Why a Labour Market Boom Does Not Necessarily Bring down Inequality: Putting Together Germany's Inequality Puzzle*

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Abstract

After an economically tough start into the new millennium, Germany experienced an unprecedented employment boom after 2005 only stopped by the COVID-19 pandemic. Persistently high levels of inequality despite a booming labour market and drastically falling unemployment rates constituted a puzzle, suggesting either that the German job miracle mainly benefitted individuals in the mid- or high-income range or that other developments offset the effects of the drastically improved labour market conditions. The present paper solves this puzzle by breaking down the observed changes in the distribution of disposable incomes between 2005/06 and 2015/16 into the contributions of eight different factors, one of them being the employment boom. Our results suggest that, while the latter did have an equalising impact, it was partially offset by the disequalising impact of other factors and substantially dampened by the transfer system. Our results point to a strong role of the German transfer system as a distributional stabiliser implying that, if the COVID-19 shock were to persistently reverse all the employment gains that occurred during the boom, this would only have a moderately disequalising effect on the distribution of net incomes.

JEL-Classification: C14, D31, I30

Keywords: income distribution, employment, social insurance, labour market reform

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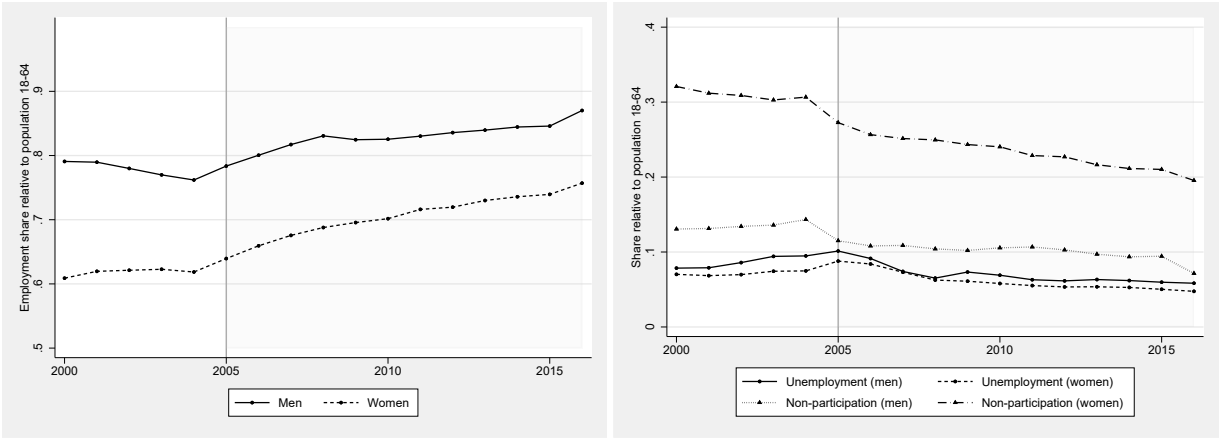
I. Introduction

Following the reunification in 1990, Germany had to face difficult economic conditions throughout the 1990s and the early 2000s: low economic growth, a high fiscal deficit and increasing unemployment. In the mid 2000s, however, the so-called 'sick man of Europe' took off to experience an unprecedented employment boom that was chasing its own records in recent years (Dustmann et al., 2014). Not even challenging events such as the global financial crisis in 2008–09 or the drastically increased immigration since 2014 (often referred to as the 'refugee crisis') interrupted Germany's economic upsurge, which was only stopped by the global COVID-19 crisis starting in 2020.



(a) Employment shares (b) Unemployment and non-participation shares

FIGURE 1
Aggregate employment, unemployment and non-participation shares by gender, 2000–16
(*Source:* Federal Statistical Office)

The magnitude of this boom is shown in Figure 1. After several years of stagnation, employment rates began to rise significantly for men, and even more so for women. The boom drastically reduced unemployment and boosted labour market participation, particularly female participation. A number of previous contributions have examined the structure of these employment gains. For instance, Rothe and Wälde (2017) claim that a large part of the unemployed who found a job during the boom did not go into full-time work. Rather they observe a substantial increase in part-time employment and non-standard work (e.g., marginal employment). On the other hand, Ehrich, Musasib and Roy (2018) and Carrillo-Tudela, Launov and Robin (2021) emphasise that the boom increased participation in general, drawing individuals into the labour market that would not have participated otherwise. This was particularly true of women who often entered part-time or marginal employment out of non-participation.

At the same time and as shown below, income inequality in Germany first stagnated after the onset of the boom in 2005 but then followed a slight upward trend from 2010 onwards. Given the nature of the boom, this constitutes somewhat of a puzzle. In view of

the drastic reduction in unemployment from over 5 million individuals to around half this value, and the additional participation in part-time and marginal employment, the boom should have massively benefitted those at the bottom of the income distribution leading to a reduction of income inequality.

A small number of previous contributions have considered the development of income inequality in Germany after 2005. Peichl, Hufe and Stöckli (2018) and Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2019) document the evolution of inequality measures for disposable incomes over the same period as we do in this paper. Both studies provide evidence for first stagnating and then slightly increasing inequality but do not attempt to relate this finding to other changes such as the employment boom. Biewen, Ungerer and Löffler (2019) consider the period 2005–10 but struggle to establish an effect of both the massive expansion and the compositional changes in employment after 2005 on the resulting distribution of household disposable incomes. Dustmann, Fitzenberger and Zimmermann (2018) present an analysis of inequality trends based on the alternative data set *Einkommens- und Verbrauchsstichprobe (EVS)*. They also find slightly rising inequality between 2003 and 2013 but their focus is on the role of housing expenditures on inequality.

This paper aims to make the following contributions. First, we provide more evidence on the exact structure of the 'German labour market miracle' (Burda, 2016) which has drawn a lot of attention in the literature.[1] We show that the boom was not a shift from full-time to part-time employment but involved net gains in both categories with the strongest component coming from the expansion of female part-time employment. Second, we present an explicit analysis of the effects of the boom on the distribution of net incomes based on rich microdata. Such an analysis is challenging because such effects depend on who exactly gained from the boom, how employment structures changed within households, and how the tax and transfer system transformed gains into net incomes. We explicitly consider heterogeneous effects of the boom on households by modelling in detail changes in labour market participation conditional on a rich set of individual and household characteristics. As employment trends are not the only source of changes in the distribution of net incomes, we also consider the effects of confounding factors such as changes in pay structures, changes in the composition of the population, changes due to immigration, changes in other income sources such as capital income, and changes in the tax and transfer system.

[1] A number of alternative explanations for the boom have been proposed: wage restraint and de-unionisation (Dustmann et al., 2014; Kügler, Schönberg and Schreiner, 2018), export boom (Dauth, Findeisen and Suedekum, 2017; Dauth, Findeisen and Suedekum, 2021), Hartz reforms (controversial, see Hartung, Jung and Kuhn, 2018; Hutter et al., 2019; Burda and Seele, 2020; Hochmuth et al., 2021; Akyol, Neugart and Pichler, 2013; Launov and Wälde, 2013; Launov and Wälde, 2016; Bradley and Kügler, 2019), changes in early retirement (Riphahn and Schrader, 2020) and in parental leave legislation (Geyer, Haan and Wrohlich, 2015; Bick, 2015).

Third, we contribute to a suprisingly small literature that analyses possible causes for changes in the distribution of *net incomes* – which is the income distribution relevant for welfare analysis and policy – but which is the complex result of a large number of elements such as employment, pay structures, household arrangements and institutional circumstances (Hyslop and Maré, 2005; Daly and Valletta, 2006; Biewen and Juhasz, 2012; Jessen, 2019; Blundell et al., 2018; Sologon, Almeida and Van Kerm, 2019). Much of the literature deals with *gross incomes* (often derived from tax records, e.g., Armour, Burkhauser and Larrimore, 2013) or individual income components such as wages, which makes it difficult to assess the consequences for the final distribution of *net incomes* (see Armour, Burkhauser and Larrimore, 2013, for a related point). An important take-away from our analysis is the distinction between developments in pre- and post-tax/transfer incomes.

We reach the following conclusions. Despite the continuing trend of rising income inequality after 2005, the employment boom did have an equalising effect. This effect, however, was substantially dampened by the generous social security system, in particular unemployment insurance. One of the main purposes of this system is to insure income losses due to job loss or other unforeseen causes. On the positive side, this substantially alleviates the effect of economic downturns. On the negative side, however, this also reduces the effects of economic upturns on net incomes. The impact of the German social security system appears particularly strong in this respect. Our results suggest that even if the economic consequences of the COVID-19 shock were to reverse all the employment gains that occurred during the boom, this would only have modest effects on the distribution of net incomes. We further show that much of the employment boom took the form of additional part-time and marginal part-time work for women, both in single and in non-single households. Thus, our results demonstrate that a long expansion of employment may have a favourable effect on the distribution of incomes, even if much of the employment gains take the form of part-time and marginal part-time work which are often seen as inferior forms of employment. Finally, we demonstrate that distributional effects of employment changes may be masked by other developments, making it hard to determine their exact magnitude. In our case, we show that the equalising impact of the boom was partly offset by immigration of individuals with low disposable incomes and by long-term compositional changes in the population (educational upgrading and population aging).

The remainder of this paper is structured as follows. In Section II, we describe the data underlying our study. Section III provides an overview of recent trends in the German income distribution. In Section IV, we present and discuss our empirical results. Section V concludes. Our Appendix contains a more detailed outline of our methods whose description in the main text is kept brief.

II. Data

Our study is based on the German Socio-Economic Panel (SOEP), a representative study of households living in Germany collected and maintained by the German Institute for Economic Research (DIW), see Goebel et al. (2019). In spite of the general limitations of survey data, the SOEP constitutes the only data source containing sufficient information for a study covering all relevant aspects of the distribution of net household incomes such as different income components, employment outcomes and socio-economic characteristics of all household members. Besides the SOEP core survey, we exploit the information in the SOEP migration samples as well as in the IAB-SOEP refugee sample to assess potential effects of immigration (see details below).

The focal point of our analysis is the distribution of annual net equivalised incomes between the years 2005/06 (when the employment boom set in) and 2015/16 (the most recent survey years with available income information at the time our study was carried out).[2] Our measure of net equivalised income is based on annual household net income

$$y = y_{Market} + y_{Pens} + y_{Trans} - ssc(y_{Labour}, y_{Pens}) - tax(y_{Tax}), \tag{1}$$

where y_{Market} denotes the sum of all household members' annual market incomes (labour income and capital incomes such as income from interest, dividends, rents[3]), y_{Pens} the sum of all pension incomes (private and public), and y_{Trans} the sum of public transfers received. Household public transfers include the full range of government transfers such as unemployment benefits, child benefits, student grants and substistence allowances (among others; for simplicity we also include under this label transfers *between* private households). The terms $ssc(y_{Labour}, y_{Pens})$ and $tax(y_{Tax})$ represent deductions of social security contributions (pensions, health, unemployment and old age care insurance) as well as income taxes paid by the household. We compute both of these components for each household using our own income tax and social security contributions module described in the Online Appendix. In order to focus only on real income changes, we inflate nominal income measures to prices of our most recent year 2016 (in the case of taxes and social security contributions we do this after the respective calculations). Finally, we equivalise annual net household income using the commonly used modified OECD equivalence scale and attribute the resulting equivalised income measure to each household member.

A big strength of a survey data set like the SOEP is the availability of individual income components, mostly at the individual level, see Grabka (2017). This is crucial for our purpose as we aim to counterfactually alter individual components such as labour incomes

[2] We pool years in order to increase statistical precision and to make our analysis less dependent on individual years as in Hyslop and Maré (2005) or Blundell et al. (2007).

[3] Following common practice, we also include imputed rental values for owner-occupied housing and imputed social security contributions for civil servants in household market income.

in order to determine their effect on the resulting distribution of annual household net incomes. An important ingredient to this analysis is the availability of summary calendar information on monthly employment activities in different categories (full-time, part-time, marginal part-time, unemployment) as well as information on income earned in different employment activities (main job, side job, self-employment).[4] The information on employment in full-time, part-time and marginal part-time work is based on the self-reports of the survey participants intending to provide a summary picture of all their employment activities during a given year. In particular, they include the possibility of cumulative, parallel and/or multiple employment spells. The distinction between full-time, part-time and marginal part-time work is made by the survey participants themselves, but we expect them to follow the fact that most full-time jobs in Germany have a contractual working week of 35 to 41 hours. Part-time jobs usually have much lower working hours. Marginal part-time work is typically either occasional or additional employment with few or irregular working hours or takes a standardised form with certain exemptions from taxes and social security contributions ('minijobs', typically 400 to 450 euros per month).

Based on the information in the monthly income and employment calendars, we construct for each individual the annual number of months worked in different employment categories (full-time, part-time, marginal part-time) along with the average monthly wage received in the respective category.[5] We include in our definition of employment both dependent and self employment. Our construction is such that multiplying and adding up individuals' months worked and monthly wages yields the annual labour income of each individual as reported in the SOEP and allows us to separately change employment quantities and wage rates in our counterfactual simulations.[6]

Our analysis makes use of a large number of further characteristics at the individual and at the household level. In general, we distinguish between the following six different household types: (i) single pensioner households (65 years or older), (ii) multiple pensioner households (at least one household member 65 years or older and no household member under 55 years), (iii) single adults without children, (iv) multiple adults without children, (v) single

[4]Given our interest in the distribution of annual incomes, we do not focus on hours worked or hourly wages apart from our distinction into full-time, part-time and marginal part-time work. See Carrillo-Tudela, Launov and Robin (2021) for some information on changes in hours worked during the period under consideration.

[5]This requires some choices to reconcile the information in the employment and income calendars, see Appendix A.II for more details. Appendix A.II also provides information regarding the comparability of SOEP employment data with those from other sources.

[6]The full use of employment information from the annual activity calendars of household members is an important difference to our previous study Biewen, Ungerer and Löffler (2019) which only used crude information on employment at the household level and only from the survey month (rather than over a full calendar year) along with descriptive information about different income measures over time. This turns out to be a crucial difference, as Biewen, Ungerer and Löffler (2019) failed to establish a clear relationship between employment changes and changes in the distribution of net incomes. Another important difference is that our earlier paper considered only the short time period 2005/06 to 2010/11, whereas the current paper covers the whole period of the economic upturn 2005/06 to 2015/16.

adults with children, and (vi) multiple adults with children. Within households we consider detailed individual information on the household head and (if present) the partner or the second oldest adult in the household (gender, age, nationality, educational qualification in three categories, work experience in years, see Table 2). For certain purposes, we also use information on individual employment histories (such as the number of months worked in different employment categories in the past three years, see below for more details). In addition to the characteristics of individual household members, we consider information on the number of children in the household in different age categories (0-3, 4-6, 7-17 years), the number of further adults in the household, and whether the household resides in East or in West Germany.

All our computations make full use of the SOEP sampling weights provided by the DIW which ensure the representativity of our results for the full German population. For statistical inference, we use bootstrapping taking account of the repeated observation of the same households in different years and the clustering of individuals within households when computing bootstrap confidence intervals (Biewen, 2002).

III. General trends

Figure 2 displays inequality trends in equivalised net incomes since the year 2000. Consistent with previous contributions, the graphs show that income inequality first stagnated after the onset of the labour market boom in 2005 but then followed a slight upward trend from 2010 onwards. The upward trend after 2010 is present in the upper half of the distribtion (percentile ratio P90/P50), but is even more pronounced in the lower half (percentile ratio P50/P10).

The development of mean and median equivalised income is shown in Figure 3a. After years of stagnation between 2000 and 2005, the average living standard started to grow again in the same year as the employment boom began. Figure 3b shows the development of the semi-official 'at-risk-of-poverty rate' (the proportion of individuals with incomes below the relative poverty line of 60 percent of the median), suggesting further strong increases in relative poverty risk after 2010.

Finally, Figure 4 presents a more detailed description of distributional change for our period under investigation. The figure displays the relative change of the percentiles of the distribution of net eqivalised incomes between 2005/06 and 2015/16, indicating in which parts of the distribution (real) income growth was largest. It turns out that all parts of the distribution were shifted upwards, but that growth was relatively modest in the lower part (2.5 to 7.5 percent), larger at the very top (around 7.5 percent), and largest in the upper middle part (7.5 to 10 percent), leading to a small increase in inequality between

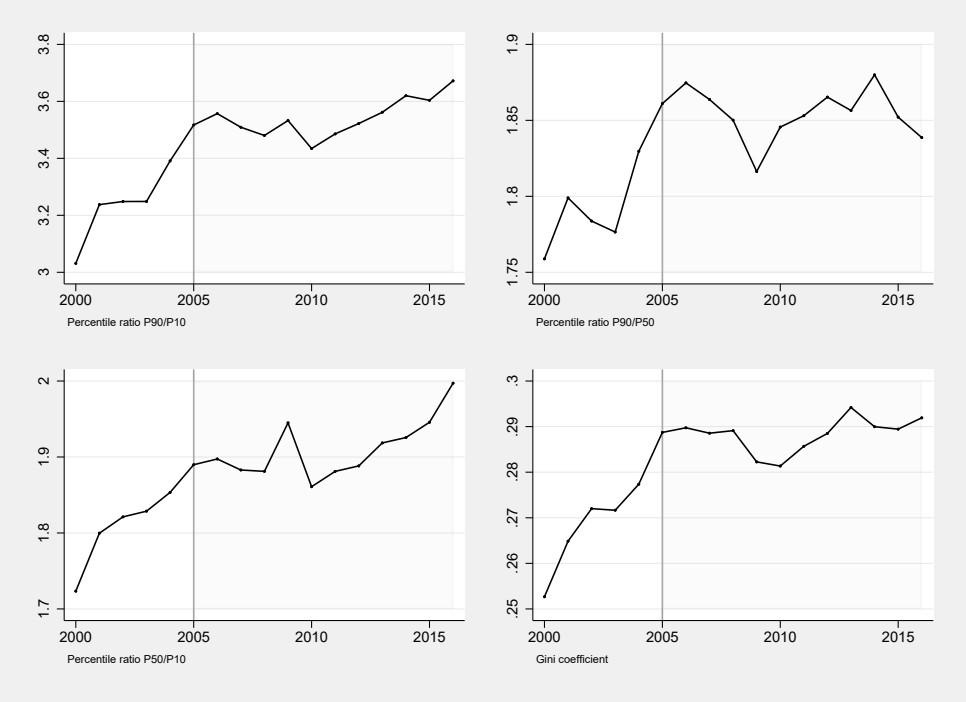
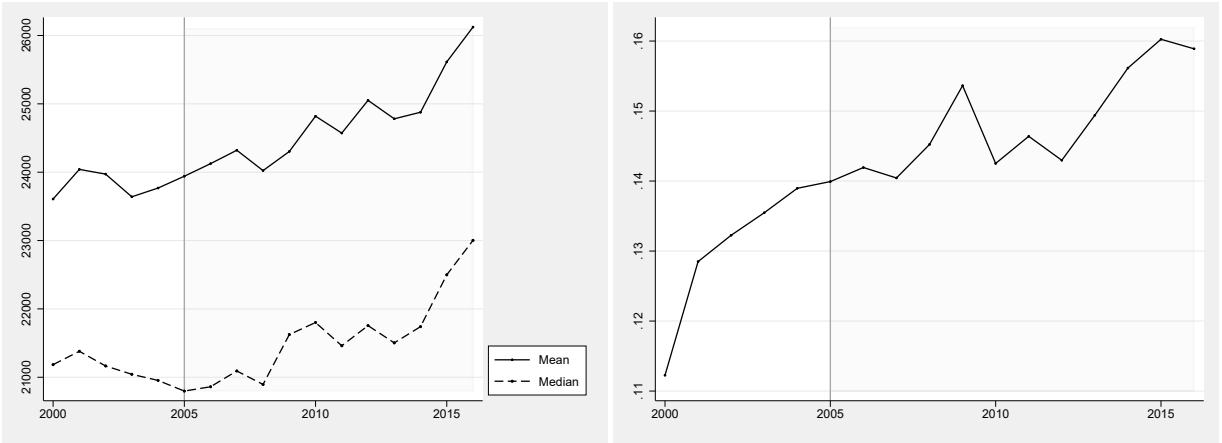


FIGURE 2
Inequality in equivalised net incomes
(*Source:* Socio-Economic Panel)



(a) Mean/median equivalised income (Euros/year) (b) Relative poverty rate

FIGURE 3
Development of mean/median income and relative poverty rate
(*Source:* Socio-Economic Panel)

2005/06 and 2015/16.[7]

[7]See Dustmann, Fitzenberger and Zimmermann (2018) for an analysis of inequality trends based on the alternative data set *Einkommens- und Verbrauchsstichprobe (EVS)*. Dustmann, Fitzenberger and Zimmermann (2018) also find slightly rising inequality between 2003 and 2013, but the fact that the EVS is only available every four years as well as a number of differences in survey design make it difficult to compare their analysis with our comparison of the years 2005/06 vs. 2015/16.

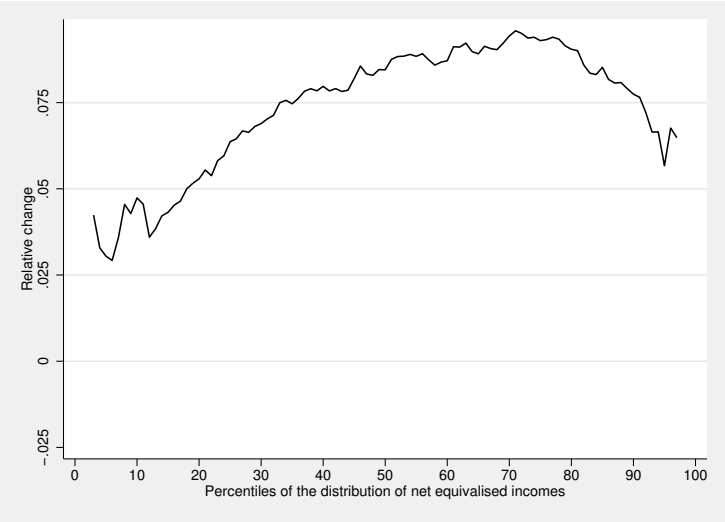


FIGURE 4
Relative changes of income percentiles of net equivalised income 2005/06 vs. 2015/16 (*Source:* Socio-Economic Panel)

IV. Empirical analysis

The goal of the following analysis is to determine the contribution of the substantial changes in the level and composition of employment between 2005/06 and 2015/16 to the observed changes in the income distribution as shown in Figure 4. In order to assess the role of potential confounders, we also describe the contribution of factors other than employment to the pattern shown in Figure 4. Our general method will be to compute *counterfactual distributions* of net equivalised incomes for the target period 2015/16 in which we change only one factor (e.g., employment), while keeping all other factors as they are in 2015/16. The comparison of counterfactual vs. factual change will then yield an estimate of the isolated effect of the given factor on the income distribution as observed in 2015/16.[8]

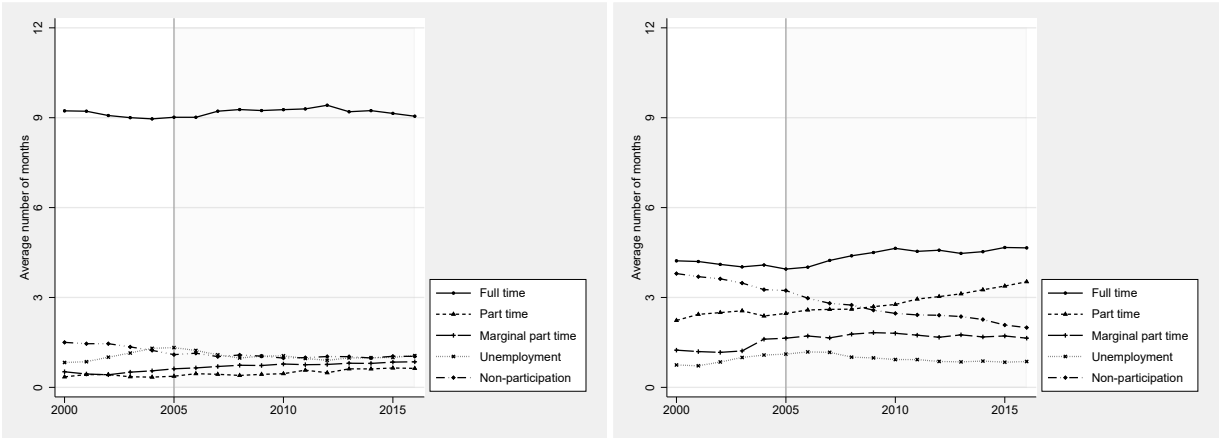
IV.1. Distributional effects of the employment boom

IV.1.a. Employment changes

We now turn to our analysis of the effects of the employment boom on the distribution of incomes. As described above, our data include detailed information on the annual number

[8]This is commonly accepted methodology in econometric decomposition analysis, see Fortin, Lemieux and Firpo (2011). It is important to note that this approach does not address general equilbrium effects. On the positive side, it avoids the large number of potentially controversial assumptions that are necessary to model such effects. Policy-makers often prefer this approach over equilibrium models for transparency. We view both methods as complementary. The advantage of the method used here is that the potential quantitative importance of different channels of distributional change can be determined in a transparent way with minimal assumptions. It provides an 'anatomy' of observed changes that allows one to assess which factors were important and which factors played a negligible role, not claiming their role as final causal determinants. See Appendix for additional discussion.

of months worked in the different categories full-time work, part-time work and marginal part-time. We will model counterfactual changes in these employment quantities below. In order to see how the employment boom affected the different forms of employment, we plot in Figure 5 the evolution of the average number of months worked per year in the different employment categories, separately for men and women. For men, we observe an increase in full-time work between 2005 and 2010, but a stagnation or even decline after 2012 (Figure 5a). Male part-time and marginal part-time work consistently grew after 2005, albeit on a relatively low level. Interestingly, male non-participation did not decline after 2005 as strongly as unemployment did.



(a) Men (b) Women

FIGURE 5
Annual number of months worked in different employment categories, individuals aged 18–64 years, not in education (*Source:* Socio-Economic Panel)

Employment changes were much more dynamic for women (Figure 5b). In particular, female full-time employment considerably grew between 2005 and 2010. Female part-time employment also consistently increased after 2005, and its growth substantially accelerated after 2010. Female participation in marginal part-time employment also continued to grow after 2005, but growth rates were much lower than in 2003 when this form of employment was liberalised. The steep decline in female non-participation shows that female employment gains mostly came out of non-participation.

To sum up, the employment boom after 2005 led to substantial employment growth for both men and women, but its most important component was additional full- and part-time employment of women out of non-participation. This evidence is consistent with that from other data sources, see Section I, Carrillo-Tudela, Launov and Robin (2021), Riphahn and Schrader (2020) and Appendix A.II.[9]

[9]Carrillo-Tudela, Launov and Robin (2021) focus on the age group 25–54 years. Riphahn and Schrader (2020) show that the group of 55–64 year old workers significantly increased their participation after 2005, countering the trend of declining male participation in younger age groups.

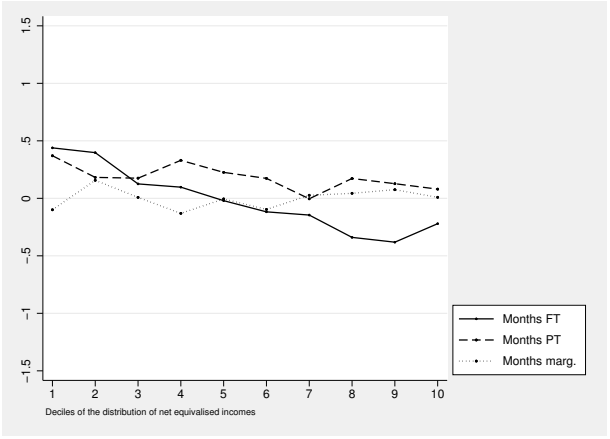
Before we turn to our detailed micro-analysis of the effect of employment changes on the income distribution, we present a suggestive preliminary analysis aimed at describing the incidence of employment growth across the deciles of the distribution. Figure 6a plots the average yearly gains in the number of months worked in the different employment categories per household across different positions of the distribution of equivalised incomes.[10] It appears as if households in the lower part of the distribution substantially gained full-time employment months, while households in the upper part lost over the period 2005–16. This would be a misleading interpretation, however, because it is likely that households in the lower part always tend to gain employment (even in the absence of an employment boom because low income is associated with low employment that can only be increased), while households in the upper part tend to lose employment (because high income is typcially associated with a high degree of employment that often cannot be increased further, i.e. mean reversion).

In order to determine the effect of the employment boom compared to the situation before, it therefore makes sense to subtract from picture 6a the corresponding picture 6b for the period before the boom, i.e. 2000–04. The differential effect shown in Figure 6c suggests that households at the bottom of the distribution indeed benefitted substantially from full-time employment gains due to the boom and that there were also gains in the middle of the distribution, albeit to a lesser extent. The pattern for part-time employment is similar but not as pronounced. Note that the general level of part-time employment is lower so that relative gains are still substantial. The growth of marginal part-time employment tends to be negative relative to the period 2000–04. This can be explained by the fact that this type of employment experienced idiosyncrated gains in the year of its liberalisation 2003. Summing up, our preliminary analysis suggests that the employment boom led to employment gains for most parts of the distribution, but that the lower part gained more than the upper part.

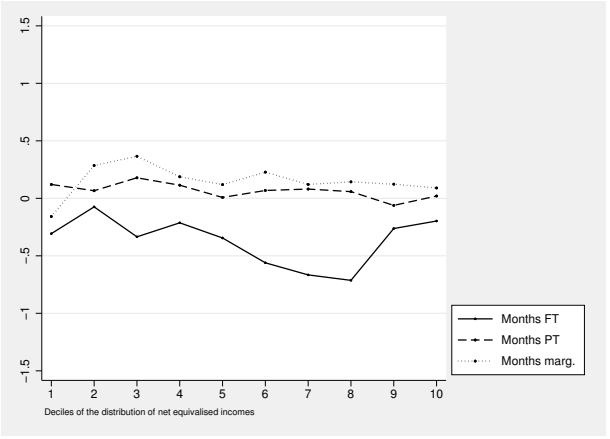
We now turn to our more datailed analysis of the effects of the employment boom on the distribution of incomes. Our goal is to model for each individual aged 18–64 years and not in education counterfactual employment quantities for 2015/16 that would have prevailed if the boom had not taken place, i.e. if the labour market situation in 2015/16 had been as unfavourable as in 2005/06. In order to do this, we describe the number of months worked per year in the different employment categories (full-time, part-time, marginal part-time) conditional on individual characteristics using logit models.[11] We estimate separate models for each gender and each employment category conditional on the following covariates:

[10] More precisely, we compute for each household from a particular income decile the change in months worked in the different categories from year t to year $t+1$ and average these changes over years and over households from the respective decile.

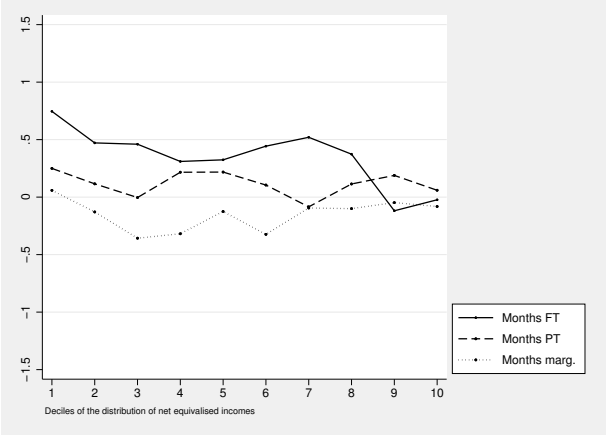
[11] What follows is an abbreviated description of our calculations. See Appendix for more details and Online Appendix for detailed estimation results.



(a) Average annual growth of the number of months worked per household per year, 2005–16



(b) Average annual growth of the number of months worked per household per year, 2000–04

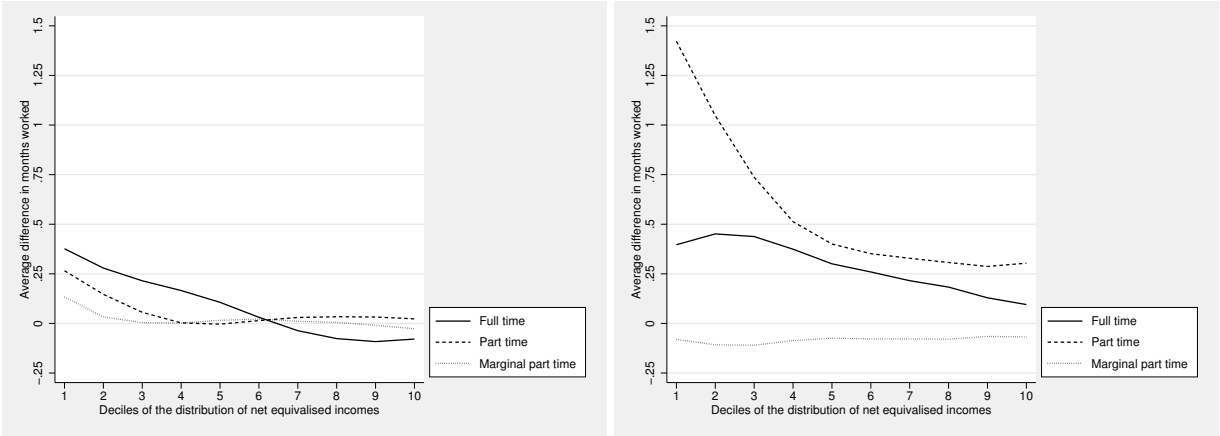


(c) Differential effect (growth incidence in months worked per year 2005–16 relative to 2000–04)

FIGURE 6
Growth of the absolute annual number of months worked per household across the deciles of the distribution of net equivalised incomes (*Source:* Socio-Economic Panel)

nationality, East German residence, disability status, age, age squared, educational qualifications in three categories, work experience, work experience squared and the number of children in different age categories. To account for state dependence in labour market participation, we also include the number of months unemployed/employed in the different employment categories (full-time, part-time, marginal part-time) in the past three years. We estimate such models both for the labour market situation in 2005/06 and in 2015/16. Comparing the predictions from these models for a given individual yields a correction term, reflecting how much less/more this individual would have worked in 2015/16 if the labour market situation had still been as in 2005/06. We use this correction term to adjust the factual number of months of each individual observed in 2015/16 into the direction of a counterfactual representing the number of months this individual would have worked in 2015/16 if the employment boom had not taken place.

Figure 7 shows the value of these correction terms across the deciles of the distribution of



(a) Men (b) Women

FIGURE 7
Difference annual months worked 2015/16 compared to counterfactual situation with individual employment probabilities as in 2005/06, individuals aged 18–64 years, not in education (*Source:* Socio-Economic Panel, own calculations)

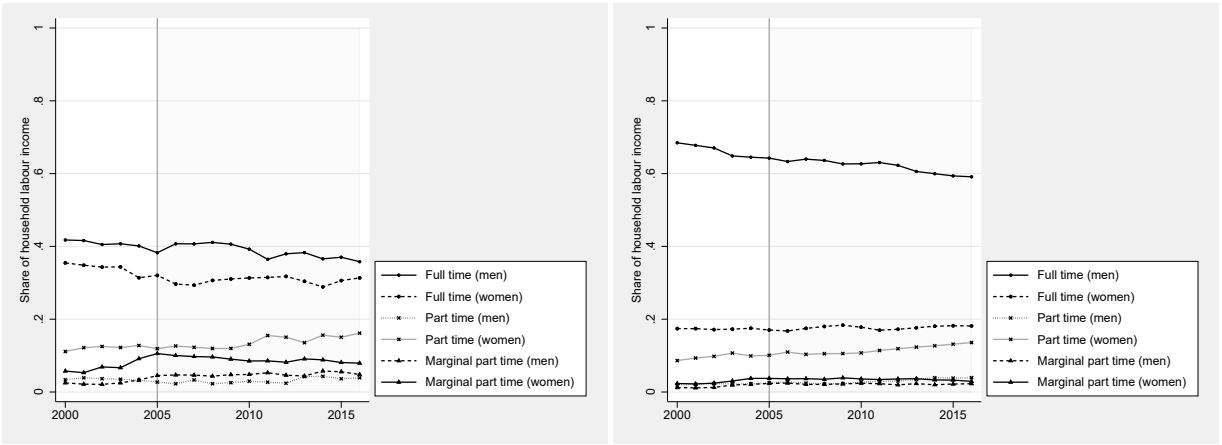
equivalised incomes, separately for men and women.[12] Again, it turns out that absolute employment gains compared to a counterfactual situation in which employment quantities were as in the pre-boom situation of 2005/06 were particularly strong for individuals in the lower part of the distribution. For example, men's average number of full-time months was around a quarter of a month higher in the lower third of the distribution compared to the counterfactual pre-boom situation (Figure 7a). For women, the average number of part-time months was .5 to 1.5 months higher in the lower part of the distribution compared to the pre-boom situation, while the number of full-time months was higher by .25 to .5 months. For women, we also observe sizable gains in part-time and full-time months in the upper half of the distribution (Figure 7b).

Given the finding that especially women increased their participation, it is interesting to see whether this was an added worker effect (i.e. wives entering full-time or part-time work) or increased participation in single households. This can be answered using transition rates between different labour market states (Tables A1 and A2 in the Appendix). The comparison of average annual transition rates for the pre-boom period 2000–04 with those for the period 2005–16 suggests for men that the moderate increases in full-time and part-time employment were mainly fueled by increased transitions from non-participation or part-time employment to full-time employment as well as by increased transitions from unemployment to part-time employment in non-single households. A further striking finding is the decline in the transition rate from unemployment, part-time and marginal part-time into non-participation.[13]

[12] We thank an anonymous referee for suggesting this representation.

[13] See Carrillo-Tudela, Launov and Robin (2021) for related evidence, but for monthly rather than yearly transitions.

For women, the comparison suggests that the increases in female full-time and part-time work were related to increased transitions from non-participation to full-time or part-time work in non-single households (supporting an added worker effect). Transitions to marginal part-time out of unemployment and non-participation also increased for women in non-single households, while downward-transitions from part-time work to marginal part-time also became less frequent. Interestingly, we find *no evidence* for upgrading from part-time to full-time work, neither for single nor for non-single women. While increased transition intensities to full-time and part-time work mostly applied to women in non-single households, the last columns of Tables A1 and A2 suggest that women in single households experienced a stabilisation of all forms of labour market participation in the sense that transitions from employment or unemployment to inactivity were considerably reduced (this was much less the case for women in non-single households). This indicates that also women in single households benefitted from employment gains.



(a) Single adults (one adult, possibly children)

(b) Non-single households (multiple adults, possibly children)

FIGURE 8
Share of different types of labour income in overall household income, non-pensioner households (*Source:* Socio-Economic Panel, own calculations)

The fact that women experienced much higher employment gains than men is also reflected in the rising contribution of female labour income to overall labour income as shown in Figures 8a and 8b. The figures display the share of household labour income that was contributed by men and women in the different employment categories among single as compared to non-single households (excluding pensioner households, see Section II for the definition of different household types). Among single households, full-time labour income of men and women contributed almost equally to overall household labour income, but while the male full-time income share declined, that of women was stable and the female part-time share strongly increased (Figure 8a). The contribution of female marginal part-time income also declined in favour of more part-time labour income. We conclude that

the substantial gains in female participation in part-time work was not only due to an added worker effect but also applied to a large extent to women in single households (possibly with children).

Among non-single households, increasing part-time participation by women also drove up the female part-time labour income share, providing evidence for an added worker effect. By contrast, the share of female full-time income in overall household income increased only slightly. In the Online Appendix, we show that there were increases in the female full-time labour share in the upper two thirds of the income distribution and in households with children, but these were counteracted by decreases in the lower third of the distribution. Increases in female part-time labour income shares mostly applied to the two lower thirds of the distribution and were much weaker in the upper third.[14]

IV.1.b. Effects on the distribution of net incomes

In order to trace the consequences of these employment changes for equivalised household incomes, we multiply the counterfactual employment months with the monthly wage of the individual in the respective employment category (if observed), or with a monthly wage that we predict using the same set of individual characteristics as in the models for employment in cases in which we do not observe the individual's wage in the respective category (these cases were rare as most individuals *reduced* their employment in the counterfactual pre-boom scenario).

In cases in which individuals counterfactually *lose* employment (because they would have been unemployed or inactive in the labour market absent the employment boom), we check whether these individuals would be entitled to unemployment benefit I (*ALG I*), which depends on the individual labour market history. In order to account for the fact that labour market histories would have been much less favourable in 2015/16 if the employment boom had not taken place, we counterfactually correct each individual's labour market history to reflect how it would have looked under the labour market conditions of 2005/06 (see Appendix for more details). We then calculate the amount of unemployment benefit I based on the corrected labour market histories and impute this income source to all individuals eligible.

In a next step, we sum up all counterfactual income changes per household and recalculate income tax and social security contributions. If the resulting household net income lies below the household minimum income threshold (*'Hartz IV Regelsatz'*) plus housing costs, the household is entitled to the so-called unemployment benefit II (*ALG II*). In these cases, we compute the exact amount of unemployment benefit II (plus housing costs)

[14] It is possible that the labour income shares also changed because wage rates for the different forms of employment changed. We show in Section IV.2.d however, that this happened only to a very small extent.

and replace the net income of the household with this amount. Finally, we equivalise the resulting household net incomes using our equivalence scale.

The comparison of the counterfactual income distribution for 2015/16 obtained in this way with the factual distribution of 2015/16 reveals which parts of the distribution gained from the boom in terms of net income and to what extent. The results shown in Figure 9 (dashed line) indicate that the lower part of the distribution benefitted more from the boom than the upper part, consistent with our preliminary analysis in Figures 6 and 7. An important reason why the effects of the boom are not larger is that the consequences of changing back employment quantities to the level of 2005/06 are considerably alleviated by the social security system. If the labour market situation in 2015/16 had been as bad as in 2005/06, not all the individuals affected would have been without income. Many of them would have been entitled to unemployment benefit I or II. In order to assess this aspect, the dotted line in Figure 9 shows the *gross effect* of the boom, i.e. without assigning unemployment benefits to individuals who counterfactually lost employment in our calculations. As expected, this effect is very substantial.

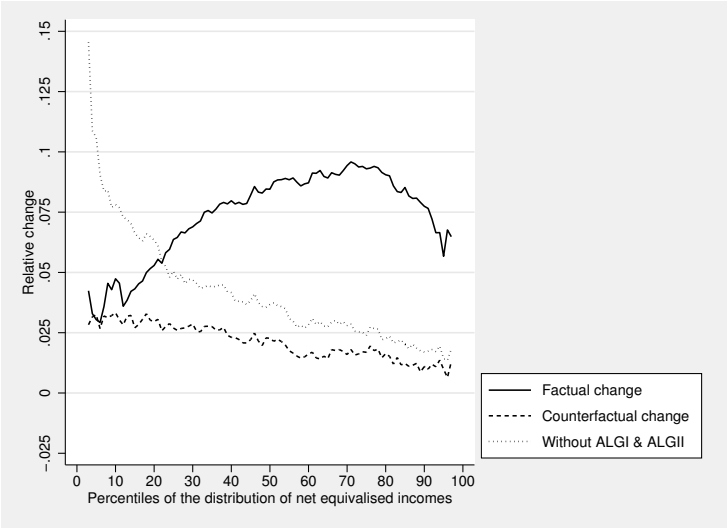


FIGURE 9
Relative change of income percentiles due to the employment boom
(*Source:* Socio-Economic Panel, own calculations)

Our counterfactual calculations are supported by Figure 10 displaying the *factual* changes in the distribution of equivalised incomes *before* and *after* taxes and transfers. Similar to Figure 9, we observe large relative gains in incomes before taxes and transfers at the bottom of the distribution, which are not translated into corresponding income gains after taxes and transfers. However, Figure 10 includes the effect of *all other factors* (apart from employment) and does not disentangle the effects of individual aspects as we do in our counterfactual analyses (see below).

Summing up, we draw the following tentative conclusions about the impact of the em-

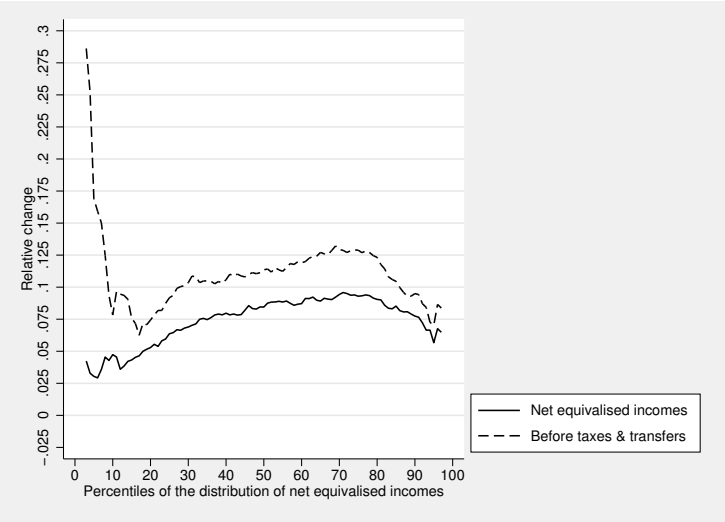


FIGURE 10
Relative changes of income percentiles 2005/06 to 2015/16 before and after taxes and transfers (*Source:* Socio-Economic Panel, own calculations)

ployment boom on the German income distribution. First, the employment boom led to substantial income gains across the whole distribution. Second, the lower part of the distribution benefitted more than the upper part, most likely because the boom prevented many individuals from being unemployed in 2015/16 (this is implicitly revealed by the difference of the dotted and the dashed line in Figure 9). Third, the main source of income gains was additional female labour income from part-time and, to a lesser extent, from full-time work out of non-participation or unemployment. Female employment expanded both in single and in non-single households. Fourth, the effects of the boom were substantially dampened by the generous social security system as many of the individuals who gained employment through the boom would have been eligible for unemployment benefits or household minimum income without it. It is well-known that, due to its generosity, in-work net income in the German system is often not much higher than out-of-work net income, especially for households at the bottom of the distribution and/or with many children. In a more general sense, the effects of additional employment on incomes were also dampened by the progressive tax system which in part taxes away additional income (this applies in particular to additional income earned by second earners in the household due to the joint taxation of spouses in the German tax system). To put it differently, the boom made incomes before taxes and transfers more equal, but this effect was less pronounced after taxes and transfers because the system is effective at counteracting inequality. Fifth, on balance, the boom had an equalising effect on the distribution of net incomes, albeit a moderate one. This follows from column 1 of Table 3 in which we compute the effect of the counterfactual changes on different inequality measures. Finally, sixth, while the boom produced a substantial contribution to overall distributional change (solid line in Figure 9), there must be other factors that also contributed.

IV.2. Other factors

Given that the employment boom cannot fully account for the changes in the distribution between 2005/06 and 2015/16, we look at a number of other potential explanations: i) immigration, ii) changes in household types, iii) changes in individual and household characteristics, iv) changes in the level and structure of pay, v) changes in capital incomes, and vi) changes in the tax and transfer system. Considering the effect of other factors is important for our understanding of the effects of the boom because its impact may have been wiped out or masked by the countervailing impact of other developments.

IV.2.a. Immigration

As many other countries, Germany experienced substantial immigration during the period under investigation, in particular in the context of the so-called 'refugee crisis' of 2014–15, in the course of which a large number of individuals from the Middle East found refuge in the country. Our data base contains information on immigration through a number of refreshment samples (SOEP samples M1 Migration 1995–2010, M2 Migration 2009–13, M3/4 Refugees 2013–15). In order to assess the potential effect of immigration on the distribution of net incomes, we carry out the following counterfactual exercise: we omit all individuals (as well as their children) who immigrated to the country after 2005 from our sample. As in our other computations, this will ignore potential general equlibrium effects of immigration. Such effects are expected to be small however, as many of the individuals who immigrated after 2005 were refugees who were not allowed to participate in the labour market in the first years after their arrival. Unfortunately, income information on individuals who immigrated as refugees is available for the first time for the year 2016, so that the following results compare 2005/06 to 2016 (rather than to 2015/16).

Migration group	Number of individuals
Aussiedler, Germans living abroad	132,574
EU foreigners	924,646
Asylum seekers/refugees	792,356
Other/no information	1,748,241
Sum	3,598,817

TABLE 1
Number of individuals who immigrated to Germany between 2005 and 2016 (*Source:* Socio-Economic Panel, grossed-up numbers using sample weights)

Table 1 gives an overview of the number of individuals in our sample counted as having immigrated into the country after 2005 (grossed up to population figures using the sample weights). The total figure of around 3.6 million corresponds well to that reported by

the Federal Government (Bundesamt für Migration und Flüchtlinge, 2017). Apart from *Aussiedler* (ethnic Germans born in Eastern European countries with the right to migrate to Germany) and Germans returning from abroad, EU foreigners and refugees constitute the largest groups among the individuals who immigrated after 2005. Our data also contain a large number of immigrants without information on their exact status (the "Other/no information" group in Table 1). Judged from their observable characteristics, most of these individuals are likely to also belong to the "Asylum seekers/refugees" group.

The effect of omitting individuals who immigrated since 2005 from the distribution of incomes in 2016 is shown in Figure 11. The lower grey line demonstrates that the overall effect of immigration was such that lower parts of the distribution were pulled downwards by up to 4 percent. The other lines show that this was mainly due to the group of refugees and the "no information" group, while the group of EU foreigners and ethnic Germans did not differ much in their composition of incomes compared to the native population. The effect at the lower end is substantial and suggests that the mere fact that a large number of individuals with very low incomes joined the population may account for some of the poor income growth at the bottom of the distribution of net incomes (and neutralise some of the positive effects of the employment boom). In Table 3, we show that this had an inequality increasing effect.

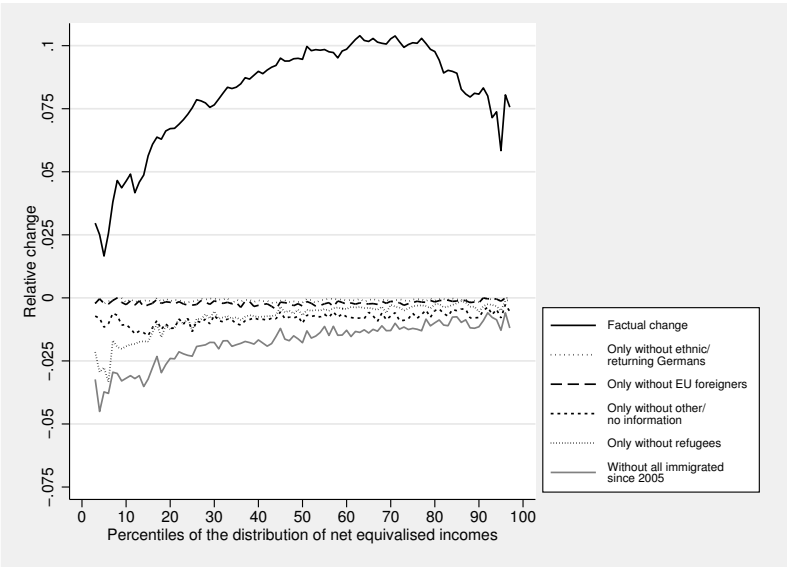


FIGURE 11
Relative change of income percentiles due to immigration between 2005 and 2016 (*Source:* Socio-Economic Panel, own calculations)

IV.2.b. Changes in household types

Changes in the composition of the population with respect to household types constitute another factor that potentially masks effects of the employment boom on the income dis-

tribution. If the share of household types with low equivalent income secularly increases (e.g., lone parents, pensioners), this will lead to increasing inequality independent of employment gains for low-income households.

Figure 12 shows that changes in household types over the period under investigation were substantial. In particular, multiple adult households without children and pensioner households increased their population shares at the expense of multiple adult households with children. In order to assess the effect of this development on the income distribution, we counterfactually change the population weights of the different households types in the income distribution of 2015/16 to those in 2005/06 (see Appendix for more details). Figure 13a shows that, despite the substantial changes, the effect of doing this is negligible, i.e. changes in household types do not help to account for changes in the distribution between 2005/06 and 2015/16.

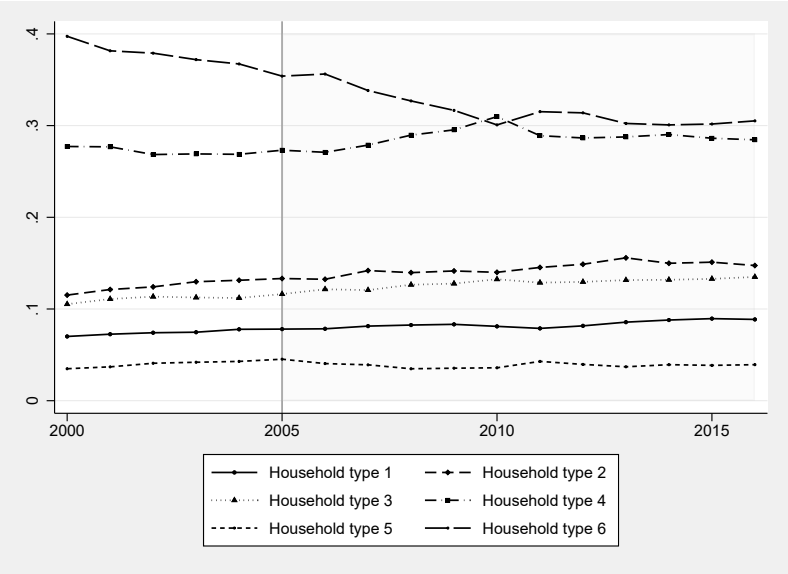
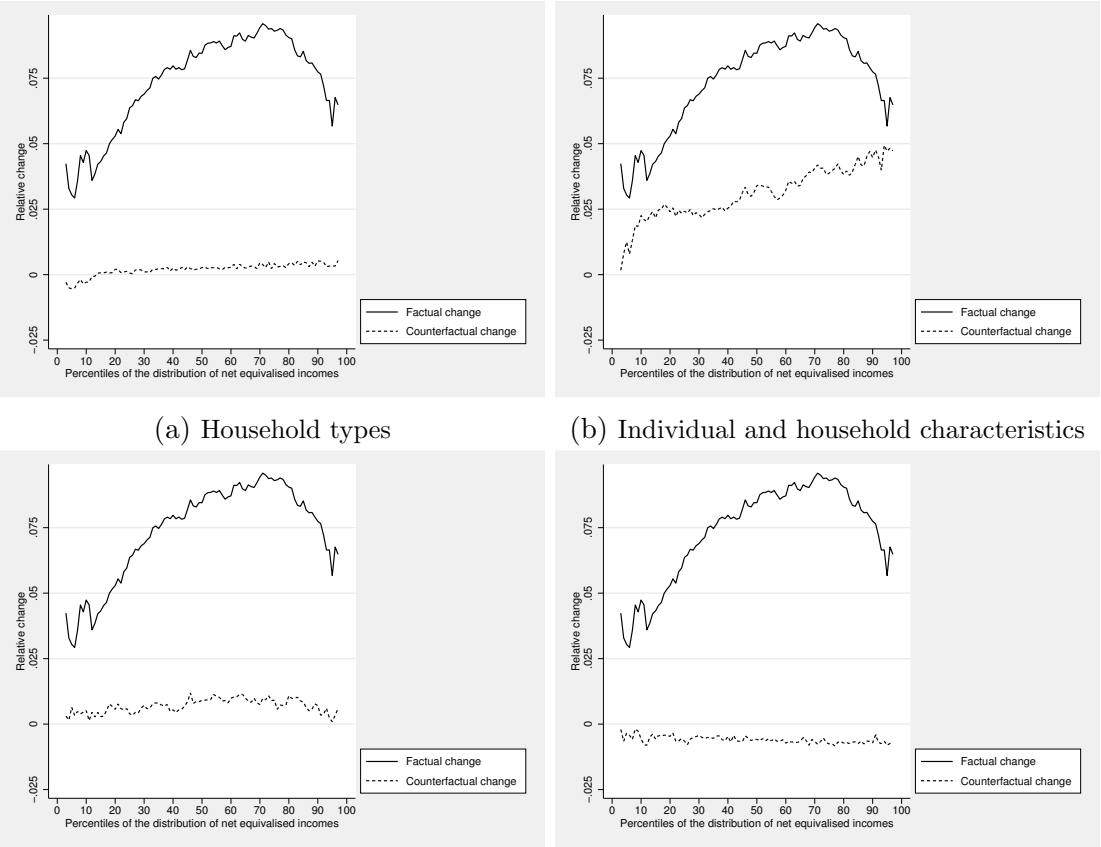


FIGURE 12
Development of household types over time: 1) single pensioners, 2) multiple pensioners, 3) single adults without children, 4) multiple adults without children, 5) single adults with children, 6) multiple adults with children
(*Source:* Socio-Economic Panel, own calculations)

IV.2.c. Changes in individual and household characteristics

Next, we consider finer compositional changes in the structure of the population. For example, it may be the case that educational upgrading and population aging induced more income inequality because a shift towards higher educational qualifications and older age groups raised the share of population subgroups with high income disperson (increasing within-group inequality), or increased the divide between education or age groups (increasing between-group inequality). The changes in the individual and household characteristics considered by us are summarised in Table 2. As expected, there is a trend



(a) Household types

(b) Individual and household characteristics

(c) Level and structure of pay

(d) Capital income

FIGURE 13
Relative changes of income percentiles due to other factors
(*Source:* Socio-Economic Panel, own calculations)

towards higher age, work experience and education as well as towards more households with female heads and fewer children.

We compute the effect of these changes on the income distribution in 2015/16 by reweighting the distribution of these characteristics back to the one observed in 2005/06, leaving everything else constant. We do this separately by household type using the semi-parametric reweighting procedure proposed by DiNardo, Fortin and Lemieux (1996) (see Appendix for more details). Figure 13b shows that the impact of changes in these characteristics on the distribution of incomes was considerable. The shift towards higher age and education groups implied higher income levels, especially in the middle and at the top of the distribution. This contributed to increasing inequality counteracting the pro-poor income growth induced by the employment boom (column 4 of Table 3). The compositional effects of changing income-relevant characteristics is consistent with findings in the literature showing that these can account for a large part of changes in the distribution of *wages* (Dustmann, Ludsteck and Schönberg, 2009; Biewen and Seckler, 2019).

Variable	Average 2005/06	Average 2015/16	Difference
Household head			
Female	0.37	0.43	+0.06
Foreign nationality	0.08	0.10	+0.02
Age	50.18	52.47	+2.29
University degree	0.19	0.25	+0.06
Vocational training	0.63	0.59	-0.04
Less than vocational training	0.18	0.15	-0.02
Work experience (years)	12.22	13.35	+1.13
Partner or second oldest person (if any)			
Female	0.72	0.63	-0.09
Foreign nationality	0.11	0.10	-0.01
Age	46.97	49.28	+2.31
University degree	0.14	0.17	+0.03
Vocational training	0.59	0.51	-0.08
Less than vocational training	0.27	0.32	+0.04
Work experience (years)	9.95	10.40	+0.45
Other household characteristics			
East Germany	0.21	0.20	-0.01
Number of children in household	0.70	0.61	-0.08
Number of children 0-3 years	0.11	0.11	0.00
Number of children 4-6 years	0.12	0.10	-0.02
Number of children 7-17 years	0.47	0.41	-0.07
More than two adults	0.18	0.17	0.00

TABLE 2
Individual and household characteristics in 2005/06 and in 2015/16
(*Source:* Socio-Economic Panel, own calculations)

IV.2.d. Changes in the level and structure of pay

Apart from quantities, prices for employment may have changed over the period considered by us. In order to describe the potential effect of this factor on the distribution of net incomes, we form for each individual observed in 2015/16 a counterfactual wage that mimics the wage this person would have earned under the pay structures of 2005/06.[15] To this end, we regress monthly (log) wages on the following characteristics: nationality, East German residence, disability status, age, age squared, three education categories, work experience and work experience squared. We do this separately for the three employment categories, the two genders, and the two situations 2005/06 and 2015/16, the latter representing the pay structures in 2005/06 and in 2015/16, respectively. We then compute for each individual observed working in 2015/16 a correction term based on the difference in wage predictions under the pay structures of 2005/06 and 2015/16, reflecting how much higher/lower the person's wage would have been under the pay structure of 2005/06. We also consider changes in pay for unobservables (i.e. wage residuals) assuming that the individual would have had the same rank in the distribution of residual wages in 2005/06

[15]See Appendix for more details and Online Appendix for detailed regression results.

as she had in 2015/16. The resulting counterfactual wages are then multiplied by the observed number of months worked in the different employment categories yielding changes in individual and household market income. Finally, we compute taxes and social security contributions for the changed sum of incomes and carry out the equivalisation.

Note that this procedure captures both changes in the *level* and in the *structure* of wages.[16] The results of this exercise are shown in Figure 13c. It turns out that changes in pay played only a minor role for the development of the income distribution between 2005/06 and 2015/16. There were small real wage gains which were slightly higher for the middle of the distribution. This did not significantly impact income inequality (see lower panel of Table 3). The (missing) effect of changes in pay structures for the period under investigation found in our analysis is consistent with evidence from administrative data showing that, after increasing inequality before 2005, the quantiles of the wage distribution mostly developed in a horizontal way, implying stagnating real incomes and no increasing inequality after 2005 (see Baumgarten, Felbermayr and Lehwald, 2020, p. 7, Figure 1b). The important conclusion for our analysis is that the income effects of the boom did not operate much through increasing wages in a tighter labour market or by changes in productivity sharing but mainly by increasing employment quantities at constant pay.

IV.2.e. Changes in capital incomes

Changes in capital incomes may also have influenced the income distribution in the period considered by us. We investigate this by constructing a counterfactual distribution of net incomes that results if one changes back the distribution of capital incomes to its state in 2005/06, leaving everything else constant. We do this by transforming each household's rental income and each household's other capital incomes by multiplying them by the ratio of the percentiles of these distributions in 2005/06 and 2015/16 based on the corresponding ranks of the household in 2015/16 (see Appendix for more details). Again, this reflects both changes in the *level* and the *dispersion* of capital incomes.

The effect of changing rental and other capital incomes is shown in Figure 13d. The figure suggests that changes in capital incomes *depressed* the income distribution. This is in line with the fact that real interest rates fell over the period considered. Perhaps surprisingly, these effects occured uniformly across the distribution. Our analysis comes with the caveat that survey data like the SOEP do not cover developments at the very top of the income distribution (Bartels and Jenderny, 2015). However, the results in Bartels and Jenderny (2015) suggest that changes at the very top of the German income distribution were relatively modest compared to those in other countries such as the United States. Also note that the respondents in our survey may report certain capital incomes as income

[16] Recall that we only consider changes in real wages as all of our wage information is expressed in prices of 2016.

from self-employment (in our study included in labour income). Drechsel-Grau, Peichl and Schmid (2015) have shown on the basis of tax data that, if one excludes incomes from owner-run enterprises, capital incomes are indeed approximately uniform across the German income distribution. Overall, we do not find any evidence for an important role of capital incomes for changes in the distribution of net incomes, but certainly cannot rule out effects at the very top not covered by our data.

IV.2.f. Changes in the tax and transfer system

We consider the effect of the following changes in the German tax and transfer system that occurred between 2005/06 and 2015/16.

Changes in transfers:

- Extension of mothers' pensions (two instead of one year of implicit contributions for children born before 1992)
- Abolishment of the temporary supplement to ALG II after receipt of ALG I (transitionary payment for individuals whose unemployment benefit I ran out amounting to 2/3 of the difference between unemployment benefit I and unemployment benefit II in the first year, and 1/3 in the second year)
- Higher child allowances, higher student allowances, higher unemployment benefit II (we only consider the part of the increase since 2005 that was higher than inflation)

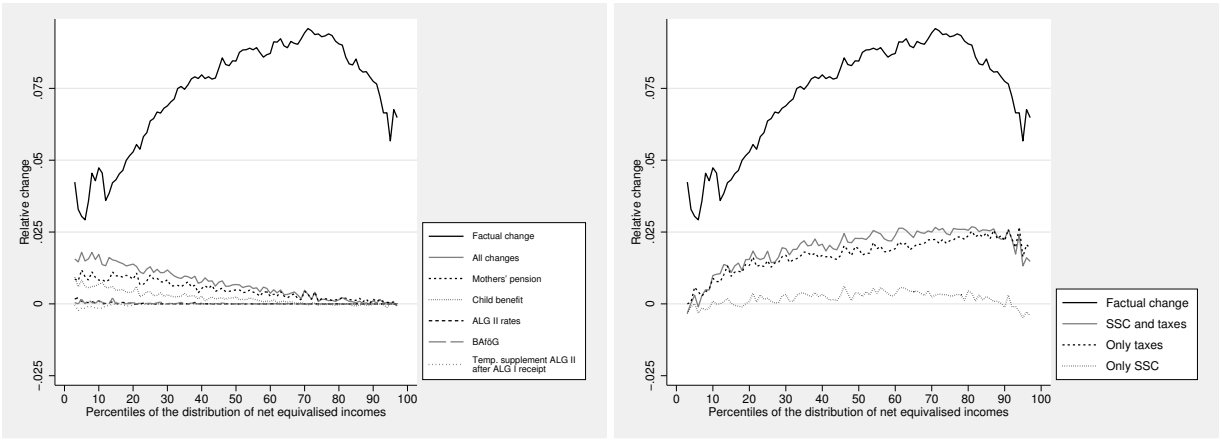
Changes in the tax system (including changes in social security contribution rates):

- Introduction of a 'rich tax' (marginal tax rate of 45 percent instead of 42 percent starting from 250,000 (500,000) euros taxable income per annum)
- Withholding tax for capital incomes (flat rate of 25 percent instead of personal tax rate)
- Changes in the tax schedule (changes in a number of tax allowances plus various changes in marginal tax rates)
- Changes in social security contribution rates (mainly reductions, e.g., lower contribution rates to unemployment insurance due to falling unemployment)

We describe the effects of these changes on the distribution of net incomes by counterfactually undoing each of these reforms. We emphasise that, as in our other computations, we ignore potential behavioural reactions to these changes.[17] The results of these operations are shown in Figures 14a and 14b. Figure 14a and the numbers in Table 3 demonstrate that the changes in the transfer system tended to have an equalising effect, mainly due

[17]Such reactions are likely to be small and they typically counteract the original effects (Jessen, 2019), rendering our calculations upper bounds.

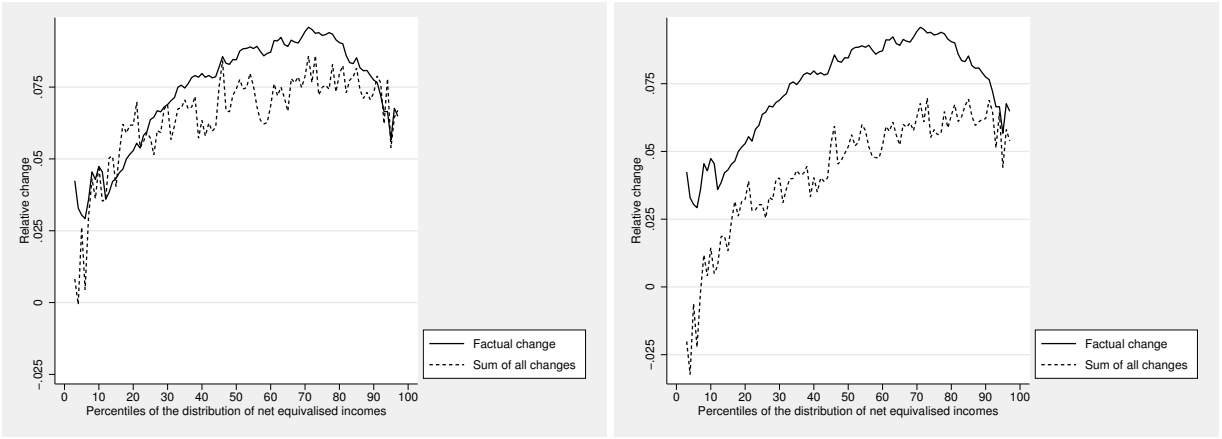
to the extended mothers' pension and the higher child allowances. On the other hand, the changes in the tax schedule mainly benefitted households in the middle and the top part of the distribution (households at the bottom of the distribution typically do not pay income tax). This had an inequality increasing effect (Figure 14b and Table 3). The fall in social security contribution rates led to small income gains in the middle of the distribution, but not at the bottom and the top (households at the bottom are typically not employed and labour incomes in households at the top typically exceed the social security contributions ceiling).



(a) Transfer system (b) Tax and SSC system

FIGURE 14
Relative change of income percentiles due to tax and transfer changes (*Source:* Socio-Economic Panel, own calculations)

IV.3. Summary of changes



(a) With employment boom (b) Without employment boom

FIGURE 15
Factual change vs. sum of counterfactual changes with and without employment boom (*Source:* Socio-Economic Panel, own calculations)

Index	Employment boom	Immigration	HH types	HH characteristics
Mean	+471.037	-362.008	+79.502	+908.138
	[+314.302 ; +626.474]	[-429.526 ; -293.971]	[-49.634 ; +205.381]	[+668.401 ; +1146.968]
Median	+512.069	-366.039	+61.764	+749.205
	[+320.035 ; +717.644]	[-485.849 ; -254.829]	[-62.887 ; +188.914]	[+510.938 ; +972.845]
P90/P10	-0.073	+0.078	+0.025	+0.090
	[-0.131 ; -0.019]	[+0.038 ; +0.121]	[+0.002 ; +0.053]	[+0.021 ; +0.156]
P90/P50	-.019	+0.011	+0.004	+0.025
	[-0.036 ; +0.000]	[-0.004 ; +0.024]	[-0.004 ; +0.014]	[-0.001 ; +0.051]
P50/P10	-0.019	+0.031	+0.010	+0.023
	[-0.047 ; +0.006]	[+0.010 ; +0.052]	[+0.000 ; +0.021]	[-0.003 ; +0.048]
Gini	-0.003	+0.004	+0.001	+0.005
	[-0.005 ; -0.001]	[+0.003 ; +0.005]	[+0.000 ; +0.002]	[+0.002 ; +0.008]
Poverty rate	-0.002	+0.005	+0.001	+0.004
	[-0.007 ; +0.002]	[+0.002 ; +0.008]	[-0.001 ; +0.003]	[-0.001 ; +0.009]

Index	Pay structures	Capital incomes	Transfers	Tax and SSC
Mean	+160.299	-159.121	+117.167	+526.212
	[-63.717 ; +385.391]	[-210.710 ; -108.257]	[+112.257 ; +121.559]	[+506.540 ; +544.972]
Median	+209.604	-144.170	+154.761	+518.147
	[+26.584 ; +400.229]	[-198.236 ; -87.573]	[+117.870 ; +196.741]	[+452.883 ; +585.615]
P90/P10	+0.001	-0.006	-0.053	+0.050
	[-0.055 ; +0.057]	[-0.026 ; +0.014]	[-0.074 ; -0.030]	[+0.024 ; +0.080]
P90/P50	-0.005	-0.002	-0.012	+0.001
	[-0.030 ; +0.018]	[-0.009 ; 0.006]	[-0.016 ; -0.007]	[-0.012 ; +0.014]
P50/P10	+0.006	-0.001	-0.016	+0.027
	[-0.012 ; +0.025]	[-0.010 ; +0.006]	[-0.027 ; -0.004]	[+0.016 ; +0.038]
Gini	-0.001	-0.000	-0.003	+0.001
	[-0.004 ; +0.004]	[-0.001 ; +0.000]	[-0.003 ; -0.002]	[+0.001 ; +0.002]
Poverty rate	+0.002	-0.000	-0.003	+0.004
	[-0.001 ; +0.006]	[-0.002 ; +0.001]	[-0.005 ; -0.002]	[+0.002 ; +0.007]

Index	Sum	Factual change
Mean	+1741.358	+1919.746
	[+1322.354 ; +2162.391]	[+1477.581 ; +2344.251]
Median	+1695.39	+1921.334
	[+1244.221 ; +2154.239]	[+1539.278 ; +2312.802]
P90/P10	+0.112	+0.121
	[-0.027 ; +0.261]	[-0.011 ; +0.246]
P90/P50	+0.003	-0.014
	[-0.057 ; +0.061]	[-0.063 ; +0.038]
P50/P10	+ 0.059	+0.080
	[-0.001 ; +0.117]	[+0.027 ; +0.136]
Gini	+0.005	+0.003
	[-0.001 ; +0.011]	[-0.006 ; +0.011]
Poverty rate	+0.011	+0.020
	[-0.001 ; +0.022]	[+0.011 ; 0.030]

95% bootstrap confidence intervals in brackets (1000 replications)

TABLE 3
Effects on inequality measures (*Source:* Socio-Economic Panel, own calculations)

How successful are our calculations at putting together Germany's inequality puzzle? Figure 15a shows that the sum of all changes modelled by us reconstructs the observed changes in the distribution strikingly well. This is also the case for the inequality calculations in Table 3, although these are more affected by the unsmooth form of the sum of changes (Figure 15a). Figure 15b showing the sum of all changes *without* the employment boom suggests that the employment boom indeed contributed substantially to distributional change between 2005/06 and 2015/16, but that its impact was masked by a number

of other developments which also undid some of its inequality reducing effects.

V. Conclusion

This paper addressed the question of why income inequality and poverty risk remained persistently high in Germany, despite an unprecedented labour market boom that drastically reduced unemployment and particularly boosted employment in the lower part of the distribution. We reach the following conclusions. First, the boom indeed increased incomes and reduced inequality as lower parts of the distribution benefitted more than the middle or the upper part. Second, the effects of the boom on net incomes were substantially dampened by the social security system and the progressive tax system, which reduce the impact of economic downturns on disposable incomes, but also that of economic upturns. Third, much of the boom took the form of additional female part-time and full-time employment, demonstrating that such employment gains may not only boost incomes but have equalising effects. Fourth, the effects of the boom on the income distribution were masked by a number of other developments such as immigration of individuals with low incomes and changes in the composition of the population (educational upgrading and population aging), making it difficult to determine their exact magnitude. Finally, our results imply that if the COVID-19 shock were to reverse all the employment gains that occurred during the boom, this would only have a moderately disequalising effect on the distribution of net incomes due to the strong role of the German tax and transfer system as a distributional stabiliser.

References

Akyol, M., M. Neugart and S. Pichler (2013), 'Were the Hartz reforms responsible for the improved performance of the German labour market?', *Economic Affairs*, vol. 33, pp. 34–47.

Armour, P., R. Burkhauser and J. Larrimore (2013), 'Deconstructing income and income inequality measures: a crosswalk from market income to comprehensive income', *American Economic Review*, vol. 103, pp. 173–177.

Bartels, C. and K. Jenderny (2015), 'The role of capital icome for top income shares in Germany', WTID Working Paper no. 1-2015.

Baumgarten, D., G. Felbermayr and S. Lehwald (2020), 'Dissecting between-plant and within-plant wage dispersion: evidence from Germany', *Industrial Relations: A Journal of Economy and Society*, vol. 59(1), pp. 85–122.

Bick, A. (2015), 'The quantitative role of child care for female labor force participation and fertility', *Journal of the European Economic Association*, vol. 14, pp. 639–668.

Biewen, M. (2002), 'Bootstrap inference for inequality, mobility and poverty measurement', *Journal of Econometrics*, vol. 108, pp. 317–342.

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

Biewen, M. and M. Seckler (2019), 'Unions, internationalization, tasks, firms, and worker characteristics: a detailed decomposition analysis of rising wage inequality in Germany', *Journal of Economic Inequality*, vol. 17, pp. 461–498.

Biewen, M., M. Ungerer and M. Löffler (2019), 'Why did income inequality in Germany not increase further after 2005?', *German Economic Review*, vol. 20, pp. 471–504.

Blundell, R., A. Gosling, H. Ichimura and C. Meghir (2007), 'Changes in the distribution of male and female wages accounting for the employment composition using bounds', *Econometrica*, vol. 75, pp. 323–363.

Blundell, R., R. Joyce, A. N. Keiller and J. P. Ziliak (2018), 'Income inequality and the labour market in Britain and the US', *Journal of Public Economics*, vol. 162, pp. 48–62.

Bonin, H., A. Krause-Pilatus and U. Rinne (2020), 'Selbständige Erwerbstätigkeit in Deutschland (Aktualisierung 2020)', Bundesministerium für Arbeit und Soziales, Forschungsbericht 545, Berlin, Germany.

Bradley, J. and A. Kügler (2019), 'Labor market reforms: an evaluation of the Hartz policies in Germany', *European Economic Review*, vol. 113, pp. 108–135.

Bundesamt für Migration und Flüchtlinge (2017), 'Migrationsbericht der Bundesregierung 2016/17'.

Burda, M. (2016), 'The German labor market miracle, 2003 -2015: an assessment', SFB 649 Discussion Papers no. 2006-005.

Burda, M. and S. Seele (2020), 'Reevaluating the German labor market miracle', *German Economic Review*, vol. 21, pp. 139–179.

Carrillo-Tudela, C., A. Launov and J.-M. Robin (2021), 'The fall in German unemployment: a flow analysis', *European Economic Review*, vol. 132, p. 103658.

Daly, M. C. and R. G. Valletta (2006), 'Inequality and poverty in United States: the effects of rising dispersion of men's earnings and changing family behaviour', *Economica*, vol. 73, pp. 75–98.

Dauth, W., S. Findeisen and J. Suedekum (2017), 'Trade and manufacturing jobs in Germany', *American Economic Review*, vol. 107, pp. 337–342.

Dauth, W., S. Findeisen and J. Suedekum (2021), 'Adjusting to globalization in Germany', *Journal of Labor Economics*, vol. 39, pp. 1–30.

DiNardo, J., N. Fortin and T. Lemieux (1996), 'Labor market institutions and the distribution of wages, 1973-1992: a semiparametric approach', *Econometrica*, vol. 64, pp. 1011–1044.

Drechsel-Grau, M., A. Peichl and K. Schmid (2015), 'Einkommensverteilung und gesamtwirtschaftliche Entwicklung in Deutschland', *Wirtschaftsdienst*, vol. 95, pp. 684–688.

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*, vol. 28(1), pp. 167–88.

Dustmann, C., B. Fitzenberger and M. Zimmermann (2018), 'Housing expenditures and income inequality', IZA Discussion Paper no. 11953.

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

Ehrich, M., A. Musasib and D. Roy (2018), 'The Hartz reforms and the German labor force', *European Journal of Political Economy*, vol. 55, pp. 284–300.

Fitzenberger, B. and A. Seidlitz (2020), 'The 2011 break in the part-time indicator and the evolution of wage inequality in Germany', *Journal for Labour Market Research*, vol. 54, pp. 1–14.

Fortin, N., T. Lemieux and S. Firpo (2011), 'Decomposition Methods in Economics', in: *Handbook of Labor Economics*, ed. by O. Ashenfelter and D. Card, 1st ed., vol. 4A, Elsevier, chap. 1, pp. 1–102.

Geyer, J., P. Haan and K. Wrohlich (2015), 'The effects of family policy on maternal labor supply: combining evidence from a structural model and a quasi-experimental approach', *Labour Economics*, vol. 36, pp. 84–98.

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*, vol. 239(2), pp. 345–360.

Grabka, M. (2017), 'SOEP 2016 - Codebook for the PEQUIV file 1984-2016: CNEF variables with extended income information for the SOEP', SOEP Survey Papers, Series D - Variable Descriptions and Coding.

Hartung, B., P. Jung and M. Kuhn (2018), 'What hides behind the German labor market miracle? Unemployment insurance reforms and labor market dynamics', CEPR Discussion Paper no. 133280.

Hochmuth, B., B. Kohlbrecher, C. Merkl and H. Gartner (2021), 'Hartz IV and the decline of German unemployment: a macroeconomic evaluation', *Journal of Economic Dynamics and Control*, vol. 127, p. 104114.

Hutter, C., S. Klinger, E. Weber and C. Trenkler (2019), 'Which factors are behind Germany's labour market upswing?', IAB Discussion Paper no. 20/2019.

Hyslop, D. R. and D. C. Maré (2005), 'Understanding New Zealand's changing income distribution, 1983–1998: a semi-parametric analysis', *Economica*, vol. 72, pp. 469–495.

Jessen, R. (2019), 'Why has income inequality in Germany increased from 2002 to 2011? A behavioral microsimulation decomposition', *Review of Income and Wealth*, vol. 65, pp. 540–560.

Kügler, A., U. Schönberg and R. Schreiner (2018), 'Productivity growth, wage growth and unions', in: *ECB Conference Proceedings: Price and wage-setting in advanced economies*, ed. by European Central Bank, pp. 215–247.

Launov, A. and K. Wälde (2013), 'Estimating incentive and welfare effects of nonstationary unemployment benefits', *International Economic Review*, vol. 54(4), pp. 1159–1198.

Launov, A. and K. Wälde (2016), 'The employment effect of reforming a public employment agency', *European Economic Review*, vol. 84, pp. 140–164.

Peichl, A., P. Hufe and M. Stöckli (2018), 'Ökonomische Ungleichheit in Deutschland – ein Überblick', *Perspektiven der Wirtschaftspolitik*, vol. 19, pp. 185–199.

Riphahn, R. and R. Schrader (2020), 'Institutional reforms of 2006 and the dramatic rise in old-age employment in Germany', *Industrial Labor Relations Review*, vol. 20, pp. 1185–1225.

Rothe, T. and K. Wälde (2017), 'Where did all the unemployed go? Non-standard work in Germany after the Hartz reforms', IAB Discussion Paper no. 18/2017.

Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2019), 'Aufstiegschancen sichern, Arbeitsanreize stärken, Jahresgutachten 2019/20', pp. 316–374.

Sologon, D., V. Almeida and P. Van Kerm (2019), 'Accounting for the distributional effects of the 2007-2008 crisis and the economic adjustment program in Portugal', Luxembourg Institute of Socio-Economic Research Discussion Paper no. 2019-05.

Appendix

A.I. Transition rates between employment states

In the following tables, the main yearly labour market state is defined as the one with the majority of months. Ties were resolved according the following ordering: full-time, part-time, marginal part-time, unemployment, non-participation.

		Men						Women				
		FT	PT	MPT	UNEM	NP		FT	PT	MPT	UNEM	NP
Single	FT	0.920	0.019	0.005	0.038	0.015	FT	0.876	0.039	0.011	0.029	0.043
	PT	0.231	0.620	0.043	0.046	0.060	PT	0.145	0.672	0.064	0.048	0.065
	MPT	0.188	0.104	0.404	0.134	0.162	MPT	0.069	0.125	0.570	0.062	0.155
	UNEM	0.142	0.033	0.046	0.650	0.128	UNEM	0.109	0.069	0.073	0.617	0.131
	NP	0.083	0.016	0.068	0.074	0.662	NP	0.058	0.039	0.044	0.060	0.701
		FT	PT	MPT	UNEM	NP		FT	PT	MPT	UNEM	NP
Non-single	FT	0.926	0.012	0.008	0.027	0.023	FT	0.830	0.069	0.018	0.030	0.053
	PT	0.248	0.403	0.133	0.059	0.151	PT	0.100	0.741	0.078	0.024	0.055
	MPT	0.152	0.080	0.448	0.080	0.220	MPT	0.051	0.149	0.619	0.027	0.151
	UNEM	0.199	0.018	0.048	0.579	0.154	UNEM	0.112	0.065	0.063	0.562	0.198
	NP	0.118	0.031	0.077	0.038	0.654	NP	0.047	0.059	0.066	0.024	0.783

TABLE A1
Average yearly transition rates between employment states (origin = rows, destination = columns) based on main employment state in given year (majority of months), 2000-2004, individuals aged 18–64 years, not in education (*Source:* Socio-Economic Panel, own calculations)

		Men						Women				
		FT	PT	MPT	UNEM	NP		FT	PT	MPT	UNEM	NP
Single	FT	0.936	0.014	0.010	0.021	0.013	FT	0.900	0.040	0.014	0.014	0.026
	PT	0.234	0.571	0.043	0.079	0.068	PT	0.149	0.717	0.043	0.033	0.044
	MPT	0.120	0.096	0.570	0.128	0.080	MPT	0.098	0.127	0.549	0.100	0.106
	UNEM	0.127	0.029	0.066	0.693	0.074	UNEM	0.077	0.068	0.100	0.659	0.087
	NP	0.078	0.020	0.084	0.060	0.681	NP	0.066	0.053	0.081	0.061	0.658
		FT	PT	MPT	UNEM	NP		FT	PT	MPT	UNEM	NP
Non-single	FT	0.938	0.014	0.008	0.015	0.018	FT	0.849	0.071	0.015	0.011	0.053
	PT	0.302	0.502	0.077	0.029	0.082	PT	0.095	0.806	0.038	0.016	0.043
	MPT	0.151	0.067	0.488	0.077	0.198	MPT	0.053	0.109	0.671	0.025	0.139
	UNEM	0.199	0.037	0.081	0.561	0.116	UNEM	0.090	0.073	0.097	0.571	0.167
	NP	0.137	0.034	0.111	0.031	0.628	NP	0.062	0.072	0.102	0.026	0.721

TABLE A2
Average yearly transition rates between employment states (origin = rows, destination = columns) based on main employment state in given year (majority of months), 2005-2016, individuals aged 18–64 years, not in education (*Source:* Socio-Economic Panel, own calculations)

A.II. Employment information in the SOEP

As described in the main text, we use information on the annual number of months worked in different employment categories along with their associated earnings in order to carry out counterfactual analyses. The information we use comes from two parts of the survey: (i) summary information on annual number of months spent in full-time, part-time and marginal part-time work (employment calendar), (ii) summary information about the earnings from different sources: self-employment, main job and side job, along

with the annual number of months worked for these categories (income calendar). The information in both calendars is in most cases consistent, but in a number of cases we observe employment spells or earnings that appear in one calendar but not in the other. In order to derive variables for the number of months worked in full-time, part-time and marginal part-time that consistently add up with the reported earnings to the total annual labour income of the individual (resulting from the income calendar), we make certain adjustments for these cases. For example, if we observe information in the income calendar but no associated spells in the employment calendar, we impute these spells into the other calendar using information on the level of pay along with other information and vice versa (codes are available on request).

Despite limitations with regard to comparability, the employment numbers in the SOEP generally correspond quite well to those from official sources, see Table A3. A notable exception are the numbers for dependent full-time employment for which our SOEP data generally implies both higher employment rates and for men also smaller increases due to the boom. One likely explanation for these differences is the fact that the employment numbers provided by the Federal Employment Agency only represent officially reported employment subject to social security contributions. Thus, they exclude substantial parts of overall employment such as civil servants (not subject to social security contributions), cross-border employment and other forms of potentially unreported employment such as work in family businesses or in the shadow economy. As to the latter, it is likely that a number of jobs that went unreported before the boom were transformed into officially reported jobs subject to social security contributions during the more stable boom conditions. Another potential difference is the sometimes unclear distinction between self-employment and dependent employment. The fact that SOEP numbers for dependent employment are generally higher but those for self-employment lower compared to the other sources suggests that SOEP participants may report jobs as dependent full-time employment although they could be defined as self-employment.

	Men			
	SOEP		Official sources	
Employment rate	2005/06	2015/16	2005/06	2015/16
Self-employed	0.091	0.084	0.104	0.102
Dependent full-time work	0.615	0.626	0.519	0.575
Part-time	0.031	0.054	0.028	0.065
Marginal part-time (main job)	0.098	0.106	0.094	0.117
Marginal part-time (side job)	0.028	0.048	0.031	0.050
	Women			
	SOEP		Official sources	
	2005/06	2015/16	2005/06	2015/16
Self-employed	0.029	0.037	0.055	0.058
Dependent full-time work	0.302	0.342	0.283	0.306
Part-time	0.194	0.267	0.181	0.264
Marginal part-time (main job)	0.179	0.178	0.169	0.184
Marginal part-time (side job)	0.028	0.048	0.031	0.050

TABLE A3
Employment rates in population aged 18-64 according to SOEP and official sources (Federal Statistical Office, Federal Employment Agency, Eurostat)

SOEP: An individual was classified as self-employed, full-time employed, part-time employed if this activity represented the majority of months in the employment calendar. An individual was classified having marginal employment if she reported a positive number of months employed in this category. An individual was classified as having marginal employment as a side job if she reported a positive number of months employed in marginal employment but was mainly classified as self-employed, full-time or part-time employed.

Official sources: All employment rates were calculated from absolute numbers which were divided by the size of the population aged 18-64 years (*Source:* Federal Statistical Office). The information on full-time and part-time employment stems from the Federal Employment Agency (administrative social security data) and refers to the number of jobs subject to social security contributions at the 30 June of each year. We corrected the structural break in reporting full-time vs. part-time employment from 2010 to 2011 (Fitzenberger and Seidlitz, 2020) by adding the jump in part-time employment between 2010 and 2011 to the numbers for part-time employment before 2011 and by subtracting it from the numbers of full-time employment before 2011. The numbers on marginal part-time jobs are also due to the Federal Employment Agency. For marginal part-time jobs in addition to other employment, no separate numbers are available for men and women (we divided these numbers proportionally among men and women). The numbers on self-employment (not included in the data of the Federal Employment Agency) are from the the Labor Force Survey/Eurostat as reported in Bonin, Krause-Pilatus and Rinne (2020).

A.III. Counterfactual analysis

This section documents more details of our counterfactual analyses.

A.III.1. Employment boom

The distribution of months worked per year in the different employment categories turns out to be very bipolar with little mass on the intermediate outcomes one to 11 months. Preliminary experiments with different ordinal models suggested that it is practically impossible to predict the exact number of months outside zero or 12 months, or even whether this number lies between zero and 12. Therefore, and in order to preserve the clear distinction between participation and non-participation, we defined in our logit models for each employment category an outcome zero (zero months worked per year in the respective employment category) and an outcome one (one to 12 months worked per year). In order to eventually also obtain predicted values one to 11 for months worked per year as observed in the data, we calculated for each observation a 'rounding correction' which is equal to the observed value minus the 'rounded value' (the rounded value is zero months for actual zero months, and 12 months for actual one to 12 months). The implied rounding correction is zero for observed months zero, and equal to the observed value minus 12 for all other observations. We then predict with our logit model zeros and ones in the usual way using a probability cutoff and assign to logit predictions zero the value zero months and to logit predictions one initially the value 12 months. We then add back the 'rounding correction', capping all resulting values at zero months (if negative) or 12 months (if larger than 12). In this way, we obtain a distribution of predicted months that very closely resembles the distribution of observed months and that at the same time preserves for a large number of observations the fact that the corresponding individual had an intermediate value of months worked per year.

In a robustness analysis reported in the Online Appendix, we vary the definition of outcomes in our logit models as follows: (i) Categorisation of zero to five months into zero and of six to 12 months into one, applying an analogous rounding correction to predicted values zero and 12 months (i.e. adding back the difference between the observed values and 'rounded values' zero and 12, always capping predictions at zero if negative and at 12 if larger than 12). (ii) Categorisation of zero months into zero and of one to 12 months into one, but no rounding correction (i.e. predictions are always either zero or 12 months). For robustness analysis (i), we obtain slightly larger income gains in the lower part of the distribution, while robustness analysis (ii) yields almost identical results to our main analysis, see Online Appendix.

In order to compute our counterfactual predictions, we estimate logit models[18] for the

[18]Full estimation results are available in the Online Appendix.

months worked (separately for full-time, part-time, marginal part-time) in the two labour market situations 2005/06 (period 0) and 2015/16 (period 1), conditional on the following individual characteristics: nationality, East German residence, disability status, age, age squared, three education categories, work experience, work experience squared, the number of children in different age categories as well as the number of months unemployed and employed in the last three years in the three employment categories. We estimate these models separately by gender and employment category. From each logit model we calculate the number of predicted months in each employment category as described in the first paragraph of this section. We use the difference in predicted number of months employed in each category for 2005/06 vs. 2015/16 per individual to correct the actual number of months worked by individuals observed in 2015/16 into the direction of the labour market situation of 2005/06 (i.e. before the boom):[19]

$$MonthsFT_i^{1,cf} = MonthsFT_i^1 + (\widehat{MonthsFT}_i^0 - \widehat{MonthsFT}_i^1) \tag{A1}$$

$$MonthsPT_i^{1,cf} = MonthsPT_i^1 + (\widehat{MonthsPT}_i^0 - \widehat{MonthsPT}_i^1) \tag{A2}$$

$$MonthsMarg_i^{1,cf} = MonthsMarg_i^1 + (\widehat{MonthsMarg}_i^0 - \widehat{MonthsMarg}_i^1). \tag{A3}$$

The correction terms reflect how much lower/higher the number of months worked by the individual would have been if the labour market situation in 2015/16 had still been as in 2005/06, given her observed characteristics. We cap the counterfactually predicted number of months worked $MonthsFT_i^{1,cf}, MonthsPT_i^{1,cf}, MonthsMarg_i^{1,cf}$ at 0 or 12 in case they lie outside the interval 0 to 12. To account for the connectedness of decisions in the three employment categories, we include the number of full-time months as a regressor in the models for part-time months and the number of full-time/part-time months in the models for marginal part-time. We also cap the counterfactual number of part-time months $MonthsPT_i^{1,cf}$ at 12 minus the counterfactual number of full-time months in order to rule out that the combined counterfactual number of full-time and part-time months exceeds 12. We do not cap the counterfactual number of marginal part-time months $MonthsMarg_i^{1,cf}$ (other than constraining it to lie in the interval 0 to 12) in order to allow for the possibility of fully parallel spells of marginal part-time along full- or part-time employment (such cases exist in our analysis as well as in the real world).

For our employment models, we only consider individuals aged between 18 and 64 years who are not in education. Our logit predictions are specified such that the counterfactual distribution of months worked in the different categories resembles the factual distribu-

[19] For the terms in brackets, note that the 'rounding correction' applied to compute the predictions is the same for 2005/06 and 2015/16, i.e. it does not include changes in the prevalence of intermediate values 1-11 months worked. However, the proportion of such intermediate values is small (lower than 10 percent or lower than 5 percent depending on the employment category) and it does not change much over time. As a consequence, results are not much influenced by this aspect.

tion of 2005/06. In order to take account of the fact that labour market histories in the situation of 2005/06 would generally have been much less favourable than in the situation of 2015/16, we also correct the observed number of months unemployed/worked in the past three years (separately by full-time, part-time, marginal part-time status) for each individual before we compute counterfactual predictions using a similar procedure as for the number of months worked (i.e. we estimate regressions for these quantities both for 2005/06 and 2015/16 and use the difference in predictions to correct the values observed for 2015/16 into the direction of 2005/06).

The counterfactual annual labour income of individuals observed in 2015/16 reflecting the labour market situation of 2005/06 is then computed as

$$MonthsFT_i^{1,cf} \cdot \overline{WageFT}_i^1 + MonthsPT_i^{1,cf} \cdot \overline{WagePT}_i^1 + MonthsMarg_i^{1,cf} \cdot \overline{WageMarg}_i^1 \tag{A4}$$

where $\overline{WageFT}_i^1$, $\overline{WagePT}_i^1$ and $\overline{WageMarg}_i^1$ denote the monthly wages of the individual in the respective employment category. If the monthly wage of the individual in an employment category with non-zero counterfactual months is not observed, we predict it based on wage regressions conditional on the following individual characteristics (separately by gender): nationality, East German residence, disability status, age, age squared, three education categories, experience and experience squared.[20]

If an individual is hit by a counterfactual loss of at least six full-time months (relative to the observed number of months worked in 2015/16), we check whether this individual would be entitled to unemployment benefits I (ALG I). For this, we use the employment history of the individual in the past three years which was corrected earlier for the fact that employment histories in 2005/06 were less favourable than 2015/16 (see above). If the individual is entitled to unemployment benefits I in the counterfactual state, we compute the exact entitlement per individual and month and assign it to the individual for the number of counterfactually lost employment months.

In the next step, we sum up all income sources per household (including the counterfactually changed labour incomes) and recompute taxes and social security contributions. The resulting counterfactual household net income is given by (in simplified notation):

$$\begin{aligned} y_{cf} = {} & y_{Market} + \hat{\Delta} y_{Labour} + y_{Pens} + y_{Trans} + \hat{\Delta} y_{Trans} \\ & - ssc_1(y_{Labour} + \hat{\Delta} y_{Labour}, y_{Pens}) - tax_1(y_{Tax} + \hat{\Delta} y_{Labour}), \end{aligned} \tag{A5}$$

where y_{Market}, y_{Labour}, y_{Pens}, y_{Trans} and y_{Tax} denote household market income, household labour income, household pension income, transfers received by the household and the household's taxable income, respectively. The terms $\hat{\Delta} y_{Labour}$ and $\hat{\Delta} y_{Trans}$ incorporate

[20] These are the same wage regressions as in Section A.III.5 and are reported in the Online Appendix.

the counterfactual changes in household labour incomes and the counterfactual addition/subtraction of ALG I due to losses/gains in employment. The changes in labour incomes further feed into social security contributions and taxes, as reflected by the last two components in equation (A5).

In a last step, we check whether the above net household income falls below the subsistence level of unemployment benefit II (ALG II or *Hartz IV*) plus costs for accommodation and heating. If this is the case, y_{cf} is replaced by the latter.

A.III.2. Immigration

To assess the impact of immigration on the distribution of net incomes between 2005/06 and 2016, we omit for the year 2016 all individuals who immigrated into the country between 2005 and 2016 as well as children below 16 years of age living in their households (see main text for more details). In the SOEP, individuals under 16 years do not complete their own questionnaire but are only described by the household head. Our results do not change in any substantial way if we do not omit children living in the households of recent immigrants.

A.III.3. Changes in household types

To establish a counterfactual income distribution in which everything is as in 2015/16 (period 1) but the distribution of household types is as in 2005/06 (period 0), we replace in the situation of 2015/16 the population shares of the different household types by those of 2005/06. Formally,

$$f_{cf}(y) = \sum_{j=1}^{6} w_{0j} f_{1j}(y), \tag{A6}$$

where w_{0j} denote the population shares of household types $j = 1, \ldots, 6$ in period 0, and f_{1j} the distribution of net equivalent incomes of individuals living in household type $j = 1, \ldots, 6$ in period 1.

A.III.4. Changes in individual and household characteristics

In a similar fashion, we construct an income distribution that would have prevailed in 2015/16 if the joint distribution of individual and household characteristics x had still been as in 2005/06. To this end, we compute, separately by household type j,

$$f_{cf,j}(y) = \int_x f_{1j}(y|x) \left[\frac{dF_{0j}(x)}{dF_{1j}(x)}\right] dF_{1j}(x), \tag{A7}$$

with reweighting factors

$$\frac{dF_{0j}(x)}{dF_{1j}(x)} = \frac{P_j(x|t=0)}{P_j(x|t=1)} = \frac{P_j(t=0|x)}{P_j(t=1|x)} \cdot \frac{P_j(t=1)}{P_j(1=0)} \tag{A8}$$

obtained from predictions based on logit models $P_j(t=1|x)$, $P_j(t=0|x)$. We include into the logit models all the individual and household characteristics listed in Table 2.[21] The reweighting factors are computed by household type and we include for each household type only the characteristics that are present in the respective type (e.g., we do not include information on children in household types without children). The terms $P_j(t=1), P_j(1=0)$ are the weighted sample fractions of period 1 and 0, respectively, in the combined sample of periods 1 and 0. The final counterfactual distribution is obtained by aggregating across all household types,

$$f_{cf}(y) = \sum_{j=1}^{6} w_{1j} f_{cf,j}(y). \tag{A9}$$

A.III.5. Changes in the level and structure of pay

In order to assess the effects of changes in the level and structure of the returns to labour market characteristics, we estimate wage regressions for the labour market situations in 2005/06 (period 0) and 2015/16 (period 1), separately by gender and the three employment categories (full time, part time, marginal part time).[22]

The regressions for monthly wages take the form

$$log(wage) = z\beta + u, \tag{A10}$$

where the vector of individual characteristics z includes nationality, East German residence, disability status, age, age squared, educational qualification in three categories, work experience and work experience squared. We include in our regressions only individuals aged between 18 and 64 years who are not in education. Our counterfactual wage computations capture three aspects: i) general wage gains (reflected in the changing regression intercepts), ii) changes in wage differentials (reflected in the changes of the estimated regression coefficients $\hat{\beta}$), and iii) changes in the dispersion of unobserved (i.e. residual) wage components u.

[21] The estimation results for these logit models are reported in the Online Appendix.
[22] The detailed regression results are available in the Online Appendix.

More concretely, we carry out the following calculations:

$$\widehat{wage}_1(z, rank_1) = exp(z\hat{\beta}_1 + \hat{u}_1(rank_1)) \tag{A11}$$

$$\widehat{wage}_0(z, rank_1) = exp(z\hat{\beta}_0 + \hat{u}_0(rank_1)) \tag{A12}$$

$$wage_1^{cf} = wage_1 + (\widehat{wage}_0(z, rank_1) - \widehat{wage}_1(z, rank_1)). \tag{A13}$$

As evident from the last line, the factual wages in 2015/16 are corrected upwards/downwards by a correction term reflecting how much more/less a person with characteristics z and $rank_1$ in the residual wage distribution of period 1 would have earned in period 1 if the pay structure in period 1 had still been as in period 0. Note that all wage changes are in real terms (all wage information is expressed in prices of 2016, except for tax calculations for which we termporarily convert incomes back to nominal values).

We then multiply the counterfactual wages of each person by the actual number of months worked in the respective employment category to obtain the counterfactual annual labour income under the assumptions that the level and structure of pay in 2015/16 had been as in 2005/06. Summing within households and recomputing taxes and social security contributions yields the counterfactual annual household net income

$$\begin{aligned} y_{cf} &= y_{Market} + \hat{\Delta}y_{Labour} + y_{Pens} + y_{Trans} \\ &\quad - ssc_1(y_{Labour} + \hat{\Delta}y_{Labour}, y_{Pens}) - tax_1(y_{Tax} + \hat{\Delta}y_{Labour}). \end{aligned} \tag{A14}$$

A.III.6. Changes in capital incomes

For the computation of counterfactual capital incomes, we first determine the rank of the household in period 1 (2015/16) in the distribution of rental incomes, $RentRank_1$, and the rank in the distribution of other capital incomes, $CapRank_1$. We then compute the ratio of the percentiles belonging to this rank in the two distributions of period 0 and period 1 to rescale the observed value of rental and other capital incomes of period 1. This leads to the correction terms

$$\hat{\Delta}y_{Rent} = PercRent_0(RentRank_1)\frac{y_{Rent}}{PercRent_1(RentRank_1)} - y_{Rent} \tag{A15}$$

$$\hat{\Delta}y_{Cap} = PercCap_0(CapRank_1)\frac{y_{Cap}}{PercCap_1(CapRank_1)} - y_{Cap}, \tag{A16}$$

which we use to correct household capital incomes in order to arrive at counterfactual household net income reflecting the level and structure of capital incomes of period 0

(2005/06)

$$y_{cf} = y_{Market} + \hat{\Delta}y_{Rent} + \hat{\Delta}y_{Cap} + y_{Pens} + y_{Trans} \\ - ssc_1(y_{Labour}, y_{Pens}) - tax_1(y_{Tax} + \hat{\Delta}y_{Rent} + \hat{\Delta}y_{Cap}). \tag{A17}$$

A.III.7. Changes in the transfer system

For our counterfactual simulations, we reverse the reforms listed in the main text (extension of mothers' pension, the abolition of the temporary supplement to ALG II after receipt of ALG I, the changes in child/student allowances and in unemployment benefits II) by changing the respective income component at the level of the individual in period 1 (2015/16) and by aggregating at the household level. This yields our counterfactual annual household income

$$y_{cf} = y_{Market} + y_{Pens} + \hat{\Delta}y_{Pens} + y_{Trans} + \hat{\Delta}y_{Trans} \\ - ssc_1(y_{Labour}, y_{Pens} + \hat{\Delta}y_{Pens}) - tax_1(y_{Tax} + \hat{\Delta}y_{Pens}). \tag{A18}$$

A.III.8. Changes in taxes and social security contributions

To assess the effects of changes in the tax and social security system, we replace in the calculations for period 1 (2015/16) the tax and social security contributions system with that of period 0 (2005/06):

$$y_{cf} = y_{Market} + y_{Pens} + y_{Trans} - ssc_0(y_{Labour}, y_{Pens}) - tax_0(y_{Tax}) \tag{A19}$$

For more details about our simulation of taxes and social security contributions, see Online Appendix.

A.III.9. Limitations of our methodology

As pointed out in the main text, our counterfactual calculations ignore behavioural reactions and equilibrium effects. Note that such effects have often been found to be small, see Jessen (2019). Modelling such effects would necessarily rely on a large number of potentially controversial and often arbitrary assumptions. This represents a trade-off. Ignoring equilibrium effects certainly also presents a limitation, but the effects calculated by us present transparent counterfactual operations allowing us to assess the quantitative importance of different channels of distributional change irrespective of whether we attach a causal interpretation to them.

On a related note, we point out that the validity of our results is generally *not* affected by the presence of endogenous explanatory variables in our models for employment and wages. The reason is that our task is counterfactual *prediction* rather than causal modelling. The only assumption we have to maintain is that the degree of endogeneity of our

regressors does not change substantially between periods 0 and 1. For example, if the correlation between education and unobservables in 2015/16 is the same as in 2005/06, we can realistically predict the wage of a person with a certain level of education in 2015/16 using the counterfactual wage schedule of 2005/06 because regression coefficients incorporate the effect of correlated unobserved components (such as ability) whose correlation with observables is, by assumption, constant over time. Any unproxied selectivity with respect to unobservables or changes therein certainly remain a limitation of the analysis. Note, however, that correcting for unobserved selectivity generally requires valid instrumental variables which are typically unavailable.

Online Appendix

Why a labour market boom does not necessarily bring down inequality: Putting together Germany's inequality puzzle

Martin Biewen (University of Tübingen, LEAD Tübingen, IZA Bonn)
Miriam Sturm (University of Tübingen)

OA.I. Income tax and social security contributions

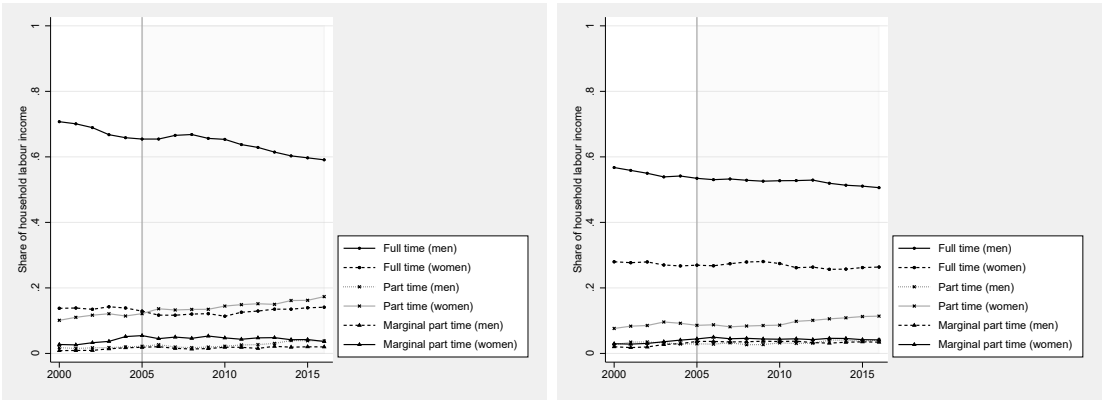
Our income tax calcuations comprise the following elements:

- Joint taxation of married couples living in the same household
- Deduction of various tax allowances (*Sonderausgabenpauschale, Werbungskostenpauschale, Altersentlastungsbetrag*, contributions to pension and social security system, extra allowances for lone parents)
- Exact computation of income tax burden using tax formula of given year
- Taxes on old age pensions incl. allowances (increasing tax rate across years, *Versorgungsfreibetrag, Versorgungshöchstbetrag, Altersentlastungsbetrag*)
- Progression clause for unemployment benefit I and maternity benefits (*Progressionsvorbehalt*, i.e. these income sources are not taxed but they are added when determining the marginal tax rate)
- Child allowance: households either receive the child allowance as a direct payment, or, if more favourable, deduct child allowances from their taxable income in order to reduce their tax burden *(Günstigerprüfung Kindergeld)*
- Withholding tax on income from interest, dividends and similar income sources introduced 1 January 2009 (*Abgeltungssteuer*, flat rate of 25 percent)
- Solidarity surcharge (5.5 percent on income tax burden)

The calculation of contributions to the social security system include the following elements:

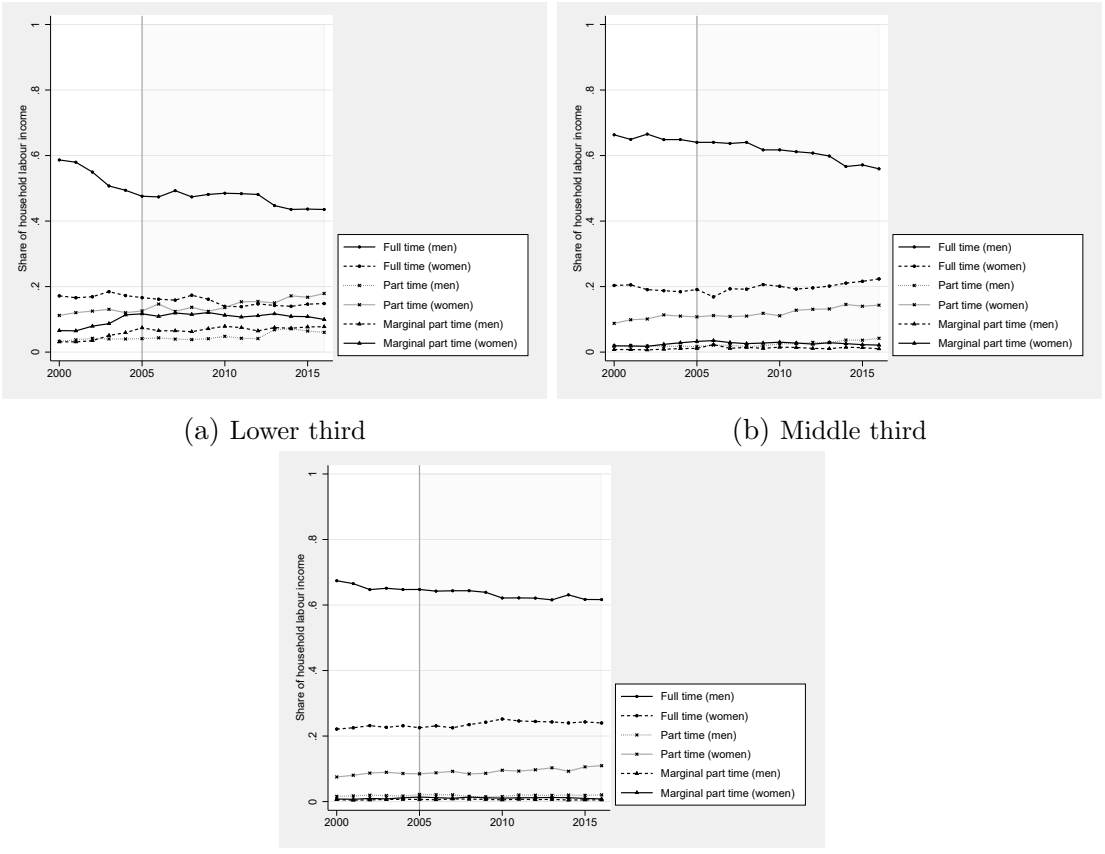
- The exact value of the social security contribution ceiling in the pension, unemployment, health and old age care insurance in each year
- The exact contribution rates in the pension, unemployment, health and old age care insurance in each year (only contributions by employees, not by employers)
- The exact contribution rates in the health and old age care insurance in each year for the income sources of pensioners that are subject to social security contributions

OA.II. Composition of household labour income



(a) With children (b) Without children

FIGURE OA1
Shares of household labour income contributed by men/women from different employment categories in households with and without children (*Source:* Socio-Economic Panel, own calculations)



(a) Lower third (b) Middle third

(c) Upper third

FIGURE OA2
Shares of household labour income contributed by men/women from different employment categories in the lower, middle and upper part of the distribution of net equivalised incomes (*Source:* Socio-Economic Panel, own calculations)

OA.III. Econometric models for employment, reweighting and wages

	Men		Women	
Variable	2005/06	2015/16	2005/06	2015/16
Foreign nationality	-0.613	0.133	-0.242	0.067
	[0.184]	[0.172]	[0.171]	[0.134]
East Germany	-0.338	-0.242	0.390	0.277
	[0.117]	[0.143]	[0.112]	[0.128]
Disability	-1.255	-1.247	-0.719	-0.904
	[0.132]	[0.158]	[0.161]	[0.137]
Age	0.208	0.272	0.061	0.050
	[0.043]	[0.040]	[0.035]	[0.033]
Age^2	-0.004	-0.004	-0.002	-0.001
	[0.000]	[0.000]	[0.000]	[0.000]
University degree	1.570	0.657	0.812	0.450
	[0.201]	[0.191]	[0.158]	[0.148]
Abitur and/or voc. train.	0.797	0.393	0.161	-0.012
	[0.153]	[0.153]	[0.135]	[0.132]
Years of work experience	0.150	0.067	0.107	0.045
	[0.048]	[0.037]	[0.025]	[0.027]
Years of work $experience^2$	-0.001	0.000	-0.003	-0.001
	[0.002]	[0.001]	[0.001]	[0.001]
FT months in past 3 years	0.094	0.122	0.111	0.138
	[0.003]	[0.005]	[0.004]	[0.004]
PT months in past 3 years	-0.081	-0.045	-0.034	-0.017
	[0.010]	[0.008]	[0.005]	[0.005]
MPT months in past 3 years	-0.043	-0.031	-0.037	-0.017
	[0.008]	[0.008]	[0.006]	[0.005]
UNEM months in past 3 years	-0.066	-0.045	-0.035	-0.026
	[0.006]	[0.008]	[0.009]	[0.006]
Fraction of HH age < 3	-0.178	-0.294	-2.799	-2.326
	[0.165]	[0.234]	[0.227]	[0.265]
Fraction of HH $3 <$ age ≤ 6	0.078	-0.103	-0.729	-0.597
	[0.173]	[0.176]	[0.196]	[0.127]
Fraction of HH $6 <$ age ≤ 17	-0.146	-0.182	-0.509	-0.427
	[0.082]	[0.066]	[0.069]	[0.061]
Constant	-2.834	-4.754	-1.571	-1.370
	[0.733]	[0.706]	[0.688]	[0.617]
N	12,751	15,267	13,936	18,117
No. cluster	6,876	8,811	7,636	10,179

Standard errors in parenthesis (clustered at the household level)

TABLE OA1

Logit models for full-time employment, 0=zero months per year, 1=one to 12 months per year (*Source:* Socio-Economic Panel, own calculations)

	Men		Women	
Variable	2005/06	2015/16	2005/06	2015/16
Foreign nationality	-0.267	0.444	-0.331	-0.032
	[0.344]	[0.234]	[0.192]	[0.169]
East Germany	-0.319	-0.008	0.013	0.099
	[0.192]	[0.209]	[0.146]	[0.128]
Disability	-0.725	-1.159	-1.216	-1.283
	[0.283]	[0.307]	[0.222]	[0.223]
Age	0.027	0.096	0.135	0.198
	[0.060]	[0.060]	[0.044]	[0.039]
Age^2	-0.002	-0.002	-0.003	-0.003
	[0.001]	[0.001]	[0.000]	[0.000]
University degree	1.519	0.988	0.871	0.951
	[0.322]	[0.284]	[0.192]	[0.179]
Abitur and/or voc. train.	0.463	0.211	0.512	0.336
	[0.264]	[0.230]	[0.144]	[0.158]
Years of work experience	0.130	-0.035	0.181	0.066
	[0.065]	[0.050]	[0.025]	[0.025]
Years of work $experience^2$	-0.001	0.002	-0.003	-0.001
	[0.002]	[0.002]	[0.001]	[0.001]
FT months in past 3 years	0.035	0.086	0.068	0.063
	[0.009]	[0.009]	[0.005]	[0.006]
PT months in past 3 years	0.126	0.175	0.116	0.152
	[0.011]	[0.011]	[0.005]	[0.006]
MPT months in past 3 years	0.008	0.044	-0.037	0.002
	[0.012]	[0.012]	[0.007]	[0.006]
UNEM months in past 3 years	-0.039	-0.008	-0.038	-0.006
	[0.011]	[0.010]	[0.008]	[0.006]
Fraction of HH age < 3	0.389	0.022	-0.851	-0.780
	[0.243]	[0.200]	[0.145]	[0.154]
Fraction of HH $3 <$ age ≤ 6	0.085	0.001	0.365	0.163
	[0.248]	[0.205]	[0.128]	[0.108]
Fraction of HH $6 <$ age ≤ 17	-0.013	0.128	0.054	-0.215
	[0.114]	[0.091]	[0.075]	[0.068]
Months in FT	-0.422	-0.447	-0.620	-0.602
	[0.024]	[0.026]	[0.030]	[0.029]
Constant	-1.663	-4.190	-4.233	-4.891
	[1.074]	[1.041]	[0.875]	[0.777]
N	12,751	15,267	13,936	18,117
No. cluster	6,876	8,811	7,636	10,179

Standard errors in parenthesis (clustered at the household level)

TABLE OA2

Logit models for part-time employment, 0=zero months per year, 1=one to 12 months per year (*Source:* Socio-Economic Panel, own calculations)

	Men		Women	
Variable	2005/06	2015/16	2005/06	2015/16
Foreign nationality	-0.507	-0.127	-0.100	0.131
	[0.282]	[0.205]	[0.183]	[0.146]
East Germany	-0.524	-0.230	-0.150	-0.299
	[0.145]	[0.148]	[0.129]	[0.135]
Disability	-0.539	-0.233	-0.701	-0.747
	[0.227]	[0.204]	[0.202]	[0.169]
Age	-0.004	0.010	-0.008	0.000
	[0.063]	[0.056]	[0.039]	[0.034]
Age^2	-0.001	-0.000	-0.001	-0.000
	[0.001]	[0.001]	[0.000]	[0.000]
University degree	0.577	-0.066	0.242	0.089
	[0.234]	[0.210]	[0.186]	[0.162]
Abitur and/or voc. train.	0.141	-0.372	0.182	0.391
	[0.189]	[0.175]	[0.143]	[0.127]
Years of work experience	0.155	0.056	0.101	0.055
	[0.065]	[0.055]	[0.028]	[0.023]
Years of work $experience^2$	-0.002	-0.002	-0.002	-0.001
	[0.002]	[0.002]	[0.001]	[0.001]
FT months in past 3 years	0.011	0.046	0.021	0.039
	[0.007]	[0.008]	[0.006]	[0.006]
PT months in past 3 years	0.060	0.060	0.045	0.058
	[0.012]	[0.012]	[0.006]	[0.006]
MPT months in past 3 years	0.140	0.145	0.134	0.133
	[0.008]	[0.007]	[0.006]	[0.005]
UNEM months in past 3 years	0.000	-0.002	-0.006	0.003
	[0.007]	[0.008]	[0.006]	[0.005]
Fraction of HH age < 3	0.035	0.335	-0.824	-0.071
	[0.193]	[0.178]	[0.150]	[0.147]
Fraction of HH $3 <$ age ≤ 6	0.135	-0.107	0.354	0.104
	[0.236]	[0.182]	[0.139]	[0.122]
Fraction of HH $6 <$ age ≤ 17	-0.023	0.130	-0.096	-0.045
	[0.093]	[0.066]	[0.073]	[0.063]
Months in FT	-0.230	-0.265	-0.271	-0.290
	[0.019]	[0.019]	[0.018]	[0.016]
Months in PT	-0.291	-0.324	-0.310	-0.285
	[0.038]	[0.039]	[0.020]	[0.015]
Constant	-1.288	-2.209	-0.688	-1.488
	[1.080]	[0.984]	[0.734]	[0.648]
N	12,751	15,267	13,936	18,117
No. cluster	6,876	8,811	7,636	10,179

Standard errors in parenthesis (clustered at the household level)

TABLE OA3

Logit models for marginal part-time employment, 0=zero months per year, 1=one to 12 months per year (*Source:* Socio-Economic Panel, own calculations)

HH-type	1	2	3
Female head of HH	-0.101		
	[0.100]		
Foreign nationality head of HH	1.008		0.852
	[0.331]		[0.153]
University degree head of HH	0.994	0.599	
	[0.145]	[0.145]	
Abitur and/or voc. training head of HH	0.570	0.174	
	[0.101]	[0.130]	
Years of work experience head of HH	0.043	0.025	0.019
	[0.006]	[0.008]	[0.005]
Age head of HH	-0.057	0.053	
	[0.011]	[0.008]	
Age head of HH^2	0.001		
	[0.000]		
East Germany head of HH		-0.396	
		[0.104]	
Spouse/2nd person female		-0.908	
		[0.119]	
Spouse/2nd person foreign		0.752	
		[0.246]	
Spouse/2nd person Abitur and/or voc. training		0.072	
		[0.089]	
Spouse/2nd person years of work experience		0.018	
		[0.004]	
Constant	-0.019	-4.024	-0.150
	[0.276]	[0.645]	[0.068]
N	4,964	13,637	8,092
No. cluster	2,430	3,370	4,582

Standard errors in parenthesis (clustered at the household level)

TABLE OA4

Logit models for reweighting (0=in 2005/06, 1=in 2015/16), household types: (1) single pensioner households, (2) multiple pensioner households and (3) single adult households without children (*Source:* Socio-Economic Panel, own calculations)

HH-type	4	5	6
Female head of HH	0.240	-0.907	
	[0.116]	[0.280]	
Foreign nationality head of HH	0.446		
	[0.151]		
University degree head of HH	0.446		0.363
	[0.123]		[0.085]
Abitur and/or voc. training head of HH	0.297		
	[0.110]		
Years of work experience head of HH	0.022	-0.079	-0.023
	[0.007]	[0.044]	[0.026]
Years of work experience head of HH^2		0.005	0.002
		[0.002]	[0.001]
Age head of HH	-0.048		
	[0.013]		
Age head of HH^2	0.000		
	[0.000]		
East Germany head of HH	-0.201	0.232	
	[0.076]	[0.182]	
Spouse/2nd person female	-0.210		
	[0.119]		
Spouse/2nd person foreign	-0.533		-0.135
	[0.154]		[0.107]
Spouse/2nd person university degree	0.308		-0.236
	[0.102]		[0.125]
Spouse/2nd person Abitur and/or voc. training			-0.469
			[0.098]
Spouse/2nd person years of work experience	-0.088		-0.058
	[0.012]		[0.021]
Spouse/2nd person years of work experience^2	0.003		0.003
	[0.000]		[0.001]
Spouse/2nd person age	0.034		-0.040
	[0.013]		[0.033]
Spouse/2nd person age^2	-0.000		0.001
	[0.000]		[0.000]
Fraction of HH age < 3			0.295
			[0.080]
Fraction of HH $3 <$ age ≤ 6			0.186
			[0.079]
> 2 adults in HH			-0.231
			[0.100]
Constant		0.799	0.065
		[0.324]	[0.598]
N	27,782	6,508	55,801
No. cluster	6,948	1,598	7,965

Standard errors in parenthesis (clustered at the household level)

TABLE OA5
Logit models for reweighting, household types: (4) multiple adult household without children, (5) single adult household with children and (6) multiple adult household with children (*Source:* Socio-Economic Panel, own calculations)

	Men		Women	
Variable	2005/06	2015/16	2005/06	2015/16
Foreign nationality	-0.044	-0.159	-0.119	-0.148
	[0.034]	[0.026]	[0.048]	[0.037]
East Germany	-0.404	-0.379	-0.360	-0.237
	[0.021]	[0.024]	[0.031]	[0.027]
Disability	-0.077	-0.118	-0.038	-0.063
	[0.034]	[0.035]	[0.058]	[0.042]
Age	0.035	0.065	0.036	0.019
	[0.010]	[0.009]	[0.012]	0.009
Age^2	-0.000	-0.001	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]
University degree	0.619	0.628	0.706	0.669
	[0.036]	[0.033]	[0.053]	[0.044]
Abitur and/or voc. train.	0.165	0.174	0.244	0.286
	[0.029]	[0.028]	[0.050]	[0.039]
Years of work experience	0.038	0.020	0.024	0.022
	[0.010]	[0.008]	[0.010]	[0.008]
Years of work experience^2	-0.001	-0.001	-0.001	-0.001
	[0.000]	[0.000]	[0.000]	[0.000]
Constant	6.876	6.311	6.698	6.932
	[0.181]	[0.184]	[0.223]	[0.174]
N	10,265	11,278	5,047	5,815
No. cluster	5,726	6,336	3,085	3,541

Standard errors in parenthesis (clustered at the household level)

TABLE OA6
Wage regressions: monthly log full-time wages
(*Source:* Socio-Economic Panel, own calculations)

	Men		Women	
Variable	2005/06	2015/16	2005/06	2015/16
Foreign nationality	-0.042	-0.025	-0.130	-0.126
	[0.133]	[0.092]	[0.063]	[0.063]
East Germany	-0.193	-0.042	-0.053	-0.046
	[0.103]	[0.082]	[0.038]	[0.045]
Disability	-0.129	-0.023	0.156	0.052
	[0.123]	[0.099]	[0.094]	[0.059]
Age	0.049	0.003	0.019	0.036
	[0.031]	[0.029]	[0.016]	[0.012]
Age^2	-0.001	-0.000	-0.000	-0.001
	[0.000]	[0.000]	[0.000]	[0.000]
University degree	0.319	0.673	0.672	0.542
	[0.143]	[0.120]	[0.058]	[0.048]
Abitur and/or voc. train.	0.117	0.207	0.166	0.164
	[0.124]	[0.095]	[0.047]	[0.042]
Years of work experience	0.024	0.069	0.040	0.032
	[0.030]	[0.025]	[0.008]	[0.006]
Years of work $experience^2$	0.000	-0.002	-0.001	-0.000
	[0.001]	[0.001]	[0.000]	[0.000]
Constant	5.935	6.789	6.542	6.287
	[0.547]	[0.511]	[0.319]	[0.235]
N	516	887	3,456	5,797
No. cluster	407	667	2,243	3,562

Standard errors in parenthesis (clustered at the household level)

TABLE OA7
Wage regressions: monthly log part-time wages
(*Source:* Socio-Economic Panel, own calculations)

	Men		Women	
Variable	2005/06	2015/16	2005/06	2015/16
Foreign nationality	0.347	0.271	-0.006	0.081
	[0.125]	[0.080]	[0.063]	[0.060]
East Germany	-0.178	-0.152	-0.379	-0.193
	[0.091]	[0.102]	[0.064]	[0.076]
Disability	-0.196	0.234	-0.280	-0.075
	[0.131]	[0.114]	[0.097]	[0.095]
Age	-0.051	-0.040	-0.018	-0.006
	[0.025]	[0.025]	[0.016]	[0.014]
Age^2	0.000	0.000	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]
University degree	-0.038	-0.076	0.083	-0.214
	[0.145]	[0.141]	[0.096]	[0.083]
Abitur and/or voc. train.	-0.013	0.018	0.068	-0.015
	[0.101]	[0.096]	[0.054]	[0.053]
Years of work experience	0.005	0.040	0.020	0.023
	[0.030]	[0.026]	[0.012]	[0.009]
Years of work $experience^2$	0.001	-0.001	-0.000	-0.000
	[0.001]	[0.001]	[0.000]	[0.000]
Constant	6.730	6.141	6.169	5.851
	[0.430]	[0.426]	[0.295]	[0.277]
N	801	1,251	2,149	3,015
No. cluster	630	972	1,472	2,092

Standard errors in parenthesis (clustered at the household level)

TABLE OA8
Wage regressions: monthly log marginal part-time wages (*Source:* Socio-Economic Panel, own calculations)

OA.IV. Robustness analysis for employment effects

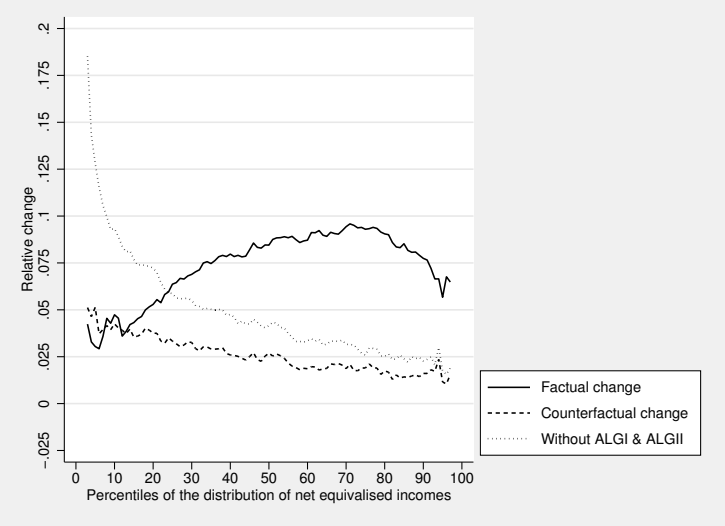


FIGURE OA3
Robustness analysis (i): relative change of percentiles of equivalised net income due to the employment boom, logit specification (zero = 0 to 5 months worked, one = 6 to 12 months worked) and rounding correction to obtain intermediate values 1 to 11 months for predicted months worked, see paper appendix for more details
(*Source:* Socio-Economic Panel, own calculations)

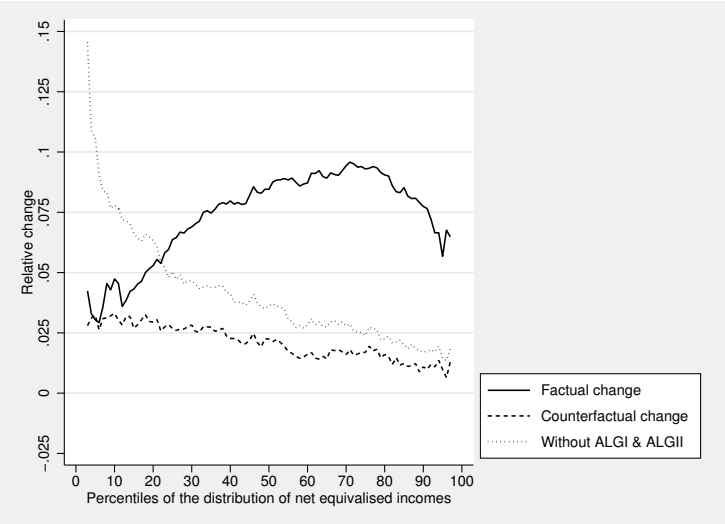


FIGURE OA4
Robustness analysis (ii): relative change of percentiles of equivalised net income due to the employment boom, logit specification as in paper (zero = 0 months worked, one = 1 to 12 months worked) but no rounding correction to obtain intermediate values 1 to 11 months for predicted months worked (i.e. counterfactual predictions are either zero or 12 months) (*Source:* Socio-Economic Panel, own calculations)