Earnings Inequality and Working Hours Mismatch

Mattis Beckmannshagen[a], Carsten Schröder[b,a]

Abstract

Using data from the German Socio-Economic Panel, we show that changes in working hours, not changes in wages, are the major driver of rising earnings inequalities in Germany since the early 1990s. Next, we analyze whether changes in working hours are in line with employee preferences by comparing mismatches between desired and actual hours. We find that underemployment among low-wage earners increased, pointing at involuntary part-time work as a source of earnings inequality. In addition, for females, the presence of children in the household is associated with underemployment. Simultaneously, the desire for a reduction of working hours is more pronounced at the upper part of the hourly wage distribution. A counterfactual earnings distribution based on desired working hours and actual hourly wages exhibits significantly less inequality than the actual earnings distribution.

JEL Code: D63, J22, J31
Keywords: Earnings inequality, Working hours, Hours mismatch, Part-time work

We thank Alexandra Fedorets, Markus Grabka, Maximilian Longmuir and Matteo Targa for their fruitful comments as well as Isabel Z. Martínez and other participants of the Young Economists Conference 2020 for the constructive feedback. Mattis Beckmannshagen gratefully acknowledges financial support from the Hans-Böckler-Foundation.
[a] Free University Berlin, School of Business & Economics, Boltzmannstr. 20, 14195 Berlin, Germany.
[b] SOEP at German Institute for Economic Research (DIW Berlin), Mohrenstr. 58, 10117 Berlin, Germany.

1. Introduction

Earnings inequality is, for both economists and politicians, a long-standing central concern (Piketty, 2015; OECD, 2016). At the same time, many countries have experienced societal changes that substantially affect the labor market. For one thing, people's views and attitudes toward labor changed: the male breadwinner model is on decline, female labor market participation is rising (Von Gleichen and Seeleib-Kaiser, 2018), while work-life balance is increasingly valued by *Generation Y* (Smith and Nichols, 2015).[1] Secondly, the institutional setting of labor markets underwent a shift toward more flexibilization: union power has declined (Fitzenberger et al., 2011), while part-time work[2] and atypical employment became more common.

These developments have important implications for the work reality of employees. According to the neoclassical labor supply model, utility-maximizing individuals can freely choose their working hours and optimal labor supply equates marginal disutility of labor and wages. Labor-market imperfections prevent employees from realizing their preferred hours and imply welfare losses. In particular, involuntary part-time employment can have adverse consequences: These not only result from low earned income or a dependence on state transfer payments today. High earned income inequalities and shorter working hours today also result in lower human capital accumulation, flatter earnings profiles, and higher transfer needs tomorrow. For example, Biewen et al. (2018) and Paul (2016) show that part-time work negatively affects wages in the long term. Thus, the increase of part-time work also contributes to earnings inequality in the long term beyond just the direct mechanical effect. Remedies discussed in the literature include compensation parity for part-time jobs, readjustments of the unemployment insurance, an empowerment of employees ("right to request" changes in hours), and a shift from hourly to monthly minimum wages (Golden, 2016).

Despite the apparent negative welfare implications of mismatches between desired and actual working hours, we are not aware of empirical studies that provide a systematic exploration of the aforementioned mismatch-inequality nexus.[3] Existing analyses of earnings inequality consider supplied working hours as fully reflect-

[1] Biewen et al. (2018) stress the importance of compositional changes in the working population for growing inequality. According to their analysis, these are responsible for 80 (50) percent of the increase in wage inequality among females (males) from 1985 to 2010.

[2] The increase of part-time work in Germany is emphasized in Granados et al. (2019) and many other studies.

[3] Working hours mismatches are mostly analyzed in the context of negative effects on health (Bell et al., 2012; Bassanini and Caroli, 2015) or well-being (Wooden et al., 2009; Başlevent and Kirmanoğlu, 2014).

ing employees' labor supply preferences. By including desired hours and working hours mismatches we make two contributions: First, we show how changes in working hours and the increase of the covariance between hours and wages contributed to rising earnings inequality in Germany. Second, we show that these changes in working hours, to a large extent, were in contrast to employees' desired working hours, and that the mismatch between desired and actual working hours is a driving force of the dispersion of earnings.

Such analysis comes with demanding data requirements. Many datasets provide information about monthly earnings but very few contain actual and desired working hours. One dataset providing the full set of required information for studying the nexus between working-hours mismatches and earnings inequality is the German Socio-Economic Panel (SOEP) (Goebel et al., 2019), used in the present study.

Germany is a particularly interesting country to investigate the connection between working hours mismatches and earnings inequality: After reunification, Germany experienced a phase of rising unemployment, particularly in the East (Snower and Merkl, 2006). To fight high and persistent unemployment rates, the German labor market was deregulated in the course of the so-called Hartz reforms[4] implemented between 2003 and 2005. In the following years, unemployment decreased markedly and the portion of marginally employed increased sharply (Jacobi and Kluve, 2007; Fahr and Sunde, 2009). At the same time, real earnings basically stagnated. In contrast to many other countries, the positive development in employment continued even after the Great Recession, the so-called "German labor market miracle" (Burda and Hunt, 2011). Finally, our observation period includes the introduction of a statutory minimum wage in 2015. This major labor market intervention targeted between 10 and 14 percent of German employees, affecting both wages and working hours[5] (Caliendo et al., 2019).

This paper provides a comprehensive descriptive examination of earnings inequalities and working hours mismatches for the period from 1993 to 2017. We refer to each of the above described phases (*post-unification, Hartz-reforms, post-recession, minimum wage*) and proceed in three steps. In the first step, we de-

[4]The main components of the Hartz reform were a liberalization of temporary employment, a rise of the limit for so-called marginal employment under which employees are exempt of social security contributions, as well as major reductions in level and duration of unemployment benefits.

[5]The German labor market imposes certain earnings ceilings on a monthly basis, such as €450 per month for marginal employees. Marginal employees are exempt of social security contributions and taxes if they stay below the threshold. If the hourly wage increases - e.g. caused by the introduction of a legal minimum wage - employees who want to stay below that threshold have to reduce their working hours. This is explained in more detail and shown empirically by Caliendo et al. (2019).

compose the observed rising inequality in earnings into three basic components: changes in the distributions of hourly wages and working hours and the correlation between the two variables. Thus, our examination takes a more fine-grained perspective than most existing studies that simply distinguish between full-time and part-time employment. As the demand for more flexible work arrangements and work-life balance is growing (Smith and Nichols, 2015), a more accurate analysis of the intensive employment margin seems appropriate.[6] In a second step, we describe mismatches between desired and actual working hours, their implications for earnings inequalities and explore their drivers. In a third step, we construct hypothetical earnings distributions if employees had realized their desired working hours, while maintaining their hourly wages.

Our empirical examination indicates a significant increase in earnings inequality, mostly in the second half of the 1990s and in the early 2000s. In recent years, earnings inequality stabilized at a high level.[7] For example, the Gini index increased from 0.31 in 1993 to 0.37 in 2017, while the Mean Log Deviation (MLD) increased from 0.19 to 0.29. The MLD of earnings is particularly well suited for our purposes. It allows for decomposing earnings inequality across three components: inequality in hourly wages, inequality in working hours, and the covariance of the two (Checchi et al., 2016). The MLD decomposition reveals that only 10 percent of the increase in earnings inequality resulted from rising wage inequalities, but that rising working hours inequalities and, especially, the increasing covariance of working hours and wages played the predominant role. In contrast to earlier years, since the 2000s, low wages are more often connected to low working hours. This changing pattern turns out to be the main driver of rising earnings inequality of in Germany.

Our examination also reveals changes in the patterns of hours mismatches. In 1993, compared to their actual workload, a majority of about 54 percent of employees preferred a working-hours reduction; about 9.0 hours per week on average. About 11 percent of the employees preferred a working-hours increase; about 7.9 hours on average. In 2017, the share of those who preferred to work less is about five percentage points smaller, while the opposite holds for those who preferred to work more. These changes are not evenly distributed along the hourly wage distribution. In 1993, 54 percent of the bottom wage quintile and 59 percent of

[6] As an illustration, take the collective agreement within the German metal industry: Since 2018, employees can choose a working time arrangement called "shortened full-time." For up to two years, they can reduce their regular working time to 28 hours per week. As other unions call for similar arrangements, working hours are likely to become more heterogeneous and the binary distinction of full-time and part-time will be insufficient to precisely analyze labor supply.

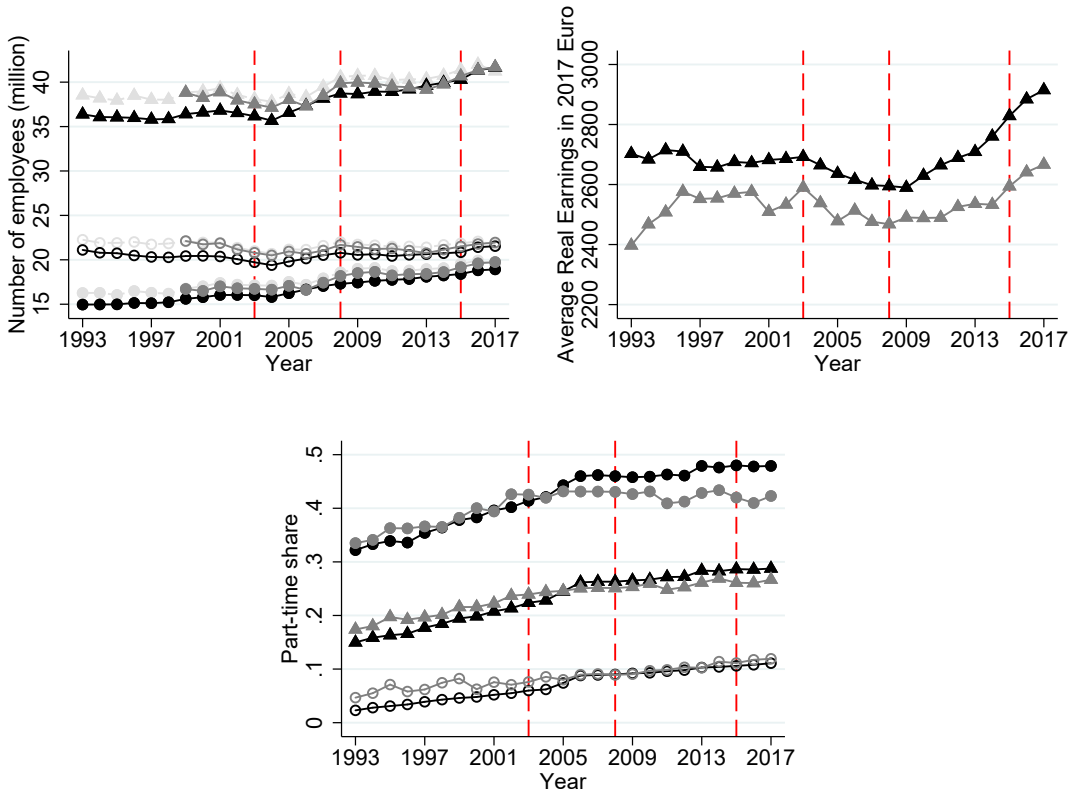
[7] This finding is in line with studies like Biewen and Juhasz (2012) and Fedorets et al. (2020).

the top quintile preferred a reduction of hours. For the bottom quintile, this share decreased to 34 percent in 2017. For the top quintile, even more employees prefer a reduction of hours in 2017: 62 percent. In 1993, the share of the workers who preferred to work more was approximately the same in all five wage quintiles at 11 percent. However, in 2017, the share is 26 percent in the bottom quintile compared to only 9 percent in the top quintile. Thus, low-wage workers are especially likely to experience underemployment. We also identify the presence of children in the household to be a major characteristic determining underemployment for women. In turn, for men, the presence of children is negligible in the context of working hours mismatches. This contradicts the notion that reduced working hours of mothers are choices completely resulting from their preferences. Finally, by constructing a counterfactual earnings distribution, we show that earnings inequality was significantly lower since the mid-2000s if employees had realized their desired working hours. From these results, we draw the conclusion that involuntary part-time work and the inability to realize the preferred volume of labor supply significantly contributes to the rising earnings inequality.

The remainder of the paper is structured as follows: Section 2 summarizes important institutional changes and resulting phases the German labor market went through from 1993 to 2017. Section 3 describes our data. Section 4 provides the results: The evolution of earnings inequality, its decomposition in hourly wages and working hours are displayed; working hours mismatches and potential determinants are identified; and counterfactual distributions are examined. Section 5 discusses the results in the light of existing literature, while Section 6 concludes.

2. The German Labor Market in a Nutshell

The macroeconomic conditions during the observation period of 1993 to 2017 likely induced institutional reforms and also directly impacted working hours and inequality. We focus on four remarkable events that characterize the development of the German labor market since German unification. These events structure the period and form the background of our subsequent analyses. Basic descriptive facts about the development of the German labor market since the early 1990s are summarized in Figure 1. The figure displays time series from official statistics and SOEP. In general, trends are very similar, although some statistics differ in levels. This is mostly due to different definitions of variables and/or of base populations. In the following, we refer to the numbers from official statistics.



Note: Filled circles represent females, hollow circles males. Triangles represent the whole working population. Black symbols and lines are based on administrative data publicly available at the Federal Statistical Office. Data on employment and part-time are based on the Microcensus. Therein, the classification of part-time and full-time is based on employee self-assessments. Gross monthly earnings per employee are based on National Accounts data. Grey symbols and lines are SOEP based. Note that the employment numbers from the SOEP are computed based on a survey question closely following the ILO-definition of employment. As this question was introduced in the SOEP in 1999, earlier numbers (in light grey) are based on a more restrictive employment definition. Part-time work in the SOEP is defined as ≤ 30 contractual working hours per week.

Figure 1: German labor market developments

Post-unification period. The integration of the former GDR's planned economy in the Federal Republic's social market economy together with the adaption of the entire legal system and institutional setting had enormous socio-economic implications. Specifically, as detailed in Snower and Merkl (2006), in the 1990s, the East German labor market struggled with low-productivity firms and high labor costs induced by the adaption of the Federal Republic's generous welfare system and counterproductive attempts to strengthen the East German labor market. As a result, the labor market in the *post-unification* phase from 1993 onward was characterized by a stagnant number of around 36 million employees, which was due to decreasing male and increasing female employment. Part-time

work increased among males and females, but at a substantially higher level for the latter. Real earnings stagnated, varying around 2,700 Euro per month (and significantly lower in the east).

Hartz-reforms period. In response to high unemployment, the Hartz Commission designed several reforms that resulted in a significant liberalization of the German labor market.[8] The German government implemented the reforms starting in 2003: Temporary employment was promoted, the upper earnings ceiling for marginal employment (under which employees are exempt of social security contributions) was raised, and unemployment benefits were markedly reduced.[9] Following these reforms, starting from a peak rate of about 12.5 percent in 2004, the unemployment rate fell to 7.6 percent in 2008. During this phase, the number of employees rose to about 38 million, with a further increasing share of female and part-time workers. On the downside, average real earnings dropped to about 2,600 Euro per month and earnings inequality increased due to the establishment of a large low-wage sector (Dustmann et al., 2014).

Post-recession period. In 2008, the Great Recession hit Germany. Like many other countries, Germany's GDP dropped sharply, yet, unlike many countries, Germany did not experience a strong upswing in unemployment: rather it experienced a continuously rising number of employees Burda and Hunt (2011). Overall the unemployment rate decreased from 7.6 to about 5 percent in 2013/14, with the number of employees further increasing to about 39 million, predominantly driven by another increase in the number of female employees.[10] This so-called "labor market miracle" (Burda and Hunt, 2011) made Germany an exceptional case – at least in Europe, where the Great Recession and the sovereign debt crisis brought large economic uncertainties, a strong recession, and high unemployment, particularly in the Mediterranean countries. For the first time since unification, employees also benefited from rising real earnings. These rose to about 2,800 euro per month in 2014. Nevertheless, high earnings inequality remained a highly debated topic.

Minimum wage period. As a response to the long-time debate about the size of the low-wage sector, declining union coverage and high inequalities, in 2015,

[8] Two years earlier, in 2001, another law became effective, creating a general right for employees to work in part-time, at the same time deregulating fixed-term contracts.

[9] Depending on age, the maximum duration for a benefit relative to the prior salary (unemployment benefit I) was heavily reduced. Afterwards unemployed fall to receiving a minimum subsistence level (unemployment benefit II), which takes into account owned assets before disbursement. Further, receivers of the type II benefit are obliged to accept any job offer that is considered reasonable by the unemployment agency.

[10] Stated reasons for the good performance of the German labor market throughout the crisis are the German system of free collective bargaining and wage restraints (Dustmann et al., 2014) as well as the increased usage of working-time accounts and a government program supporting short-time work (Burda and Hunt, 2011).

for the first time, the German government introduced a statutory minimum wage: Except for few exemptions, all employees are subject to the minimum wage, which was introduced, initially, at a level of €8.50 and raised several times during the *minimum wage* phase. It directly affected more than 10 percent of the work force. Pessimistic pre-reform assessments about strong negative implications for employment, (e.g., Knabe et al., 2014), did not manifest. Instead, until the end of our observation period in 2017, Germany experienced a further moderate rise in employment, rising earnings, and, for the first time in the century, a marked and above-average rise of wages at the bottom of the distribution (Burauel et al., 2020).

The four time periods shape the structure of the following descriptive analyses of monthly earnings, hourly wages and hours mismatches. The prevailing macroeconomic conditions between the periods differed markedly: stagnating employment numbers and earnings in the *post-reunification* period, rising employment but decreasing earnings during the *Hartz-reforms* period and a labor market boom with rising employment and earnings in the *post-recession* and *minimum wage* period. While causal analyses of these events or reforms are not aim of this paper, the macro conditions during a specific period likely impacted the development of wages, desired and actual working hours.

3. Data and Sample Construction

The database for the empirical analyses is the German Socio-Economic Panel (SOEP). The SOEP is a longitudinal household survey comprising, as of 2019, around 30,000 respondents annually (Goebel et al., 2019). It is particularly well-suited for our purposes, as it provides a representative sample of the German population, including data covering a comprehensive list of socio-economic indicators including high-quality information on the three focal variables of our analyses: actual monthly earnings, actual weekly working hours and desired weekly working hours. The latter are surveyed by the following question:

> "If you could choose your own working hours, taking into account that your income would change according to the number of hours: How many hours would you want to work?"

As a result, respondents are asked to report their desired working hours based on their current hourly wage.[11]

[11] For a validation of measures of desired working hours see Faberman et al. (2020).

In order to keep the analyses comparable over time, we focus the period following German reunification, starting in 1993[12] and ending in 2017. We restrict the sample to working individuals with information available on gross monthly earnings as well as on both actual and desired working hours. By means of winsorizing, we adjust for outliers in the data on monthly earnings and hourly wages.[13] Ultimately, this leaves us with a sample containing 278,960 observations overall.

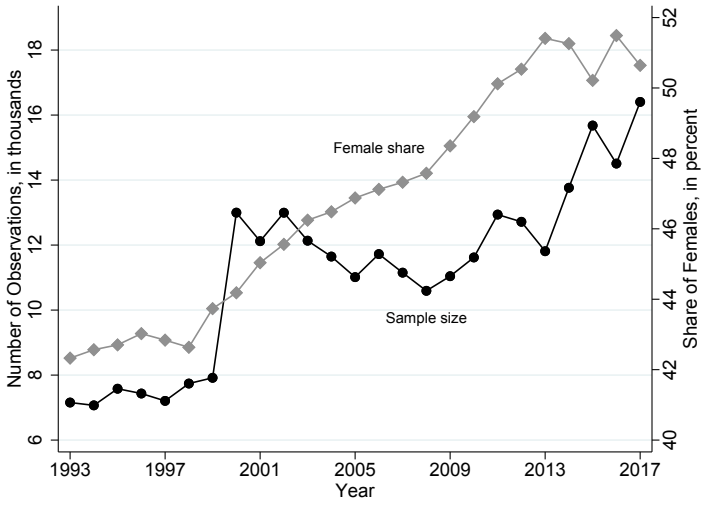
Over time, SOEP has expanded its scope, adding more subsamples to its range in order to counteract panel attrition and improve the representation of the German population.[14] This is also reflected in our working sample as displayed in Figure 2: For the 1990s, our working sample contains between 7,000 and 8,000 observations per year. In 2017 our sample consists of over 16,000 observations. As we are only focusing on the working population, it is not surprising that the share of females within our sample also increased from around 42 percent in 1993 to almost 51 percent in 2017. This development reflects the general trend of rising female labor market participation in Germany, although the stated share refers to the unweighted sample.

Structurally and important for our analyses are three expansions of the SOEP. In 1995, the SOEP started sampling a so-called immigrant sample to adequately represent immigrants, which was not the case in earlier years. This better representation explains the 1995 kink in time series of some SOEP variables (see also Grabka and Schröder (2018)). The same is true in 2002, when Sample G was integrated so as to better represent the top tail of the income distribution (Siegers et al., 2019). Starting in 2013, in response to a large influx of migrants to Germany, 4 migrant samples were integrated. SOEP weighting factors are available to address these structural changes and provide inference on the base population: individuals in private households resident in Germany.

[12] Before 1993, desired working hours were not surveyed among the East German population. Further, desired working hours were not surveyed in 1996. Thus, in 1996, our analysis solely focuses on earnings, leaving the hours mismatch aside.

[13] Specifically, we conducted winsorizing, setting values above (below) the 99th (1st) percentile equal to the respective percentile boundary. To adjust for outliers in working hours, we set values above 60 for desired and actual weekly working hours to be 60. In Germany, 60 hours is the legal maximum number of working hours per week.

[14] For a detailed overview of the development of the SOEP subsamples, see Siegers et al. (2019).

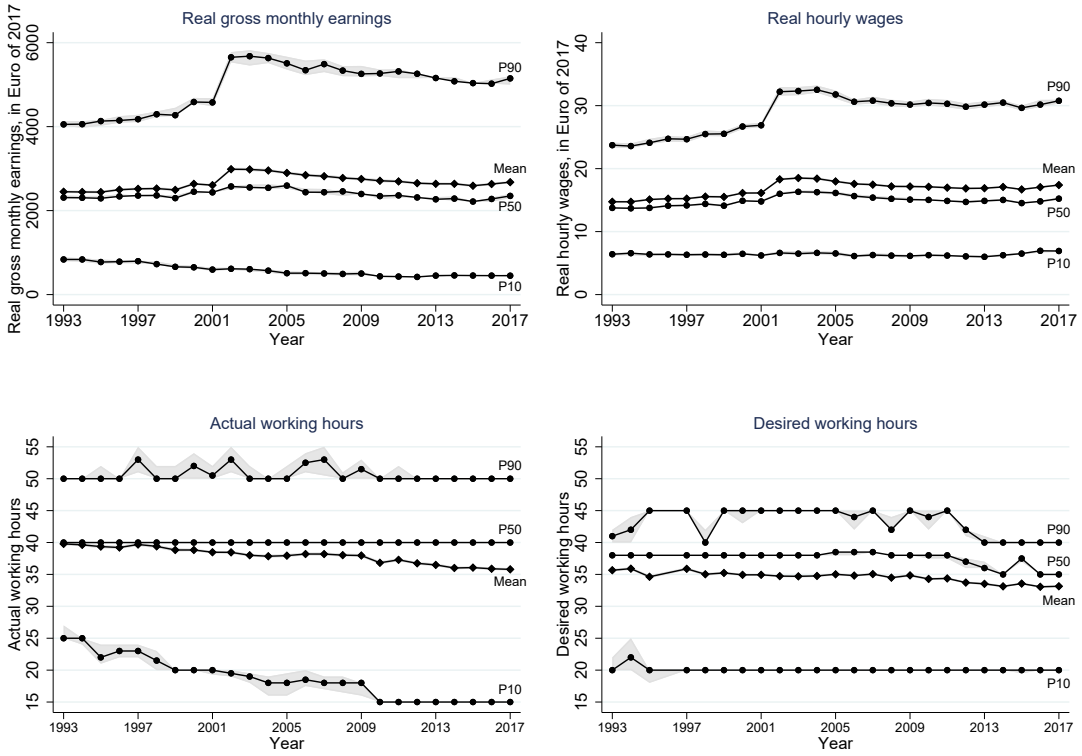


Note: Black line (left y-axis): Number of observations per year. Grey line (right y-axis): Share of females in the working sample.

Figure 2: Sample size and gender composition

Figure 3 presents unweighted sample statistics of our four focal variables: Gross monthly earnings, hourly wages, actual working hours, and desired working hours. Means and percentiles for the whole times series of 1993 to 2017 are displayed. All values of earnings and wages throughout this paper are real values in prices of 2017. Despite the structural changes in the sample, even the *unweighted* time series of the focal variables run rather smoothly. The only exemption is a marked increase of the 90th percentile of earnings in 2002, which is due to the incorporation of the high income sample. This finding is an important indicator for the validity of our subsequent analyses. Equally important is that the *weighted* SOEP data match the time series for the labor-market statistics, as detailed in Figure 1.[15] For the analyses we use the weighted data, which diminishes the effect of sample adjustments within the SOEP and makes our examination comparable over time as well as representative of the whole German labor force.

[15]Note that slight differences in levels occur due to different definitions in the SOEP and the administrative data sources.



Note: Unweighted sample statistics of SOEP v34. Grey shaded areas indicate bootstrapped 95% confidence intervals.

Figure 3: Data description: Sample statistics of key variables

4. Results

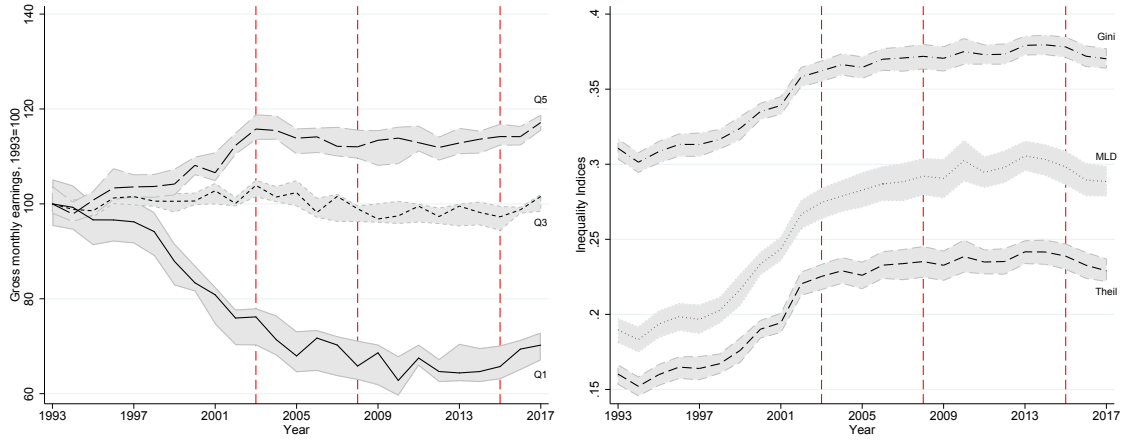
The results are organized in two subsections. Based on several well-known indices, Section 4.1 provides the inter-temporal evolution of inequalities in earnings, hourly wages, and working hours during each phase that the German labor market went through between 1993 and 2017. Furthermore, the Mean Log Deviation is used to decompose earnings inequality in three components: inequality in hourly wages, inequalities in workings hours, as well as the correlation of wages and hours (see Checchi et al. (2016)). To enable statistical inference, in all the following descriptive analyses, point estimates are accompanied with bootstrapped confidence intervals.[16] Section 4.2 examines the extent to which the actual working hours of the employees correspond to their desired working hours, how possible working-hours mismatches can be explained, and what the earnings distribution would be if the employees could have achieved their desired working hours.

[16] We draw 1,000 bootstrap samples, from which we derive 95% confidence intervals by applying the percentile method. Consequently, the confidence bands are not necessarily located symmetrically around the point estimates.

4.1. Earnings Inequality, Wages and Working Hours

Long-run Inequality Trends

There are various statistical measures for the description of inequalities. We use quintiles, the Gini index, the Theil index, and the Mean Log Deviation (MLD). All measures yield a consistent picture of rising earnings inequalities, as seen in Figure 4. The left panel provides the normalized average earnings for the first, third, and fifth quintiles. Between 1993 and 2017, average earnings rise in the top, remain stable in the middle, and fall in the bottom quintiles, respectively. The widening gap between top and bottom earners is of significant magnitude: While average earnings in the bottom quintile decrease by about 30 percent, they increase by about 16 percent in the top quintile. Most of this divergence can be attributed to the *post-unification* period: Average earnings of the bottom quintile decreased by 24 percent while the top quintile gained close to 16 percent. During the *Hartz reforms* period, average earnings of all quintiles shrank but not to the same extent. The bottom quintile's average earnings decreased by an additional 8 percentage points, while the top quintile earnings shrank by about six percentage points. In the *post-recession* phase, average earnings stagnated for all of the 3 displayed quintiles, while they gained between 3 and 4 percentage points in the *minimum wage* period.



Note: Left graph: Solid line: 1st quintile, short-dashed line: 3rd quintile, long-dashed line: 5th quintile. Right graph: dashed-dotted line: Gini index, dotted line: MLD, dashed line: Theil index. Source: SOEP v34, weighted using SOEP weighting factors.

Figure 4: Development of the first, third, and fifth quintile of monthly earnings and earnings inequality from 1993 to 2017

The right panel provides the three inequality indices. All indices point at rising earnings inequalities. The Gini (Theil) increased from 0.31 (0.16) in 1993 to 0.37

(0.23) in 2017, while the MLD rose from 0.19 to 0.29. This marked rise happened during the *post-unification* phase, while the point estimates peaked in 2013-2014 and slightly decrease in the *minimum wage* period.

Our results are in line with many previous studies observing a rise in inequality in Germany during the 1990s and 2000s.[17] At the same time, we provide a more recent picture that includes the minimum wage introduction. Another distinctive feature is that many previous examinations of wage inequalities, particularly those based on administrative data, focus on full-time employees. The reason is that administrative data do not provide working hours but only categorical information about whether employees are full-time or part-time employed. This categorical information is not suited to derive hourly wages from monthly earnings.[18] Thus, our results apply to the working population in general and are not numerically comparable to aforementioned previous studies. Nevertheless, the strong inequality increase between the late 1990s and the first half of the 2000s corresponds to the results of Dustmann et al. (2009) and Card et al. (2013). Among the cited causes for wage dispersion during that phase are skill-biased technological change,[19] compositional changes of the labor force and assortative matching,[20] and institutional changes, such as de-unionization and the Hartz reforms.[21]

Figure 5 displays the development of normalized average wages (left graph) and (non-normalized) actual working hours (right graph) for the first, the third, and the fifth quintiles of the 1993 to 2017 hourly wage distributions. Quintile averages for hourly wages exhibit a pattern rather different from that for earnings (as displayed in Figure 4) and, thus, cannot explain the rise in earnings inequality: At the end of the *post-unification* period, average wages of the first and fifth quintiles start diverging, which intensifies during the *Hartz-reforms* phase. This divergence results from a decrease in the bottom quintile's average hourly wages by 15 percent, while the top quintile's wages stagnated. Starting in the *post-recession* period, the bottom quintile's wages caught up. Since then, wages in the lowest quintile grew faster than in the top quintile, additionally experiencing a boost in the *minimum wage period*. As a result, over the entire observation period, average real hourly wages of the bottom and the top quintiles grew by a moderate, but

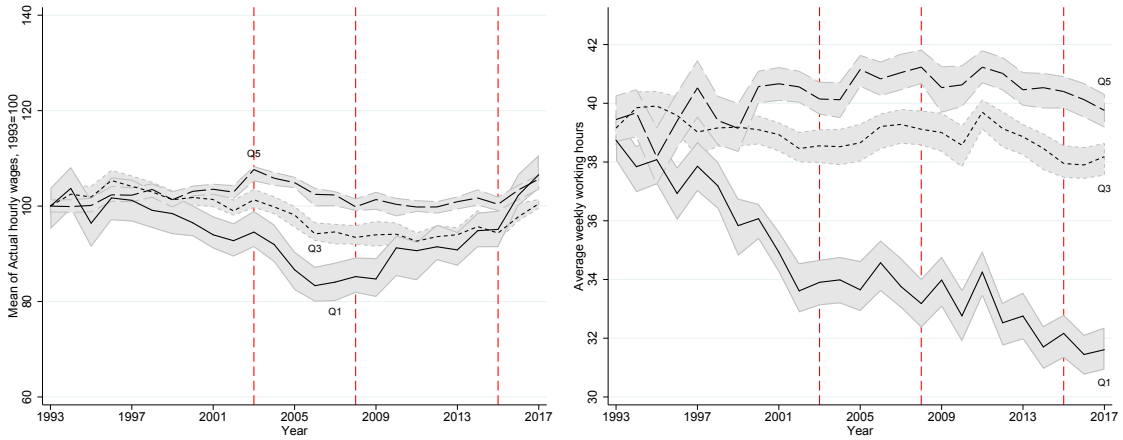
[17] For example, Fuchs-Schündeln et al. (2010) provide SOEP-based Gini coefficients corresponding to ours. Additionally, Gerold and Stein (2020) come to very similar figures for the Gini, MLD, and Theil in 2006, 2010, and 2014, based on the German Structure of Earnings Survey.

[18] See for example Dustmann et al. (2009); Card et al. (2013); Fitzenberger et al. (2013); Dustmann et al. (2014); Antonczyk et al. (2018).

[19] See for example Dustmann et al. (2009).

[20] See for example Dustmann et al. (2009); Card et al. (2013); Biewen et al. (2018).

[21] See for example Fitzenberger et al. (2013); Dustmann et al. (2014).



Note: The solid, (short-dashed), and [long-dashed] lines represent the 1st, (3rd), and [5th] quintiles, respectively, of the hourly wage distribution. Source: SOEP v34, weighted using SOEP weighting factors.

Figure 5: Development of wages and actual working hours among the first, third, and fifth quintiles of the hourly wage distribution from 1993 to 2017

rather similar, rate of about 5 to 6 percent.

Changes in working hours among the wage quintiles turn out to be an important driver of earnings inequalities: These averages move much like the quintile averages of earnings. In 1993, employees, on average, worked around 39 to 40 hours per week, no matter at what part of the hourly wage distribution they were located. During the *post-unification* phase, average working hours of the bottom wage quintile decreased to 34 hours per week. Meanwhile, average working hours of the top quintile marginally increased to 40 hours. During the *Hartz-reforms* period, the divergence continued slightly as the bottom quintile's hours decreased by one additional hour per week, while the opposite was the case for the top quintile. In the *post-recession* period, average hours decreased by about one hour for all wage quintiles. Finally, in the *minimum wage* period, working hours remained roughly constant. In 2017, average hours in the bottom wage quintile are about 7 hours lower than in 1993, while the top quintile gained one hour and the mid quintile's average hours decreased by one hour.

In sum, it is the marked reduction of working hours at the bottom of the wage distribution that substantially contributes to the growing dispersion of earnings. This, in addition to the potential role of changes in the covariance between hourly wages and working hours, is formally explored in the subsequent decomposition exercise.

Decomposing Earnings Inequality

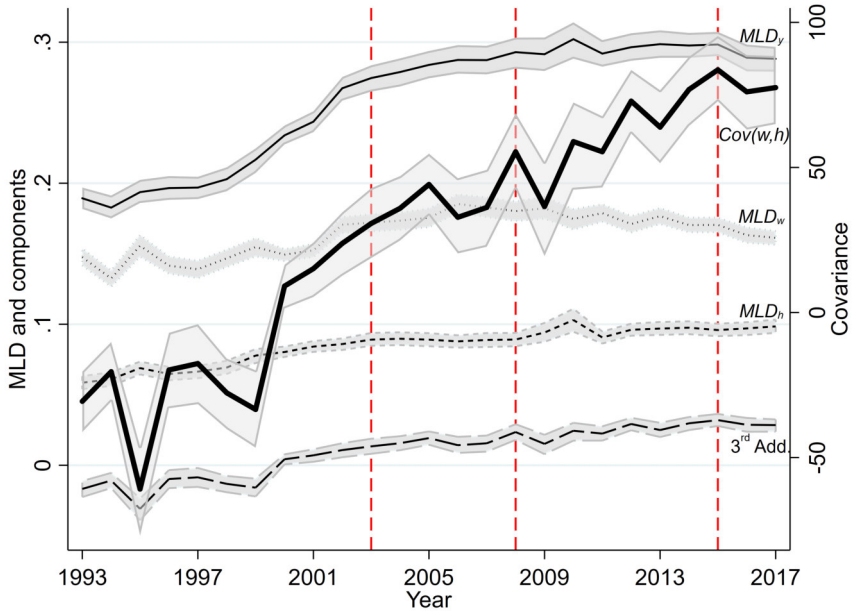
As shown by Checchi et al. (2016), the MLD of earnings, MLD_y, can be expressed as the sum of the MLDs of hourly wages, w, and working hours, h, and a third term that includes the covariance of wages and hours:

$$MLD_y = MLD_w + MLD_h + ln(1 + \frac{Cov(w,h)}{\bar{w} \times \bar{h}}). \quad (1)$$

Figure 6 provides all three terms together with the covariance of hourly wages and working hours for each year of the observation period. MLD_y (solid line) increases from 0.19 in 1993 to 0.29 in 2017. Around 10 percent of this increase can be attributed to rising inequalities in hourly wages. Wage inequality peaks during the *Hartz-reforms* period and declines slightly thereafter. The MLD of working hours, MLD_h, increases by 0.03 during the *post-unification* period and by one additional percentage point afterwards, thus accounting for around 40 percent of the increase in earnings inequality. Accordingly, almost half of the increase in the MLD of earnings is due to the third addend, which is mainly defined by the covariance of hourly wages and working hours (thick colored line, right y-axis). In fact, during the 1990s, this covariance is negative, indicating that higher hourly wages in the cross section are correlated with fewer working hours. This changes substantially over the observation period: The covariance rises almost steadily until the end of the *post-recession* phase and remains stable in the *minimum wage* period.[22]

In sum, the rise in earnings inequality is less a story of diverging wages but rather of working hours and the fact that, in the 2010s, low wages are related to fewer working hours, which was the opposite until the turn of the century. Possible explanations for the increase of the covariance could be the decline of union density or changes in the labor force, such as risen female labor market participation and up-skilling (Checchi et al., 2016). Indeed the composition of the workforce changed substantially during the observed 25 years: In 2017, the labor force was more than 4 million people larger. One could assume that the growth of the labor force also led to increased heterogeneity with respect to working hours. Thus, the question arises whether the reduction of actual working hours among low-wage employees reflects lower preferred working hours or is a result of other constraints preventing individuals with low wages from working more hours.

[22]Note that the negative covariance in the 1990s is mostly driven by the East German population, while the covariance for West German employees is close to zero. However, the trend of an increase in the covariance holds throughout the whole working population.



Note: Solid black line: MLD of earnings. Dotted line: MLD of hourly wages. Short-dashed line: MLD of hours. Dash-dotted: Third addend of Equation 1. Thick black line (right y-axis): Covariance of hourly wages and working hours. Source: SOEP v34, weighted using SOEP weighting factors.

Figure 6: Mean Log Deviation 1993-2017

4.2. Desired versus Actual Working Hours

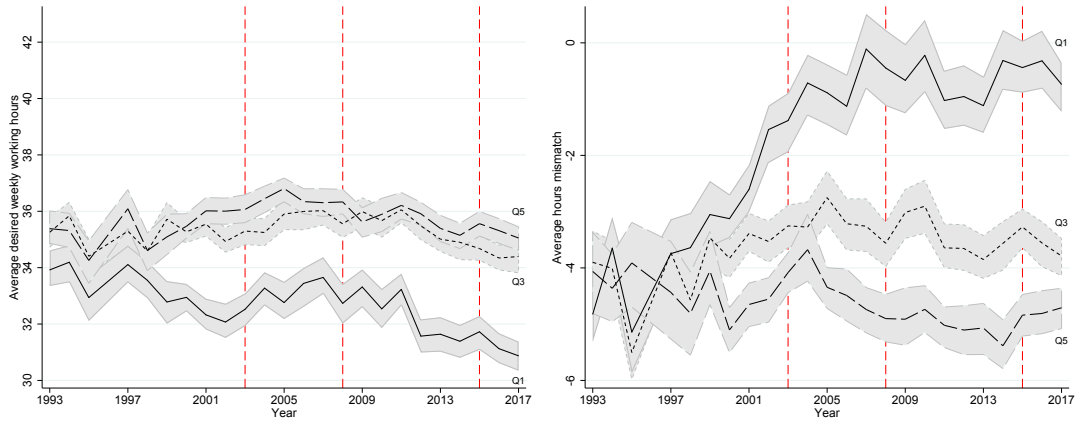
Desired Working Hours

We now explore whether the inter-temporal changes in the distribution of working hours comply with changes in the working-time preferences of the workers.[23] In case of compliance, the hours-induced rise in earnings inequality is less of a concern from a welfare perspective compared to a situation of a rising divide in actual and desired working hours.

The left panel of Figure 7 shows average desired working hours (left panel) and average hours mismatches (right panel) for the first, third, and fifth quintiles of hourly wages.[24] In the third and fifth wage quintiles, average working hours are rather stable over time at about 35 hours. In the bottom quintile, desired hours start with a similar level of about 34 hours, decline to between 32 and 33 hours by the end of the *post-unification* period, and fluctuate around 33 hours during the *Hartz-reforms* period. There is another drop in the *post-recession* phase to about 31 to 32 hours and in the *minimum wage* period it sinks to just below 31 hours.

[23] Besides intrinsic motivation, working-time preferences might depend on household composition and net income considerations based on the tax and transfer system. Labor supply effects of tax policies have been studied extensively and are not within the scope of this study.

[24] Appendix B provides the raw distributions of actual and desired working.



Note: The solid, (short-dashed), and [long-dashed] line represent the 1st, (3rd), and [5th] quintiles of the hourly wage distribution, respectively. Source: SOEP v34, weighted using SOEP weighting factors.

Figure 7: Development of desired working hours and hours mismatch among the first, third, and fifth quintiles of the hourly wage distribution from 1993 to 2017.

To better understand if working hours comply with the preferences of the workers, we analyze hours mismatches, i.e. differences between desired and actual working hours:

$$\Delta h_i = h_i^* - h_i^{act}. \tag{2}$$

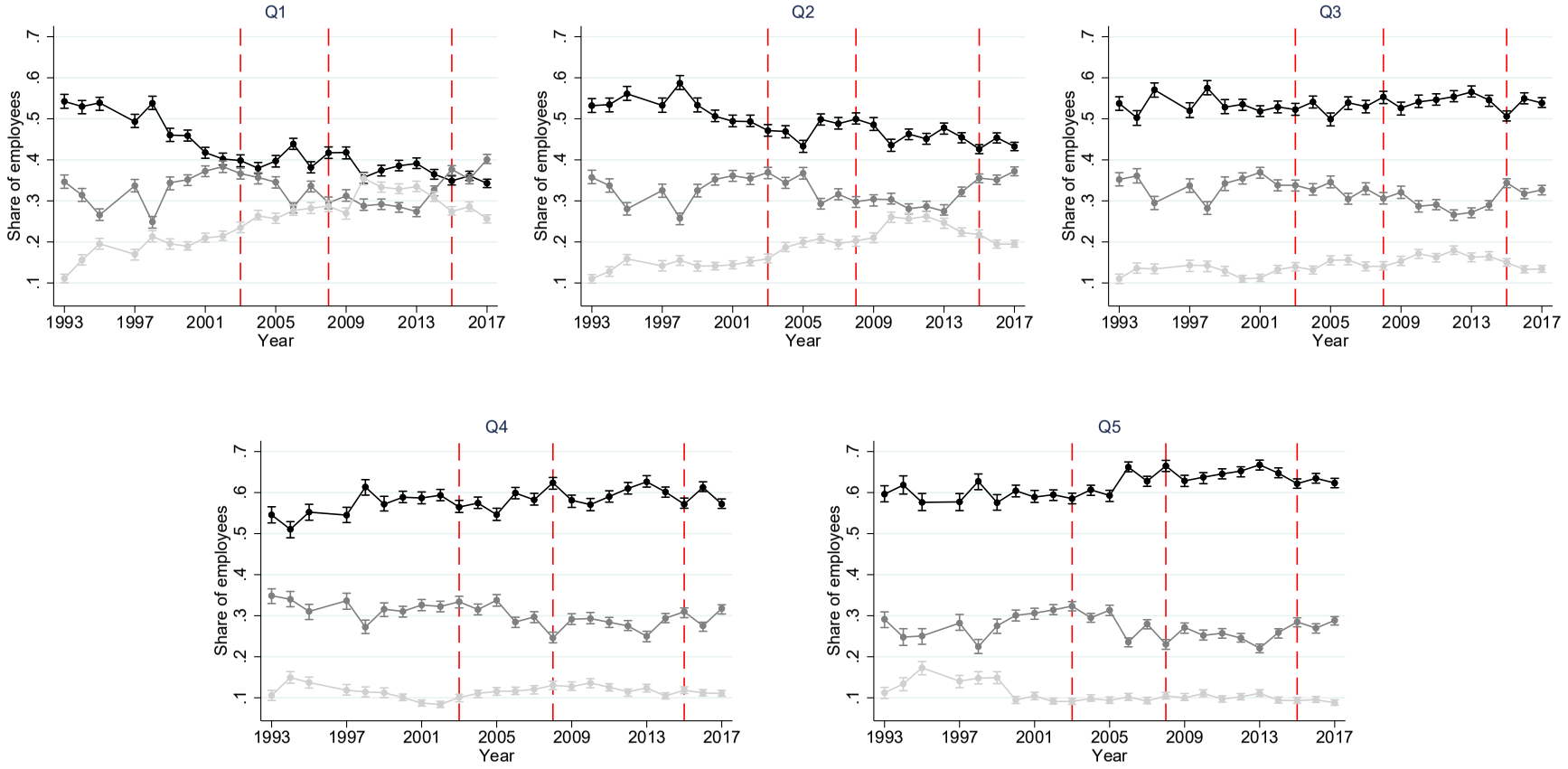
The right panel of Figure 7 shows hours mismatches, averaged over the workers in a certain quintile. A positive average mismatch indicates that desired working hours of employees in a quintile exceed their actual working hours. We refer to such a constellation as underemployment. The converse situation, we refer to as overemployment.

On average, employees in all three depicted quintiles of hourly wages are overemployed by about four hours per week at the beginning of our observation period. For the middle and top quintile, the level of overemployment is rather stable over time. Until 2017, it slightly declines by 0.1 hours in absolute value for the middle quintile and gets slightly larger, by 0.6 hours in absolute value, for the top quintile. The trend is very different for employees in the bottom quintile of hourly wages: a steady decline in the level of overemployment. Indeed, their average hours mismatch is basically zero since the *post-recession* period. Hence, while the average employee in the bottom wage quintile desired to reduce actual weekly working hours by about 4 hours in the early 1990s, this is no longer true in the 2000s, when average desired and actual working hours about balance.

That desired and actual working hours in a quintile are roughly balanced on average does not mean that they match for each individual employee. In partic-

ular, the decreasing level of overemployment for the bottom wage quintile could be driven by changes in the shares of over- and underemployed employees. For an assessment, Figure 8 shows the share of overemployed, underemployed and adequately employed employees from 1993 to 2017 by quintiles of the hourly wage distribution. We define adequately employed as employees with $|\Delta h_i| \leq 1$, allowing for a difference of one hour between desired and actual hours.

In 1993, the share of overemployed, adequately employed, or underemployed employees was almost identical among the five quintiles of hourly wages: Between 53 and 60 percent of employees were overemployed, while 11 percent were underemployed. These shares markedly change during the *post-unification* period: In the bottom quintile, there is a trend toward lower shares of overemployed and higher shares of underemployed employees. The shares of overemployed drop to about 34 percent in 2017. The shares of underemployed increased to 35 percent in 2010, then decreased to 26 percent in 2017. Thus, the observed movement of the average hours mismatch of the lowest wage quintile toward zero is indeed a result of both fewer employees overemployed and more underemployed employees. For the second wage quintile a similar development can be observed, but to a lesser extent. In the third quintile, only marginal changes in the distribution of overemployed, adequately employed, and underemployed are observed. The share of overemployed fluctuates between 50 and 55 percent and is at 54 percent in 2017. At the same time the share of underemployed fluctuates between 11 and 15 percent and is at 13 percent in 2017. Thus, for the third quintile, little movement in the average mismatch is accompanied by stable shares of overemployed, adequately employed and underemployed. For the two upper quintiles the share of overemployed slightly increased and peaked in 2013 at 63 (Q4) and 67 (Q5) percent respectively. Afterwards, the share of overemployed decreased to 57 (Q4) and 62 (Q5) percent in 2017. At the same time, the share of underemployed among the top quintile slightly but significantly shrank from 11 percent in 1993 to 9 percent in 2017. Thus, the small increase in the absolute value in the hours mismatch of the top quintile is a result of a small shift toward more overemployed and less underemployed.



Note: Black: Share of overemployed. Dark grey: Share of adequately employed (defined as $|\Delta h_i| \leq 1$). Light grey: Share of underemployed. Including bootstrapped 95% confidence intervals. Source: SOEP v34, weighted using SOEP weighting factors.

Figure 8: Shares of employees with positive, negative, and no working hours mismatch by hourly wage quintile

Drivers of Hours Mismatches

The distributions of working hours, desired working hours, and working hours mismatches change over time. Further, the changes differ along the quintiles of the wage distribution. To confirm the descriptive findings on the quintile-specific time trends and better understand if these differences can be attributed to wages, at least in a statistical interpretation, or if it is other background characteristics that matter, we turn to a multivariate regression analysis of the determinants of the working hours mismatch and its two components, i.e. desired and actual working hours. The basic specification takes the form,

$$Y_{i,t} = \alpha + \sum_{q=1}^{5} \beta_q D_{q,i,t} + \sum_{t=1994}^{2017} \gamma T_t + \sum_{q=1}^{5} \sum_{t=1994}^{2017} \phi_{q,t} D_{q,i,t} \times T_t + \varepsilon_{i,t}, \quad with\, Y_{i,t} \in \{\Delta h_{i,t}, h^*_{i,t}, h^{act}_{i,t}\}. \tag{3}$$

It contains the following variables:

1. $Y_{i,t}$ is the dependent variable: $\Delta h_{i,t}$, the working hours mismatch; $h^*_{i,t}$, desired working hours; or, $h^{act}_{i,t}$, actual working hours.
2. $D_{q,i,t}$ with $q \in \{1, 2, 4, 5\}$ are four dummy variables, taking the value 1 if a person is located within the respective wage quintile;[25]
3. T_t with $t \in [1994, 2017]$, taking the value 1 in each specific year of the observation period;[26] and
4. $D_{q,i,t} \times T_t$, the interactions of quintile and year dummies.

To ease the presentation of the large number of coefficients, Figure 9 provides the year and quintile specific estimates of $\hat{Y}$. To assess the robustness of the estimates from specification (1), a second model specification (2) includes individual- and household characteristics. Specification (2) takes the form,

$$Y_{i,t} = \alpha + \sum_{q=1}^{5} \beta_q D_{q,i,t} + \sum_{t=1994}^{2017} \gamma T_t + \sum_{q=1}^{5} \sum_{t=1994}^{2017} \phi_{q,t} D_{q,i,t} \times T_t + \delta \mathbf{X}_{i,t} + \varepsilon_{i,t}, \quad with\, Y_{i,t} \in \{\Delta h_{i,t}, h^*_{i,t}, h^{act}_{i,t}\}. \tag{4}$$

Vector $\mathbf{X}$ contains the following variables:

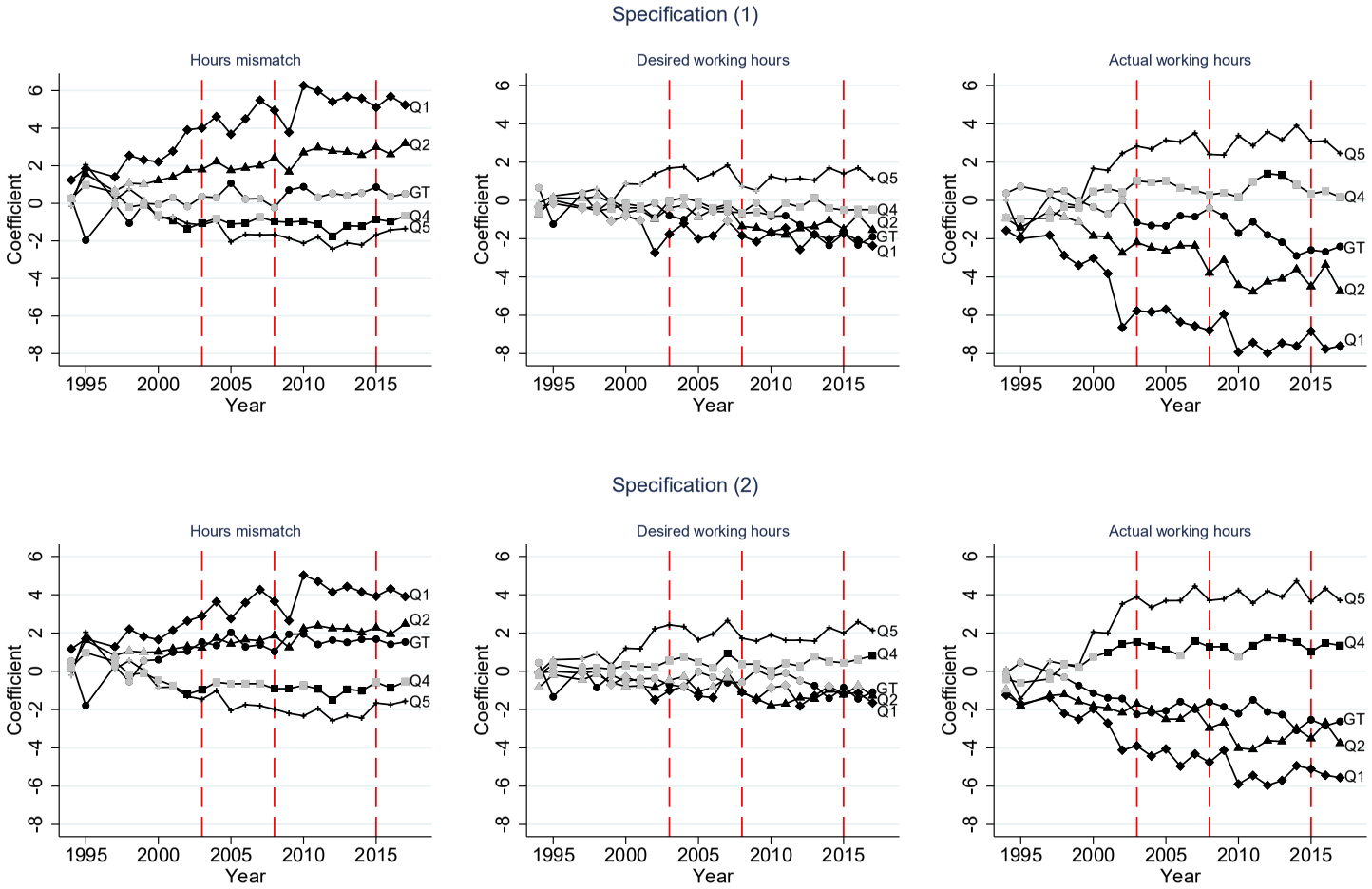
1. $female_i$, a dummy variable taking the value 1 for female employees;

[25] The third wage quintile is taken as reference category and therefore excluded from the regression.
[26] 1993 is taken as reference year and, therefore, excluded from the regression.

2. $age_{i,t}$, a categorial variable, assigning employees to five age groups: 18-29, 30-39, 40-49, 50-59 and 60+;
3. $occupation_{i,t}$, a categorial variable, assigning employees to seven occupation classes: apprentices, unskilled manual labor, skilled manual labor, white-collar with simple tasks, white collar professionals, self-employed, civil servants;
4. $educ_{i,t}$, a categorial variable, signaling whether individuals obtained primary, secondary or tertiary education;
5. $children_{i,t}$, a dummy variable taking the value 1 if at least one child under the age of 16 is present in the household;
6. $care_{i,t}$, a dummy variable taking the value 1 if at least one person in need of care is present in the household;
7. $partner_{i,t}$, a dummy variable taking the value 1 if a person is living in the same household as her/his partner;
8. $part\_empl_{i,t}$, a dummy variable taking the value 1 if an individual's partner is employed;
9. $part\_earn_{i,t}$, containing the partner's earnings; and
10. Interactions of variables (5) through (9) with $female_i$ to quantify gender-related differences in the role of conditioning variables.

As important independent variables such as gender and education are time-invariant, we run pooled OLS instead of fixed effects regressions. However, in Appendix C, results for random effects and (separately by gender) fixed effects regressions are presented as robustness checks. Overall, the time and wage quintile coefficients confirm our descriptive results: For the lowest wage quintile the hours mismatch increased over the observed period, resulting from a small decrease in desired hours exceeded by a larger decrease in actual working hours. For the highest wage quintile the opposite can be observed, as actual working hours increased slightly more than desired working hours. As the bottom panel of Figure 9 shows, these results hold, even when personal and household characteristics are controlled for.

In addition to the descriptive evidence, the regression analysis reveals how personal and household characteristics are associated with the hours mismatch. Table 1 displays regression coefficients pertaining the vector $\mathbf{X}$. The hours mismatch is a u-shaped in age: It is highest for the youngest and the oldest age cohorts, suggesting that both tend to work less than desired. The mismatch is also higher for female than male employees, employees with children compared to childless employees, particularly for female employees with children. Having a partner implies a lower mismatch, especially for men. For male employees, the mismatch further



Note: Displayed values are the regression coefficients for the year dummies, respectively interacted with hourly wage quintile dummies. Upper panel: First specification. Bottom panel: Second specification, including household characteristics. Black: significant at the 95% significance level. Grey: not significantly different from zero. Circles ≡ General trend (γ-coefficients), Diamonds ≡ 1st quintile, triangles ≡ 2nd quintile, squares ≡ 4th quintile, plusses ≡ 5th quintile of hourly wages. Source: SOEP v34.

Figure 9: Intertemporal evolution of hours mismatches - regression coefficients of time and wage quintile interactions

decreases if their partner is employed and with increasing earnings obtained by the partner.

Desired working hours are declining with higher age, are lower for female employees (about three hours), and lower for employees with children, particularly for female employees with children. Female employees also desire to work less when care is needed for other household members. Male employees desire to work more in the presence of a partner in the household, particularly if their partner is employed, while the opposite is true for female employees. Finally, desired working hours decrease with partner's earnings and this decrease is higher for female employees.

Table 1: Results of pooled OLS regressions of hours mismatch, desired and actual hours on personal and household characteristics

	Δh_i	h_i^*	h_i^{act}
Female	0.646***	-2.668***	-3.313***
	(0.098)	(0.096)	(0.115)
Age: 18-29	1.258***	-0.385***	-1.643***
	(0.076)	(0.072)	(0.087)
Age: 40-49	-0.215***	-0.358***	-0.143**
	(0.057)	(0.051)	(0.063)
Age: 50-59	-0.180***	-1.817***	-1.638***
	(0.067)	(0.062)	(0.076)
Age: 60+	1.072***	-7.927***	-9.000***
	(0.104)	(0.126)	(0.150)
Apprentices	-1.312***	1.100***	2.412***
	(0.133)	(0.126)	(0.148)
Unskilled manual labor	3.086***	-2.281***	-5.366***
	(0.082)	(0.075)	(0.091)
White-collar, simple tasks	1.778***	-2.670***	-4.448***
	(0.086)	(0.082)	(0.100)
White-collar, professionals	-2.149***	0.136**	2.285***
	(0.071)	(0.063)	(0.076)
Self-employed	-3.270***	2.073***	5.344***
	(0.105)	(0.096)	(0.121)
Civil servants	-2.420***	0.357***	2.778***
	(0.100)	(0.091)	(0.105)
Primary educ.	-0.060	0.597***	0.656***
	(0.070)	(0.062)	(0.075)
Tertiary educ.	-0.708***	0.178**	0.887***
	(0.081)	(0.075)	(0.089)
Female × Primary educ.	0.115	-1.737***	-1.852***
	(0.099)	(0.097)	(0.116)
Female × Tertiary educ.	-0.979***	0.931***	1.910***
	(0.109)	(0.104)	(0.130)
Children	0.145**	-0.203***	-0.347***

	(0.067)	(0.061)	(0.072)
Female × Children	2.499***	-4.279***	-6.779***
	(0.089)	(0.085)	(0.105)
Care	-0.341	-0.265	0.077
	(0.227)	(0.202)	(0.247)
Female × Care	0.091	-1.441***	-1.532***
	(0.323)	(0.316)	(0.394)
Partner	-1.197***	1.706***	2.903***
	(0.095)	(0.089)	(0.107)
Female × Partner	0.492***	-4.429***	-4.921***
	(0.130)	(0.130)	(0.157)
Partner employed	-0.332***	0.317***	0.649***
	(0.086)	(0.081)	(0.095)
Female × Partner empl.	0.217	0.666***	0.449**
	(0.135)	(0.169)	(0.209)
Partner earnings	-0.005*	-0.033***	-0.028***
	(0.003)	(0.003)	(0.004)
Female × Partner earn.	0.017***	-0.039***	-0.056***
	(0.003)	(0.005)	(0.006)

Note: Reference age group is 30-39. Reference occupation class is skilled manual labor. Reference education group is secondary education. The coefficients for earnings are multiplied by 100. Robust standard errors are displayed in brackets below coefficients. Source: SOEP v34, own calculations.

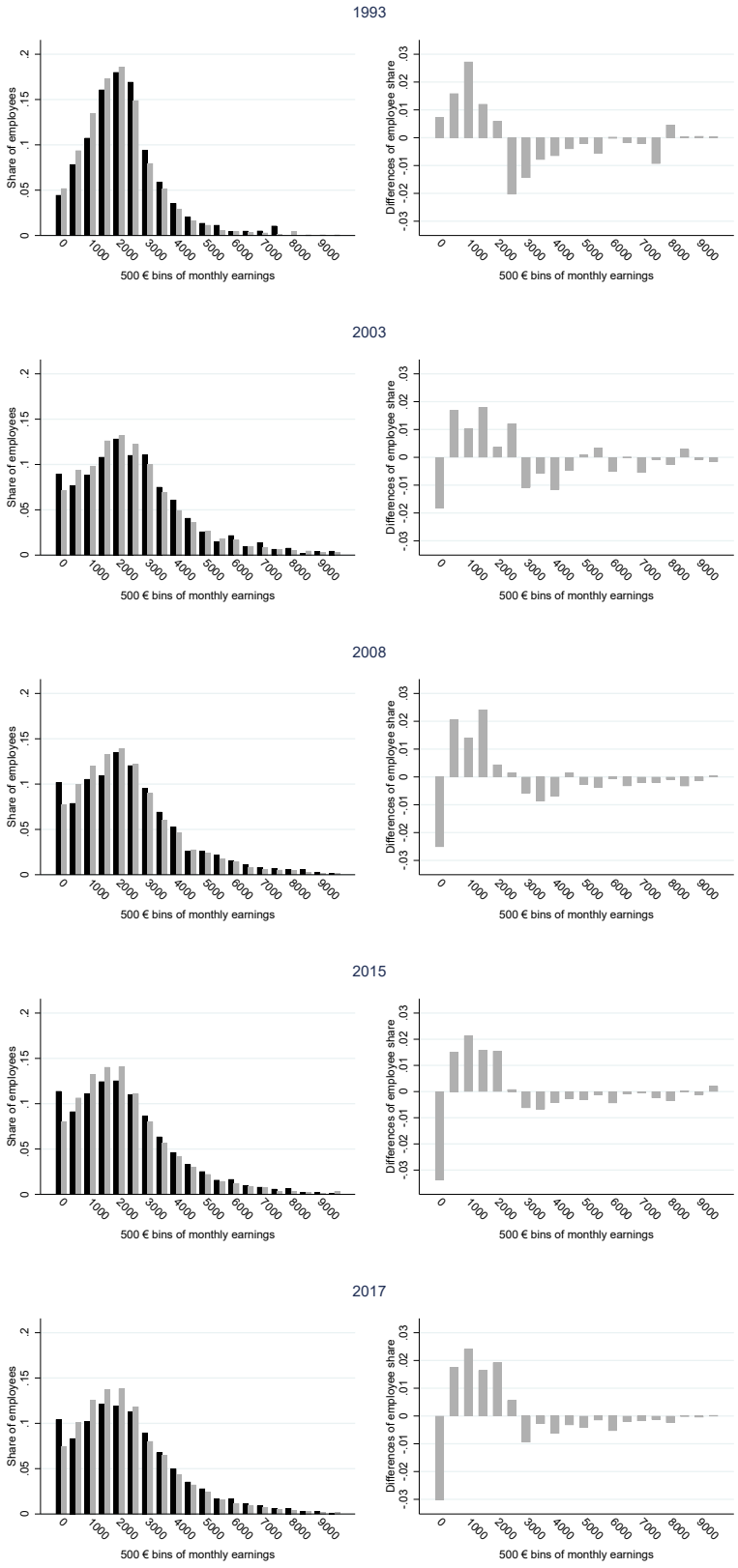
For actual working hours, in qualitative terms, we find the same patterns as for desired working hours. Quantitatively, most coefficients differ from those for desired hours, consequently yielding the aforementioned estimates for the hours mismatch. For example, the coefficients for females with children point at 6.8 fewer actual hours, but only 4.3 fewer desired hours, revealing the nature of the mismatch by 2.6 hours: for females with children, working hours are reduced to a larger extent than desired.

Overall, the time and wage quintile coefficients confirm our descriptive results: Even after conditioning on personal and household characteristics, employees with lower hourly wages experience a shift toward underemployment. This strong association is caused by a sharp decrease in actual working hours exceeding a slight reduction in desired working hours. Thus, the reduction in actual hours can only be attributed to preferences to a very small degree. For employees in the top wage quintile, overemployment increases during the *post-unification* period and stagnates thereafter. Furthermore, the distribution of care work within families, i.e. childcare, particularly drives a wedge between the desired and actual working hours of women.

Counterfactual Earnings Distribution

Turning to the third step, this section derives a "counterfactual" distribution of earnings that had emerged if individuals were always able to realize their desired working hours. We then analyze this hypothetical distribution over time with regard to inequality. To derive the counterfactual earnings distributions, we take the hourly wage and multiply this wage with the desired working hours, as reported by the respondents. The exercise thus rests on the (simplifying) assumption that a change in working hours has no effect on the hourly wage.

Figure 10 compares the actual with the counterfactual monthly earnings distributions in 1993, 2001, 2009, 2015, and 2017. Displayed are the shares of employees in each bin of €500 and the differences of the shares between the actual and the counterfactual distribution. In 1993, over 50 percent of employees obtained monthly earnings between €1,500 and €3,000. This holds for the counterfactual and the actual earnings distribution. For the five bottom bins $[0, 499]$ to $[2000, 2499]$, the employee shares are higher for the counterfactual distribution. The bin $[1000, 1499]$ exhibits the largest difference between the counterfactual and the actual distribution. In the counterfactual scenario, an additional 2.7 percentage points would obtain earnings in that range. At the same time, employee shares in the earnings bins above €2,500 are usually lower in the counterfactual scenarios. For example, in contrast to the actual distribution, 2 percentage points less would locate in the $[2500, 2999]$ bin in the counterfactual scenario. Only the bins above €8,000 Euros are slightly larger in the counterfactual distribution. From simply comparing the actual and the counterfactual earnings distribution in 1993, one cannot draw unambiguous conclusions with respect to inequality as most differences occur in the middle of the distribution.

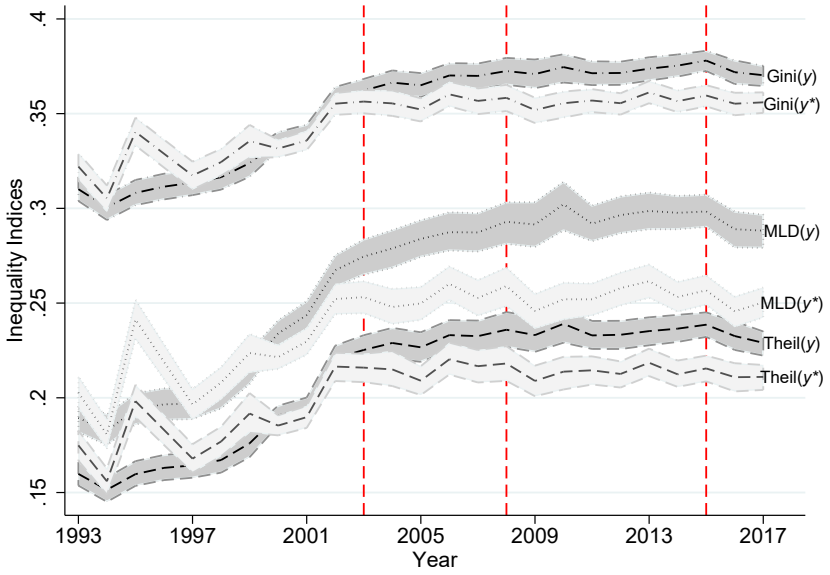


Note: Figures on the left show the share of employees in each 500 Euro bin for the actual earnings distribution (black bars) and the counterfactual earnings distribution (grey bars). Figure on the right show the difference between the two distribution for each bin. Source: SOEP v34.

Figure 10: Actual vs. Counterfactual distribution of monthly earnings

The most striking change over the following 25 years is the large increase of the bottom earnings bin in the actual earnings distribution, which was not accompanied by a comparable increase of that bin in the counterfactual distribution. Accordingly, the difference between counterfactual and actual distribution changed from +0.7 percentage points in 1993 to -1.8 percentage points after the *post-unification* period, -2.5 percentage points after the *Hartz-reforms* period, and -3.3 percentage points after the *post-recession* period. In the *minimum wage* period, the difference slightly decreased to -3.0 percentage points, caused by a smaller bottom earnings bin in the actual distribution. To examine the middle of the distribution, we aggregate the three earnings bins $[1500, 1999]$, $[2000, 2499]$, and $[2500, 2999]$. In 1993, the share of employees located in this range was 0.2 percentage points lower in the counterfactual than in the actual earnings distribution. In 2017, this part of the counterfactual distribution was 4.1 percentage points larger than in the actual distribution. The upper part of the earnings distribution with earnings above €3,000 was smaller in the counterfactual scenario throughout the whole observation period. However, the difference decreased in absolute value from -4.8 percentage points in 1993 to -4.1 percentage points in 2017. Overall, in the counterfactual scenario, the very bottom of the distribution grew much less while the middle of the distribution grew stronger compared to the actual scenario. Consequently, one could expect the counterfactual distribution to develop less inequality than the actual distribution throughout the observation period.

Figure 11 compares the development of inequality among the actual earnings distribution to this counterfactual distribution earnings from 1993 to 2017. Displayed are the Gini index, the Theil index, and the MLD, including 95% confidence intervals. The counterfactual distribution is shaded in light grey. All considered inequality indices indicate that a realization of desired working hours would have no statistically significant distributional effects in the *post-unification* period. In 1993, point estimates of the Gini, (Theil), and [MLD] of the actual distribution were at 0.31, (0.16), and [0.19] compared to 0.32, (0.17), and [0.20], respectively, for the counterfactual distribution. Since the *Hartz-reforms* period, the MLD indicates that a realization of desired working hours would have resulted in a reduction of inequality. As an example, in 2017 the MLD from the counterfactual, $MLD(y^*)$, is about 0.04 points lower than the MLD of 0.29 from the actual distribution, $MLD(y)$. Taking the Gini and (Theil) indexes, the hypothetical distribution is significantly less unequal only since the *post-recession* period. In 2017, the actual Gini and (Theil) are at 0.37 and (0.23), compared to 0.36 and (0.21), respectively, for the counterfactual distribution. Despite the differences seeming



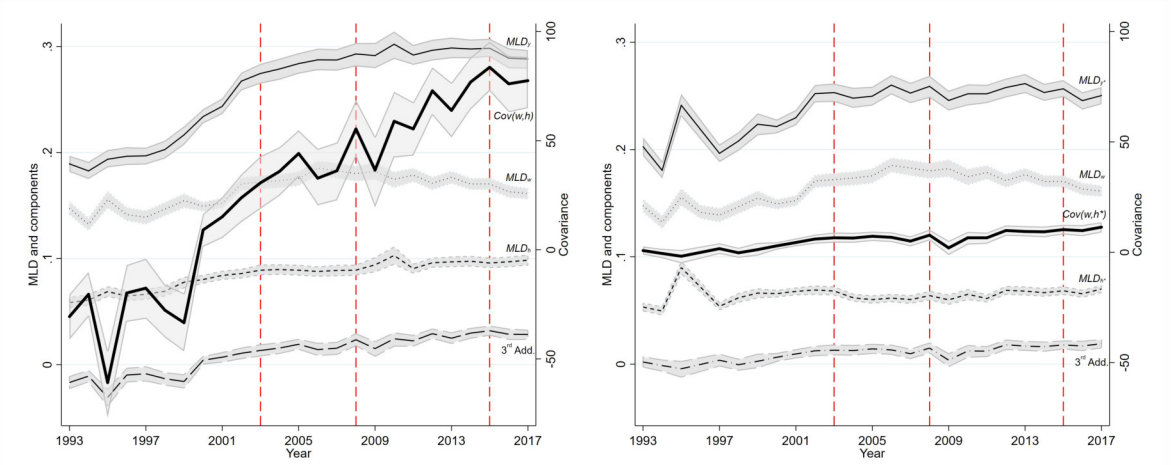
Note: The dashed-dotted, (dotted), and [dashed] lines show the Gini, (MLD), and [Theil] Indexes, respectively, of actual monthly earning (dark grey) and the hypothetical earnings if all employees realized their desired working hours. Source: SOEP v34, weighted using SOEP weighting factors.

Figure 11: Development of earnings inequality from 1993 to 2017, reality vs. counterfactual

small in size, the counterfactual distribution exhibits significantly less inequality than the actual distribution. The difference in inequality between the actual and the counterfactual distributions is the largest when considering the MLD, which is particularly sensitive to changes at the lower part of the distribution. A realization of desired instead of actual hours would consequently reduce inequality, particularly at the lower end of the earnings distribution.

Parallel to the analysis of the actual earnings distribution, the decomposition of $MLD(y^*)$ can yield further insights about the counterfactual inequality development: As shown in the left graph of Figure 12, the covariance between hourly wages and working hours changed substantially from below -30 in 1993 to above 77 in 2017. The right graph shows the decomposition of the counterfactual distribution. Over the same time span, the covariance of hourly wages and desired working hours only grew marginally from basically 0 to 11. Heterogeneity of desired hours, captured by $MLD(h^*)$ only grew by 0.02 compared to an increase of 0.04 for $MLD(h)$. Thus, the sharp change in actual working hours, which substantially contributed to rising earnings inequality, is only reflected in individuals' desired working hours to a very small degree.

Accordingly, the quantitatively large increase in the correlation between actual hours and hourly wages is not reflected in the correlation between desired hours



Note: Solid line: MLD of earnings. Dotted line: MLD of hourly wages. Short-dashed line: MLD of hours. Long-dashed: Third addend of Equation 1. Thick black line (right y-axis): Covariance of hourly wages and working hours. Source: SOEP v34, weighted using SOEP weighting factors.

Figure 12: MLD Decomposition, reality vs. counterfactual

and hourly wages. Therefore, the counterfactual distribution exhibits an increase in inequality to the extent of only 60 percent of the actual distribution. In conclusion, 40 percent of the rise in earnings inequality between 1993 and 2017 can be attributed to an increase of hours mismatches.

5. Discussion

We are assessing the mechanical effect of hours mismatches assuming that a working hours adjustment leaves the hourly wage unaltered. While we believe that this scenario is a useful benchmark, it is also true that hourly wages are a function of work experience and thus dynamically depend on past and recent working hours. Thus, for instance underemployed individuals are penalized twice: Their monthly earnings today are directly lower due to the lower working hours. Additionally, their hourly wage in the future is likely lower than it would have been in the case of longer working hours due to reduced human capital accumulation. If employees with low wages and low working hours - in line with their preferences - worked more, we would underestimate the inequality reducing effect of an alignment of desired and actual working hours.

This paper has shown the crucial role of actual working hours and the covariance between hourly wages and actual working hours. These results have been confirmed also when contractual hours and hourly wages are used instead of actual hours.[27] One could argue that contractual hours should be considered in the

[27]See Appendix D for the results based on contractual hours and contractual hourly wages. Examining

first place when analyzing earnings which are also contractually agreed upon. But, as exclusively focusing on contractual hours ignores the role of overtime work, we decided to focus on actual hours as the main subject of investigation.

The important role of working hours and the covariance between wages and working hours for the evolution of earnings inequality in Germany is also documented by Biewen and Plötze (2019) as well as Gerold and Stein (2020).[28] According to estimates by Biewen and Plötze (2019), between 10 and 30 percent of the rise in male, and 37 to 47 percent of the rise in female earnings inequality between 2001 and 2010 can be explained by working hours changes. Gerold and Stein (2020) attribute 50 percent of the increase in overall earnings inequality between 2006 and 2014 to changes in working hours. These results are in line with the static cross-country comparison by Fournier and Koske (2013). They show that in 2007, Germany was one of few cases where the distribution of working hours had an earnings inequality increasing impact compared to the US.[29] Checchi et al. (2016) compare the evolution of earnings inequality and the role of wages and hours in the US, the UK, France and Germany between 1990 and 2012. Only for France and Germany they find an increase (and change from negative to positive) of the correlation between wages and hours. At the same time they show that in both the UK and the US, the wages-hours correlation remained basically unchanged on high levels throughout the observed period. This is in contrast to earlier decades. Heathcote et al. (2010) find that in the US a decline in working hours among low-skilled employees led to an increase in earnings inequality at the bottom of the distribution during the 1970s and 1980s. For the UK, Blundell and Etheridge (2010) observe an increase from a negative to a positive correlation between wages and hours among males during the 1980s but a rather stable correlation thereafter and among females. So, while rising earnings inequality is a phenomenon observed in many western economies the driving factors behind this development appear to be country-specific.

In Germany, the composition of the labor force certainly affected the evolution of earnings inequality (Biewen et al., 2018). During our observation period female labor market participation as well as the share of employees working part-time increased (see figures 1 and 2).[30] To understand the extent to which our findings

mismatches between desired and contractual hours yields fewer overemployed and more adequately employed.

[28] Both studies, Biewen and Plötze (2019) as well as Gerold and Stein (2020), are based on the German compulsory firm study Structure of Earnings Survey.

[29] Other countries where the distribution of hours raises earnings inequality relative to the US are Australia, Japan and Canada. In contrast, in most European countries, especially in Scandinavia, the hours distribution decreases earnings inequality.

[30] While the level of part-time work is much higher for females it increased for both, female and male

bear out for each of these groups of workers separately, we reran our analyses group-wise: for full-time employees, part-time employees, male and female employees. The complete results can be found in Appendices E and F. Our main results, the increase of the covariance between hourly wages and actual working hours, and the increased working hours mismatch for the bottom wage quintile, are confirmed for each group. However, the patterns differ in magnitude, which comes at no surprise. By definition individuals are classified as full-time employees if they work more than 30 hours per week. Accordingly changes of average working hours for this group are relatively limited.

6. Conclusion

This study provides comprehensive descriptive evidence that changes in working hours substantially contributed to rising earnings inequality in Germany since 1993. More precisely, the correlation between hourly wages and working hours turned from strictly negative in the 1990s to strictly positive in the 2000s. The growing covariance seems to be an ongoing trend, starting long before the Hartz reforms and continuing up until 2015. In the 2010s, the dispersion of working hours offset a slight decrease in wage inequality, resulting in stagnant earnings inequality.

These changes in working hours vary widely from individuals' preferences. The desire for a reduction of hours became more prevalent among the higher wage quintiles, whereas the share of employees with a preference for an extension of hours more than doubled among the lowest wage quintile. We also show that earnings inequality did not increase simply because people with a preference for part-time work entered the labor market. This explanation falls short as the desire for longer hours increased among low-wage earners. The possible explanation would then be that individuals with a lower capability to realize their desired working hours entered the low-wage sector.

Reducing hours mismatches could significantly attenuate earnings inequality, calling for a critical assessment of labor market and family policy in order to identify barriers limiting free hours choice and find potential ways how to remove them.

The persistent finding of sizeable working hours mismatches suggests that companies struggle to meet the demands of their employees. Potential hurdles include higher costs of administering and coordinating (more) employees with different

employees.

working-time arrangements or higher costs for the equipment of their workplaces (e.g. software licenses). If more flexibility implies a reduction of the average working time of the employees in a company, this will increase the number of employees, affecting hiring costs and, eventually, triggering tighter working regulations. For example, in Germany the obligation of a company to allow an employee works council depends on the number of employees. Employers, however, should weigh such costs against the potential productivity gains from having more satisfied and more motivated employees.

Policy makers can contribute to reduce working hours mismatches. Our analyses show that mismatches for mothers are particularly large: Raising children is associated with a reduction of working hours to a much larger extent than desired. Accordingly, classifying mothers' reduced working hours as choices solely resulting from preferences falls short. Even when living with their partner (and with increasing earnings of the partner), women are more likely to be underemployed. Thus, besides improvements in childcare policies, the incentive system connected to family taxation, i.e. income splitting, should also be taken into consideration when aiming to reduce hours mismatches. In future work, identifying all roots of working hours mismatches and their causal impact on the evolution of inequality could allow for more specific policy recommendations.

Lastly, taking into account desired working hours can open a new perspective for the normative evaluation of earnings inequality and the impact of working hours. If the rise in equality is solely a result of desired changes in working hours, one could probably care less about inequality since it simply results from heterogeneity of individuals' labor-leisure preferences. Instead, we show that this is not the case as the growing dispersion of working hours is only partially reflected in employee's desired hours. This adds another dimension to the analysis of inequality and calls for flexible working hours arrangements to be discussed.

References

Antonczyk, D., T. DeLeire, and B. Fitzenberger (2018). Polarization and rising wage inequality: Comparing the US and Germany. Econometrics 6(2), 20.

Başlevent, C. and H. Kirmanoğlu (2014). The impact of deviations from desired hours of work on the life satisfaction of employees. Social indicators research 118(1), 33–43.

Bassanini, A. and E. Caroli (2015). Is work bad for health? The role of constraint versus choice. Annals of Economics and Statistics/Annales d'Économie et de Statistique (119/120), 13–37.

Bell, D., S. Otterbach, and A. Sousa-Poza (2012). Work hours constraints and health. Annals of Economics and Statistics/Annales d'économie et de statistique (105/106), 35–54.

Biewen, M., B. Fitzenberger, and J. de Lazzer (2018). The role of employment interruptions and part-time work for the rise in wage inequality. IZA Journal of Labor Economics 7(1), 10.

Biewen, M. and A. Juhasz (2012). Understanding rising income inequality in Germany, 1999/2000–2005/2006. Review of Income and Wealth 58(4), 622–647.

Biewen, M. and D. Plötze (2019). The Role of Hours Changes for the Increase in German Earnings Inequality. Jahrbücher für Nationalökonomie und Statistik 239(2), 277–304.

Blundell, R. and B. Etheridge (2010). Consumption, income and earnings inequality in Britain. Review of Economic Dynamics 13(1), 76–102.

Burauel, P., M. Caliendo, M. M. Grabka, C. Obst, M. Preuss, C. Schröder, and C. Shupe (2020). The Impact of the German Minimum Wage on Individual Wages and Monthly Earnings. Jahrbücher für Nationalökonomie und Statistik 240(2-3), 201–231.

Burda, M. C. and J. Hunt (2011). What Explains the German Labor Market Miraclein the Great Recession? Working Paper 17187, National Bureau of Economic Research.

Caliendo, M., C. Schröder, and L. Wittbrodt (2019). The Causal Effects of the Minimum Wage Introduction in Germany – An Overview. German Economic Review 20(3), 257–292.

Card, D., J. Heining, and P. Kline (2013). Workplace heterogeneity and the rise of West German wage inequality. The Quarterly Journal of Economics 128(3), 967–1015.

Checchi, D., C. García-Peñalosa, and L. Vivian (2016). Are changes in the dispersion of hours worked a cause of increased earnings inequality? IZA Journal of European Labor Studies 5(1), 15.

Dustmann, C., B. Fitzenberger, U. Schönberg, and A. Spitz-Oener (2014). From sick man of Europe to economic superstar: Germany's resurgent economy. Journal of Economic Perspectives 28(1), 167–88.

Dustmann, C., J. Ludsteck, and U. Schönberg (2009). Revisiting the German wage structure. The Quarterly Journal of Economics 124(2), 843–881.

Faberman, R. J., A. I. Mueller, A. Şahin, and G. Topa (2020). The shadow margins of labor market slack. Working Paper 26852, National Bureau of Economic Research.

Fahr, R. and U. Sunde (2009). Did the Hartz reforms speed-up the matching process? A macro-evaluation using empirical matching functions. German economic review 10(3), 284–316.

Fedorets, A., M. M. Grabka, C. Schröder, J. Seebauer, et al. (2020). Lohnungleichheit in Deutschland sinkt. DIW Wochenbericht 87(7), 91–97.

Fitzenberger, B., K. Kohn, and A. C. Lembcke (2013). Union density and varieties of coverage: The anatomy of union wage effects in germany. ILR Review 66(1), 169–197.

Fitzenberger, B., K. Kohn, and Q. Wang (2011). The erosion of union membership in Germany: determinants, densities, decompositions. Journal of Population Economics 24(1), 141–165.

Fournier, J.-M. and I. Koske (2013). The determinants of earnings inequality. OECD Journal: Economic Studies 2012(1), 7–36.

Fuchs-Schündeln, N., D. Krueger, and M. Sommer (2010). Inequality trends for Germany in the last two decades: A tale of two countries. Review of Economic Dynamics 13(1), 103–132.

Gerold, S. and U. Stein (2020). Are working hours a new driver of inequality? IMK Working Paper No. 203.

Goebel, J., M. M. Grabka, S. Liebig, M. Kroh, D. Richter, C. Schröder, and J. Schupp (2019). The german socio-economic panel (soep). Jahrbücher für Nationalökonomie und Statistik 239(2), 345–360.

Golden, L. (2016). Still falling short on hours and pay: Part-time work becoming new normal. Report, Economic Policy Institute.

Grabka, M. M. and C. Schröder (2018). Inequality in Germany: decrease in gap for gross hourly wages since 2014, but monthly and annual wages remain on plateau. DIW Weekly Report 8(9), 83–92.

Granados, P. G., R. Olthaus, K. Wrohlich, et al. (2019). Teilzeiterwerbstätigkeit: Überwiegend weiblich und im Durchschnitt schlechter bezahlt. DIW Wochenbericht 86(46), 845–850.

Heathcote, J., F. Perri, and G. L. Violante (2010). Unequal we stand: An empirical analysis of economic inequality in the United States, 1967-2006. Review of Economic Dynamics 13(1), 15 – 51. Special issue: Cross-Sectional Facts for Macroeconomists.

Jacobi, L. and J. Kluve (2007). Before and after the Hartz reforms: The performance of active labour market policy in Germany. Journal for Labour Market Research 40(1), 45–64.

Knabe, A., R. Schöb, and M. Thum (2014). Der flächendeckende Mindestlohn. Perspektiven der Wirtschaftspolitik 15(2), 133–157.

OECD (2016). Income inequality update: Income inequality remains high in the face of weak recovery. Paris: 2016.

Paul, M. (2016). Is there a causal effect of working part-time on current and future wages? The Scandinavian Journal of Economics 118(3), 494–523.

Piketty, T. (2015). Putting distribution back at the center of economics: Reflections on capital in the twenty-first century. Journal of Economic Perspectives 29(1), 67–88.

Siegers, R., V. Belcheva, and T. Silbermann (2019). Data documentation: Documentation of sample sizes and panel attrition in the German Socio-Economic Panel (SOEP)(1984 until 2017). SOEP Survey Papers 606: Series C. Berlin: DIW/SOEP.

Smith, T. J. and T. Nichols (2015). Understanding the millennial generation. The Journal of Business Diversity 15(1), 39.

Snower, D. J. and C. Merkl (2006). The caring hand that cripples: The East German labor market after reunification. American Economic Review 96(2), 375–382.

Von Gleichen, R. D. and M. Seeleib-Kaiser (2018). Family policies and the weakening of the male-breadwinner model. In Handbook on Gender and Social Policy, pp. 153–178. Edward Elgar Publishing.

Wooden, M., D. Warren, and R. Drago (2009). Working time mismatch and subjective well-being. British Journal of Industrial Relations 47(1), 147–179.