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DISCUSSION PAPER

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Wage Inequality Consequences of Expanding Public Childcare

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Family policies are often analyzed at the micro-level with respect to their short-run effects, even though, for female workers, they play a role as labor market institutions. Therefore, this paper assesses the impact of a large expansion of public childcare in Germany on wage inequality. Exploiting regional variation in childcare supply over the 1990s, I show that in regions with stronger increases in childcare, wage inequality among women increased less strongly compared to regions with fewer added childcare slots. This is driven by changes in workforce composition playing a larger role, it is more pronounced in the lower half of the wage distribution and qualitatively similar for full- and part-time workers. Larger expansions in childcare, however, do not contribute to a further closing of the gender wage gap.

Keywords: wage inequality, childcare, gender wage gap

JEL: J13, J16, J21, J31

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I Introduction

A large body of literature documents the impact of changes in labor market institutions on inequality of wages (Fortin and Lemieux 1997). Common examples for such institutions are labor unions or minimum wage regulations. Most of the existing studies focuses on the male part of the workforce since women face a different set of constraints when making decisions on human capital acquisition and labor supply. Almost all constraints women face additionally to men are—directly or indirectly—related to the costs of having children. The impact that children have on female careers is large, long-lasting and well-documented, ranging from direct earnings losses due to maternity leave breaks or part-time work (Angelov, Johansson, and Lindahl 2016; Adda, Dustmann, and Stevens 2017; Kleven, Landais, and Søgaard 2019; Melentyeva and Riedel 2025) to reductions in fertility (Doepke and Kindermann 2019). Consequently, policies that change women's calculus with respect to work and fertility choices play a role as institutions that shape the labor market as well. In this paper, I therefore evaluate which impact a large expansion of publicly provided childcare in Germany had on wage inequality. I analyze both the dispersion of wages among women, but also the gender wage gap as a measure for wage inequality between women and men.

Over the course of the past decades most developed countries have seen striking increases in female labor force participation (Olivetti and Petrongolo 2016). One enabling factor in increasing female labor supply was the expansion of publicly provided childcare, which made reconciling market and household work easier. While a direct effect of childcare on wage inequality (such as observed for union membership or minimum wages) is unlikely, this paper's hypothesis is that easier and more widespread availability of childcare promoted increases in female labor supply, leading to changes in the composition of the female workforce such that in turn inequality in wages was affected as well.

Germany provides a very well suited setting to assess the impact of childcare on wage inequality. Before the expansion of childcare, female labor force participation was relatively low and likely selective. One of the major family policies was parental leave. By granting job protection and benefit payments during leave—both was extended multiple times until 1993—it set incentives for prolonged labor market absence of women after childbirth. When in 1996 Germany introduced the legal right to a slot in public childcare for children of kindergarten age (usually starting at age three until the start of primary school at age five or six), this marked a shift in policy towards promoting labor supply of women, especially mothers, by lowering the opportunity costs of work. Consequently, from the mid of the 1990s onward, the participation of women in the labor market substantially increased—to a large degree due to work in part time—and wage inequality (among both genders) increased as well. To connect these observations, I analyze how the development of wages and wage inequality as well as changes in workforce composition differed between regions with differential increases in public childcare supply. I further decompose the changes in wage inequality within female workers and between genders to show the impact of workforce composition. For most analyses, I distinguish between full- and part-time working women to highlight similarities and differences between both groups.

I use administrative data on wages and worker characteristics along with data on county-level childcare supply to provide the following main findings on the development of wage inequality between 1986 and 2010. First, while wage inequality among women overall increases, stronger regional increases in childcare are associated with smaller increases in wage inequality. In 1986, counties that increase their childcare supply more strongly show the larger levels of wage inequality—this relationship reverses until 2010, i.e. counties with the largest increases in childcare supply then tend to exhibit the lowest levels of wage inequality. This is primarily driven by workers from the lower end of the wage distribution. In 1986, an (at this time future) increase in childcare at the county-level by one standard deviation (or 13.36 additional slots per 100 children) is associated with a p50–p15 log wage gap that is larger by 21 percent of a standard deviation. In 2010, however, the same increase in childcare is associated with a p50–p15 wage gap that is smaller by 8.5 percent of a standard deviation. Second, along with inequality the composition of the female workforce changes as well. In regions with larger increases in childcare supply, more women select into part-time work, female workers are more often from the middle of the education distribution and work in more stable jobs. Third, to quantify the impact of workforce composition wage inequality, I use the DiNardo, Fortin, and Lemieux (1996, henceforth abbreviated as DFL) decomposition to show that stronger regional increases in childcare are associated with larger fractions of the increase in inequality being explained by compositional changes in the workforce (up to 76 percent for full-time working women). This is more pronounced in the lower end of the wage distribution. Among these compositional changes, those that are related to changes in the participation decision appear to be more relevant than changes in the choices of women who already work. Several robustness checks show that these findings are not driven by regional trends or mediated by differential economic performance. Lastly, I move from a within-gender perspective to comparing women and men. The gender wage gap decreases over the observation period. However, in regions with stronger increases in childcare supply, smaller fractions of this decrease can be explained by changes in the workforce composition, i.e. an inverse relationship between inequality and workforce composition compared to within-gender inequality. Taken together, this suggests that an increasing supply of public childcare affected primarily the participation decisions of women with lower earnings potential. Compared with the initial lower end of the female wage distribution, those who provided additional labor were a more positive selection such that inequality among women increased less. At the same time, when comparing with male workers, they were negatively selected such that they only made a small contribution to the reduction of the gender wage gap. For part-time workers, the findings are broadly similar, with the relationship between larger increases in childcare and smaller increases in inequality being stronger.

This paper builds on and contributes to several strands of the literature. A number of studies analyzes the development of wage inequality in Germany, though concentrating on male workers. Dustmann, Ludsteck, and Schönberg (2009) focus on the roles of composition, declining unionization and polarization between occupations, whereas Card, Heining, and Kline (2013) highlight sorting between workers and firms. Dauth, Findeisen, et al. (2022) extend studying worker-firm sorting to assess spatial wage inequality. Dustmann, Lindner, et al. (2022) and Bossler and Schank (2023) analyze the effects of the German minimum wage. While West Germany often is often the sole focus of studies, Brüll and Gathmann (2020) analyze wage inequality in East Germany. With respect to inequality between women and men Antonczyk, Fitzenberger, and Sommerfeld (2010) assess gender wage inequality in Germany focusing on workforce composition and unionization. They and especially the results of Biewen, Fitzenberger, and de Lazzer (2018) put emphasis on personal characteristics such as education or experience in explaining rising inequality. Bruns (2019), building on Card, Cardoso, and Kline (2016), analyzes the growing role of firms for wage setting (among other factors due to the decline in collective bargaining coverage) and the gender inequality contribution of sorting of workers to firms. Drechsel-Grau et al. (2022) combine social security and tax data to calculate inequality series on income of both genders. In comparison to most existing work, this paper focuses on female workers in particular. It is the first to relate wage inequality to a family policy, namely an expansion in public childcare. In addition, it provides the first results on wage inequality among part-time working women who—both during the 1990s and 2000s as well as today—account for a large part of the female workforce. My findings on the gender wage gap highlight the role of selection into work for women (Olivetti and Petrongolo 2008; Mulligan and Rubinstein 2008) and connects that to a change in family policy.

Moreover, I contribute to the literature evaluating the labor supply effects of public childcare expansions. Existing evidence paints a mixed picture with some work finding no or small impacts or effects only for some groups such as single mothers (Havnes and Mogstad 2011; Fitzpatrick 2010; Goux and Maurin 2010; Fitzpatrick 2012), whereas a number of other papers conclude positive effects (Gelbach 2002; Berlinski and Galiani 2007; Lefebvre and Merrigan 2008; Baker, Gruber, and Milligan 2008; Cascio 2009; Nollenberger and Rodríguez-Planas 2015; Carta and Rizzica 2018). Olivetti and Petrongolo (2017) and Albanesi, Olivetti, and Petrongolo (2022) give overviews of the literature. Geyer, Haan, and Wrohlich (2015), K.-U. Müller and Wrohlich (2020), and Busse and Gathmann (2020) provide evidence from Germany on expansions targeted at children below kindergarten age; Gathmann and Sass (2018) analyze an increase in the childcare price. Bauernschuster and Schlotter (2015) provide an important finding on which this paper builds as they analyze the expansion of childcare slots in Germany in the 1990s at the micro-level. They conclude that it led to marked increases in maternal labor supply, both on the intensive and the extensive margin. I extend these findings by looking at the entire wage distribution and address the question how additional women joining the workforce as well as changing behavior of those who were already part of it led to compositional changes and, in turn, affected wage inequality.

The remainder of this paper is organized as follows. Section II introduces the German labor market and policy environment with respect to the changes in family policy and the expansion of childcare supply. Section III describes the data, identifying variation and methods. Section IV explains which effects of additional childcare options on wage inequality can be expected under which circumstances. Section V shows how wages and wage inequality evolved over time and relates that to childcare. Section VI quantifies the role of changes in workforce composition. Section VII turns from within-female wage inequality to the impact of childcare on the gender wage gap. Section VIII concludes.

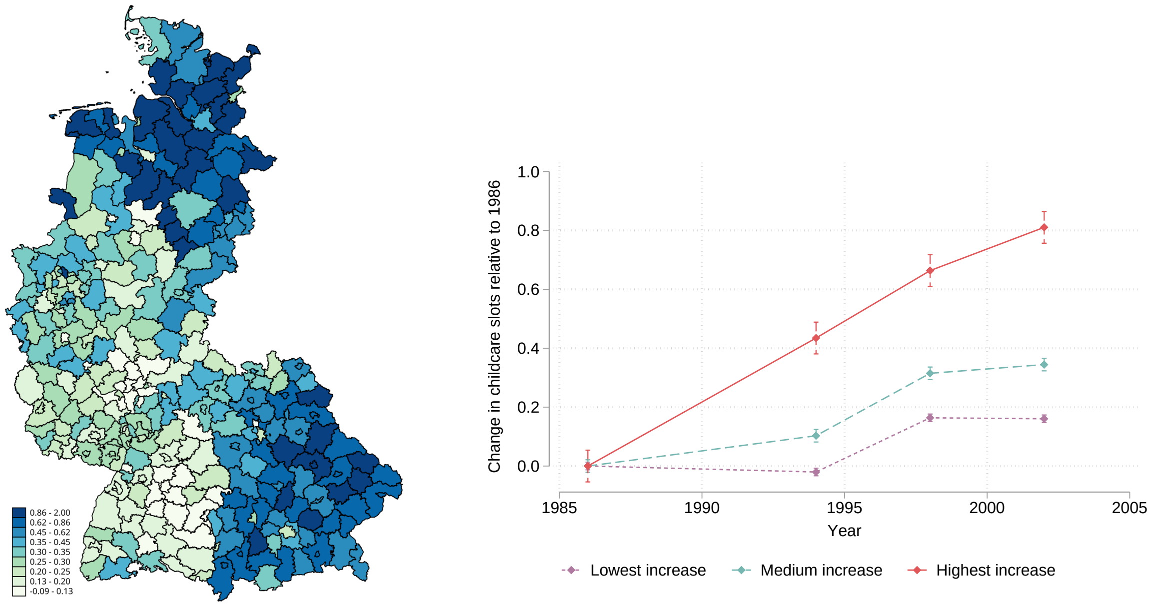
II Developments in the Labor Market and Institutional Background

This sections gives an overview of the relevant changes in the German labor market that affected female labor supply over the 1990s to then introduce this paper's object of investigation, the expansion of public childcare.

Over the 1990s and early 2000s, the German economy and the labor market faced several difficulties until a recovery in the later 2000s. Starting in the mid of the 1990s, we observe marked increases in wage inequality, both for men and for women (Dustmann, Ludsteck, and Schönberg 2009). In 2003 and the following years, Germany implemented a set of labor market reforms intended to foster flexibility of employment (coined "Hartz IV"). Subsequently, the economy recovered and unemployment decreased, which however was not necessarily an effect of these reforms. Dustmann, Fitzenberger, et al. (2014) point instead to the decline in unionization and the share of workers covered by collective bargaining agreements starting in the mid 1990s. By allowing for more decentralized wage setting, this contributed to lower wages, mostly at the lower end of the distribution, which in turn increased competitiveness and contributed to the overall recovery of the German economy.

Female Workers and Changes in Family Policy Against the backdrop of these broad trends, the female part of the workforce experienced additional changes. Most notable is the increasing number of women who entered the workforce, though a substantial fraction of them chose to work in part-time (see also the descriptive statistics in Table 1 as well as Section VI.1).

As women take on the main responsibility for raising children and household work (still today, but even more so in the 1990s), family policies can play an especially important role for female labor supply. Before the expansion of childcare in the mid of the 1990s, parental leave was the arguably most important family policy. Starting in 1979, Germany first introduced six months of job protected maternity leave during which maternity benefits were paid. Multiple reforms extended the duration of both job protection and benefits as well as they introduced eligibility for men, among whom the take-up is, however, small. Between 1993 and 2006, parental leave was in terms of duration most generous offering 36 months of job protection and up to 24 months of benefit payments. The incentives this policy set were ambiguous as, on the one hand, it promotes employer continuity which can be career improving, but, on the other hand, it encourages longer labor market breaks after childbirth that can be harmful for maternal careers through losses of human capital and in unrealized earnings growth. As benefits were paid as lump sums until 2006, their theoretical effect of delaying the re-entry to the labor market is of relatively greater importance for lower earning mothers. Schönberg and Ludsteck (2014) find overall small effects of this policy on maternal labor market outcomes which Findeisen et al. (2023) attribute to the beneficial effect of job protection. An additional reform in 2007 tied the level



(a) Geographical distribution of increase in childcare supply between 1986 and 2002, normalized by 1986 values.

(b) Increase in childcare supply between 1986 and 2002, normalized by values in 1986 and grouped by counties with low, medium and high increases.

Figure 1: Increase in childcare slots per 100 children of kindergarten age between 1986 and 2002.

Notes: The left-hand figure shows the geographical distribution at the county-level of the increases in childcare supply. The right-hand figure documents the increase in childcare supply relative to levels in 1986 along with 95-percent confidence bands. Absolute levels are plotted in Figure A.1 in the Appendix. Childcare supply is measured at the county-level as the number of slots in public childcare for children of kindergarten age per 100 children aged three to five.
Source: Own representation using the county-level data described in Section III.2.

of benefit payments to mothers' pre-birth earnings from which the higher earning mothers gained relatively more.[1]

Contrary to incentives to take longer post-childbirth labor market breaks, the average duration of maternity leave starts to decline for children born since 1994 (conditioning on returning after at most six years of leave, from 2.8 years in 1993 to just 1.7 years in 1998; see Figure A.2 in the Appendix) suggesting that the preferences of mothers started shifting towards an increased willingness to participate in the labor market, even in the presence of small children. The increase in childcare supply, thus, happened in a environment where mothers generally appear to be willing to make use of it.

Expansion of Childcare A further work incentive for mothers was set by the expansion of childcare that this paper uses as its main variation of interest. Starting as of 1996[2], children from the age of three to school entry (which can be between age five and seven, depending on the federal state and the parents' decisions) were granted the legal right to a place in kindergarten. This right entitled children and their

[1] Bergemann and Riphahn (2023) and Kluve and Schmitz (2018) assess the labor market consequences of these reforms, Raute (2019) shows that fertility increased for higher earning women.
[2] The relevant reform changed the social security legislation in the *SGB VIII, Achtes Buch Sozialgesetzbuch*.

parents only to half-day care; full-day childcare options were sparse at that time. As Bauernschuster and Schlotter (2015) point out, the supply with childcare could not meet the demand, such that initially rationing measures had to be implemented. Importantly for this paper, childcare supply was expanded by different extents and at different speed at the regional level. The map in Figure 1a plots the county-level relative increase in the number of available slots in public childcare for children of kindergarten age per 100 children of age three to five between 1986 and 2002, normalized to zero in 1986. It shows that the largest increases were concentrated in Bavaria in the south and Lower Saxony and Schleswig-Holstein in the north. In these regions, the number of available childcare slots on average doubled, in some counties it even tripled. The smallest increases, in some counties slight decreases, can be found in Baden-Württemberg and Hesse. Especially the difference between Bavaria and Baden-Württemberg stands out as in both regions conservative gender norms tend to be more prevalent. This suggests that regional differences in gender norms are unlikely to be a main driver of this paper's findings.

This expansion of childcare had significant effects on maternal labor supply. Bauernschuster and Schlotter (2015) estimate that childcare attendance of the youngest child increases mothers' labor supply. Their participation increases by around 37 percentage points; labor supply on the intensive margin by around 14 hours per week. Their findings at the micro-level underline the substantial effect of childcare provision on mothers' labor market choices upon which this paper builds.

A legal entitlement to care for younger children of age one and above was introduced in 2013. From August 2026 onward, a similar right applies to children of primary school age.

III Data and Methods

This paper uses individual-level, administrative data on workers and combines them with information on the availability and utilization of childcare facilities at the regional level. This section describes the datasets and how they are used.

III.1 Individual-level Labor Market Data

As most work on wage inequality in Germany, this paper relies on the well-established *Sample of Integrated Employment Biographies* (SIAB, Frodermann, Schmucker, et al. 2021; Frodermann, Graf, et al. 2021) provided by the *Institute for Employment Research* (IAB) as the main source of data on workers and their characteristics. The SIAB is a two-percent-sample drawn from the universe of German social security records containing information on the labor market biographies, wages and employers of workers who are subject to social security contributions (i.e. does not include civil servants or the self-employed) for the period from 1975 to 2019. For this paper, I focus on workers in West Germany over the period 1986–2010.

As the data is sourced from notifications by employers to the federal employment agency which do not explicitly consider the data needs for research purposes, some limitations apply.[3] Most relevant for this paper is the treatment of information on part-time work. While the majority of existing studies on wage inequality restricts their samples to those working full time, this paper covers women in part-time as well. Dropping women in part-time work would reduce the sample size substantially as during the 1990s and early 2000s between around 25 to 40 percent of women worked part time. As part-time work among women is a choice that is likely related to circumstances such as the presence of children and the availability of childcare, focusing only on those in full-time work would reduce the overall representativeness of the analysis. To allow for different effects across full- and part-time workers, the analysis treats them separately.

Note, that the indicator for part-time work in the SIAB data has limitations. In 2011, the notification procedure to record workers in part-time has changed. Fitzenberger and Seidlitz (2020) argue that for the period prior to 2011 the share of actual part-time workers was larger than the one identified in the SIAB.[4] In practice, this means that while the full-time sample can include women in part-time work and thus some bias cannot be fully ruled out, the sample of part-time working women likely includes only those who actually work in part-time. There is no indication that the amount of false part-time reports changed substantially over time prior to 2011. Fitzenberger and Seidlitz (2020) compare observed and corrected wage percentiles between 2000 and 2010 finding differences in levels, though no different trends. As this paper primarily focuses on changes in inequality a bias that some full-time workers in fact work in part-time is unlikely to have a large impact on its results.

Beyond the part-time indicator, the SIAB data does not include information on working hours. When measuring how inequality changes over time, this poses the threat that changes in inequality among part-time workers are driven by changes in intensive margin labor supply, such that the missing information on hours constitutes an omitted variable bias. Since this concern cannot be addressed directly with the SIAB, I use survey data from the German Socio-Economic Panel (SOEP) to assess working hours of full- and part-time workers. Figure B.1 in the Supplemental Appendix plots contracted working hours of women in full- and part-time for the sample period between 1986 and 2010. Working hours of full-time workers vary little, both over time and within each year. Part-time workers show a larger spread in hours which is likely to explain some fraction of cross-sectional wage disparity. Over time, however, the variation in working hours does not show substantial changes. Wanger (2020) also documents only small changes in mean working hours of women in part-time and additionally points out that hours changes for part-time workers are often driven by workers in marginal employment, i.e. a group that this study drops from the sample (see below). It is thus unlikely as well that changes in working hours drive changes in inequality.

[3] Further details on the data preparation are given in Supplemental Appendix D.

[4] They also propose a correction which, however, can only be used for workers who are part of the sample in 2012 (i.e. in a year where their part-time status is recorded correctly). As the probability to observe a person in 2012 decreases with greater distance in time and this paper focuses on a period starting in the mid 1980s, this correction cannot be applied.

Table 1: Summary statistics for women in 1986 and 2010.

	1986		2010	
	Mean	SD	Mean	SD
Log daily wage	4.13	0.49	4.25	0.57
Share censored wage	0.02	0.12	0.03	0.16
Age	37.84	11.21	42.26	10.23
Share part-time	0.26	0.44	0.40	0.49
Education (shares)				
no vocational degree	0.24	0.43	0.08	0.28
Vocational degree	0.71	0.46	0.77	0.42
University degree	0.04	0.19	0.14	0.34
Years in employment	7.79	3.58	15.89	8.79
Years in current job	5.70	4.00	7.31	7.03
Occupational tasks (shares)				
Un-/semiskilled	0.11	0.31	0.08	0.26
Skilled	0.80	0.40	0.74	0.44
Complex and highly complex	0.10	0.29	0.18	0.39
Observations	132,550		164,493	

Notes: Summary statistics for women in regular employment, age 21–60 in the years 1986 and 2010. The log of daily wages is given in Euro, inflation adjusted to 2015 as base year. Values for education and tasks that do not add up to 1 within year are due to rounding.
Source: Own calculations using the SIAB data described in this section.

The final dataset is a panel of West German workers in regular employment who are between 21 and 60 years old. Workers in vocational training, marginal employment, interns and others in less common employment relationships are dropped. I chose 1986 as starting point as this is the first year for which data on childcare is available (see Section III.2). I extend the observation period beyond the last data point for childcare (2002) until 2010 to be able to capture long-run effects. These are likely, because initially childcare slots had to be rationed, such that, an immediate effect cannot be expected and as shown by Bauernschuster and Schlotter (2015), the size of the effect of childcare on labor supply increases over time. Both for mothers who intended to utilize it as well as for all women, it takes time to adapt decision making on having children and labor supply. For instance, the duration of parental leave is typically decided on before the birth of the child, thus, the decision needs to take into account the childcare supply around three years before the child can enter kindergarten. Extending the analysis to years beyond 2010 is not possible because of the break in the reporting of part-time work in 2011.

Table 1 provides summary statistics of the SIAB data in 1986 and 2010. Throughout the paper, monetary values are expressed in Euro, inflation adjusted to the base year 2015; wages always refer to log daily wages (including imputations for wages above the social security contribution threshold, see Appendix D). The table points out some of the changes the female workforce underwent over time. Education levels improved substantially. In 2010, only on third of the initial 24 percent of women without a vocational degree remains, the share of women with vocational education increases from 71 to 77 percent and the share of women who own a high school degree more than triples (from 4 to 14 percent). The share of women who work in part-time strongly increased from 26 to 40 percent. In comparison, the German Federal Statistical Office records an increase from 29 to 46 percent during this time period (Statistisches Bundesamt 2023a) which gives an impression of the amount of underreporting in the SIAB data. Contrary to the dataset used in this paper, the data from the Statistical Office additionally include workers above the age of 60 as well as those in marginal employment. These are both groups for whom the part-time share is relatively large. Taking this into account implies that underreporting by the SIAB is even smaller than suggested by the numbers given here.

III.2 County-level Data on Childcare

Since the SIAB data do not allow to observe individual take-up of childcare, I use regional differences in the supply of care for children of kindergarten age as a proxy for individual exposure, comparable with an intention-to-treat approach in a policy analysis setting. The main explanatory variable is the county-level change in the ratio of kindergarten slots to the number of children between age three and five. It is constructed by combining data from the regional database of the German Youth Institute (Bertram, Bayer, and Bauereiss 1993) and the German Federal Statistical Office (Statistisches Bundesamt 2023c; Statistisches Bundesamt 2023b).

Identifying Variation Most analyses in this paper use aggregated county-level changes in childcare supply and relate them to changes in workforce composition and wage inequality. I group the 324 West German counties (*Landkreise*, i.e. the NUTS-3-level) into terciles with 108 counties each. The variable to build the terciles is the increase at the county-level in the number of childcare slots available to children of kindergarten age between 1986 and 2002. It differentiates between three groups of counties, henceforth referred to as *regions*, with low, medium and high increases in their childcare supply. Figure 1b illustrates the relative increase in childcare supply by region. In the low- and medium-increase regions the increase over time amounts to 16, respectively 34 percentage points, with the largest increases between 1994 and 1998. Between 1986 and 1994, childcare supply in the low-increase regions even decreases slightly while it increases by 10 percentage points in the medium-increase regions. The high-increase regions show a steady increase over the entire period of observation, in 2002 it amounts to around 81 percentage points relative to 1986 levels. Note that the regions did not start at equal levels of childcare. Figure A.1 in the Appendix plots the absolute increases in the number of childcare slots by region. It indicates that larger increases are associated with lower initial levels, while in 2002 all regions reached similar levels. The stronger increase in childcare in some regions is thus rather a catch-up process than an overtaking of other regions. On average, a county added 28.3 additional childcare slots.

Apart from these observable initial differences between the regions, there can be unobservable ones. For instance, women's preferences regarding labor supply can differ as well as gender norms of women, their families or of employers. To take them into account, this paper primarily aims to explain changes in workforce composition and inequality by changes in childcare supply. As long as regional differences are constant over time, this approach does not consider them, comparable to a difference-in-differences setting. Partitioning the sample into three regions allows for a sufficiently large number of observations in each region to provide robust graphical results and to calculate DFL weights while ensuring common support between baseline and target year. To provide a further validation of the results that are obtained across regions, I provide additional results at the county-level in Section V.2.

III.3 Decomposition of Changes in Wage Inequality

To quantify the contribution of observable worker characteristics to changes in wage inequality in Section VI.2, I rely on the reweighing approach introduced by DiNardo, Fortin, and Lemieux (1996). This approach allows to construct counterfactual wage distributions that hold the characteristics of the workforce constant at the levels of a given baseline. It decomposes differences between two groups (in this paper's case between two years) into one part, that is due to differences in the characteristics of the groups and into a second—residual—part.[5] Specifically, I use the composition of the workforce in the baseline year $t' = 1986$ to estimate weights ψ_z to reweight the wage distribution in year $t = 2010$ to obtain the distribution of wages that would have prevailed if the workforce composition in terms of observable characteristics z had remained at its baseline level in year t'. Comparing how actually observed and reweighted distributional statistics change between years t' and t allows to decompose the total change into two effects. First, the *composition effect* is given as the change in a statistic that can be explained by changes in observable characteristics. Second, the unexplained part of the total effect is commonly referred to as wage structure or *price effect*. This is due to changes in how the labor market values both observed and unobserved characteristics of workers. The underlying assumption to identify the contribution of workforce composition changes on wages is that the relationship between characteristics z and wages does not change because of the change in z, i.e. that there are no general equilibrium effects. This assumption is common for decomposition methods (Fortin, Lemieux, and Firpo 2011).

IV Potential Effects of Childcare on Wage Inequality

How easier and more widespread access to childcare affects inequality in wages is, ex ante, ambiguous. It depends on which group of women adjusts their labor supply in which ways. To give the later analysis a background, this section provides an overview of the potential channels.

The following considerations make some assumptions. First, a greater availability of childcare decreases its price, both in terms of direct monetary costs but also with respect to the non-monetary opportunity costs of organizing care for a child. These can include that public and informal care by relatives can easier be combined or that childcare is more convenient to access, for instance due to

[5] Section E in the Supplemental Appendix gives a formal description of the decomposition.

being located closer to the home or the workplace. Second, women increase their labor supply as long as the monetary net benefits of working—the difference between earnings and childcare costs—are positive and outweigh any potential disutility from working. Third, I assume sufficient labor demand, i.e. that increasing female labor supply translates into employment, and rule out general equilibrium effects such that more labor supply by women due to childcare does not lead to changes in wages.

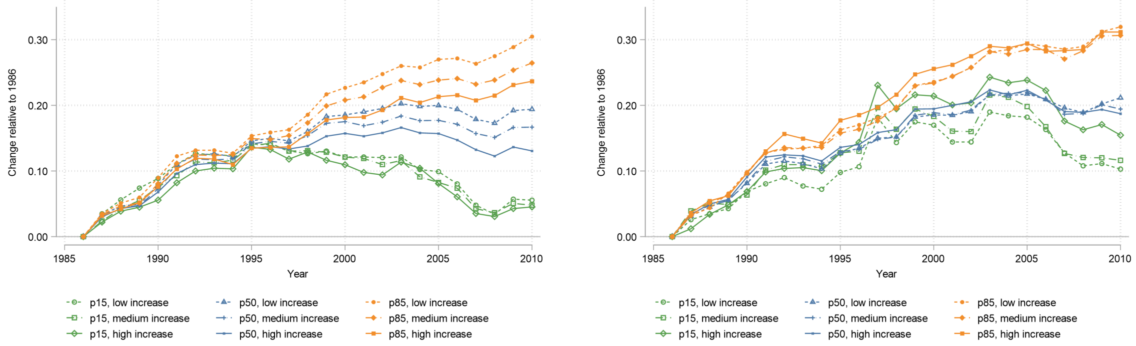
Mothers with young children are the likeliest beneficiaries of an increased availability of childcare. First, a sufficient decrease in childcare costs affects labor supply at the extensive margin. If the net benefit of working becomes large enough, some mothers who did not work before chose to take up work. They either revert a non-participation decision or decrease the duration of their post-birth labor market break. Second, lower childcare prices also affect the intensive margin of labor supply. They increase the flexibility of mothers who already work—for instance by giving them more time to commute—enabling them to work more hours, to choose from a wider range of employers or to invest more in their career. This is especially relevant for those who already utilize some level of informal childcare, because during the observation period public childcare only covered half of the day.[6] Reaction on the extensive and intensive margin are not mutually exclusive. Given the results by Bauernschuster and Schlotter (2015) who find labor supply effects of the German childcare expansion on both margins, it is plausible to expect a combination of both.

Third, turning away from mothers, an expansion of childcare also changes the long-term considerations of women before they have children. For them, not the current but the expected benefits of working increase.[7] With increasing prospects of a career that can be sustained in the long run, investments into education are more likely to pay off such that the probability of young women pursuing higher degrees and selecting into higher-paying occupations increases as well. After women have entered the labor market, better long-run career prospects can affect employer choice, effort put into work or on-the-job training.

How changes in labor supply affect inequality in wages depends on which group of women reacts how strongly. If childcare costs are similar across mothers, changes in participation will not affect mothers with sufficiently high earnings potential as they had larger net benefits of working already before the childcare expansion. Instead, such a mechanism will rather expand the workforce towards those mothers with lower earnings potential such that their increased participation will increase inequality. Similarly, changes at the intensive margin as well as changes in expectations likely show stronger effects for women with lower earnings potential. If that facilitates upgrades of women in the lower part of the wage distribution such that they gain in earnings, the result is a decrease in wage inequality.

[6] Informal care likely plays a substantial role since a market for private childcare was almost nonexistent in the early and mid 1990s (see Bauernschuster and Schlotter 2015).

[7] This rests on the assumption that these women expect to have children at some point in the future. Given that for the cohorts who were of childbearing age during the 1990s the share of those who eventually become mothers is close to or above 80 percent (Statistisches Bundesamt 2019), this is likely to be the case.



(a) Full-time workers

(b) Part-time workers

Figure 2: Development of the 15th, 50th and 85th log wage percentiles of women by change in childcare supply, 1986–2010.

Notes: The figure plots changes in percentiles of log daily wages between 1986 and 2010. All values are normalized to 0 in 1986. Figure 2a focuses on full-time workers, Figure 2b on part-time workers. Both panels differentiate between regions with low (plotted as short dashed lines), medium (longer dashed lines) and high (solid lines), increases in childcare supply. The 15th percentile is plotted in green, the 50th in blue and the 85th in orange. Figure A.3 in the Appendix plots the average for a full sample that does not differentiate by childcare.
Source: Own estimations using the SIAB data described in Section III.1.

V The Evolution of Wages and Wage Inequality by Childcare Supply

This section starts with the results. It documents the regional wage development over time and then estimates the relationship between wage inequality and children.

V.1 Trends in Full- and Part-time Wages

Figure 2 plots the development of the 15th, 50th and 85th wage percentiles, separately for regions with high, medium and low increases in their childcare supply. Overall, wages across regions follow the same broad trends, but show substantial differences when compared to each other. All observed full-time wages (plotted in the left-hand panel) grow in a similar fashion until the mid of the 1990s; only after 1995, the regions and wage percentiles start to diverge. Wages in the 15th percentile decrease between 1995 and 2010 and show almost no regional differences. The 50th percentiles grow modestly after 1995 or remain stagnant while the higher wages of the 85th percentile continue to grow. With the divergence of wage groups, the 50th and 85th percentile also start to differ across regions. For both percentiles, the regions exhibit a clear pattern that increases in wages and childcare are inversely related. Median and high wages increase stronger where childcare supply increases were the smallest, while those regions with the largest changes in childcare supply show the lowest wage gains. In 2010, the wage growth of the 85th percentile ranges between 30.5 and 23.6 percent, for median wages between 19.4 and 13.1 percent and for the 15th percentile around 5 percent.

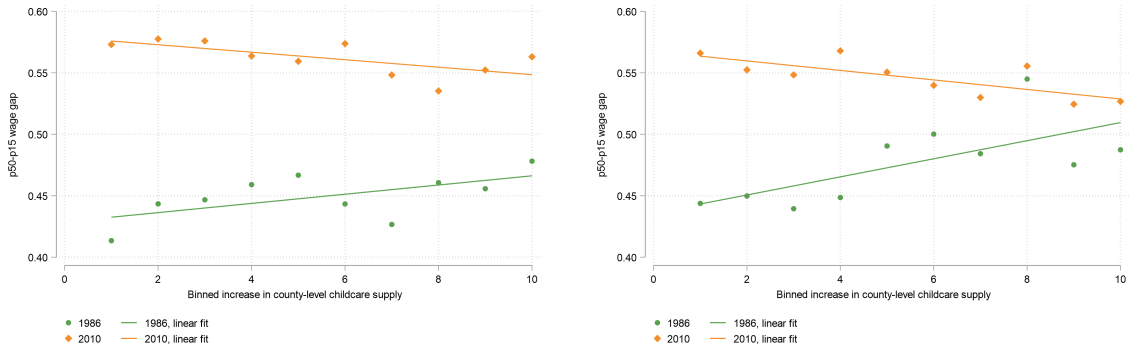
Wages of part-time working women are plotted in the right-hand panel. Their 50th and 85th percentiles have on average similar trajectories and slightly larger growth rates compared to those of their full-time counterparts. The regional differences for median and high wages are small, though between the 1990s and 2005 increases are larger in those regions with greater changes in childcare. Especially the lower part-time wages stand out with high growth rates. The trajectory of the 15th wage percentile is overall less smooth compared to the median and the 85th percentile, suggesting a greater degree of heterogeneity in the underlying part of the female workforce. Despite the more uneven trajectory, it is clearly observable that in regions with larger childcare increases gains in low wages are larger. Between 1996 and 2006, the increase of the 15th wage percentile in regions with high childcare increases even exceeds the growth of median wages. Until 2010, low wages in high-increase regions grew by 15.4 percent; in low-increase regions by 10.3 percent.

The comparatively strong growth of part-time wages, together with an increasing number of women who work in part-time (more details are provided in Section VI.1), points out that the additional part-time labor supply was met by a sufficient demand for work, giving women a further incentive to join the labor market. This is more pronounced in regions with larger increases in childcare supply. It is further consistent with an increase of labor supply on the extensive margin in reaction to having more childcare options.

V.2 The Relationship Between Childcare Supply and Wage Inequality

Having shown that wages of both full- and part-time working women develop differentially with respect to the regional change in childcare supply, this section turns to inequality in wages. Figure 3 shows binned scatter plots for the relationship between the regional increase in childcare supply (in ten bins of counties on the x-axis) and the size of the p50–p15 gap in log wages (on the y-axis). The relationship between both variables is plotted for the years 1986 (in green) and 2010 (in orange). Since the increase in childcare supply is a time-constant measure, each bin contains the same counties in both years. Those in the first bin increase their childcare supply between 1986 and 2002 by on average 6.5 slots per 100 children, while for counties in the tenth bin the increase is on average 54 additional slots.

The left-hand panel of Figure 3 plots results for full-time working women. Over time, the relationship between the increase in childcare supply and lower-tail wage inequality clearly changed. In 1986, those counties where the (at this time future) increases in childcare are larger, show slightly larger wage gaps. This relationship reverses over time. In all bins, the wage gaps increase and those bins with the smallest increases in childcare exhibit the largest increases of the p50–p15 wage gap such that the overall relation is negative in 2010. For part-time workers (plotted in the right-hand panel of Figure 3) the relationship between childcare supply increases and inequality is qualitatively similar, though markedly more pronounced, both the positive relationship in 1986 and the negative one in 2010. While inequality on the lower end of the wage distributions reacts to changes in childcare, no such relationship can be found for the upper end, i.e. the p85–p50 wage gap. Results for overall inequality, measured by the



(a) Full-time workers

(b) Part-time workers

Figure 3: p50–p15 wage gap of women in 1986 and 2010 by binned regional increase in childcare supply.

Notes: The figure plots the p50–p15 gap in log daily wages of women by binned regional increase in childcare supply. The relationship in 1986 is plotted in green, results for the year 2010 are plotted in orange. Each bin contains 32–33 counties where those in the first bin increase their childcare supply by on average 6.5 additional slots per 100 children and those in the tenth bin by on average 54 additional slots. Figure A.4 in the Appendix plots the analog for the p85–p15 wage gap.
Source: Own estimations using the SIAB data described in Section III.1.

p85–p15 wage gap, show a similar but less strong pattern as the p50–p15 gap (see in Figure A.4 in the Appendix).

Table 2: County-level relationship between increase in childcare supply and wage inequality (in standard deviations), 1986 and 2010.

	Full-time workers			Part-time workers		
	1986	2010	$\Delta_{2010\text{-}1986}$	1986	2010	$\Delta_{2010\text{-}1986}$
p85–p15	0.202***	−0.032	−0.234	−0.070	−0.126***	−0.056
p85–p50	0.057	0.060	0.003	−0.089**	−0.046	0.043
p50–p15	0.210***	−0.085*	−0.295	0.130**	−0.119***	−0.249

The table reports the relationship between the increase in childcare supply and percentile wage gaps for female workers in 1986 and 2010. The values for each year indicate by which fraction of a standard deviation the percentile gap would change if the increase in childcare supply was stronger by one standard deviation (additional 13.36 slots per 100 children). The columns marked with Δ indicate the change from 1986 to 2010. All results are obtained from linear regressions on the county level, weighted with each county's observation share. Analog results for male workers in full-time are given in Table B.1 in the Appendix. */**/*** indicate significance at the 10/5/1 percent levels.
Source: Own estimations using the SIAB data described in Section III.1.

To quantify the graphical findings, Table 2 reports the county-level relationships between different log wage gaps and childcare increases in terms of standard deviations. The results are obtained from regressing each respective log wage gap on the increase in childcare supply in the years 1986 and 2010. The regression results are converted to effects for an increase in childcare by one standard deviation, i.e. by 13.36 additional slots per 100 children (the mean increase is 28.3 slots per 100 children). The columns marked with $\Delta_{2010\text{-}1986}$ report the difference between the two years. As before, the increase in childcare supply is a time-constant measure. The aim of this task is thus to assess how the relationship between inequality within counties and childcare supply changed over time.

For full-time working women in 1986, a larger increase in childcare slots is associated with a significantly larger p85–p15 log wage gap; for an increase in childcare by one standard deviation, the p85–p15 wage gap increases by around 20 percent of a standard deviation. In 2010, this increase in childcare is associated with a decrease in the p85–p15 wage gap by around 3 percent of a standard deviation. As there is virtually no effect for the p85–p50 gap, this is driven by the lower half of the wage distribution. In 1986, I observe an increase of the p50-p15 gap by 21 percent of a standard deviation, but for 2010 a decrease by 8.5 percent of a standard deviation (both values are statistically significant).

For part-time workers, the finding that larger increases in inequality are associated with a decrease in wage inequality is confirmed. As for full-time workers, this is driven by inequality in the lower end of the wage distribution. Larger increases in childcare by one standard deviation are related to a slightly smaller p85–p15 wage gap in 1986 (by 7 percent of a standard deviation); until 2010 this has numerically almost doubled to a significantly negative effect of 13 percent. Results for the p85–p50 wage gap are again comparatively small. For lower wages, a positive association of a 13 percent larger p50–p15 wage gap per standard deviation increase in childcare in 1986 decreases to −12 percent of a standard deviation in 2010. The overall smaller effect magnitude compared to full-time workers is consistent with Figure 2 that documents smaller regional differences for part-time workers.

In summary, this section shows that larger increases in childcare supply at the county-level are related to smaller increases in wage inequality among women between 1986 and 2010. This result is primarily driven by the lower part of the wage distribution.

Robustness The findings in this section are consistent across different levels of aggregation; either bins of around 30 counties each, or in regressions where the single county is the smallest entity. This suggests that other results that are aggregated over three regions, each consisting of around 100 counties, do not suffer from biases by the broader level of aggregation. As the results are based on regional differences in changes (in inequality), they are, further, not driven by time-constant differences between regions, for instance structural features of the regional economies.

There might be the concern that the observed lower wage inequality is not directly related to childcare but is rather driven by other factors. One possibility is that childcare and wage inequality are unrelated and that the latter is reduced by good regional economic conditions which increase labor demand. If this was the case, male and female workers would likely be affected in a similar way. Table B.1 in the Supplemental Appendix therefore reports results analog to Table 2, but for men working in full-time. In addition, Figure B.2 plots the relationship between childcare supply increases and wage inequality for this group, thus the analog to Figure 3. They show that there are level-differences in wage inequality across counties, which however remain stable over the period of observation indicating no relationship with the increase in childcare supply.

A second possibility is that favorable economic conditions contribute to less strong increases in wage inequality, but also to higher local tax revenues that enable the expansion of public childcare. Table B.2 in the Supplemental Appendix tests this hypothesis by again repeating the estimations from Table 2, but with controlling for the county-level change in the log of per-capital GDP. This additional variable turns out to have no significant impact on wage inequality in almost all estimations, and importantly, it does not lead to relevant changes in the measured relationship between childcare and wage inequality. Both tests together show that a bias in this section's results through economic conditions or other changes that would affect men and women in a similar way is unlikely.

VI The Role of Workforce Composition

Childcare gives women more options when deciding on their labor supply, such that a potentially more diverse selection of them participates in the labor market. Thus, an effect of childcare on inequality in wages operates largely through changing the characteristics of the female workforce which this section explores. Women in regions with larger childcare expansions show stronger increases in part-time work, they are more often in the middle of the education distribution and have accumulated longer tenure in their current job. Against this descriptive background, I decompose the changes in wage inequality to quantify the contribution of different aspects of workforce composition.

VI.1 Average Changes in Workforce Composition

Table 3 lists summary statistics by region for the baseline year 1986 and for 2010.[8] It shows that the regions exhibit marked differences in wages levels—regions where childcare supply increased stronger have lower wages, both in 1986 and in 2010. With respect to the composition of the female workforce, they are mostly similar in the beginning of the observation period, but systematic differences emerge over time.

The most distinct change over time is the increase in part-time work. Between 1986 and 2010, the average share of women who are recorded as working in part-time in the SIAB data rose from 26 to 40 percent. This trend is observable in all regions, although there are clear differences in how strong it is. Regions with large increases in childcare supply have the initially slightly higher share of part-time workers (27 vs. 25 percent on average), but also show the strongest increase by 63 percent to in total 44 percent on average. The change in the other regions with low or medium sized increases in childcare supply is still large (at between 52 to 54 percent), but around ten percentage points smaller and less distinct from another.

Workforce composition with regard to education improved, mostly driven by the a substantial decrease in the share of workers with low education levels (from 23 to 8 percent) while the share of

[8] Section C in the Supplemental Appendix provides graphical representations of the changes by region over time; summary statistics without differentiating by region are listed in Table 1.

Table 3: Change in characteristics of female workers by regional increase in childcare supply between 1986 and 2010.

	1986			2010		
	Low	Medium	High	Low	Medium	High
Log daily wage	4.17	4.12	4.03	4.30	4.24	4.13
Share censored wage	0.02	0.01	0.01	0.04	0.02	0.01
Age	37.93	37.91	37.46	42.14	42.31	42.44
Share part-time	0.25	0.26	0.27	0.38	0.40	0.44
Education (shares)						
No vocational degree	0.24	0.23	0.26	0.09	0.08	0.08
Vocational degree	0.71	0.71	0.70	0.75	0.77	0.82
University degree	0.04	0.04	0.03	0.16	0.13	0.10
Years in employment	7.84	7.76	7.70	15.84	15.8	16.14
Years in current job	5.72	5.71	5.64	7.25	7.26	7.55
Occupational tasks (shares)						
Un-/semiskilled	0.10	0.11	0.12	0.07	0.08	0.09
Skilled	0.80	0.80	0.80	0.74	0.74	0.75
Complex and highly complex	0.10	0.10	0.09	0.19	0.19	0.17
Observations	61,654	46,904	23,299	74,126	58,639	31,692

Notes: Summary statistics (mean values) for women in regular employment, age 21–60 in the years 1986 and 2010. The table differentiates between regions with low, medium and high increases in childcare supply as described in Section III.2. The log of daily wages is given in Euro, inflation adjusted to 2015 as base year. Values for education and tasks that do not add up to 1 within region and year are due to rounding.
Source: Own calculations using the SIAB data described in Section III.1.

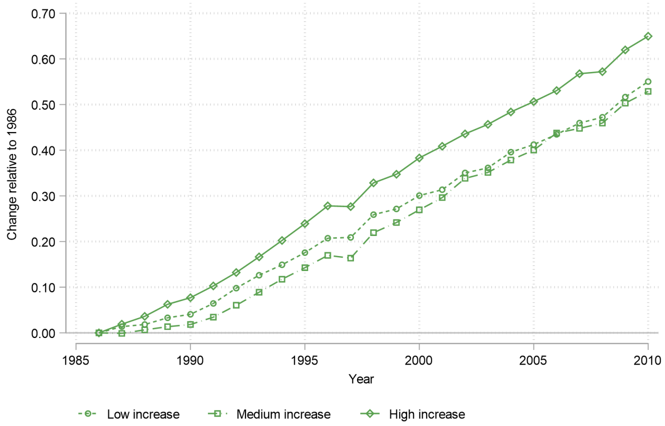


Figure 4: Change in part-time work relative to 1986 by year and development of childcare supply.

Notes: Changes in part-time work of the female workforce over time by development of childcare supply. The plots indicates changes relative to 1986. Observations are grouped by the position of a region in the distribution of the change in childcare supply between 1986 and 2002. The tercile of regions with the largest increases is plotted as a solid line, the second tercile as a long-dashed line, and the tercile of regions with the smallest increases as a short-dashed line.
Source: Own estimations using the SIAB data described in Section III.1.

workers with university-level education increased (from 4 to 14 percent). Nevertheless, the majority of the female workforce is made up of those owning a vocational degree; their average share increased over time from 71 to 77 percent. Regional trends are qualitatively similar when differentiating by regional increases in childcare supply, but show some noticeable quantitative differences.[9] Larger increases in childcare are correlated with smaller increases in university-level education, but with stronger decreases in low education as well as stronger increases in vocational education. As the initial education levels of women in full-time across the regions show only little variation, the difference between low and high-increase regions almost continuously widens over time, in 2010 it amounts to −4 percentage points for below vocational, 11 percentage points for vocational and −39 percentage points for university education. These developments are similar for women working in part-time, though for them the decrease in low education and the increase in vocational education are stronger and university-level education increases to a smaller degree. Taken together, this indicates a greater degree of upgrading from the bottom to the middle of the education distribution in regions with larger childcare expansions. In comparison, in the other regions a relatively larger fraction of the female workforce can be found in the tails of the education distributions, especially the upper one.

Age and, more importantly, work experience of women increase between 1986 and 2010. Table 3 points out that in 1986 both measures decrease slightly in the regional increase in childcare supply whereas in 2010 they increase. An equivalent pattern can be found for tenure in the current job[10], which is the more informative measure for current wages as it accounts for the time to accumulate firm and job-specific human capital. In 1986, women in regions with the largest increases in childcare had accumulated 5.64 years of tenure (compared to 5.72 years for the low-increase regions). Until 2010, this value increased to 7.55 years, whereas for women in the low-increase regions only 7.25 years are recorded. The patterns for full- and part-time workers are mostly similar, though the difference between the high-increase and other regions is more pronounced for women working in part-time. This is consistent with childcare making it easier to continue work after childbirth and parental leave, such that older and more experienced women are more likely to be found in the workforce

In addition, both women who work in full- and in part-time upgrade in terms of occupations. Consistent with the findings for education, they work less often in occupations requiring low levels of qualification, but more often in occupations that demand medium to high qualification levels. There are some differences in levels, though no differential trends between regions with different increases in childcare supply.[11]

The skills required within occupations complement the occupational perspective. This skill measure is derived from the fifth digit in the occupation classification KldB 2010 (Bundesagentur für Arbeit 2021) differentiating between unskilled and semi-skilled, skilled and complex tasks workers have to carry out. Rather than comparing *between* occupations, this measure captures differences *within* an occupation,

[9] See Figure C.1 in the Supplemental Appendix.
[10] See Figure C.2 in the Supplemental Appendix.
[11] See Figure C.3 in the Supplemental Appendix.

thus it is more suitable to detect changes over the career trajectory, for instance due to receiving further training or being promoted. The aggregate measures in Table 3 show overall upgrading over time, but only little differences across regions. Women who work in full-time in regions with high increases in childcare tend to remain in the middle of the skill distribution more often. This can be found for part-time workers as well, though less pronounced. Instead, for them larger childcare increases are associated with substantially larger increases in the share of women working in jobs that demand more complex tasks (122 percent compared to 101 and 98 percent in the medium- and low-increase regions).[12]

These findings suggests that larger childcare supply is associated with more stable employment relationships among women, which, in turn, induces upgrades in the skill levels of tasks that women perform in their jobs. The more pronounced changes for women who work in part-time are consistent with the larger increases of part-time work where childcare increases are larger, as well as with the overall higher prevalence of part-time work among mothers.

VI.2 How Large is the Contribution of Compositional Changes?

Having established that regions with larger increases in their childcare supply exhibit smaller increases in wage inequality and show differential developments of workforce composition, this section connects both aspects and assesses the contribution of workforce composition to changes in wage inequality. To this end, I use the DiNardo, Fortin, and Lemieux (1996) decomposition (see Section III.3) to separate the inequality growth between 1986 and 2010 into a composition and a price component. In the following, I first differentiate between full-time and part-time workers. Second, I differentiate within full- and part-time workers, between a full sample and region-specific subsamples. The full sample includes all working women in West Germany. The region-specific samples split them with respect to regions with low, medium and high increases in childcare supply. The DFL weights are always calculated and applied specific for each subsample which, first, allows for different initial conditions in each subsample, for instance for lower wages or different education levels of the workforce. Second, it is able to capture differential trends in the development of wages as well as workforce composition across subsamples. The main specification uses three education and five age categories as well as all interactions between them to calculate the DFL weights.

Table 4 provides the main results. It lists observed and reweighted changes in the log wage gaps between the 85th and 15th, the 85th and 50th as well as the 50th and 15th percentile for women between 1986 and 2010.[13] The top part of the table shows results for the full sample, the bottom part differentiates between regions with respect to their childcare supply increases. Panel I collects the results for women who work in full-time, Panel II those for women in part-time.

[12] See Figure C.4 in the Supplemental Appendix.

[13] The corresponding levels are reported in Table A.1 in the Appendix. They reflect the graphical findings from Section V.2, especially that the p50–p15 wage gap in 1986 increases in childcare supply changes while it decreases in 2010.

Table 4: Observed and reweighted changes in wage inequality among women, 1986–2010.

	I. Full-time workers			II. Part-time workers		
	Observed change	Composition	Price	Observed change	Composition	Price
Full sample						
p85–p15	0.233	0.108 (46 %)	0.125	0.198	0.016 (8 %)	0.181
p85–p50	0.106	0.046 (43 %)	0.061	0.109	0.012 (11 %)	0.097
p50–p15	0.127	0.063 (50 %)	0.064	0.088	0.004 (5 %)	0.084
By regional increase in childcare supply						
p85–p15						
Low	0.250	0.094 (38 %)	0.156	0.218	0.016 (7 %)	0.202
Medium	0.216	0.112 (52 %)	0.104	0.196	0.017 (9 %)	0.179
High	0.195	0.104 (54 %)	0.090	0.154	0.013 (8 %)	0.141
p85–p50						
Low	0.110	0.041 (38 %)	0.068	0.105	0.014 (14 %)	0.091
Medium	0.096	0.049 (51 %)	0.047	0.111	0.013 (12 %)	0.098
High	0.106	0.037 (35 %)	0.069	0.122	0.010 (8 %)	0.112
p50–p15						
Low	0.140	0.053 (38 %)	0.087	0.113	0.001 (1 %)	0.112
Medium	0.119	0.062 (52 %)	0.057	0.086	0.004 (5 %)	0.082
High	0.089	0.068 (76 %)	0.021	0.032	0.004 (11 %)	0.029

Notes: Observed and reweighted changes in inequality measures for log imputed daily wages between 1986 and 2010. The observed change is decomposed into a composition effect (columns 3 and 6) and a price (wage structure) effect (columns 4 and 7). Percentage values indicate the contribution of the composition effect to the observed change. Price effects correspond to the change from observed values in 1986 to reweighted values in 2010. Estimates in Panel I are for full-time workers, Panel II reports results for part-time workers. All specifications use three education and five age categories as well as all possible interactions to estimate the DFL weights. The lower part of the table reports results separately for regions with low, medium and high increases in their childcare supply between 1986 and 2002.
Source: Own estimations using the SIAB data described in Section III.1.

Women Working Full-time In the full sample of full-time working women (see top part of Panel I in Table 4), the p50–p15 wage gap, representing the lower part of the wage distribution, increases stronger than the p85–p50 wage gap (12.7 vs. 10.6 log points). This adds up to an overall increase in the p85–p15 wage gap by 23.3 log points. The decomposition with respect to age and education explains between 43 (p85–p50) and 50 percent (p50–p15) of inequality increases.

Differentiating by regions with low, medium and high increases in their childcare supply yields results in a overall similar range compared to the full sample. While the regional differences for the p85–p50 wage gap are relatively small, they are substantial for the p50–p15 gap. For women in the lower half of the wage distribution, larger increases in childcare supply are associated with markedly smaller increases in wage inequality. The p50–p15 wage gap increases by 14 log points in regions with low increases compared to 8.9 log points in regions with a high increase, i.e. a difference of more than one third. This finding is consistent with the graphical results in Figure 2 that show smaller increases in the 85th and 50th percentiles of wages in regions with larger increases in childcare while the 15th percentile shows little regional variation.

The contribution of compositional changes in the workforce increases in childcare supply changes, which explain between 38 and 76 percent of the change in the p50–p15 wage gap. This pattern translates qualitatively to overall wage inequality measured in the p85–p15 gap where it is less pronounced as there is no clear relationship between childcare increases and inequality for higher wages. These results show that workforce composition plays a more important role to explain the raise in inequality in lower wages of full-time working women where the increases in childcare supply are larger.

Women Working Part-time Panel II of Table 4 reports observed and reweighted inequality changes for women working in part-time. The results for the full sample indicate an increase in overall wage inequality by 19.8 log points, smaller but broadly in a similar range compared to full-time workers (23.3 log points). Contrary to full-time workers, the larger part of the increase in the p85–p15 wage gap is due to the upper end of the wage distribution. The p85–p50 gap increases by 10.9 log points, whereas the p50–p15 wage gap increases by only 8.8 log points. This is in line with the graphical evidence in Figure 2b that shows relatively large increases in the 15th wage percentile for a major part of the observation period.

The results for reweighted wages show that for part-time workers in all parts of the distribution, the fraction of the inequality increase that workforce composition can explain is, at between 5 and 18 percent, four to ten times smaller compared to full-time workers. Given the nonetheless sizeable compositional changes among part-time workers (see the previous section), this results seems counterintuitive at first. As Section III.1 argues, the possibility of changes in working hours as a driver of wage inequality can be largely ruled out. Therefore, it is important to note that the share of women who work in part-time increased by on average around 50 percent. With this large raise it is plausible that both supply with and demand for part-time work increased, such that a greater variation in how the labor market values part-time work, i.e. the price effect, is likely. In addition, more women who work in part-time also increase the heterogeneity of the part-time workforce with respect to unobservable characteristics, that cannot be considered in the decomposition, as well. For instance, the duration of parental leave taking—one of the most significant interruptions in women's careers—first increased, then decreased over the observation period (see Figure A.2 in the Appendix). As Goldin and Katz (2008) show for highly educated women, the earnings penalty for a given parental leave duration varies considerably across occupations, which is a mechanism that can also apply to the group under study here.

The lower part of Panel II lists separate results by regions with low, medium and high increases in childcare supply. The absolute change of the p85–p15 wage gap of part-time working women is smaller in regions where childcare supply increased stronger. For low-increase regions, I measure 21.8 log points, for medium-increase regions 19.6 and for high-increase regions 15.5 log points. With the upper half of the wage distribution showing a small and positive relationship with childcare changes (increases from 10.5 to 12.2 log points), the pattern for overall inequality is driven by the p50-p15 wage gap. It substantially decreases from 11.3 (in low-increase regions) to just 3.2 log points (in high-increase regions).

The impact of workforce composition, again, differs between earners of high and low wages. It explains fractions of the p85–p50 gap that decrease in childcare supply changes (from 14 to 8 percent); for the p50-p15 wage gap, the opposite is the case. Composition explains increasing fractions of its change, just 1 percent in low-increase regions and 11 percent in high-increase regions. Even though there is a level-difference, the finding that compositional changes are of greater importance to explain the change in the p50-p15 wage gap where the supply with childcare increased stronger, holds for both full- and part-time workers.

Importance of Labor Supply Changes on the Extensive Margin In line with most of the existing literature, the main decomposition in Table 4 uses age and education as explanatory variables. Additionally, Table A.2 in the Appendix lists the results from decompositions that use age and education as well, but further add interactions between age group and experience in the current job and indicators for occupation (at the 3-digit-level) and industry (1-digit-level). In contrast to age and education, the added variables include characteristics that are more likely subject to recent choices made by workers. Given participation in the labor market, a worker's choices rather affect their job, occupation or industry while education typically remains unchanged.[14] A comparison of these two sets of explanatory variables thus allows to make a distinction between mechanical compositional changes that happen when workers change their participation status and changes that happen when workers, who are already part of the labor force, sort to different employers or into different jobs.

As shown in Table 4, age and education are more important to explain changes in inequality where the increase in childcare supply was larger. For women working in full-time, adding experience, occupation and industry to the decomposition adds on average some explanatory power. As Panel I of Table A.2 shows, this is—both in the full sample and in the region-specific decompositions—almost entirely driven by the upper part of the wage distribution, while there are only minor changes in its lower part. With the additional variables, composition explains 53 percent, compared to previously 46 percent, of the change in overall inequality; mostly driven by women with higher wages. Thus, for them, there are adjustments in the intensive margins of labor supply that are proxied for by experience, occupation and industry. The development of inequality in this group shows, similar to the main decomposition, no relationship with childcare. On the other hand, wage inequality changes among lower earning women are correlated with increases in childcare and primarily driven by age and education, i.e. rather pointing to changes in participation decisions.

The results for women working in part-time (see Panel II of Table A.2 in the Appendix) are markedly different. For them, adding experience, occupation and industry to the decomposition explains—compared to age and education—less of the change in the p85-p50 wage gap (from 11 to 6 percent) but more of the change in the p50-p15 wage gap (from 5 to 12 percent). This generally holds in the decompositions

[14] This holds especially since observations of individuals in vocational training and marginal employment (that could cover a number of students who work parallel to studying), i.e. two typical reasons to observe educational upgrades in the early career phase, are excluded.

by regional childcare supply increases. Adding more variables leads to some decreases in explanatory power for high wages, while it provides more explanatory power to changes in lower wages. The impact of workforce composition increases from between 1 and 11 percent to between 5 and 22 percent for the p50-p15 wage gap; however, there is no clear relationship with the changes in childcare supply. Experience, occupations and industries show to be relevant to explain inequality changes for part-time workers with lower wages across all regions, not supporting the hypothesis of childcare as enabling factor for women in part-time to alter intensive margin labor supply. Childcare supply is, however, positively related to the impact of age and education as predetermined factors. This points out that childcare facilitated labor market participation of lower earning women in part-time.

Discussion of the Main Findings Observable worker characteristics are distinctly more relevant to explain the increase in wage inequality among women who work full-time. For the more heterogeneous group of part-time workers, there is a greater degree of residual changes. Regardless of part-time status, there is no or only little association between childcare and inequality in the upper part of the wage distribution. Inequality among women with lower wages increases less strongly with more additional childcare supply. Larger fractions of these smaller increases can be explained by mechanical factors—age and education—that are mostly related to changes in participation. This suggests that for women with lower earnings potential, the incentives to take up work provided by additional childcare options are more relevant. Changes in decision making by women who are already part of the workforce but opt, for instance, into different occupations show no clear relationship with childcare. The larger relevance of participation decisions, in particular in the lower part of the wage distribution, is consistent with the institutional details of the childcare expansion. It did not start at zero levels, but rather provided additional supply that was relatively affordable, especially in comparison to, at this time, scarce alternatives on the private market. Therefore, public childcare rather addressed a demand among those women with lower earnings potential and thus the lowest willingness to pay for childcare. Higher earning women with a higher willingness to pay for childcare, on the other hand, have likely organized their labor market participation already before the policy change.

Robustness I assess the robustness of the results from the re-weighting exercise by using DFL weights that include additional explanatory variables as well as by comparing the findings for women with results for men. Table B.3 in the Supplemental Appendix repeats the decomposition in Table A.2, but with finer, 4-digit instead of 3-digit, occupation codes and adds indicator variables for four groups of required skills in the occupation. As the more detailed explanatory variables lead to some loss in the number of observations, the results differ slightly, but the patterns described above remain generally unchanged.

To test if there is a common trend that affects both female and male workers, Table B.4 in the Supplemental Appendix provides a decomposition for full-time working men (thus it is to be compared with Panel I of Table 4). The overall increase in wage inequality between 1986 and 2010 as measured by the p85–p15 wage gap is larger for male workers compared to female workers (27.7 vs. 23.3 log points). Further similarities are that inequality in the lower end of the wage distribution shows the stronger increase (15.1 vs. 12.5 log points) and that the p50–p15 wage gap tends to increase less in regions with larger additional childcare supply, though the relationship is markedly weaker than for women. Importantly, the share of the difference between 1986 and 2010 in all wage gaps that can be explained by workforce composition does not show an association with regional childcare supply increases. Thus, there is no sign that the findings on the association between wage inequality and childcare for women are driven by a common trend that affected both genders alike.

VII Inequality Between Women and Men

Even though larger expansions in childcare supply are associated with less strongly increasing levels of wage inequality within the group of female workers, it is—ex ante—ambiguous if and how this changed women's position in the workforce relative to men. To assess this question and to put the previous findings into a broader context, this section studies the development of the gender wage gap.

Those regions with the largest increase in their childcare supply initially have a larger raw gender gap in full-time wages (around 44 vs. 42 percent in other regions; Figure A.5 in the Appendix gives a graphical representation).[15] Regions with medium or low increases differ only slightly. This pattern persists over the entire observation period while pay differences decrease substantially. The most pronounced change is in the early 1990s when the wages of men stagnate or even decline (documented by Dustmann, Ludsteck, and Schönberg 2009) while the wages of women, on average, continue to increase (see Figure 2) which leads to a decrease of the gender gap by around 6 to 7 percentage points. Until 2010, the raw gaps fall to levels between 33 and 36 percent.

The adjusted gender wage gap (the unexplained pay differences after controlling for age, education, experience, occupation, industry and a dummy for censored wages) decreases over time in all regions. In 1986, the adjusted gender gap ranges between 24 and 28.6 percent, in 2010 between 19.4 and 23.9 percent. For each year though, its levels are larger with greater regional changes in childcare, consistent with the finding that women in regions with stronger childcare expansions do worse with respect to observable characteristics (see Section VI.1).

To further assess the role of workforce composition in comparison to other factors, I use the DFL weights to decompose the change in the gender wage gap. Precisely, I recalculate the raw gender wage gap in 2010 with the characteristics of the female part of the sample reweighted to match their levels in 1986. Observations from men are not reweighted. This assesses the contribution of the compositional changes in the female workforce to the decrease in the gender wage gap. Table 5 reports the results for the full sample and by regional childcare increase.

[15] I restrict attention to workers in full-time since part-time working men likely follow different selection patterns compared to their female counterparts and their number is too small to serve as a comparison group.

Table 5: Observed and reweighted changes in the gender gap in log wages among full-time workers, 1986–2010.

	Observed			I: age, education		II: age, education, experience, occupation, industry	
	1986	2020	$\Delta_{2010\text{-}1986}$	Composition	Price	Composition	Price
Full sample	0.426	0.341	−0.085	−0.089 (105%)	0.004	−0.073 (86%)	−0.012
By regional increase in childcare supply							
Low increase	0.423	0.345	−0.078	−0.100 (128%)	0.022	−0.085 (109%)	0.007
Medium increase	0.425	0.331	−0.094	−0.083 (88%)	−0.011	−0.068 (72%)	−0.026
High increase	0.438	0.362	−0.076	−0.064 (84%)	−0.012	−0.046 (61%)	−0.030

Notes: Columns 2–4 of the table report estimates of the raw gender gap in log wages in 1986 and 2010 along with the difference between the two years. Columns 5–8 decompose the change in the gender gap into a composition and a price effect using the DFL weights described in Section III.3. Percentage values indicate the contribution of the composition effect to the observed change. Estimates in Panel I use three education and five age categories as well as all possible interactions to estimate DFL weights, in Panel II experience in the current job along with its interaction with the age categories, occupation (3-digit) and industry (1-digit) identifiers are added. The lower part of the table reports results separately for regions with low, medium and high increases in their childcare supply between 1986 and 2002.
Source: Own estimations using the SIAB data described in Section III.1.

In the full sample for all workers in West Germany, the gender wage gap decreases by 8.5 percentage points. The composition effect measured when reweighting with respect to age and education exceeds the actual decrease slightly, indicating that composition alone would have led to an even stronger reduction but that the price effect dampens it. Adding experience, occupation and industry to the weights reduces the impact of composition to 86 percent of the total change, implying that the female workforce became more similar to the male one in terms of age and education but this is counteracted by differences with respect to experience and selection into occupations which have a widening effect on the gender wage gap.

The decomposition of the gender gap by regional childcare increases is reported in the lower part of Table 5. Size and contribution of the composition effect follow a distinct pattern. For both sets of explanatory variables, workforce composition explains substantially larger fractions of the reduction of the gender wage gap in regions with lower increases in childcare supply (128 vs. 84 percent and 109 vs. 61 percent respectively). Compared to the results in the previous section, this underlines that those compositional changes that reduced the increase in wage dispersion among women, at the same time, did not contribute to a larger reduction of wage inequality between genders. This is consistent with the previous findings that larger increases in childcare supply rather affect the participation of low-earning women. It, further, provides an example for the relationship between rather negative selection into employment and the gender gap. As shown, for instance, by Mulligan and Rubinstein (2008) and Olivetti and Petrongolo (2008), those women who work are on average a positive selection from all women such that measures of the gender wage gap include a selection bias. When a policy—such as an expansion of childcare provision—draws more women into employment, the selection bias decreases such that observed wage differentials between women and men increase.

VIII Conclusion

The decision for a large expansion of publicly provided childcare over the 1990s marked a major step in German policy towards promoting maternal labor supply. In this paper, I utilize this reform to demonstrate the role of a family policy measure as a labor market institution for women and assess its contribution to wage inequality.

Wage inequality among women increases over the period of observation between 1986 and 2010. This increase is smaller in those regions with stronger increases in the supply with public childcare. The primary driver of this development is the lower half of the wage distribution. In regions with stronger increases in childcare, a larger share of the total change in wage inequality can be explained by compositional changes in the female workforce. There, more women select into part-time work, and medium levels of education, higher levels of experience as well as work in more stable jobs are more common. These compositional patters are, again, more pronounced in the lower half of the wage distribution. Relating workforce characteristics and wage inequality, I show that compositional changes with respect to age and education—factors that largely remain constant given labor market participation—play a larger role compared to experience, occupation or industry choices in explaining changes in wage inequality. Thus, childcare rather affects women's labor supply decisions on the extensive margin compared to sorting to employers or into occupations of those already employed. My findings are overall similar for women in full- and part-time. For the latter, the relationship between larger increases in childcare and smaller increases in inequality is stronger. In sum, the results suggest that this expansion in childcare has an impact on wage inequality mostly by changing the participation decisions of women with lower earnings potential. This is consistent with expectations and with the institutional details, as the reform added more relatively affordable care for children of age three to school entry. It is further consistent with the micro-level findings of Bauernschuster and Schlotter (2015), who emphasize positive participation effects where part-time work plays a larger role than full-time work.

Even though inequality among women decreases with stronger increases in childcare, the opposite holds for inequality between women and men, i.e. the gender wage gap. Both the raw and adjusted gender gap in wages remain the largest in those regions with the strongest increases in childcare supply over the observation period. Consistently, in these regions workforce composition explains the smallest fraction of the overall decrease of the gender gap over time.

Taken together, the expansion of childcare contributed to less unequal wages among women, whereas I find no indication that it improved the overall composition of the female labor force relative to men beyond existing trends. Therefore, this childcare expansion provides an example for a family policy that encouraged female labor supply, such that women profited via higher current earnings and consequently through higher pension entitlements in the long-run. At the same time, however, there is no direct contribution to a lower gender wage gap as more participation of women rather decreased the selection bias in measuring female wages.

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Appendix

A Additional Figures and Tables

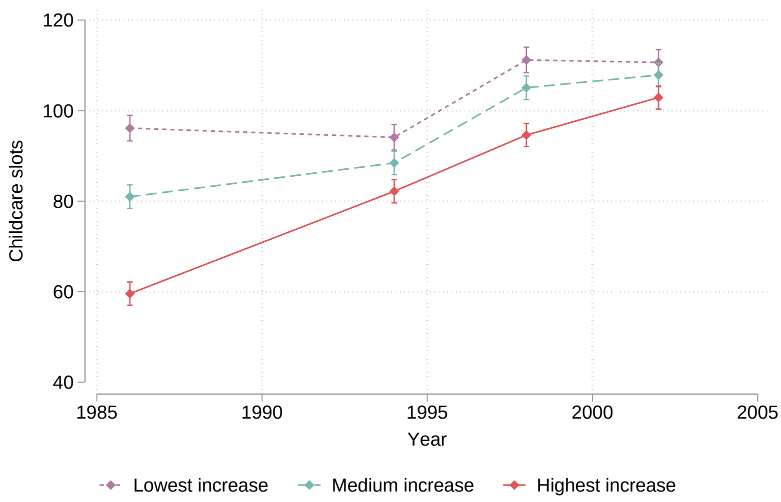


Figure A.1: Number of childcare slots for children of kindergarten age between 1986 and 2002, grouped by counties with low, medium and high increases.

Notes: The figure documents the increase in childcare supply between 1986 and 2010 along with 95-percent confidence bands. Childcare supply is measured at the county-level as the number of slots in public childcare for children of kindergarten age per 100 children aged three to five. Values above 100 do not indicate excess supply with childcare but rater that kindergarten age can include age levels up to age seven. As population data by age is not available for this group, the number of children of age three to five is used for scaling. The analyses in this paper use the relative supply measure plotted in Figure 1 in the main text.
Source: Own representation using the county-level data described in Section III.2.

Table A.1: Percentile gaps in log wages of women, 1986 and 2010.

	I: full-time workers		II: part-time workers	
	1986	2010	1986	2010
Full sample				
p85–p15	0.791	1.023	0.834	1.032
p85–p50	0.343	0.449	0.374	0.484
p50–p15	0.448	0.575	0.460	0.548
By regional increase in childcare supply				
p85–p15				
Low	0.775	1.025	0.812	1.030
Medium	0.792	1.008	0.837	1.033
High	0.793	1.008	0.863	1.017
p85–p50				
Low	0.339	0.449	0.376	0.481
Medium	0.345	0.441	0.374	0.485
High	0.339	0.445	0.362	0.484
p50–p15				
Low	0.436	0.576	0.436	0.549
Medium	0.447	0.567	0.463	0.549
High	0.454	0.543	0.501	0.533

Notes: The table reports percentile gaps in log imputed daily wages in 1986 and 2010. Panel I reports values for full-time workers, Panel II for part-time workers. The lower part of the table reports wage gaps separately for regions with low, medium and high increases in their childcare supply between 1986 and 2002.
Source: Own estimations using the SIAB data described in Section III.1.

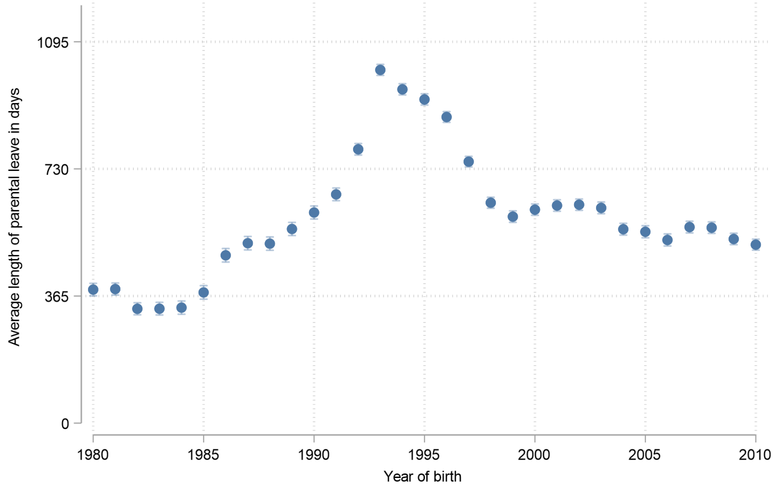
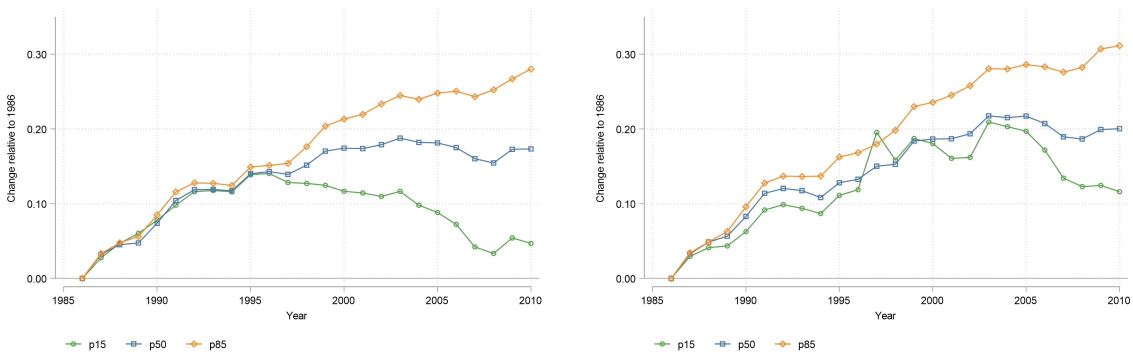


Figure A.2: Average length of parental leave taking by birthday of the first child (1980–2010).

Notes: Average length of parental leave in days after the birth of the first child. The plot restricts observations to mothers who return to the labor market after at most six years after childbirth. Without this restriction the levels for the years before 1993 are similar to those in 1993, the trend that the length of parental leave decreases, which starts at around 1994, remains unaffected. Mothers are identified based on the length of their absence from work following D. Müller, Filser, and Frodermann (2022).
Source: Own estimation using the SIAB data described in Section III.1.

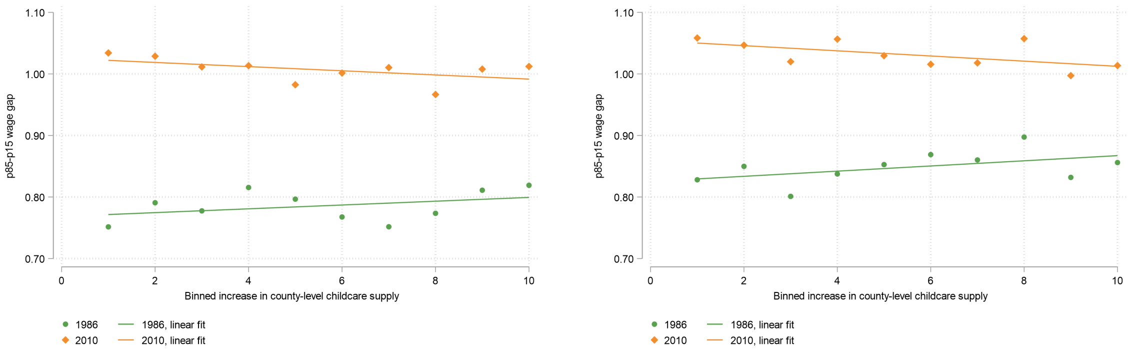


(a) Full-time workers

(b) Part-time workers

Figure A.3: Development of the 15th, 50th and 85th log wage percentiles of women, 1986–2010.

Notes: The figure plots changes in percentiles of log daily wages between 1986 and 2010. All values are normalized to 0 in 1986. Figure A.3a focuses on female full-time workers, Figure A.3b on female part-time workers. The 15th percentile is plotted in green, the 50th in blue and the 85th in orange.
Source: Own estimations using the SIAB data described in Section III.1.



(a) Full-time workers

(b) Part-time workers

Figure A.4: p85–p15 wage gap of women in 1986 and 2010 by binned regional increase in childcare supply.

Notes: The figure plots the p85–p15 gap in log daily wages of women by binned regional increase in childcare supply. The relationship in 1986 is plotted in green, results for the year 2010 are plotted in orange. Each bin contains 32–33 counties where those in the first bin increase their childcare supply by on average 6.5 additional slots per 100 children and those in the tenth bin by on average 54 additional slots.
Source: Own estimations using the SIAB data described in Section III.1.

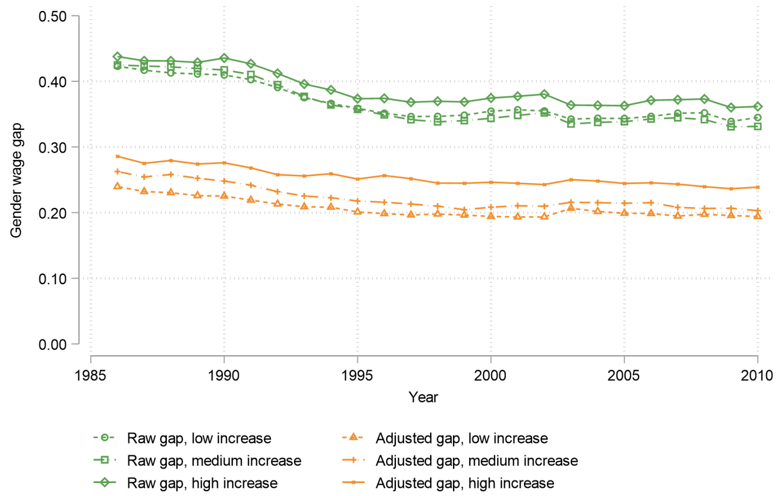


Figure A.5: Raw and adjusted gender wage gaps of full-time workers by development of childcare supply between 1986 and 2010.

Notes: The figure plots the raw (in green) and adjusted (in orange) gender wage gaps, measured as the average difference between the log wages of men and women. The plot differentiates between regions with low (plotted as short-dashed lines), medium (plotted as long-dashed lines) and high increases (plotted as solid lines) in childcare supply. Adjusted gender gaps control for interactions of age group with education, experience in employment and experience in the current job as well as for occupation (3-digit-level), industry (1-digit-level) and if an individual's wage is censored. To improve readability, the gender gap is shown as a positive number.
Source: Own estimations using the SIAB data described in Section III.1.

Table A.2: Observed and reweighted changes in wage inequality among women, 1986–2010. Reweighting controls for age, education and additionally experience, 3-digit occupation and 1-digit industry.

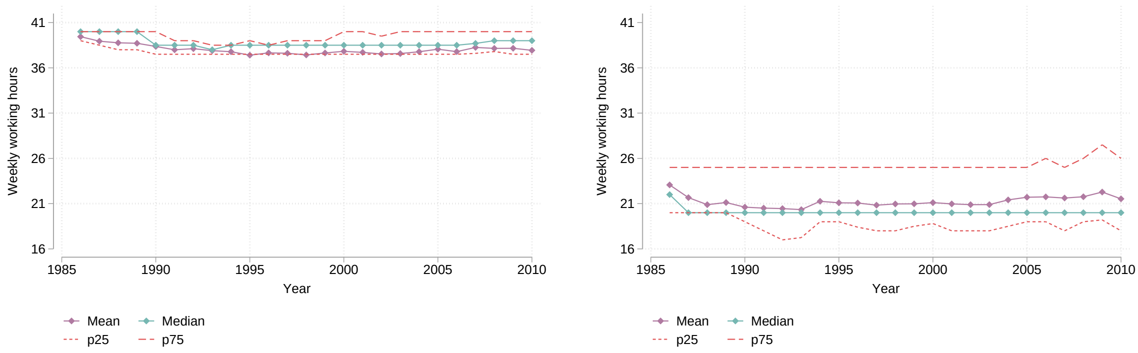
	I. Full-time workers			II. Part-time workers		
	Observed change	Composition	Price	Observed change	Composition	Price
Full sample						
p85–p15	0.233	0.124 (53%)	0.109	0.198	0.024 (12%)	0.174
p85–p50	0.106	0.059 (56%)	0.047	0.109	0.007 (6%)	0.102
p50–p15	0.127	0.065 (51%)	0.062	0.088	0.016 (18%)	0.072
By regional increase in childcare supply						
p85–p15						
Low	0.250	0.108 (43%)	0.142	0.218	0.033 (15%)	0.184
Medium	0.216	0.129 (60%)	0.087	0.196	0.023 (12%)	0.174
High	0.195	0.115 (59%)	0.078	0.154	0.016 (10%)	0.137
p85–p50						
Low	0.110	0.052 (47%)	0.058	0.105	0.010 (9%)	0.095
Medium	0.096	0.070 (72%)	0.027	0.111	0.013 (12%)	0.097
High	0.106	0.051 (48%)	0.054	0.122	0.009 (7%)	0.112
p50–p15						
Low	0.140	0.056 (40%)	0.084	0.113	0.024 (21%)	0.089
Medium	0.119	0.059 (50%)	0.060	0.086	0.010 (12%)	0.076
High	0.089	0.064 (74%)	0.023	0.032	0.007 (22%)	0.025

Notes: Observed and reweighted changes in inequality measures for log imputed daily wages between 1986 and 2010. The observed change is decomposed into a composition effect (columns 3 and 6) and a price (wage structure) effect (columns 4 and 7). Percentage values indicate the contribution of the composition effect to the observed change. Price effects correspond to the change from observed values in 1986 to reweighted values in 2010. Estimates in Panel I are for full-time workers, Panel II reports results for part-time workers. All specifications use three education and five age categories as well as all possible interactions, experience in the current job along with its interaction with the age categories, occupation (3-digit) and industry (1-digit) identifiers to estimate the DFL weights. The lower part of the table reports results separately for regions with low, medium and high increases in their childcare supply between 1986 and 2002.

Source: Own estimations using the SIAB data described in Section III.1.

Supplemental Appendix

B Validations and Robustness Checks



(a) Full-time workers

(b) Part-time workers

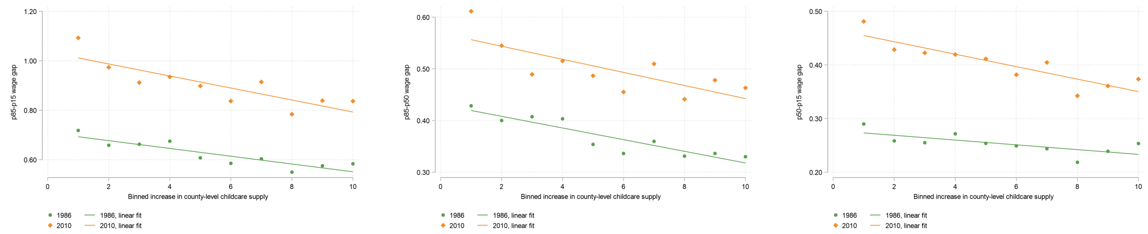
Figure B.1: Weekly working hours of females between 1986 and 2010 (SOEP data).

Notes: The figure plots mean, median as well as the 25th and 75th percentiles of usual weekly working hours of women aged 21 to 60 in regular employment in West Germany between 1986 and 2010. It shows that the cross-sectional variation in hours of part-time workers is large compared to full-time workers, whereas there is little variation over time.
Source: Own estimations using the SOEP v37 data (Wagner, Frick, and Schupp 2007). Sample restrictions similar to those for the SIAB data described in Section III.1 are applied.

Table B.1: County-level relationship between increase in childcare supply and wage inequality (in standard deviations), 1986 and 2010, male workers.

	Male full-time workers		
	1986	2010	$\Delta_{2010\text{-}1986}$
p85–p15	-0.539^{***}	-0.532^{***}	0.007
p85–p50	-0.493^{***}	-0.413^{***}	0.080
p50–p15	-0.444^{***}	-0.522^{***}	-0.078

The tables reports the relationship between the increase in childcare supply and percentile wage gaps for male workers in 1986 and 2010. Each value indicates by which share of a standard deviation the percentile gap would change if the increase in childcare supply was stronger by one standard deviation (additional 13.36 slots per 100 children). The row marked with Δ indicates the change from 1986 to 2010. All results are obtained from linear regressions on the county level, weighted with each county's observations share. */**/*** indicate significance at the 10/5/1 percent levels.
Source: Own estimations using the SIAB data described in Section III.1.



(a) p85–p15 wage gap (b) p85–p50 wage gap (c) p50–p15 wage gap

Figure B.2: p85–p15, p85–p50 and p50–p15 wage gaps of full-time working men in 1986 and 2010 by binned regional increase in childcare supply.

Notes: The figure plots the p85–p15 gap in log daily wages of full-time working men by binned regional increase in childcare supply. The relationship in 1986 is plotted in green, results for the year 2010 are plotted in orange. Each bin contains 32–33 counties where those in the first bin increase their childcare supply by on average 6.5 additional slots per 100 children and those in the tenth bin by on average 54 additional slots.
Source: Own estimations using the SIAB data described in Section III.1.

Table B.2: County-level relationship between increase in childcare supply and wage inequality (in standard deviations) controlling for changes in county-level GDP, 1986 and 2010.

	Full-time workers			Part-time workers		
	1986	2010	$\Delta_{2010\text{-}1986}$	1986	2010	$\Delta_{2010\text{-}1986}$
p85–p15	0.132**	−0.104	−0.236	0.033	−0.138**	−0.171
p85–p50	−0.007	−0.054†	−0.047	−0.125**	−0.034	0.091
p50–p15	0.161**	−0.085	−0.246	0.105*	−0.146***	−0.246

The table reports the relationship between the increase in childcare supply and percentile wage gaps for female workers in 1986 and 2010. The values for each year indicate by which fraction of a standard deviation the percentile gap would change if the increase in childcare supply was stronger by one standard deviation (additional 13.36 slots per 100 children). The columns marked with Δ indicate the change from 1986 to 2010. All results are obtained from linear regressions on the county level, weighted with each county's observation share and additionally controlling for the change in log per-capita GDP between 1992 and 2010. 1992 is chosen as baseline year as earlier data is not available. */**/*** indicate significance at the 10/5/1 percent levels; † indicates significance of the change in GDP at the 10 percent level.
Source: Own estimations using the SIAB data described in Section III.1.

Table B.3: Observed and reweighted changes in wage inequality among women, 1986–2010. Reweighting controls for age, education and additionally experience, 4-digit occupation, skill group and 1-digit industry.

	I. Full-time workers			II. Part-time workers		
	Observed change	Composition	Price	Observed change	Composition	Price
Full sample						
p85–p15	0.221	0.110 (50%)	0.111	0.196	0.023 (12%)	0.173
p85–p50	0.102	0.055 (54%)	0.047	0.108	0.009 (8%)	0.100
p50–p15	0.118	0.055 (46%)	0.064	0.087	0.014 (16%)	0.073
By regional increase in childcare supply						
p85–p15						
Low	0.241	0.099 (41%)	0.142	0.217	0.031 (14%)	0.186
Medium	0.204	0.116 (57%)	0.088	0.194	0.025 (13%)	0.169
High	0.197	0.110 (56%)	0.086	0.154	0.019 (12%)	0.135
p85–p50						
Low	0.107	0.047 (44%)	0.059	0.104	0.008 (8%)	0.095
Medium	0.093	0.065 (70%)	0.028	0.109	0.015 (14%)	0.094
High	0.108	0.051 (47%)	0.057	0.123	0.011 (9%)	0.112
p50–p15						
Low	0.134	0.052 (39%)	0.083	0.113	0.022 (20%)	0.091
Medium	0.110	0.051 (46%)	0.060	0.085	0.010 (11%)	0.075
High	0.089	0.059 (67%)	0.030	0.031	0.008 (27%)	0.023

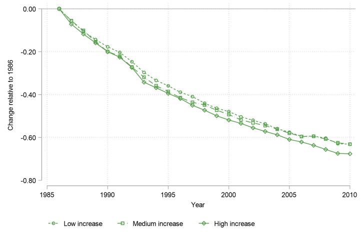
Notes: Observed and reweighted changes in inequality measures for log imputed daily wages between 1986 and 2010. The observed change is decomposed into a composition effect (columns 3 and 6) and a price (wage structure) effect (columns 4 and 7). Percentage values indicate the contribution of the composition effect to the observed change. Price effects correspond to the change from observed values in 1986 to reweighted values in 2010. Estimates in Panel I are for full-time workers, Panel II reports results for part-time workers. All specifications use three education and five age categories as well as all possible interactions, experience in the current job along with its interaction with the age categories, occupation (4-digit), four groups of skill requirements in the occupation and industry (1-digit) to estimate the DFL weights. The lower part of the table reports results separately for regions with low, medium and high increases in their childcare supply between 1986 and 2002.
Source: Own estimations using the SIAB data described in Section III.1.

Table B.4: Observed and reweighted changes in wage inequality among full-time working men, 1986–2010.

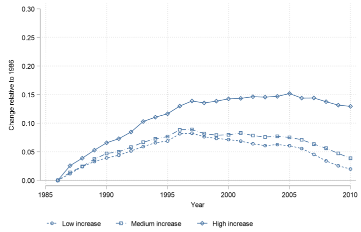
		I: education, age		II: education, age, experience, occupation, industry	
	Observed change	Composition	Price	Composition	Price
Full sample					
p85–p15	0.277	0.075 (27%)	0.202	0.105 (38%)	0.171
p85–p50	0.125	0.060 (48%)	0.066	0.054 (43%)	0.071
p50–p15	0.151	0.016 (10%)	0.136	0.051 (34%)	0.100
By regional increase in childcare supply					
p85–p15					
Low	0.309	0.101 (33%)	0.208	0.136 (44%)	0.172
Medium	0.274	0.078 (29%)	0.196	0.107 (39%)	0.166
High	0.257	0.075 (29%)	0.182	0.109 (42%)	0.150
p85–p50					
Low	0.139	0.084 (61%)	0.054	0.080 (58%)	0.058
Medium	0.130	0.064 (49%)	0.066	0.060 (46%)	0.070
High	0.130	0.065 (50%)	0.066	0.067 (51%)	0.064
p50–p15					
Low	0.170	0.016 (10%)	0.154	0.056 (33%)	0.114
Medium	0.144	0.014 (10%)	0.130	0.047 (33%)	0.096
High	0.126	0.010 (8%)	0.116	0.042 (33%)	0.086

Notes: Observed and reweighted changes in inequality measures for log imputed daily wages between 1986 and 2010. The observed change is decomposed into a composition effect (columns 3 and 5) and a price (wage structure) effect (columns 4 and 6). Percentage values indicate the contribution of the composition effect to the observed change. Price effects correspond to the change from observed values in 1986 to reweighted values in 2010. Estimates in Panel I use three education and five age categories as well as all possible interactions to estimate the DFL weights, in Panel II experience in the current job along with its interaction with the age categories, occupation (3-digit) and industry (1-digit) identifiers are added. The lower part of the table reports results separately for regions with low, medium and high increases in their childcare supply between 1986 and 2002.
Source: Own estimations using the SIAB data described in Section III.1.

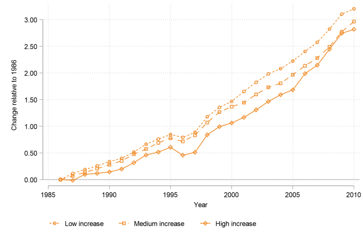
C Additional Graphical Evidence on Changes in Workforce Composition



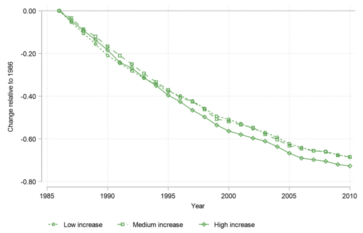
(a) Full-time workers, below vocational education



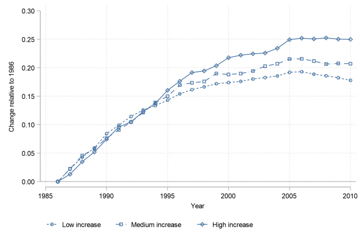
(b) Full-time workers, vocational education



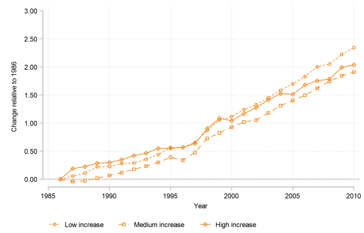
(c) Full-time workers, university or equivalent education



(d) Part-time workers, below vocational education



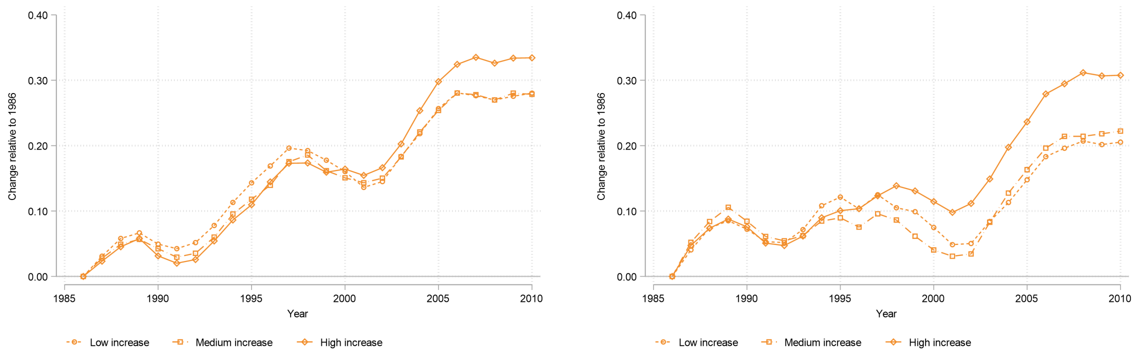
(e) Part-time workers, vocational education



(f) Part-time workers, university or equivalent education

Figure C.1: Changes in education of female full-time (top row) and part-time (bottom row) workers relative to 1986 by year and development of childcare supply.

Notes: Changes in the education levels of the female full-time and part-time workforce over time by development of childcare supply. Plots indicate changes relative to 1986. Observations are grouped by the position of a region in the distribution of the change in childcare supply between 1986 and 2002. The tercile of regions with the largest increases is plotted as a solid line, the second tercile as a long-dashed line, and the tercile of regions with the smallest increases as a short-dashed line.
Source: Own estimations based on the SIAB data described in Section III.1.

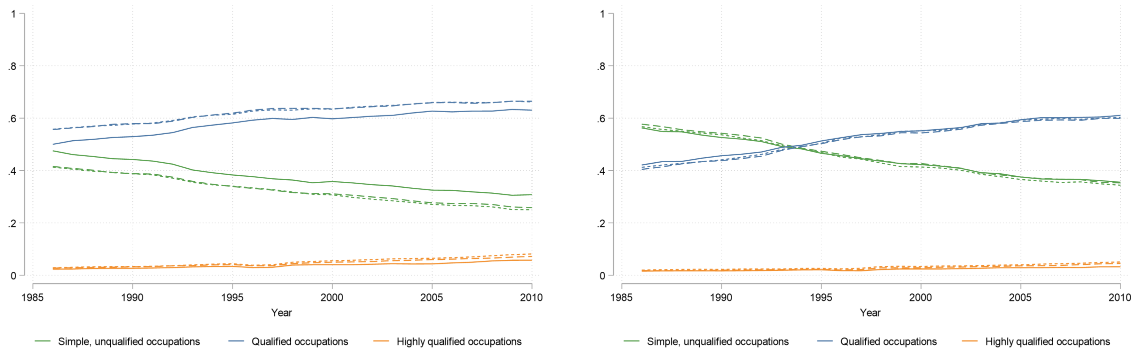


(a) Full-time workers

(b) Part-time workers

Figure C.2: Change in tenure in the current job relative to 1986 by year and development of childcare supply.

Notes: Changes in years spent in the current job of the female workforce over time by development of childcare supply. Plots indicate changes relative to 1986. Observations are grouped by the position of a region in the distribution of the change in childcare supply between 1986 and 2002. The tercile of regions with the largest increases is plotted as a solid line, the second tercile as a long-dashed line, and the tercile of regions with the smallest increases as a short-dashed line.
Source: Own estimations using the SIAB data described in Section III.1.



(a) Full-time workers

(b) Part-time workers

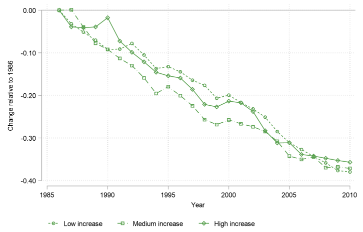
Figure C.3: Shares of women working in occupations of different qualification levels by development of childcare supply between 1986 and 2010.

Notes: Occupations of women by year change in the supply of childcare. Occupations requiring simple, unqualified work plotted in green, those requiring qualified work in blue, and highly qualified occupations in orange. The occupation categories are derived from the occupation groups constructed by Blossfeld (1985) and indicate occupations that require on average low, medium and high levels of qualification. Table C.1 provides the mapping between the Blossfeld groups and the categories by qualification along with average wages and employment shares by occupation categories. The tercile of regions with the largest increases in childcare is plotted as a solid line, the second tercile as a long-dashed line, and the tercile of regions with the smallest increases as a short-dashed line.
Source: Own estimations using the SIAB data described in Section III.1.

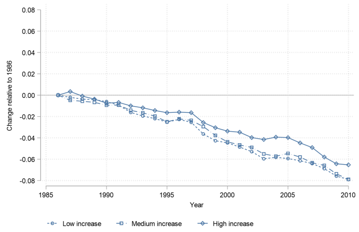
Table C.1: Occupation categories derived from the Blossfeld occupation groups.

	Simple, unqualified	Qualified	Highly qualified
Description	Agricultural Simple manual	Qualified manual Technicians	Engineers Professionals (service sector)
	Simple service sector Simple clerks, office jobs	Qualified service sector Semi-professionals Qualified office and administrative	Managers
Wage			
1986	4.21	4.41	4.79
2002	4.30	4.60	5.01
Employment share			
1986	46.2%	51.3%	2.5%
2010	29.9%	63.8%	6.3%

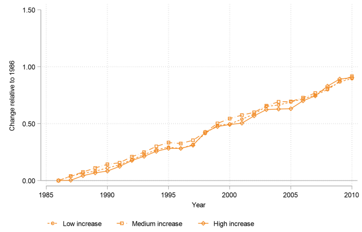
Notes: The top part of the table shows the mapping of occupation groups defined by Blossfeld (1985) to the broader occupation classifications by qualification level that is used in Figure C.3. The bottom part reports the according average log daily wages and employment shares of women per occupation group in 1986 and 2010.
Source: Own estimations based on the SIAB data described in Section III.1.



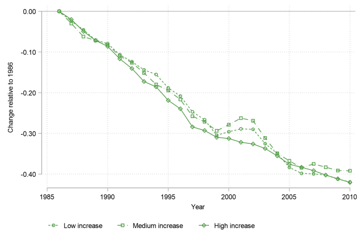
(a) Full-time workers, un-/semiskilled tasks



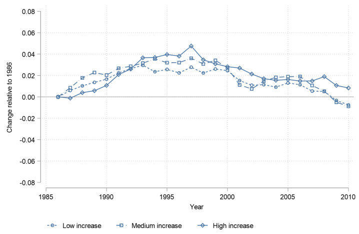
(b) Full-time workers, skilled tasks



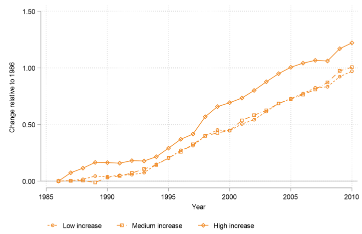
(c) Full-time workers, complex and highly complex tasks



(d) Part-time workers, un-/semiskilled tasks



(e) Part-time workers, skilled tasks



(f) Part-time workers, complex and highly complex tasks

Figure C.4: Changes in the skill levels of female full-time workers relative to 1986 by year and development of childcare supply.

Notes: Changes in the skill level derived from occupations of the female full-time and part-time workforce over time by development of childcare supply. Plots indicate changes relative to 1986. Observations are grouped by the position of a region in the distribution of the change in childcare supply between 1986 and 2002. The tercile of regions with the largest increases is plotted as a solid line, the second tercile as a long-dashed line, and the tercile of regions with the smallest increases as a short-dashed line.
Source: Own estimation based on the SIAB data described in Section III.1.

D Data Preparation and Sample Choices

This section describes in more detail which limitations apply to the SIAB data, how they are addressed and which choices are made when creating the main sample.

Censored wages above the social security threshold Earnings are only subject to social security contributions up to an upper limit. If earnings exceed this limit, the associated daily wages are right-censored such that they need to be imputed based on individual-level characteristics. All results reported in the paper are based on these imputed daily wages.

In practice, the wage imputation is based on work by Dauth and Eppelsheimer (2020) who follow the two-step approaches by Dustmann, Ludsteck, and Schönberg (2009) and Card, Heining, and Kline (2013). The imputation is done separately by year, education group (no vocational training, vocational training and university or similar) and gender. The first step fits Tobit regressions of observed log wages on variables for experience (linear and squared terms) and different age profiles for older and younger workers. Predictions based on the regression coefficients $\hat{\beta}$ and observable characteristics $\mathbf{X}$ as the expected value $\mathrm{E}\left[ln(\text{wage})\right] = \mathbf{X}\hat{\beta}$ are likely to exhibit a too strong correlation with $\mathbf{X}$ since they neglect the contribution of unobservable factors. Therefore, a normally distributed random term is added to the expected value. Assuming that wages follow a log-normal distribution, the additional random term is chosen such that for each individual i the following equation holds.

$$ln\left(\text{wage}_i^{\text{imputed}}\right) = \varepsilon_i\hat{\sigma} + \mathbf{X}_i\hat{\beta} \tag{1}$$

ε_i is drawn from the distribution of wages above the censoring limit and $\hat{\sigma}$ refers to the standard deviation of the residuals in the Tobit regression. Gartner (2005) and Dauth and Eppelsheimer (2020) describe the procedure in more detail.

The imputed wages are then used to calculate mean wages at the worker- and establishment-level where always the contribution of the current observation is omitted. In the second step, the Tobit regressions from the first step are repeated, but with these mean wages as additional control variables. They serve as proxies for time-constant effects at the worker- and establishment level, i.e. follow the idea of controlling for worker- and establishment fixed effects. After the second regression, again a random term as described above is added to the prediction from the regression and wages are adjusted to be not larger than ten times the 99th percentile of the predicted wage distribution.

Compared to work that focuses on men, censored wages are a much less severe concern for the results in this paper as it puts its emphasis on women. Card, Heining, and Kline (2013), who use the German social security records as well, report a share of only 2 to 3 percent of censored wages for women, whereas around 10 percent of male wages are censored. In this paper's sample up to 3 percent of female wages are censored on average (see Table 1), in some regions up to 4 percent (see Table 3).

Break in the notification procedure for workers in marginal employment Before April 1999, employers are not required to submit employment notifications for workers in marginal employment (Frodermann, Schmucker, et al. 2021). As this reporting change would lead to an inconsistent sample over time, these workers have to dropped. This is in line with Dustmann, Ludsteck, and Schönberg (2009).

Workers in East Germany Apart from East Germany not being fully covered by the data over this paper's period of observation, there are additional reasons only West German workers can be considered in this paper. Family policy in the German Democratic Republic (GDR) put an emphasis on the widespread availability of childcare to promote maternal labor supply. The expansion of childcare the western part of Germany experienced thus does not have an analog in the East. Family policies in the GDR are further associated with generally different attitudes towards female employment such that East and West Germany are hardly comparable. Becker, Mergele, and Woessmann (2020) argue that marked differences in gender norms between the eastern and western parts of Germany even predate the creation of the GDR. Boelmann, Raute, and Schönberg (2022) exploit these differences to provide evidence on the relationship between gender norms and the labor supply of mothers. Therefore, keeping East German workers in the sample with an adjusted period over observation would likely introduces biases to the analysis.

E DiNardo, Fortin and Lemieux Reweighting

The reweighting approach by DiNardo, Fortin, and Lemieux (1996) follows the idea of the Oaxaca-Blinder decomposition (Oaxaca 1973; Blinder 1973), but extends it from differences in means to the entire distribution such that other statistics as variance or quantiles can be calculated. This property is particularly important to assess changes in specific parts of the wage distribution. The reweighting procedure treats each individual observation (of wages w and individual characteristics z at a time t) as an element of a joint distribution at a given point in time, $F(w, z|t)$. The density of wages at t, $f_t(w)$, is then equal to the integral of the density of wages that is conditional on z at time t_w, $f(w|z, t_w)$, over the distribution of characteristics $F(z|t_z)$ at time t_z (where t_w and t_z refer to the points in time when w and z are measured). Formally, this can be written as

$$\begin{aligned} f_t(w) &= \int_z dF(w, z|t_{w,z} = t) \\ &= \int_z f(w|z, t_w)\, dF(z|t_z = t) \\ &\equiv f(w; t_w = t, t_z = t) \end{aligned} \tag{1}$$

where the last line refers to the density of wages that is actually observed, i.e. when both w and z are measured at time t. For this paper, the aim of the reweighting procedure is to obtain a counterfactual wage distribution for time t that would have prevailed if individual characteristics z remained unchanged at the levels at time t'. Formally, the counterfactual density of wages at time t given the characteristics z being measured at time t' is given by $f(w; t_w = t, t_z = t')$. By definition, this is unobservable. Using the second line of equation (1) to rewrite the counterfactual density gives

$$\begin{aligned} f(w; t_w = t, t_z = t') &= \int_z f(w|z, t_w = t)\, dF(z|t_z = t') \\ &\equiv \int_z f(w|z, t_w = t)\, \psi_z(z)\, dF(z|t_z = t). \end{aligned} \tag{2}$$

This expresses the counterfactual wage density as the integral of the density of wage at time t over the distribution of individual characteristics at time t'. Multiplying with $\frac{dF(z|t_z=t)}{dF(z|t_z=t)}$ allows to rewrite the expression as the integral of the wage density at time t over the distribution of z at time t, weighted by ψ_z. The weights are given as

$$\begin{aligned} \psi_z \equiv \frac{dF(z|t_z = t')}{dF(z|t_z = t)} &= \frac{\Pr(z|t_z = t')}{\Pr(z|t_z = t)} \\ &= \frac{\Pr(t_z = t'|z)/\Pr(t_z = t')}{\Pr(t_z = t|z)/\Pr(t_z = t)}. \end{aligned} \tag{3}$$

To go from the first to the second line of equation 3, Bayes' rule is applied to express $\Pr(z|t_z = t')$ as $\Pr(t_z = t'|z)$. In the last line of equation (3), the conditional probabilities can be estimated using a logit or probit model that pools the observations from t and t' and estimates the probability of t' conditional on z. The unconditional probabilities are obtained as the sample shares of observations from time t and t'.

The estimated weights $\hat{\psi}_z$ can be used to calculated weighted statistics for wages in year t. The observed change between years t' and t can be decomposed into a *composition effect* and a *wage structure effect* (commonly also referred to as *price effect*) (Fortin, Lemieux, and Firpo 2011). For instance, for the percentile difference between the 85th and the 15th percentile PD_{85-15} the composition effect is given as $\text{PD}^{t,c}_{85-15} - \text{PD}^{t}_{85-15}$, i.e. the reweighted counterfactual percentile difference in year t net of its unweighted observed analog. The wage structure effect is given as $\text{PD}^{t'}_{85-15} - \text{PD}^{t,c}_{85-15}$, i.e. as the difference between the observed value in the base year and the counterfactual value in year t. Note, that for the common case of increases in both the observed statistic and the reweighted statistic where the reweighted one is smaller than the observed one both effects are defined as negative numbers. This highlights their counterfactual nature as they report by how much a statistic would have been smaller in year t if workforce composition or wage structure had remained at their levels in year t'. To improve readability and to highlight that both effects typically contribute to increases, this paper displays them as positive numbers.

Note that, specifically in the context of this paper, this approach shows indirect effects of changes in the childcare supply on inequality, i.e. that childcare, first, affects workforce composition via changing participation decisions and sorting into, for instance, occupations which, in turn, affects inequality. An approach that follows the suggestion by DFL to assess inequality consequences of unionization (or other binary-coded changes) directly is not applicable here. It would, instead of an indirect one, require that there is a direct effect of childcare supply on wages, similar to union membership usually implying to be covered by collective bargaining.

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