness, including a broader range of service occupations.

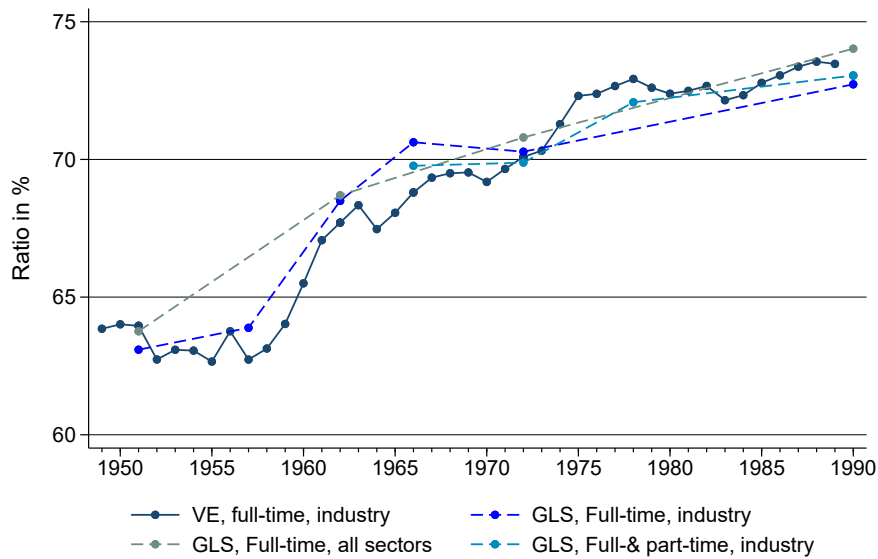
A.2 Robustness

Comparison of the structure of earnings survey (*Verdienststrukturerhebung*) and the salary and wage structure survey (*Gehalts- und Lohnstrukturerhebung, GLS*): To construct the benchmark series for the post-World-War-II period, I draw on the yearly structure of earnings survey (*Verdienststrukturerhebung, VE*). The *VE* is a yearly standardized survey since 1957 for blue- and white-collar workers.³⁵ It is based on earnings totals of specific worker groups. Blue-collar workers' earnings were surveyed in mining, quarrying and industry. White-collar workers were additionally surveyed in commerce, banking and insurance. The *VE* only comprises full-time workers. In comparison, the *GLS* is an individualized survey comprising blue- and white-collar workers in mining, quarrying, industry, commerce, transport, banking and insurance as well as selected services. From 1966 onwards, it comprises part-time workers in several survey waves, which became a prominent group among women from the 1950s onwards. Problematic about the *GLS* are 1) its sporadic availability every six to ten years and 2) its changing composition of industries. Different industries and sectors were surveyed in different waves. Part-time workers were only irregularly included (see data appendix). Figure A.2 shows that the development and level of the gender pay ratio for blue-collar industrial workers is comparable for both data sources.

Comparison with the Socio-Economic Panel (SOEP): From 1984 to 2021, I use the Socio-Economic Panel because of its comprehensiveness. To ensure that this change in the database does not introduce a break in the time series, I contrast this new benchmark with the time series based on the structure of earnings survey (*VE*). Figure A.3 compares the *VE* and *SOEP* series for the Federal Republic of Germany (FRG, West Germany) and reunified Germany. The *SOEP* series connects very well to the *VE* series in the mid-1980s with differences of less than one percentage point. The biggest deviation between the two series is visible from 1989 until 1992 when the gender earnings ratio based on the more comprehensive *SOEP* (including newly emerging service occupations) stands two percentage points higher

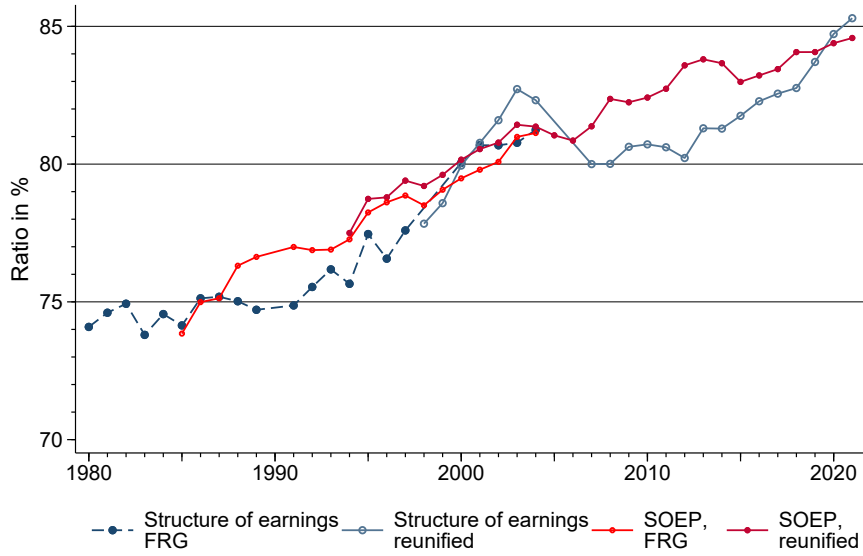
³⁵The statistical office of the FRG took up the methodology already used since Statistisches Reichsamtsamt (1935) in 1946, but first only for blue-collar workers in a small range of industries. (see data appendix for more documentation).

Figure A.2: Gender pay ratio of blue-collar industrial workers based on the structure of earnings survey (benchmark) and the salary and wage structure survey (*Gehalts- und Lohnstrukturerhebung, GLS*)



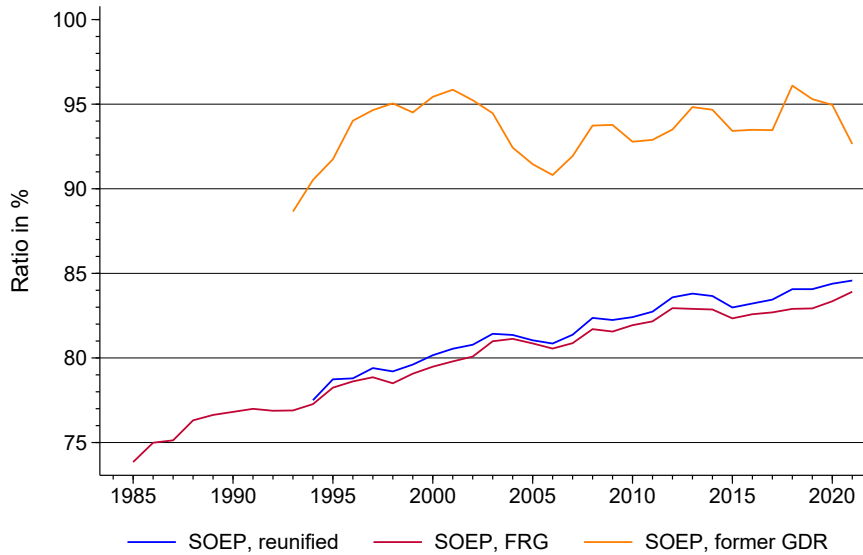
than based on the VE series. Thereafter both series deviate by 1 to 2 percentage points from each other but show the same trend. For reunified Germany, the VE only provides integrated data since 1998 while SOEP has integrated East German data from 1990 onwards. Due to data issues, I use SOEP data for reunified Germany from 1994 onwards. From 1998 until 2006, differences are negligible. From 2007 onwards, the SOEP-based gender pay ratio shows a significantly higher level of about two percentage points. I attribute those differences to the higher coverage of the dataset.

Figure A.3: Gender pay ratio based on SOEP (benchmark from 1985) and the structure of earnings survey.



Note: Restricted to full-time employed, SOEP treated with 3-year-MA process.

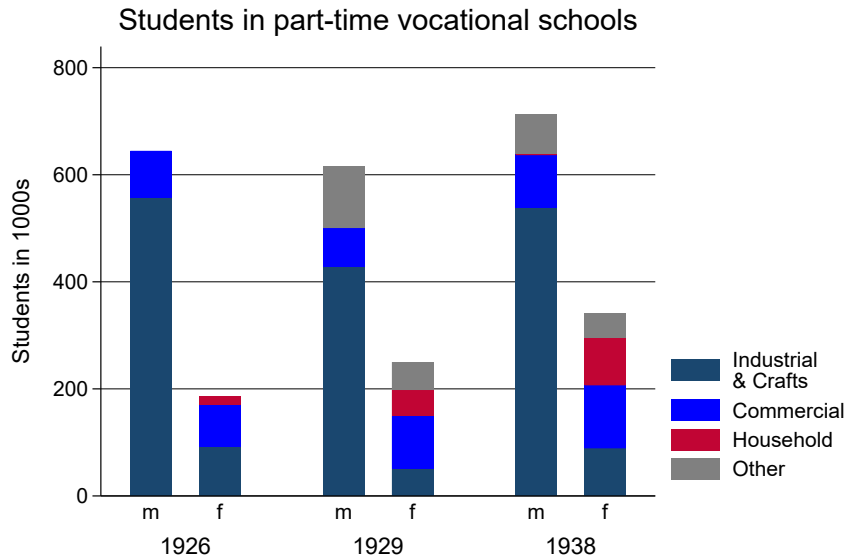
Figure A.4: Gender pay ratio based on SOEP (benchmark from 1985) for former FRG, GDR and reunified Germany



Note: Time series smoothed via a 3-year moving average. The years 1990-1993 were not included for reunified Germany and the former GDR due to a slow roll-out in the former GDR after 1990.

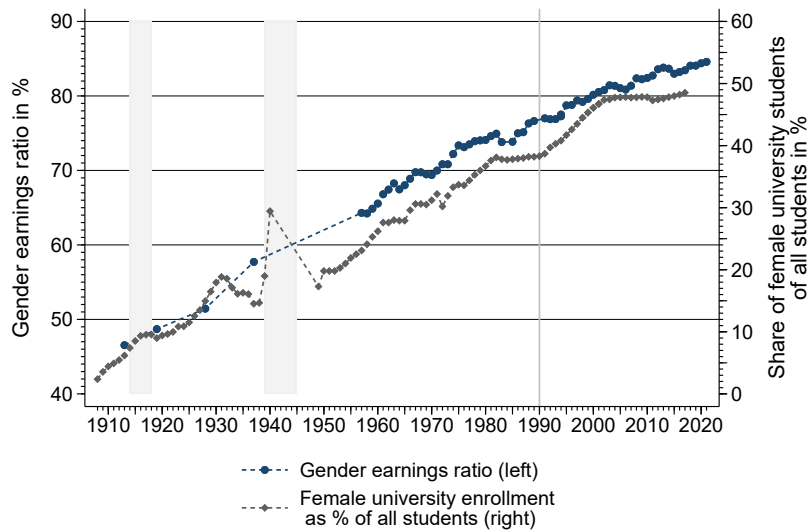
A.3 Education

Figure A.5: Composition of schooling content for female (f) and male (m) students in part-time vocational schools



Source: Own calculations based on Herrmann et al. (2021) and Herrmann (2006).

Figure A.6: Women's share among university students



Source: Gender earnings ratio based on own calculations; reunified Germany since 1994. Education series based on data by Rahlf (2015), reunified Germany since 1991.

A.4 Occupational segregation

Table A1: Gross hourly earnings in current Reichsmark

Occupational group	1913		1919		1928		1937	
	Male	Female	Male	Female	Male	Female	Male	Female
Agriculture	0,20	0,15	1,03	0,72	0,31	0,22	0,40	0,27
White-collar	0,69	0,35	1,79	0,94	1,28	0,73	1,26	0,71
Blue-collar	0,49	0,24	1,69	0,75	1,08	0,56	0,86	0,48

Table A2: Distribution of employees across the three broad occupational groups

Occupational group	1913		1919		1928		1937	
	Male	Female	Male	Female	Male	Female	Male	Female
Agriculture	18,1%	39,6%	15,6%	32,2%	13,6%	23,7%	12,0%	19,3%
White-collar	13,5%	12,9%	16,2%	18,1%	18,3%	25,0%	17,4%	28,6%
Blue-collar	68,4%	47,4%	68,2%	49,7%	68,2%	51,3%	70,6%	52,0%

Table A3: Gender pay ratio within three broad occupational groups

Occupational group	1913	1919	1928	1937
Agriculture	73,7%	70,5%	70,8%	67,6%
Blue-collar	44,0%	44,4%	51,5%	55,8%
White-collar	51,4%	52,3%	57,2%	56,2%

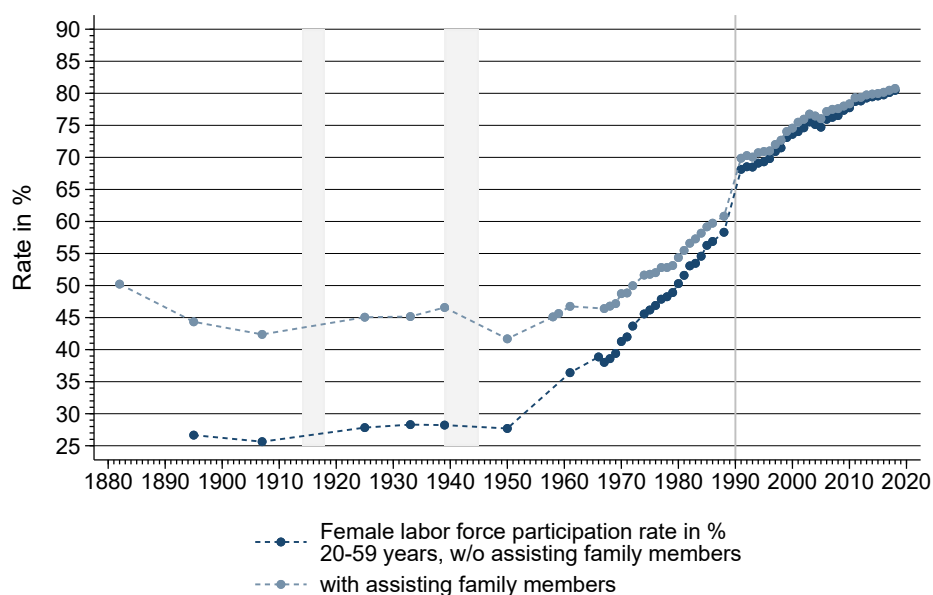
Table A4: Gender pay ratio across all three occupational groups and counterfactuals

	Occupation 1913	Occupation 1919	Occupation 1928	Occupation 1937
Earnings 1913	46,5	48,0	50,3	51,6
Earnings 1919	48,3	48,4	48,9	49,1
Earnings 1928	46,1	48,4	51,4	53,0
Earnings 1937	51,3	53,2	55,9	57,7

Note: This table shows the observed and counterfactual gender earnings ratio across all occupational groups of the sample population. The observed ratio is highlighted in gray. Note that based on equation 2, the female (male) earnings are the weighted average of occupation-specific female (male) earnings. The observed gender earnings ratios are based on the earnings and occupational-group weights of the same year, while for the counterfactuals the year of the occupational distribution and the occupation-specific earnings diverge. Columns keep the occupation and sector distribution constant for the indicated year, while rows keep the gendered average earnings of the occupational groups constant for the indicated year. Holding the occupation-specific average earnings constant at the 1913 level and shifting the occupational distribution to 1928 shows a larger increase than keeping the occupational distribution stable at 1913 and varying the earnings to the 1928 level. Thus in this period, changes in the occupational distribution seemed to have played a more dominant role.

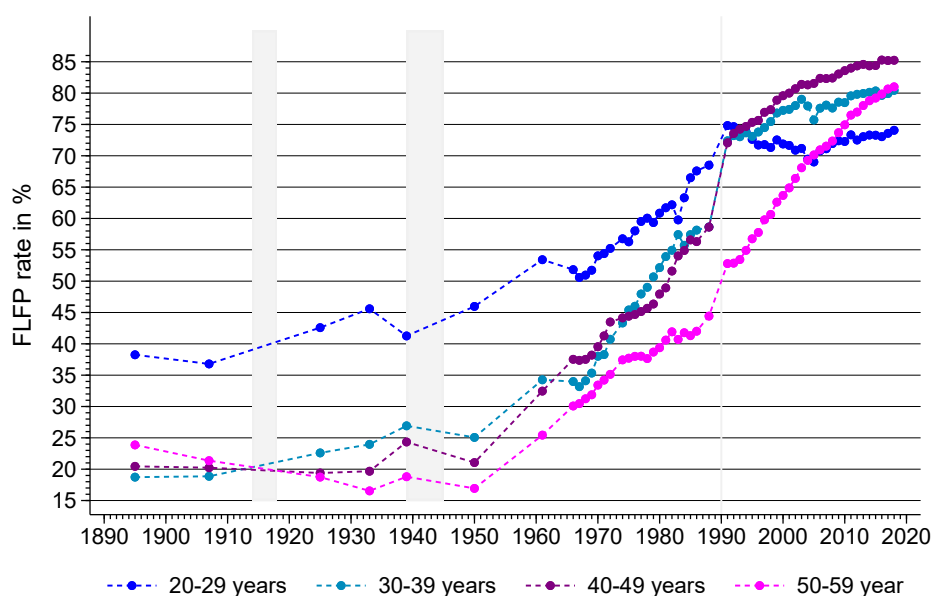
A.5 Labor force participation

Figure A.7: Female participation rate (with and without assisting family members)



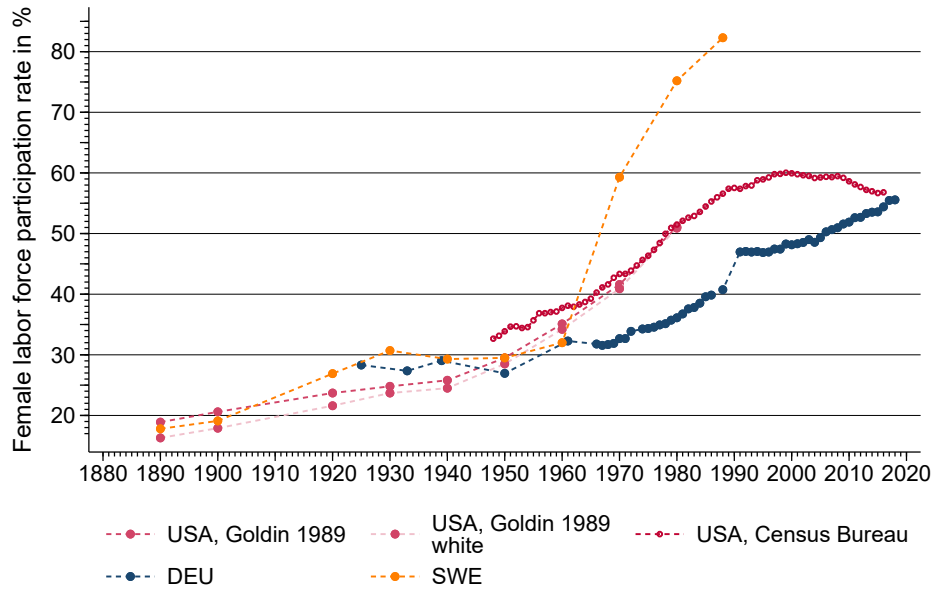
Note: The German occupational censuses included assisting family members. This graph shows the effect of this inclusion. Source: Occupational census (Berufszählung) 1882, 1895, 1907, 1925, 1933, 1939, 1950, 1961, 1970 and thereafter, micro census. Reunified Germany since 1991. For more details, see data appendix. Before 1925 assisting family members were not fully accounted for in the occupational censuses. I use data by Müller et al. (1983) who correct for this.

Figure A.8: Female participation rate by age group (without assisting family members)



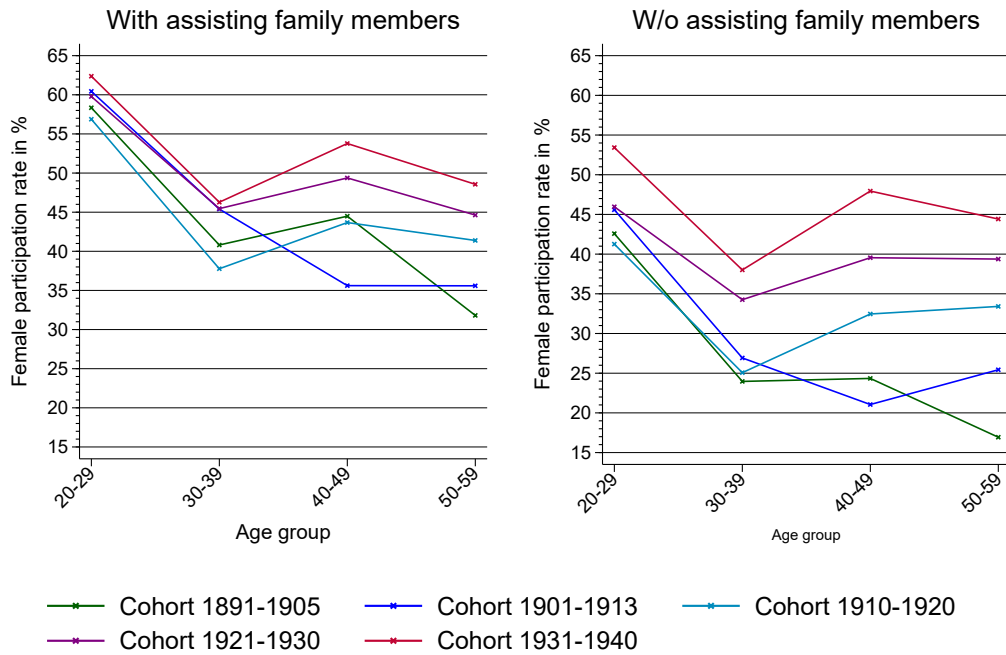
Note: Source: Occupational Census (Berufszählung) 1895, 1907, 1925, 1933, 1939, 1950, 1961, 1970 and thereafter, micro census. For more details, see data appendix. Reunified Germany since 1991.

Figure A.9: Female participation rate in the population of 15+ years (without assisting family members), Germany, Sweden and the United States



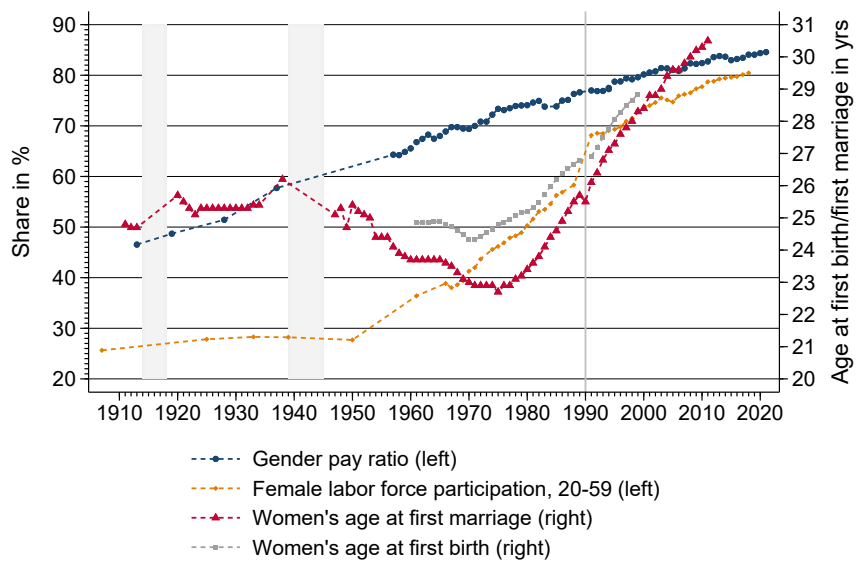
Note: United States taken from Goldin (1990) & Census Bureau. Germany own calculations based on occupational censuses. Share of women in the labor force of 15 years and above. For Germany including employed and unemployed, 1882-1939. Reunified Germany since 1991.

Figure A.10: Female participation rate (with and w/o assisting family members) over the life cycle



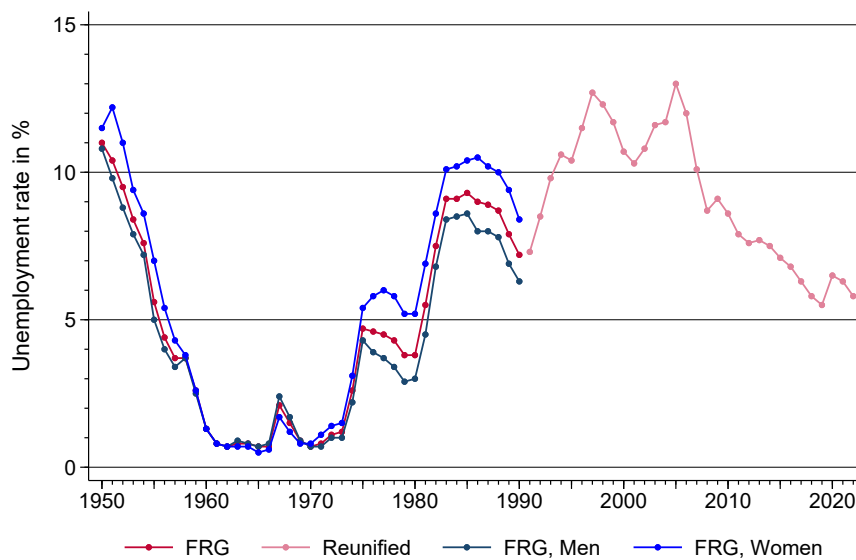
Note: Own calculations based on occupational censuses.

Figure A.11: Gender pay ratio, female labor force participation and marriage age



Note: Gender earnings ratio and participation rate based on own calculations. For data documentation, see data appendix. Participation rate without assisting family members. Marriage age and age at first birth are visualizations based on (Rahlf, 2015). Reunified Germany since 1991 for participation rate, marriage age and age at first birth; since 1994 for gender earnings ratio.

Figure A.12: Unemployment rate



Source: Own visualisation based on Bundesagentur für Arbeit (2023).