Hours Inequality*

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Abstract

The vast literature on earnings inequality has so far largely ignored the role played by hours of work. This paper argues that in order to understand earnings dispersion we need to consider not only the dispersion of hourly wages but also inequality in hours worked as well as the correlation between the two. We use data for the US, the UK, France, and Germany to examine the evolution of hours inequality and of the correlation between individual hours and wages, and assess their contribution to recent trends in earnings inequality. We find that, other than in the US, hours inequality is an important force, which has changed over the period under analysis (1990-2016). The elasticity of hours with respect to wages has also played a key role in the European economies. This elasticity used to be negative, thus tending to reduce inequality as those with lower hourly wages worked longer hours, but has increased over the past decades, becoming nil or positive, and hence eroding an important equalizing force. The paper examines which are the potential causes behind the change in the elasticity, notably the role of trade and labour market institutions

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1 Introduction

Over the past decades, a vast literature has documented changing patterns in the distribution of earnings in high-income countries.[1] The timing and the extent varies across countries, with some experiencing an increase in the 1980s and then stability (e.g. the UK), others witnessing increased inequality only in recent years (e.g. Germany). Changes in the dispersion of hourly wages have been the major explanation for these differences. Earnings are, however, the product of hourly wages and hours of work, yet the behaviour of the latter has received little attention in the literature. This is particularly surprising in the light of the evolution of average hours of work, as a number of papers have shown a divergence in working patterns between the US and Europe since the 1970s and a decline in average hours in many countries.[2] Just as the average of working hours differs across countries and over time, its distribution may also have changed, thus contributing to overall earnings inequality. The aim of this paper is to document the extent of inequality in working hours and its impact on the distribution of earnings.

We use data for the US, the UK, Germany and France since the early 1990s to compute measures of hours inequality. Figure 1 plots the distribution of weekly hours worked by employed individuals in our sample countries.[3] The data cover a 5-year period, 20012-2016, so as to avoid choosing a single, potentially unrepresentative, year. The distribution of hours is fairly concentrated in France and the US, with about a third of individuals working between 36 and 42 hours. France is characterised by a bimodal distribution following the introduction of the 35-hour week. The distributions are much more dispersed in Germany and the UK, both of which present thick tails at both ends of the distribution. These differences raise the question of to what extent hours inequality has contributed to changes in earnings inequality. The role of hours dispersion is not straightforward as it depends on the correlation between hours and hourly wages. If the two are positively correlated, a more unequal distribution of hours will reinforce wage inequality. However, when the correlation is negative, that is, when those with the lowest wages work the most, hours inequality will tend to dampen wage dispersion making the distribution of earning less unequal than that of wages.

Our empirical strategy proceeds in three steps. First, we decompose earnings inequality. Using as our inequality index the mean log deviation (MLD), an inequality index belonging to the general entropy family, we can decompose earnings dispersion into the sum of hourly wage inequality, inequality in hours and a term capturing the covariance between hours and hourly wages, with the latter term being positive or negative depending on whether the two variables are positively or negatively correlated. Our results indicate that in the US and France the

[1] See, for instance, Juhn et al. (1993) and Atkinson (2007).

[2] See, for instance, Prescott (2004), Bell and Freeman (2001), Alesina et al. (2006), and Blundell et al. (2013).

[3] See below for the details, as well as our companion paper Checchi et al. (2016).

overall contribution of hours and the covariance with earnings inequality is moderate, with wages accounting for at least two-thirds of inequality in earnings. In contrast, these two terms play a crucial role in the UK and Germany, being responsible for up to 58 percent of the dispersion in earnings. We find that the dynamics of the hours-wage correlation are an important element. Wages and hours move together in the UK and the US economies, while they are negatively correlated in France and Germany at the start of the sample period, implying that part of the dispersion in wages was offset by low-wage individuals working more. These countries exhibit, however, an increase in the covariance over time and by the end of the period, those with higher wages also work longer hours. In the case of Germany, this change accounts for half of the increase in earnings inequality, in France it is the major culprit. That is, the equalizing force due to those with lower wages working longer hours seems to have been eroded over time.

The second step in our analysis consists in estimating individual hour equations, under the assumption that hours worked depend (in a non-causal way) on the individual's hourly wage as well as on individual characteristics, such as sector, occupation, gender and family characteristics controlling for self-selection into employment. The elasticity of hours with respect to wages proves to be positive and stable in the US, but initially negative in the other countries and increasing over time in all three. The hours equation allows us to perform a number of simulations, keeping wage inequality, the hours-wage elasticity and population shares constant, so as to assess the contribution of the various factors to changes in earnings dispersion. While the hour-wage elasticity played no role in the US, its increase was the major factor behind observed changes in Germany, and France, and an important one in the UK. Changes in population shares were also a driver of inequality, as the increase in the employment share of women, who tend to work fewer hours than men, implied a rise in overall hours dispersion.

We then proceed to account for possible correlates of the wage-hour elasticity, by interacting the wage with labour market institutions, finding that a greater trade share in an industry raises it, in line with the hypothesis that trade increases competition and hence the correlation between hours and wages. Three labour market institutions are included in our regressions, employment protection legislation, union density and weeks of paid maternity leave, all of which are correlated with a lower elasticity. Overall, these results indicate that both openness and weakening labour market institutions can be behind the observed increase in the elasticity and thus in hours and earnings dispersion.

Our paper contributes to several strands of literature. There is a substantial literature on cross-country differences in average working hours, and we add to this a new dimension by focusing on hours inequality. We also contribute to our understanding of what drives earnings dispersion by focusing on the neglected role of hours. Few authors have examined the role of hours. Gottschalk and Danziger (2005) examine the relationship between individual wage rate inequality and household income inequality in the US. They focus on household income inequality and emphasize, amongst other things, the importance of considering the distribution of hours. They find an important role for changes in the hours worked by women, in line with our results. Our paper has a different focus as we provide an international comparison. Bell and Freeman (2001) and Bowles and Park (2005) argue that greater wage inequality is associated with higher average hours of work, implying that the increase in wage inequality that occurred over the last decades is likely to have spurred an increase in hours worked. Our analysis implies that the impact of this mechanism on earnings inequality depends on two channels, how unequal the hours response is and on the correlation of hours worked and hourly wages.

A vast literature has examined the determinants of individual hours of work focusing on the supply side of the labour market in shaping the hour decision (Alesina et al. (2006), Prescott (2004), Blundell et al. (2013)), but recent work has considered how changes in demand affect the distribution of hours across different occupations (Autor and Salomons (2017), Ngai and Petrongolo (2017), Goos et al. (2009)). This latter strand suggests that the trends in demand are the central element behind broad patterns of working hours, and in particular of the observed polarization in employment. These supply and demand forces are important elements when we examine the hour-wage elasticity in various institutional frameworks. However, our end aim differs as we seek to understand to what extent these patterns have affected earnings inequality.

The paper is organized as follows. Section 2 describes our empirical approach, and is followed by section 3 describing the data. Section 4 presents our main results, starting with a decomposition of earnings inequality. We then estimate individual hour regressions which yield an elasticity of hours with respect to wages. The changes in the estimated elasticity are then correlated with changes in the institutional frameworks by interacting hourly wages with demand and supply shocks, related to trade and investment on one side and employment protection and unions on the other. We conclude in section 5.

2 Empirical strategy

2.1 Decomposing earnings inequality

Our empirical strategy consists of two steps. First, we decompose the inequality index in order to assess the contribution of inequality in hours of work to earnings inequality. The second step consists of estimating an individual regression of the determinants of hours worked, and in particular its correlation with wages, in order to try to understand the elements that can explain changes in earnings that do not stem directly from the behaviour of hourly wages.

Defining total earnings of individual i as y_i, we can write them as the product of the hourly wage, w_i, and the number of hours worked, h_i. That is,

$$y_i = w_i h_i. \tag{1}$$

Our two terms of interest appear multiplicatively and, as a result, there are few inequality indices that can be satisfactorily decomposed. As we argue in Checchi et al. (2016), a suitable index is the mean log deviation (MLD), an index belonging to the general entropy (GE) family. The MLD, also called Theil's L index, is the general entropy index for α =0, and shares a number of desirable properties of this class of indices. [4] The parameter α in the GE class of indices captures the weight given to income differences at various parts of the income distribution. For lower values of α, such as $\alpha = 0$, GE is particularly sensitive to changes in the lower tail of the distribution.

The MLD is defined as the standard deviation of the logarithm of the variable of interest, that is

$$I_y = \frac{1}{N}\sum_{i=1}^{N} \ln \frac{\bar{y}}{y_i}, \tag{2}$$

where N is the number of observations and $\bar{y}$ is average earnings.[5] Inequality in earnings can be expressed as the sum of three components: inequality in hourly wages, inequality in hours worked, and a component capturing the correlation between hours worked and hourly wages. Denote by I_w and I_h the MLD of hourly wages and hours worked, namely,

$$I_w = \frac{1}{N}\sum_{i=1}^{N} \ln \frac{\bar{w}}{w_i}, \tag{3}$$

$$I_h = \frac{1}{N}\sum_{i=1}^{N} \ln \frac{\bar{h}}{h_i}, \tag{4}$$

where $\bar{w}$ and $\bar{h}$ are the average levels of the two variables. Define $cov(w, h)$ as the covariance between hourly wages and hours worked, and note that $cov(w, h) = \overline{y} - \overline{w}\overline{h}$. Then, equation (2) can be expressed as the sum of (3) and (4) plus a third term capturing the covariance between hours worked and hourly wages. That is,

$$I_y = I_w + I_h + \underbrace{\ln\left(1 + \frac{cov(w,h)}{\bar{w}\bar{h}}\right)}_{\rho} \tag{5}$$

These three terms represent the absolute contributions to inequality of the various elements. The first two terms are simply inequality in hourly wages and hours worked, and both are

[4]See Atkinson (1983).

[5]This index was first shown to be decomposable by Duro and Esteban (1998).

positive. The third term, denoted ρ, captures the covariance between hours and wages. If the covariance is negative, this term will be negative, reducing earnings dispersion. The contribution of hours to overall inequality hence crucially depends on the covariance. Whenever the correlation between hours and wages is negative, a greater dispersion of hours tends to reduce overall inequality. If, instead, the correlation is positive, hours inequality magnifies the impact of wage inequality on earnings dispersion.

2.2 The determinants of hours worked

2.2.1 A simple model

The second step in our analysis consists in understanding what are the factors determining both the dispersion of hours and the way they covariate with wages. The term ρ is determined by the covariance between hours and wages, with $cov(w, h)$ being a purely statistical concept that makes no assumptions about causality. A correlation between the two variables can hence be the result of supply-side factor or of the fact that, on the demand side, certain jobs imply certain hour-wage combinations. We consider both in turns.

Labour supply Hours may vary across individuals because they choose to supply more or less labour. To examine some possible determinants, suppose that the individual's utility function takes the form $U = (c - \bar{c})^a / a - bh$, where c is consumption, $\bar{c}$ a minimum consumption requirement, h are hours worked and a and b are positive parameters. She maximizes utility subject to the budget constraint $c = wh + x$, where x is non-labour income. The source of this income can vary, and the term captures both capital income stemming from accumulated wealth or an income transfer from a spouse.

The resulting optimal hours chosen by the individual are then given by

$$h = \frac{1}{w}\left(\bar{c} - x + \left(\frac{w}{b}\right)^{\frac{1}{1-a}}\right).$$

This expression implies that there are both income and substitution effects, as a higher wage may increase or decrease the hours worked. Note also that the higher the consumption requirement relative to wages, the more the individual works, while the higher her non-labour income is, the less she works. This second effect implies that both women with spousal income and those with capital income will work fewer hours. Women will also work less than men if they have a higher disutility of hours worked (higher b).

The elasticity of hours worked with respect to wages is given by

$$\varepsilon = \frac{dh}{dw}\frac{w}{h} = \frac{1}{1-a}\frac{(w/b)^{\frac{1}{1-a}}}{(w/b)^{\frac{1}{1-a}} + \bar{c} - x} - 1,$$

which is increasing in non-labour income. Women who enjoy some of their husband's income will hence tend to have higher elasticities, as will individuals who have accumulated savings in the past. Moreover, ε will be positive if and only if $a/(1-a)\,(w/b)^{\frac{1}{1-a}} > (\overline{c} - x)$. That is, the elasticity can be positive or negative depending on whether the income or the substitution effect dominates. Note that a high minimum consumption requirement, $\overline{c}$, implies a negative elasticity; as its value falls relative to both wages and non-labour income, the elasticity becomes positive. Over a long time span, such as the one we consider, it is conceivable that changes over time in $\overline{c}$ change the sign of this elasticity.

For our purposes, the analysis indicates that a number of factors can be behind the changes in both individual hours and their correlation with wages. On the one hand, the distribution of hours worked can change if the composition of the population changes, as individuals with different disutility of work (b) and/or non-labour income (x) become more or less numerous in the labour force. On the other, the elasticity of hours with respect to wages may change over time for a particular category of individuals, thus affecting the covariance term. For example, as wages grow, the elasticity can shift from being negative to being positive; while changes in the minimum consumption requirement, $\overline{c}$, will also have an impact. The elasticity can also change if, for instance, women become less reliant on their spouses' income or if the amount of capital income received changes (e.g. if returns to assets change).

Labour demand To examine possible demand-side factors affecting this covariance consider the following simple partial-equilibrium model. Suppose that firms have tasks to be performed. A task requires a labour input of $\bar{l}$. Consider a worker i, whose hours of work h_i are assumed to exhibit diminishing returns, so that the actual labour input she provides is given by h_i^z with $0 < z < 1$. The actual total labour input for the firm, l, is then given by $\sum_{i=1}^{n} h_i^z$. This expression implies that the more workers a firm uses, the more labour input they will get from a given number of hours.

The tendency to employ many workers is offset by the fixed costs associated with employing a worker. We suppose that there is a fixed administrative cost c_a and a firm-specific cost c_f. The first term includes things like administrative costs of payment, monitoring, organizing shifts, worker insurance, or compensation of workers for their commuting time and cost. The second cost can be thought of as the transmission of firm-specific knowledge or skills to the worker, and we assume that it is zero for the unskilled as there is no investment by the firm, but positive for the skilled.

The firm wants to hire the number of workers n that minimizes the cost of producing the task, which is given by $C(n) = n\left(\bar{l}/n\right)^{1/z} w + n\,(c_a + c_f)$, with the wage being exogenous and taken as given by the firm. The optimal number of workers and hours of work are then given by

$$n^* = \bar{l}\left(\frac{1-z}{z}\frac{w}{c_a+c_f}\right)^z, \tag{6}$$

$$h^* = \left(\frac{\bar{l}}{n}\right)^{1/z} = \frac{z}{1-z}\frac{c_a+c_f}{w}. \tag{7}$$

Our simple model has several implications. First, note that hours and employment are both positively correlated to the demand as captured by $\bar{l}$, as a greater demand is spread along both the intensive and the extensive margins. Second, within a skill category, i.e. for given costs, these expressions imply a negative correlation between hours and wages –as those with a lower wage will be offered contracts with more hours– and thus a negative elasticity, equal to -1 under our assumptions. The intuition is simple. The firm faces a trade-off between the fixed cost and the reduction in productivity as workers work more; a low wage implies that it is not very costly to have individuals working long, not-very-productive hours, and the firm prefers to pay more in wages than in fixed costs. Second, the model implies that if we compare the skilled and the unskilled, the gap in hours can be either positive or negative. The higher wage of the skilled implies contracts with fewer hours but their higher cost (since $c_f > 0$) leads to contracts with more hours.[6] Either effect could dominate.

Moreover, the wage-hour contract offered may change over time. For example, if technology reduces the administrative cost c_a, hours will tend to fall. If c_f is large relative to c_a, this effect could be large for the unskilled but negligible for the skilled, for whom the main cost is the investment made by the firm. Those with low wages would hence be offered contracts with fewer hours in response to the change in administrative costs, while those with higher wages would not be affected.

We can also consider the role of labour market institutions. Suppose that there is a minimum number of hours required by law, λ. Suppose also that the optimal number of hours is such that $h^* < \lambda$, i.e. they are below the legal contractual hours. The firm then needs to decide if to hire n^* workers and make them work the contractual hours λ or if to hire $n^* - 1$ and have them work over-time. It is possible to show that there exists a $\overline{\lambda}$ threshold value so that when $\lambda > \overline{\lambda}$ the firm prefers to hire $n^* - 1$ workers and have them work overtime.[7] A reduction in λ, i.e. a weakening of labour market institutions, would make this inequality less likely to hold and can hence result in firms hiring more workers but offering them contracts with fewer hours.

[6] Note that $\bar{l}$ or z could also differ across skill groups. For example, tasks performed by the skilled could take longer or diminishing returns be weaker.

[7] To see this, note that if the firm hires $n^* - 1$ workers, they will each work $\overline{h} = \left(\bar{l}/(n^*-1)\right)^{1/z}$ hours. We suppose that $\lambda < \overline{h}$. The firm then compares the costs of hiring n^* workers and making them work 'too much', $C(n^*) = n^*\left(\lambda w + c_a + c_f\right)$, or hiring one less worker at cost $C(n^*-1) = (n^*-1)\left(w\overline{h} + c_a + c_f\right)$. The firm prefers to hire n^* workers and have them all work λ hours if and only if $\lambda < \overline{\lambda} = (1 - 1/n^*)\overline{h} - (c_a + c_f)/wn^*$.

Overall, our framework implies that there are both supply and demand considerations that affect the correlation between hours and wages. The demand function derived above implies a negative correlation, while supply-side effects indicate that the elasticity of hours with respect to wages can be either negative or positive, depending on the substitution and income effects. The interplay between the two will depend on whether the short or the long-side of the market prevails. These aspects indicate that the composition of the labour force is likely to play an important role in the observed aggregate elasticity, whether in terms of skills or gender.

2.2.2 Hour regressions

Our analysis above indicates that both individual hours -and hence their dispersion- and the covariance between hours and wages can change in response to changes in the population composition – as preferences, marriage patterns, and non labour incomes change– as well as in demand and supply forces that are affected by the institutional framework. In order to identify the forces behind the changes in hours inequality and the covariance term we estimate a regression for hours worked that will help us understand how individual characteristics affect h and give us values for the elasticity of hours with respect to hourly wages. We suppose that individual hours are given by

$$\ln h_{i(c)t} = \alpha_{ct} + \beta_{ct} \ln \frac{w_{it}}{\overline{w}_t} + \gamma_{ct} X_{it} + \delta_{ct} Z_{ct} + u_{it}, \tag{8}$$

where β_{ct} is the elasticity of the hours of individual i in country c at time t with respect to her wage rate w_{it}, X_{it} is a vector containing the characteristics of individual i at time t, Z_{ct} is a vector containing variables at the country level that capture the effect of, for example, labour market institutions or trade and which vary over time, and u_{it} the error term. We assume that hours are correlated to the individual's wage relative to the average one. Given that we are using a log-log specification this has no effect on the estimate of β, but allows more a more intuitive decomposition of inequality when we look at a long period of time during which average wages grow. It is important to highlight that the elasticity β should not be interpreted as a causal impact of wages on hours but simply as a correlation because both wage and hours changes in equilibrium, depending on the nature of the shock.

Hours worked depend on personal characteristics.[8] Ideally, we would have liked to use information on spousal income and capital income, but these are not available in all datasets. We hence use age, gender and the number of children. The above expression implies that

[8] It is important to recall that worked hours are observed if and only if a worker is hired, which raises the issue of selection into employment. In the empirical analysis we will account for potential bias by modelling the selection equation and including the Mills's ratio into equation 8.

hours inequality is given by

$$I_{ht} = \ln \overline{h}_t - \alpha + \beta I_{wt} - \gamma \overline{Z}_t, \tag{9}$$

where $\overline{Z}_t$ is the expected value of Z_{it}. Using equation (8), we can rewrite earnings inequality, (2), as

$$I_{yt} = \ln \frac{\bar{y}_t}{\overline{w}_t} + (1+\beta) I_{wt} - \gamma \overline{Z}_t - \alpha. \tag{10}$$

This expression allows us to compute the contribution to changes in inequality of various elements. The first term captures the ratio of average earnings to average hourly wages, and takes into account scale effects as both wages and earnings grow over time. The second term reflects both changes in wage inequality and in the elasticity of hours, and captures the fact that depending on this elasticity a given increase in wage inequality will have a stronger or weaker impact on earnings inequality. In particular, a negative β has the effect of dampening earnings inequality, while a positive β implies a magnifying effect of hours. The third term captures the impact of individual characteristics and measures how changes in demographics affect the distribution of hours worked and hence earnings inequality. For example, if women work, on average, fewer hours than men, then an increase in the share of women in employment will tend to increase hours dispersion and thus earnings inequality.

The decomposition in equation (10) allows us to perform a series of counterfactuals. If hours depended only on individual characteristics and not on the wage, i.e. $\beta = 0$, we would have $I_{yt} = \ln \bar{y}_t/\overline{w}_t + I_{wt} - \gamma \overline{Z}_t - \alpha$, and a change in wage inequality would only have a direct effect. We can also compute a counterfactual MLD of earnings if either wage inequality or the elasticity had remained unchanged over our period of study.

The coefficients in equation (8) are, however, potentially different across groups and over time. These differences may be due to the nature of the job, for example if certain sectors or occupational categories allow for more flexibility in choosing working hours and hence a more elastic response to changes in wages or if certain types of jobs have highly non-linear remuneration schemes. There may also be differences across genders in the labour supply response to wages or other individual characteristics, and these responses may also have changed over time. Denoting country by c and gender by g, we estimate the individual hours regression as follows:

$$\begin{aligned} \ln h_{i(g,c)t} &= \alpha_{gct} + \beta_{gct} \ln \frac{w_{i(g,c)t}}{\overline{w}_{gct}} + \gamma_{gct} Z_{i(g,c)t} + u_{i(g,c)t} \\ &= \widetilde{\alpha}_{gct} + \beta_{gct} \ln w_{i(g,c)t} + \gamma_{gct} Z_{i(g,c)t} + u_{i(g,c)t}, \end{aligned} \tag{11}$$

where $\widetilde{\alpha}_{gct} = \alpha_{gct} + \beta_{gct} \ln \overline{w}_{g,ct}$. As before, β_{gct} captures the elasticity of hours with respect to own wages, but now it is specific to each of the gender, job, country, year groups. The vector Z_{it} includes age, age squared, the number of children, and a dummy capturing whether the individual is high-skilled.

Using this expression, we can rewrite equation (10) to obtain an expression for earnings inequality in country c at time t given by

$$I_{y,ct} = \ln \frac{\bar{y}_{ct}}{\overline{w}_{ct}} + \sum_{g=0}^{1j} p_{gct} \ln \frac{\overline{w}_{ct}}{\overline{w}_{gct}} + \sum_{g=1}^{2} p_{gct} \left[(1+\beta_{gct}) I_{w,gct} - \gamma_{gct} \overline{Z}_{gct} - \alpha_{gct} \right], \qquad (12)$$

where p_{gct} is the share of group k in the population, $I_{w,gct}$ is the MLD of hourly wages for gender g, and $\overline{Z}_{gct}$ are average characteristics. As before, the first term captures the ratio of average earnings to average hourly wages. The second is a measure of inequality in average wages across gender groups. We next have a term capturing the impact of wage inequality, which is magnified or dampened by the elasticity of hours, while the term $\gamma_{gct}\overline{Z}_{gct}$ captures the impact of individual characteristics. A new element in the analysis are the population weights p_{gct} which captures the importance of the distribution of employment across genders.

However if we aim to gain efficiency associated to larger samples, we can replace the regressions by population subgroups proposed by equation (11) and introduce interactions among the relevant variables

$$\ln h_{it} = \alpha_g \delta_i + \beta \ln w_{it} + \eta \delta_i \cdot \ln w_{it} + \gamma Z_{it} + \zeta X_{ct} + \theta X_{ct} \cdot \ln w_{it} + \alpha_c + \alpha_t + \mu \widehat{\lambda}_i + u_{it} \quad (13)$$

where δ_i is a dummy variable identifying females: as a consequence $\widehat{\beta}$ indicates the hour elasticity for men, while $(\widehat{\beta} + \widehat{\eta})$ identifies women elasticity. Similarly X_{ct} denotes a vector of labour market institutions (like union presence or employment protection) and demand shocks (like trade exposure or investments), that are varying by time$\times$country: thus the elasticity prevailing in a country/year will be given by $(\widehat{\beta} + \widehat{\theta} X_{ct})$ for men and $(\widehat{\beta} + \widehat{\eta} + \widehat{\theta} X_{ct})$ for women. Additional individual controls (like age and citizenship) are accounted by Z_{it}, while country/year heterogeneity are controlled by fixed effects α_c and α_t. Finally potential self-selection into employment is controlled by the inverted Mills ratio $\widehat{\lambda}$ obtained from an associated selection equation. Other things constant, we can use equation (10) to describe the evolution of income inequality by means of changes in the estimated elasticity.

3 The data

We use an updated version of the harmonized dataset we constructed for Checchi et al. (2016) that relies on different national surveys collected from national statistical institutes. These are household or labour surveys for the US, the UK, Germany, and France, covering three decades, starting between 1989 and 1991, depending on the country, and going up to between

2016 and 2019. In particular, we use the *Current Population Survey* for the US, the *British Household Panel Survey* and, from 2009, *Understanding Society* for the UK, the *German Socio-Economic Panel* for Germany, and the *Enquete Emploi* for France (which becomes the *Enquete Emploi en temps continue* in 2003). Although changes in the survey design, notably the US in 1994 and France in 2003, require a careful interpretation of the results, all the surveys have been widely used in the empirical literature on inequality.[9] Measurement, comparability and alternative data sources are discussed in detail in Checchi et al. (2016).

Our sample is composed of prime-age workers, i.e. individuals aged between 25 and 54, who are dependent employees in either the private or the public sector. As is well established, employment patterns for young and for mature workers differ substantially across countries, much more than for prime-age workers. Focusing on this age group allows us to abstract for differences in the education system and in retirement possibilities. We also exclude the self-employed since the treatment of this type of workers varies across national surveys, as we discuss in our earlier work.[10] Details on sample sizes by country and year are provided in the Appendix. The data cover the period 1989-2019, although the initial and final years for which we have data available vary slightly across countries.[11]

Our two key variables of interest are weekly earnings and hours worked, out of which we then compute the hourly wage. For both variables we use questions referring to the current job of the individual. This contrasts with papers that use annual hours and earnings and compute wages from those. There are good reasons for not pursuing this path, since both unemployment rates and vacation patterns vary substantially across countries and would have a major impact on measured hours. Focusing on a snapshot of weekly hours/earnings implies greater comparability of the data.[12]

The measure of earnings that we employ is the usual gross income from labour that the individual receives over a week from the main current job, including both contractual wages and overtime pay.[13] Hourly wages are then computed by dividing earnings by hours worked. Hours are defined as follows. For most of the databases we use "usual hours worked in the main current job", which include both contractual hours and "usual hours of overtime"

[9]See, for instance, Murphy and Welch (1992) for an application using CPS data, Bell and Freeman (2001) for the GSOEP, and Blundell et al. (2013) for an international comparison of hours of work.

[10]Including income for the self-employed would be interesting as they tend to be over-represented at the top and bottom of the distribution. However, we decided against it for two reasons. The first is that this group is not always treated in the same way across countries and surveys. The second is that they are characterized by high non-response and under-reporting rates. For example, the self-employed are not asked about current usual earnings in the CPS, and in the BHPS, over one fifth of self-employed respondents either refuse to give information or do not know how much they earn. We therefore decided to remove the self-employed from our sample.

[11]We have data for 1989-2019 for the US, 1990-2017 for France, 1991-2016 for the UK, and 1991-2017 for Germany.

[12]When possible, we focused on the same period of the year, notably the first quarter or the month of March, to avoid capturing cross-country differences that may be due to seasonality.

[13]Except for France where we use net income from labour.

(although exceptional overtime is not included).[14] The harmonization of this variable was not straightforward due to coding problems. First, we had to make sure that it included both contractual hours and overtime. Second, it is a variable that is often truncated. In particular, Germany truncates at 90 hours per week and the USA at 99 hours. Given the issue we are interested in, this may be a concern as truncation affects the upper tail of the distribution of hours worked. Inspection of the data indicates that this is not the case since we did not find a concentration of observations at the truncation points. We hence consider only workers that spend at least 2h a week working on their main job, and truncate hours worked at 90 hours for all four countries.

Although these data are the most suitable available and have been extensively used in previous work on both inequality and wages, two caveats are in order. First, data are for the main job and hence income and hours from additional jobs are not accounted for. If those at the bottom of the distribution are more likely to have multiple jobs, then we may be underestimating both their hours and their income, thus overestimating inequality; the opposite occurs if it is those at the top that have multiple jobs (e.g. managers doing external consultancy or doctors working in a secondary practice). This problem is common to the literature using labour market data to compute earnings or wage inequality. The under-reporting of earnings could be overcome by using fiscal data, however these data are not useful for our purposes since hours are not reported in tax records. Second, Borjas (1980) argues that computing wages as we do is problematic due to what he refers to as the 'division bias', i.e. the risk of downward-biased estimates of the elasticity of hours with respect to hourly wages if hours are miscomputed. Unfortunately, none of the surveys has data on all three variables, so there is no alternative option. Under the assumption that the measurement error in hours is consistent throughout the survey waves, the trends should be well identified.

These individual data are used to compute, on the one hand, the inequality index and its decompositions, and on the other the hour regressions that will give us information on the elasticity of hours with respect to the wage. In the second part of the analysis we include variables that can affect hours worked. As we argued above, the elasticity of hours may differ across job categories; we hence consider the role of both occupation and industry. We group occupations and industries into three categories each. We follow Goos et al. (2009) and divide occupations into top, middle and bottom-paying ones, while we loosely follow Autor and Salomons (2017) for the grouping of industries into (1) manufacturing, agriculture, mining and construction, (2) capital-intensive and health and education services, and (3) labour-intensive services.[15] The resulting ranking of occupations and the classification of industries are provided in tables A.2 and A.3 in the Appendix, respectively.

[14] Actual hours, in contrast, may include exceptional over time. Actual hours were used to complement usual hours in the US if respondents answered that usual hours vary. This is not a possible reply in the other surveys.

[15] In order to avoid having too few observations in certain industries, we group the categories in Autor and Salomons (2017) into three rather than five categories. See Table A.3 in the Appendix.

We also consider the impact of country-level variables in order to understand the role of the supply and demand sides of the labour market in determining inequality.[16]. To measure institutions that impact the supply of labour, we use the degree of employment protection concerning both individual dismissal and temporary contracts, an indicator of union density, and the legislation on parental leave, both its maximum length and the number of paid weeks. We argue that both unionisation and strict employment regulation promote wage rigidity and, therefore, decrease hour flexibility. We expect those variables to be negatively correlated with the elasticity of hours with respect to hourly wages. In contrast, a more generous parental leave increases flexibility and thus is expected to raise the elasticity.

Concerning the demand side, we focus on indicators that capture the demand for skills, output volatility, and trade openness. By doing so, we account for changes in the profile of jobs, business cycle, and globalization. We use an aggregate measure of volatility and trade openness common to all sectors to measure the business cycle and exposure to trade.

A complete list of the variables used as proxies for the supply side and the demand side of the labour market is presented in the data Appendix. Descriptive statistics of the individual and aggregate datasets are provided in Tables A.1 and A.4 respectively, while time trends of the aggregate variables are reported in Figures A.2 and A.3.

4 Results

4.1 Decomposing earnings inequality

The decomposition of the Mean Log Deviation (MLD) of weekly earnings is presented in Figure 2, which plots the evolution over time of earnings inequality as well as of its three components, and in Table 1 which presents the corresponding figures for selected years.[17] In Table 1, we also report the relative contributions of wage dispersion, hour dispersion, and the covariance term that are obtained by dividing the three additive terms by earnings inequality so that they add up to 100. The top left panel shows the evolution of the level of inequality in earnings, with high levels of overall dispersion in the UK and the US (the MLD index ranges between 0.20 and 0.26) and low ones in France (around 0.14). Over the period 1995-2016, earnings inequality grew by 6% in the US, remained constant in France, and fell by 13% in the UK. In Germany, earnings dispersion initially declined from 0.18 in 1991 to 0.15 in 1995, and then rose sharply (by 45%), reaching a level comparable to that in the Anglo-Saxon economies (0.23 in 2016).[18]

[16] As detailed int the appendix, the data are from the OECD database and from the Penn World Tables; see Penn World Tables and OECD website for details.

[17] For additional years refer to Tables B.1, B.2, B.3, and B.4.

[18] Changes in sampling are clearly visible for the US in 1994, for Germany in 2003, for France in 2008, and for the UK in 2009.

The US and the UK show different patterns concerning the role of wage and hours inequality. The US records the highest wage inequality, with a slight increase in the MLD, from around 0.16 to 0.18, and has a low and roughly constant MLD of hours. As a consequence, hourly wages explain a large fraction of inequality in earnings, reaching 76%. In contrast, in the UK high (but lower than in the US) wage inequality is accompanied by a high dispersion of hours, and wage dispersion initially accounted for 52% of the overall dispersion. With wage inequality stable over the period, that in hours falling and the covariance term becoming less positive, this share increased over time to reach 60%, higher than in 1995 but well below that observed in the US.

In Germany the contribution of wages fluctuates, being around 55% throughout the 2000s. The increase in earnings dispersion is a result of three factors all moving in the same direction: higher wage dispersion, higher hours inequality, and a growing covariance term that passed from being negative to being positive. France stands out as the least unequal country in our sample. The stability in hours dispersion was accompanied by two offsetting factors: falling wage inequality (with the MLD of wages reaching values below 0.10) but a growing covariance term which, as is the case for Germany goes from being negative to positive. As a result, the contribution of wages fell from 79% to 63%.[19]

The bottom graphs of Figure 2 depict the absolute contribution of the dispersion of hours worked and of the covariance between hours and hourly wages, respectively. The patterns just described are apparent there. Hours inequality increased markedly in Germany, while it decreased in the UK. Concerning the contribution to earnings inequality of the covariance between hours and wages, we identify two different patterns: the Anglo-Saxon countries exhibit a mildly positive covariance, constant over time, explaining around 10% of overall inequality in those countries; Germany and France both exhibit negative or nil contributions in the 90's and positive values after the year 2000. Hence this term went from being an equalising force to becoming an unequalising one.

The figures in Table 1 allow us to compute the contribution of changes in the three terms to the overall change in earnings inequality over the period. In the US, the change was driven by wage inequality which amounts to 150% of the change in earnings inequality and is partially offset by the fall in the covariance term. In the UK the reduction in I_y is mainly due to the fall in I_h (which accounts for 61% of the change) and of ρ (36%). France exhibits a decline in wage inequality which is exactly offset by a higher correlation term. In Germany, only 18% of the change is due to higher wage dispersion, the rest being caused by greater hour inequality (14%) and, above all, by a higher ρ (68%).

[19] Our results on wage dispersion are in line with those of Kügler et al. (2018).

4.2 Hours worked by quintiles

In order to explore further the role of hours of work, we examine the evolution of average hours worked by quintiles of the hourly wage distribution. We partition the sample into five groups according to their hourly wages. The results are reported in Figure 3 which plots the evolution of average hours worked for each group in each country.

Our data identify a novel pattern: with the exception of Germany and France during the initial years, those with higher wages tend to work more. These gaps, however, vary across countries and over time. The US presents a stable pattern in which the lower the quintile the fewer hours individuals work, a pattern consistent with a standard labour supply in which the substitution effect dominating the income effect, and exhibits a large gap between the bottom quintile and the rest, with this group working (on average over the period) 5 hours less than the top one. Germany and the UK exhibit greater dispersion in the average hours by group, consistent with the greater overall dispersion that we identified earlier. The UK is striking in that those at the bottom of the wage distribution work less than anywhere else, although their hours increase over the sample period (from 30 hours in 1991 to 33 in 2016). In contrast, higher quintiles have slightly reduced their work hours, resulting in lower dispersion across groups at the end than at the start of the period. Germany presents the opposite pattern, with dispersion rising over time. The differences across quintiles are small in the early 1990s and widen over time. There is a marked decline in hours worked by the second and, especially, the first quintile, stability in the middle of the distribution, and an increase in the hours worked by those in the top quintile. The bottom and top quintiles worked, respectively, 38 and 39 hours in 1991 and 32 and 41 hours in 2016.

France stands out in various dimensions. In the early 1990s, it was the top and bottom quintiles that exhibited the lowest average hours, with the other three groups working more. The dynamics are characterised by a decline in working hours up to the early 2000s for all groups, except the top quintile for which there was no change. Thereafter there was an increase that was steeper for higher quintiles, so that by 2016 we observe the same pattern prevalent in other countries with higher quintiles working more. The gap is nevertheless smaller than in the other three economies, with the bottom quintile working 35 hours and the top 38 in 2016. The increase in working hours is surprising given that in 2000 France moved from a 39- to a 35-hour week, and is consistent with existing evidence on its limited impact. [20]

The increase in working hours supplied by top earners that we observe in Germany and France is consistent with various arguments found in the literature. Corneo (2015), for instance, states that the substitution effect is more likely to increase work effort among high-skilled than among low-skilled and maintains that this may be the result of an increase in

[20] The aim of the reform was to reduce hours per worker so as to increase employment rates, yet existing evidence indicates that there was no significant impact on the latter; see, for example, Wasmer2009.

the progressivity of the tax-transfer system that led to a stronger decrease in work hours for those in the lower part of the skill distribution. Bell and Freeman (2001) claim that wage dispersion can be a source of hour dispersion. They argue that when earnings inequality is higher within an occupation, those in the occupation have greater incentives to get a promotion, and they react by working more so as to signal commitment and increase the chances of a promotion. An equivalent argument applies if earnings dispersion increases within the top quintile, inducing longer hours to try to get to the top of the quintile.

The UK and Germany display strikingly different behaviours of the poorest workers. In 2016, the less-well-paid worked on average around 32 hours a week in both countries, but while in the UK this is the result of an increase over the previous two decades, in Germany it was the result of a dramatic reduction in hours worked from a level that was close to that of other quintiles in the early 1990s. Differences in labour market regulation between the two countries could explain these patterns. As argued by Burda and Hunt (2011) increased flexibility in Germany favoured a positive labour demand change that increased the extensive margin of previously inactive workers, largely driven by female participation.[21] On the other hand, in the UK, a minimum wage was introduced in 1999, and kept increasing since. Such a policy might potentially have had the effect of reducing the demand for workers at the lower end of the wage distribution, in favour of more unemployment or better jobs, especially among low-skilled young workers.

4.3 Hours regression

We turn next to the determinants of individual hours and their elasticity with respect to hourly wages. We start by considering selection into employment. Table 2 presents the correlations between the probability of employment and various potential determinants of participation and employment, with the first column reporting the coefficients when all workers are pooled and the next two columns looking at men and women separately. Gender is important, with women exhibiting a probability of employment that is 13.5% lower than that for men, and the coefficients differing considerably across groups. The effect of age exhibits an inverted U-shaped, which peaks at a younger age for women, and being of $foreign$ origin displays a negative coefficient, suggesting potential discrimination and/or segregation in entering the labour market.[22] Not surprisingly, educational attainment is positively correlated with employment, with an estimated employment differential of 20 percentage points between a low-educated person and a college graduate.

[21] See Burda and Hunt (2011) for details on the Hartz reform and Caliendo et al. (2019) on the introduction of the minimum wage in Germany in 2015.

[22] We exclude from the regression those who self-declare to be self-employed, without indicating their level of earnings, because in the Heckman procedure they would be considered non-employed as they do not report any income. Assigning them to non-employment barely changes the estimated coefficients.

Four possible exclusion restrictions are considered. First of all we take into account the possibility of an income effect, by summing the incomes of all family members (excluding the respondent's). This variable is an imperfect proxy for household income since we do not observe the earnings of self-employed. We hence also include the share of self-employed among the working members of the household. In line with the literature, we also include marital status and the number of children in the household. Surprisingly, household income exhibits a positive coefficient rather than the negative one the theory would predict; it may capture social status effects, according to which the entire family is committed to maintaining an adequate standard of living. The share of share of self-employed in the household has a positive and significant coefficient, consistent with a positive income effect. Being single increases the likelihood of being employed, with the effect being much stronger for women than for men, while the coefficient on the number of children is positive for men and negative for women, as found in previous work. [23]

As is standard in the literature, from the selection equation we obtain the estimated *Mills ratio*[24], which is then included in the regression for hours of work in order to correct for the bias induced by selection into the labour market. Note that both in the selection equation and in the following hours estimation, institutional differences across countries are controlled by $country \times year$ dummies. Table 3 reports the results for our regressions of hours worked, starting with the simplest version, where we only control for demographics (column 1): females work less hours (between 40 and 50% less), the wage elasticity is slightly positive for men and highly positive for women, and older people tend to work less hours. Selection into employment plays a role, as shown by columns 2 and 3, when the *Mills ratio* is included in the regression in two versions, not distinguishing between genders (corresponding to column 1 of Table 2) or combining two separate probabilities for men and women (columns 2 and 3 of table 2). In both cases the wage elasticity for men becomes statistically not different from zero, while female elasticity is estimated around 0.10 . Also $foreign$ origin exhibits a similar pattern: while the average elasticity is small and negative (column 1), when selection is considered it disappears (column 2) and even becomes positive (columns 3) when separate *Mills ratio* are considered. In accordance with the literature we maintain a unique *Mills ratio* and proceed with commenting the results associate to its use. In column 4 we add educational attainment, which is positively associated to hours, though with a small elasticity. If we aim to isolate a "pure" wage effect, we should abstract from constraints associated to job

[23]Most of the literature has focused exclusively on female selection, but recent work has started to address the question of male employment; see Arellano and Bonhomme (2017), Dolado et al. (2020), and Elass (2022). This literature points at the fact that while selection issues where usually seen as self-selection into the labour force, which was traditionally seen as absent for men, high rates of unemployment imply that selection into employment can also be driven by demand and hence is likely to affect men.

[24]It is computed from $Mills_i = \frac{f(\widehat{p}_i)}{F(\widehat{p}_i)}$ where $\widehat{p}_i$ is the individual predicted probability of employment, $f(\cdot)$ is the normal density function and $F(\cdot)$ is the cumulative normal function.

requirements, as captured by the combination of skill by sector (column 6 of table 2): in this case the male elasticity is even negative and significant (−0.031) while the female elasticity remains positive (0.068) but smaller than earlier. These contrasting evidence reinforces our interpretation based on compositional changes: as the share of women in the labour market increases over time, the wage elasticities are destined to become more and more positive, thus emphasising the role of hours in accounting for income inequality.[25]

This is highlighted by the figure ELASTICITY which plots the estimated wage elasticity using dummies defined by gender×country×year, while controlling for age, education, origin and job requirements. UK and US look rather similar, with a rigid supply of hours by men (elasticity fluctuates around zero) and a positive elasticity for women. Conversely, in the case of France, it is the female elasticity which is negligible, while the male one is clearly negative. Germany represents an intermediate case, transiting from a France-like situation at the beginning of the period to a Anglo-Saxon model in the final part.

4.4 Hours elasticity and labour market institutions

In order to investigate further the determinants of hours inequality, we examine the correlation between wage elasticity and proxies for the demand and supply side of the labour market and estimate equation 13. The vector X_{ct} is a vector of country-level variables that capture the supply side of the labour market (union density, employment protection legislation (EPL) for permanent and temporary contracts, unemployment benefits, minimum wage and weeks of parental leaves for parents) as well as demand shocks affecting the quest for more flexible use of working hours (*outputvolatility*, *trade openness*, investments and their share in ICT and $R\&D$ components).

Our intuition is that more regulated labour markets (i.e. where unions are powerful, possibly supported by minimum wage legislation, firing is limited and unemployed are supported by public subsidies) are associated to lower elasticities because working time has to be negotiated. However, when family supportive policies are in place and allow for better reconciliation of housewiving and external employment, elasticity should increase, because the labour supply becomes more adaptable.

On the other side, there is an increasing demand for flexible use of working hours on the employer side, which we have proxied with alternative measures. If the demand becomes more/less volatile, other things constant the employer ask for more/less flexibility to adapt to these fluctuations. In a similar way, external competition induced by globalization increases the demand for adaptability, thus suggesting a demand for more elasticity. But the possibility of flexibility is also associated to technological constraints: thus investment in information

[25] The US survey contains information about the ethnicity of the interviewees, which is missing n the other countries. In order to assess whether it may be relevant, we have constructed a new variable *minority* which is one whether one is foreign born or non-white. This variable obtains a positive and significant sign.

and communication, as well as in research and development, should favour greater flexibility in hours applied to production.

These supply and demand indicators by countries are plotted in Figures A.2 and A.3 and their descriptive statistics are reported in Table **??**. The most relevant institutional variations charcterising our sample are the decline of union presence in Germany and UK, partially compensated by the increase in the minimum wage. Despite the low union density, France remains a regulated country, as indicated by the high level of employment protection, minimum wage and unemployment benefit. Conversely, the market flexibility of US is apparent from the lack of employment protection, the declining minimum wage and the absence of parental leaves.

On the demand side, Germany is the country more affected by trade exposure, though their technology (desumed by investment component) does not seem at the frontier as compared to US, which symmetrically seems less exposed to external trade and demand fluctuations.

We then introduce these additional regressors in the estimation of the amount of worked hours, in levels and interacted with the hourly wage, while retaining the controls for selection into employment (Mills ratio), gender (also interacted with wage), age, educational attainment, and foreign origin. Results are reported in table INSTITUTIONS. In column 1 we include full interacted institutional and demand shocks, showing that only the $female$ component of the workforce is associated to a positive wage elasticity, which is however reduced by *unions*, *minimum wage* and/or *employment protection legislation* for temporary contract. Not surprisingly, it is also positively associated to conciliation policies (parental leave) and to the unemployment benefit replacement rate, which looks partially counter-intuitive: when the value of the outside option increases, a worker would be more reluctant to work more hours.

The demand shocks of *output volatility*and trade openness are positively associated to wage elasticity, while the negative contribution of *investments* may be explained by their multiplicative impact on the aggregate demand: getting closer to full employment reduces flexibility in the utilization of the available workforce. When considering the investment components, information and communication technologies are insignificantly correlated to wage elasticity, while research and development is associated to greater wage elasticity. These results are robust against alternative specifications, which are introduced in the following columns. The first one concerns the impact of the minimum wage, which is observed for fewer years in UK and Germany. In order to retain observations, in column 1 we have replaced with zero the missing values (as if it were set to be nil), while we have dropped this artificial variable in column 2: all the estimated coefficients retain sign and significance except the interaction of wage and union density, suggesting that union and minimum wage act as substitutes with respect to hour elasticity.[26] In column 3 we introduce additional controls given by job types and

[26] An alternative solution we have explored to cope with missing information on minimum wage is replacement with the country mean of the same variable, which does not alter the estimated coefficient. In such a case the union interaction is negative but not significant.

public sector (coefficients not shown): this reduces statistical significance for the interactions of union, parental$leaveandR\&D, confirmingthathourregulationissomehowjobspecific$.

In column 4 we report our preferred specification, where we have removed wage interaction that are not statistically significant (employment protection legislation for permanent contracts and ICT investment). Note that the wage level (i.e. the wage elasticity associated to men in a country with no institution) remains statistically insignificant.[27] Country heterogeneity is controlled by country and year fixed effects, but they are robust to the inclusion of country×year fixed effect, as done in column 5; the errors are clustered by country×year. Finally, in column 6 we show the beta coefficients (namely the estimated coefficients when the variables are standardised) associated to the model estimated in column 4. The strongest impact on wage elasticity is associated to EPL for temporary contract, followed by trade openness and investment.

In order to appreciate the role of contextual factors in shaping the dynamics of wage elasticity, we have considered the variations of supply and demand shocks over the common sample period 1991-2016 and we have multiplied the change by the estimated interaction coefficient. Table IMPACT displays the $\widehat{\theta}\Delta X_{jc}$ for each shock j and each country c. According to the table, the German elasticity has grown by 17.2 percentage points, mostly due to the reduction in employment protection (+10.4 p.p.) and by increased trade exposure (+7.4 p.p.). Similarly, the French elasticity has also grown by 5.2 percentage points, mostly driven by increase trade openness (+3.6 p.p.) and increased investment in R&D (+1.3 p.p.). UK and US elasticities exhibit limited fluctuations: in the case of UK the decline of 3 percentage points is driven by the increase in the minimum wage (+4.1 p.p.), while in the case of US it is impossible to identify a dominant factor.

Institutions and demand shocks are effective in diving the elasticity dynamics. In figure SIMULATED we have computed the predicted wage elasticity by simply using the estimated interaction coefficients multiplied by the observed contextual variables. By comparing with the previous graph ELASTICITY, is easy to recognise that our estimated model well replicates the change observed in Germany, as well as the lack of trend for UK and US. Our model does not fully capture the upward trend of hour elasticity in France, which is predicted to remain almost nil for women while negative for men.

The Appendix reports time trends for these variables (Figures A.2 and A.3) and identifies well-established patterns. France, for instance, has the highest level of employment protection legislation and it allows women to stay longer out of the labour market after having a child, despite providing weeks of paid leave comparable to the other European countries, and low union density. Union density is low in the US, and it declines over time in Germany and the UK. Employment protection of temporary work in Germany becomes weaker over time, being close to the one in France in 1990 and it is as lows as that in the UK by the end of the period.

[27] Removing the wage variable from the estimation does not change the results.

Germany also witnessed changes to maternity leave legislation after the year 2000.

Output volatility behaves in a comparable way across countries and captures the shock stemming from the Great Recession. The index for trade openness indicates a general increase in the propensity to trade, which is largely driven by the openness of capital-intensive services. Lastly, the evolution of the share of high-skilled suggests that it is easier to be hired in top-paying jobs.

The coefficients obtained when we estimate equation 11 are reported in Table **??**. We run a fixed effect model with country and year fixed effects, clustered the errors at the country level, and the estimates are obtained using the inverse of the standard error of the elasticity as weights. The first four columns report a core regression and then add, one at a time, the three labour market institution variables. The next four columns reproduce these results but include the MLD of hourly wages.

Women are characterized by higher elasticities, while age and the level of education do not seem to play a role. The degree of openness of the sector is positively correlated to the elasticity, indicating a greater correlation between wages and ours in more competitive environments. Higher volatility is associated with a lower β, implying that a more volatile output is likely to make workers more willing to accept to work longer hours for given wages. Including one institutional variable at a time, we find that all three indicators of the strength of labour market institutions are negatively correlated with the elasticity, as expected, consistent with the standard theory that indicates that stronger labour market regulation implies more rigidity. Overall these results support the idea that both openness and a weakening of labour market institutions are behind the observed increase in the elasticity of hours. Lastly, the MLD of wages has a negative and significant effect. This result is puzzling. Bell and Freeman (2001) argue that higher earnings dispersion tends to increase individual hours. In contrast, it seems that the hours response to own wages does not increase with wage inequality in the job. Rather, greater inequality seems to make labour supply less responsive to own wages.

Table 6 reports the results from a counterfactual exercise equivalent to those performed above but where we keep labour market institutions (LMI) constant. That is, we have kept one institution constant at a time, giving it its 1995 level, and computed the counterfactual inequality index and the percentage change when compared to actual inequality that year. We use our estimates from columns (1) to (4) in table **??**, implying that a change in a LMI will impact β, which in turn will affect hours and earnings inequality. In order to be concise, we report the index and changes averaged over a 3-year period. The figures reported imply that institutions played a minor role in the Anglo-Saxon countries. In contrast, their effect on earnings dispersion in the continental economies was considerable, with, in some instances, a single institution implying a counterfactual I_y of up to 5% lower than the actual one. In Germany, changes in our three measures where unequalising, as indicated by the fact that inequality in earnings would have been lower had the 1995 institutions prevailed (negative changes). The opposite happened in France where all changes in LMIs had an equalising effect.

4.5 Explaining the changes in hours inequality

Though the bottom left panel of Figure 2 shows hours to be less unequal than wages or earnings, still cross-country differences are noticeable. Hours are more concentrated in the US and France, while they are more unequal in Germany and the UK. Furthermore, while hours inequality appears to be decreasing in the UK, it is on the rise in Germany, and it can explain up to 40% of earnings dispersion, as depicted in Table 1. In this section, we aim at exploring the determinants of hours inequality.

In Figure **??** and 5, we report hour dispersion by job type for females and males, respectively. As expected, hours are more dispersed for women than for men, the difference being explained by the higher frequency of part-time among females. Surprisingly, the level of hours inequality depends on the job type, hours are more dispersed in bottom-paying occupations, while they appear more concentrated at the top. Such difference is particularly evident when we focus on top-paid positions in capital-intensive services for females, the only panel where hours inequality is comparable to male's hour dispersion. This seems to suggest that less traditional high-paying jobs may value longer hours, therefore, not allowing different arrangements of time. Cortes and Pan (2016), in particular, show that top-paying occupations have a higher return to hours than other types of job, and that this difference is an explanation for the wider gender wage gap at the top. Figure A.1 shows that the employment share in capital-intensive services is increasing over time, and so is employment in top-paying occupation, raising the question of whether more concentrated hours are a result of changing industry or occupation relative importance.

5 Conclusion

This paper argues that earnings dispersion is partly determined by the dispersion of hours, an aspect that has been largely neglected by the literature. We decompose an inequality index, the mean log deviation, into three components: earnings dispersion, hours dispersion and the covariance between hours and wages. Our results indicate that while the contribution of hours worked to earnings inequality is moderate in France and the US, it explains between 30% and 40% of earnings inequality in Germany and the UK. Moreover, substantial changes have occurred during the period we examine, with hours dispersion falling markedly in the latter two countries. The data also show a marked change in the covariance of hours worked and wages. This correlation was negative in the 1990's and it appears positive or null in 2012, therefore, contributing positively to earnings dispersion in the most recent years. In France, the stability of earnings inequality has been the result of a falling dispersion of hourly wages and an offsetting increase in the correlation term. In Germany, the sharp increase in this correlation has been the main culprit behind growing earnings inequality.

The observed changes in hours inequality and the covariance with wages can be due to both composition effects and changes for a particular category of individuals. For example, women tend to work fewer hours than men and have a greater elasticity of hours with respect to wages, hence some of the observed changes could be due to increased female participation in the labour market over the past decades. We hence run individual level regressions for hours worked, which allow us to examine to what extent the changes observed are due to changing population shares or to different responses for a particular group. Using the estimated coefficients we can compute counterfactual inequality indices under various scenarios, keeping constant one aspect at a time. Our results suggest that the changes in the hour-wage elasticity are an important driver of earnings inequality in the UK, France, and, most notably, in Germany. The covariance between the two variables was negative at the start of our period of study, thus providing an equalizing force that has been eroded as the covariance became positive or nil. Changes in population shares have also had a substantial impact, with the increase in female employment observed in all countries tending to increase inequality.

Since changes in the hour-wage correlation have been a major factor affecting the dispersion of earning, we provide an exploratory analysis of what can be behind such changes. The correlation we examine is a purely statistical relationship, and hence it could be that individuals with higher wages now work more (supply-side) or that jobs that pay lower wages also provide fewer hours (demand-side). Our findings indicate that greater output volatility and stronger labour market institutions reduce the elasticity, while trade openness magnifies it. These results imply that demand-side considerations are likely to be behind the changes in the covariance, with weak institutions and increased openness being important factors behind the emergence of low-pay/few-hours jobs that seem to have been an important element in rising earnings inequality.

Our analysis raises important questions that our current framework cannot answer. Those at the bottom of the wage distribution are working today less than they did two decades ago. Our positive analysis implies that this increases earnings inequality, but is silent about the welfare implications. If reduced working hours are the result of individual choices, the increase in leisure may offset the loss in relative income and result in higher welfare. Alternatively, if low-pay workers are simply unable to work as much as they would like, a deteriorated income position will be associated with under-employment and hence a loss in utility. Answering these questions requires both further data on both actual and desired hours of work, but also a conceptual framework to fully spell out the welfare implications. We leave these issues for further work.

Figure 1: Distribution of hours worked by country, years 2012-2016

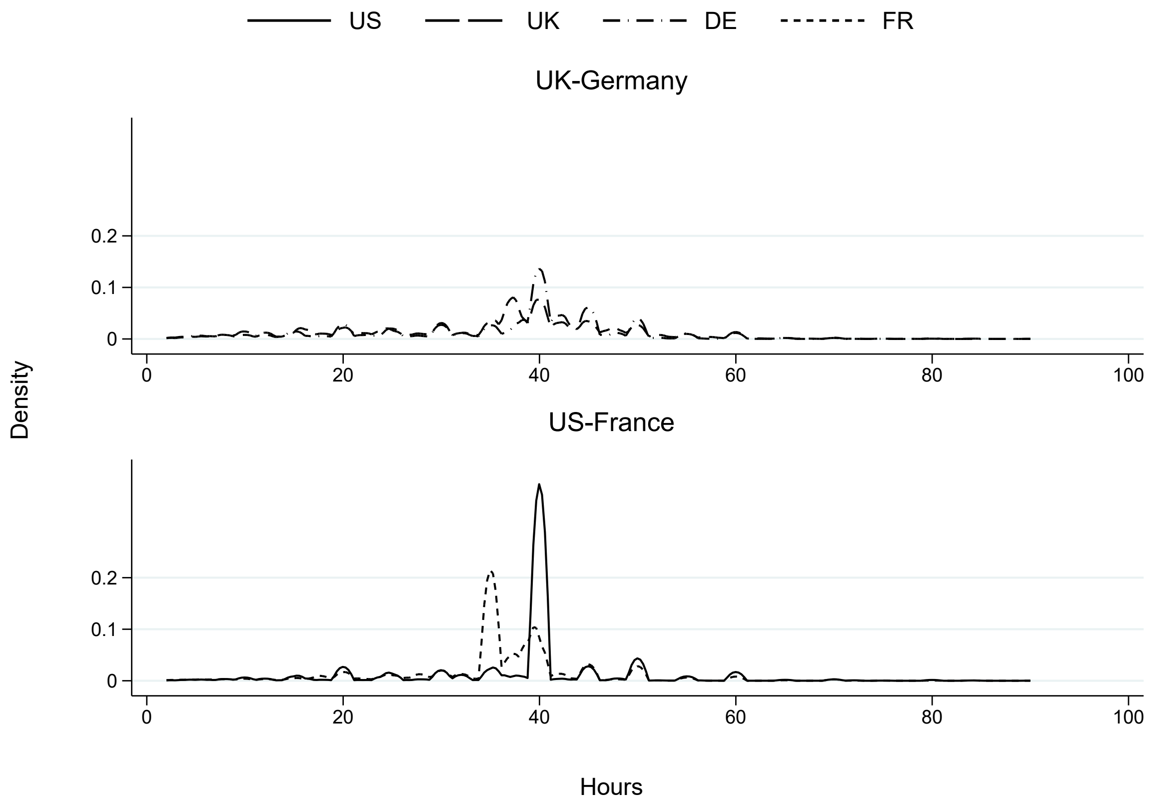


Figure 2: Decomposition of Earnings Inequality

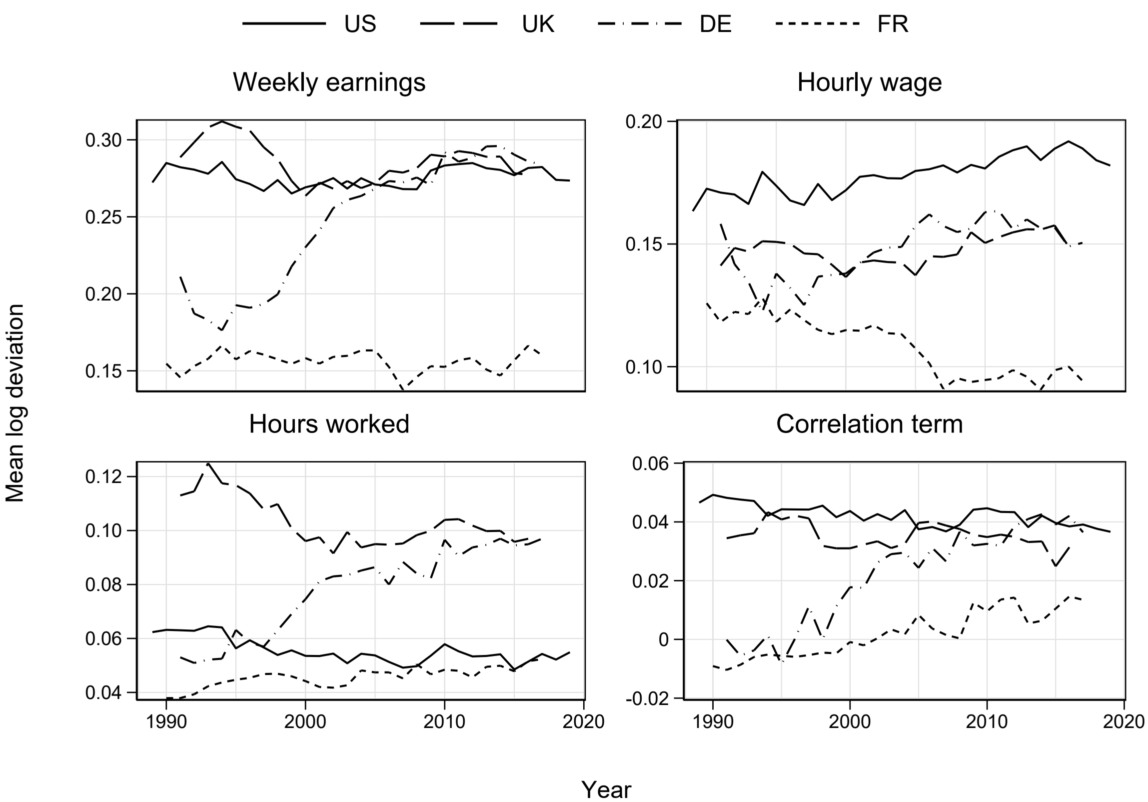
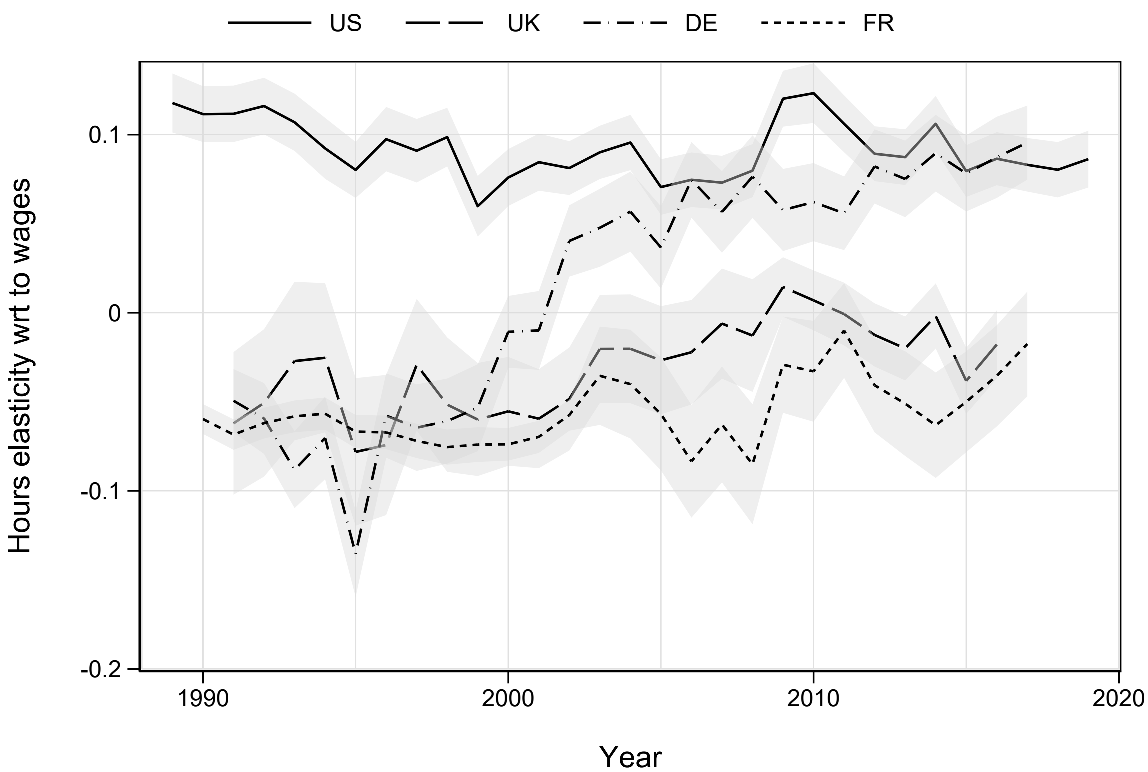


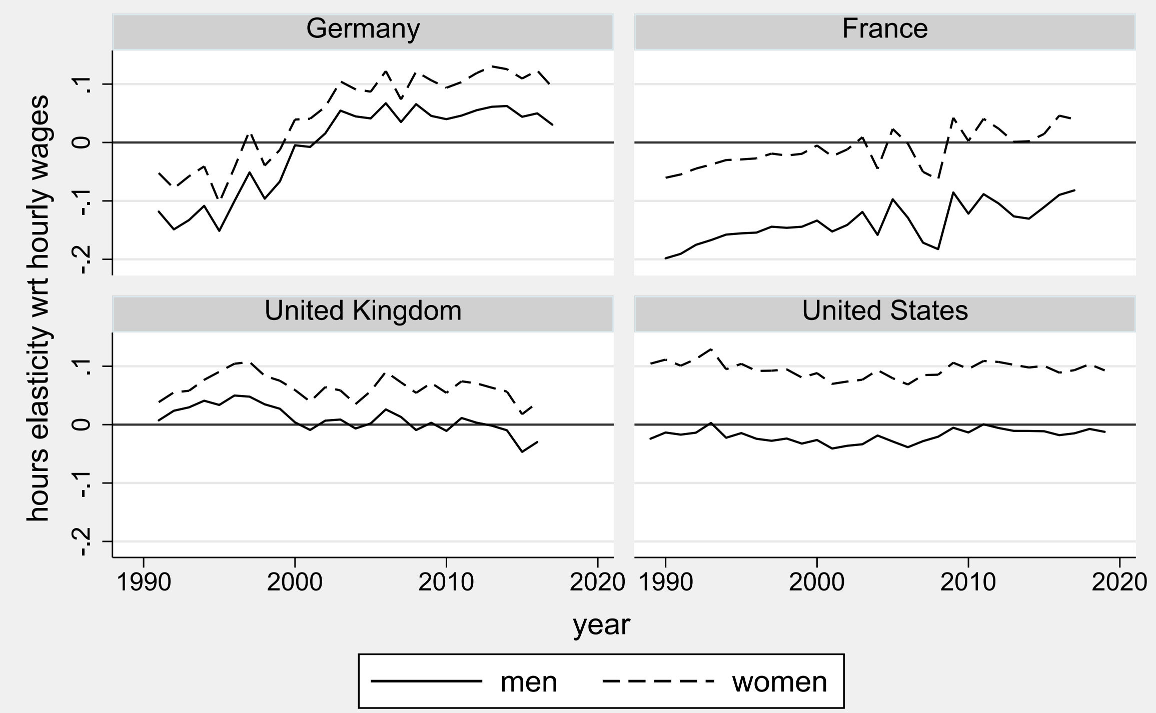
Figure 3: Average Hours Worked by Quintile of the Hourly Wage Distribution

Figure 4: Hours Elasticity w.r.t. Wages (no selection equation - Heckman)



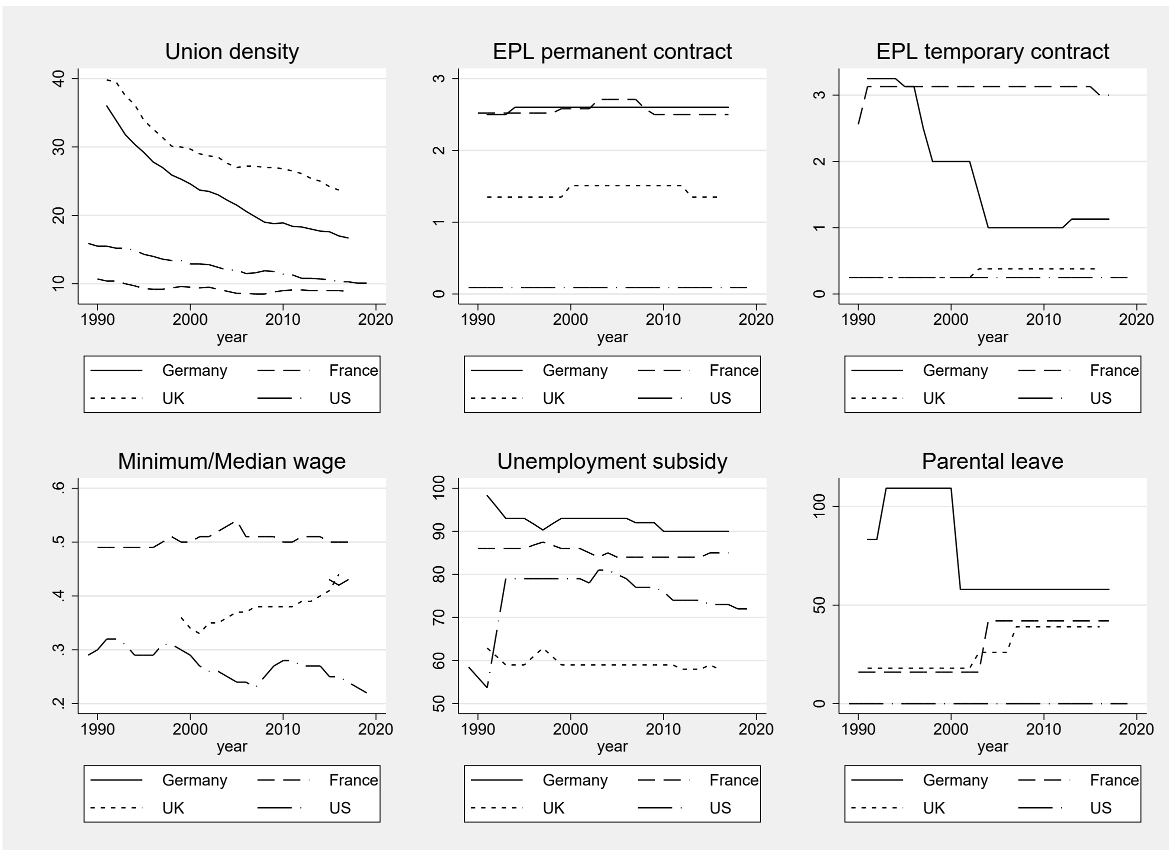
Note: We report the value of the coefficient associated with lnW, but not the one of $lnW \times Female$.

Figure 5: Elasticity of hours with repect to hourly wages



Estimates include controls for age and age², education, foreign born, job skill requirement, sector and country x year dummies - self-selection into employment controlled using household level information (single, number of children, others' incomes)

Figure 6: LMI



Union density
EPL permanent contract
EPL temporary contract
Minimum/Median wage
Unemployment subsidy
Parental leave
year
Germany
France
UK
US

Figure 7: Demand

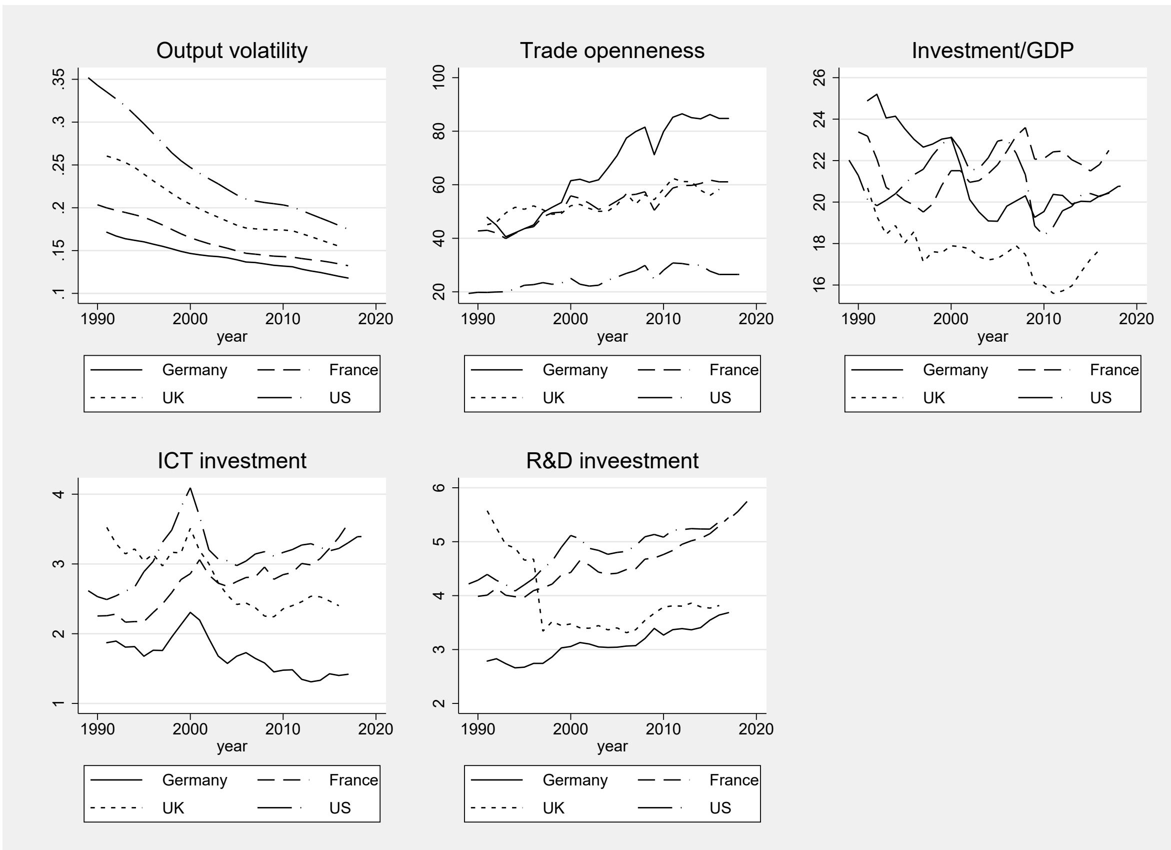


Figure 8: Simulated elasticity

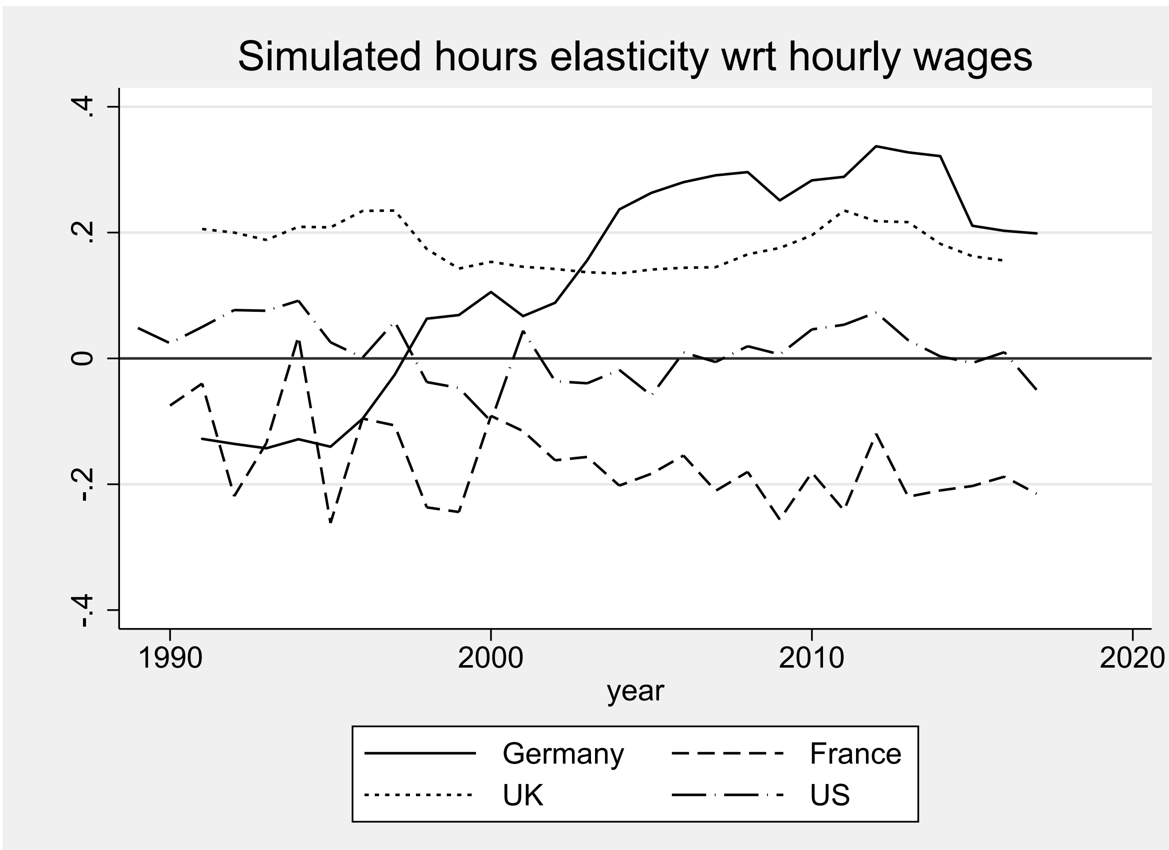


Figure 9: Simulated elasticity

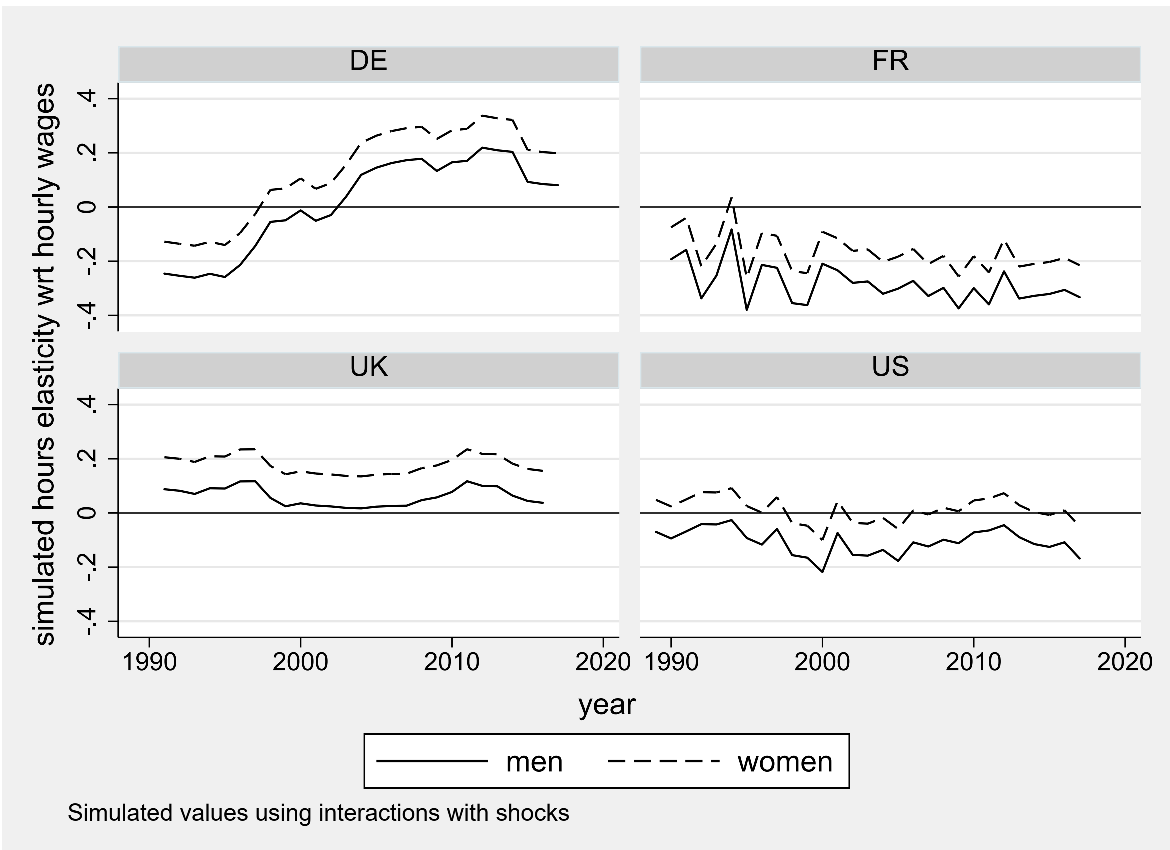


Figure 10: Simulated elasticity

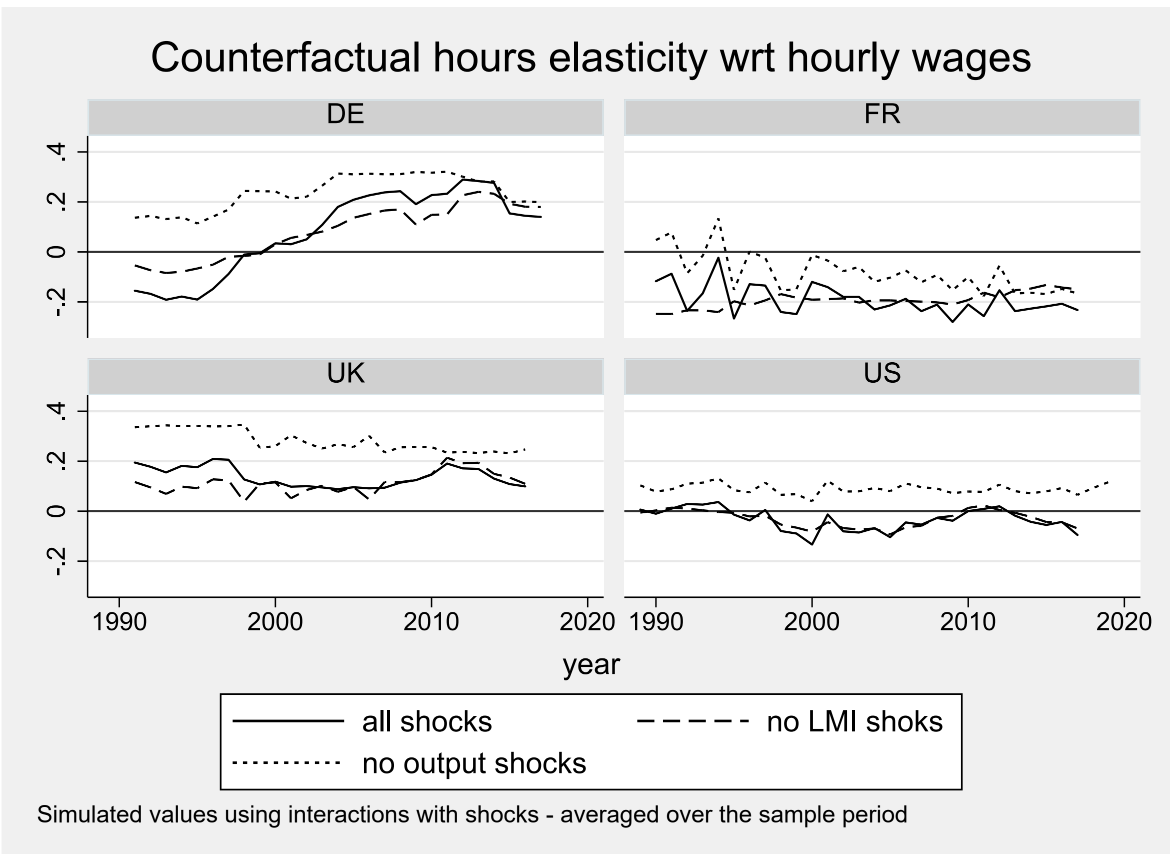


Figure 11: Simulated elasticity

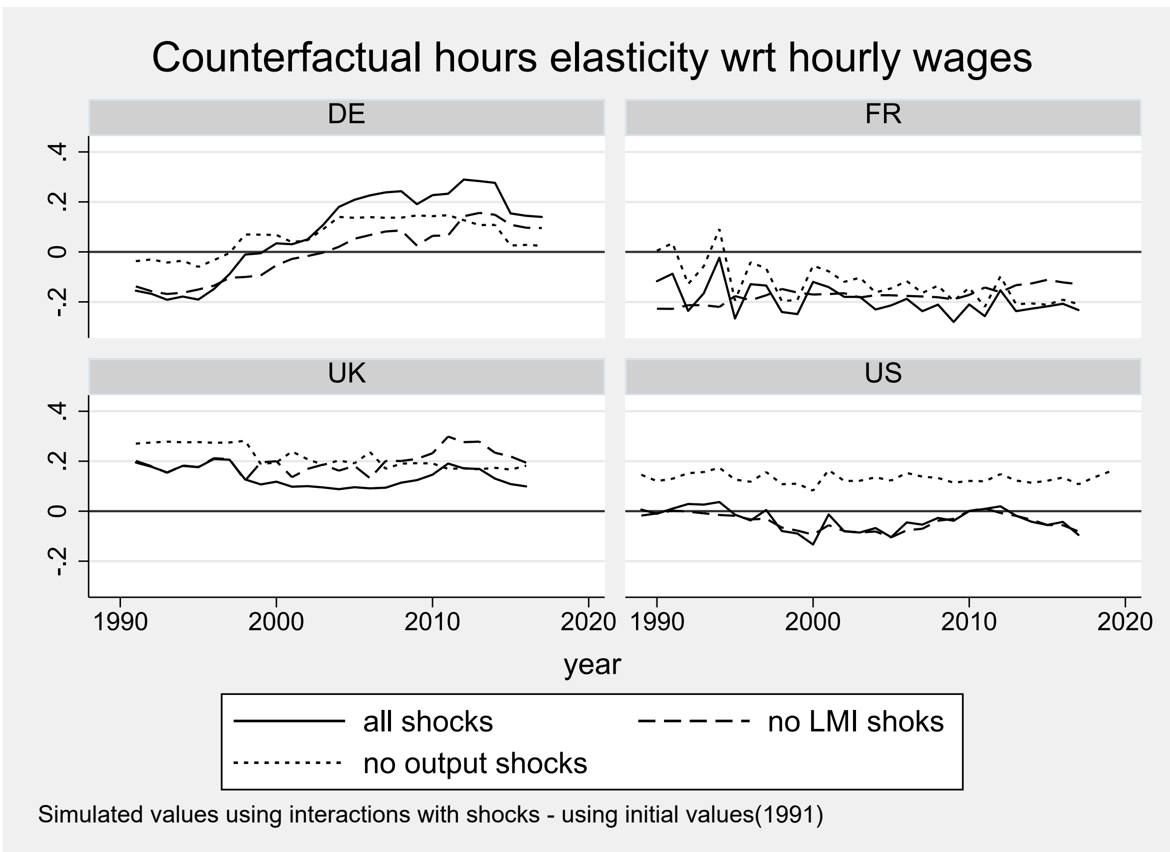


Table 1: Decomposition of Earnings Inequality

Country	Year	MLD_Y	MLD_W	MLD_H	CorrTerm	Rel_W	Rel_H	Rel_Corr
US	1995	0.274	0.174	0.056	0.044	0.633	0.205	0.161
	2002	0.275	0.178	0.054	0.043	0.647	0.198	0.155
	2009	0.280	0.182	0.054	0.044	0.651	0.191	0.158
	2016	0.282	0.192	0.051	0.038	0.681	0.182	0.137
UK	1995	0.309	0.151	0.117	0.041	0.489	0.379	0.132
	2002	0.268	0.143	0.092	0.033	0.534	0.341	0.125
	2009	0.290	0.155	0.100	0.036	0.533	0.344	0.123
	2016	0.277	0.149	0.097	0.031	0.537	0.350	0.113
DE	1995	0.193	0.138	0.063	-0.009	0.716	0.328	-0.044
	2002	0.256	0.147	0.083	0.026	0.573	0.325	0.102
	2009	0.271	0.156	0.082	0.032	0.578	0.304	0.118
	2016	0.286	0.149	0.095	0.042	0.521	0.332	0.147
FR	1995	0.157	0.118	0.045	-0.006	0.751	0.284	-0.035
	2002	0.159	0.117	0.042	0.000	0.735	0.263	0.002
	2009	0.153	0.094	0.047	0.013	0.613	0.306	0.082
	2016	0.166	0.100	0.052	0.015	0.602	0.310	0.088

Table 2: Linear probability model for employment - self-employed excluded

	(1) All	(2) Men	(3) Women
Female	-0.135***		
	(0.00437)		
Age	0.0388***	0.0282***	0.0498***
	(0.00158)	(0.00151)	(0.00218)
AgeSq	-0.000486***	-0.000363***	-0.000631***
	(0.0000194)	(0.0000181)	(0.0000277)
Foreign born	-0.0709***	-0.0342***	-0.108***
	(0.00626)	(0.00834)	(0.00536)
Medium Educ.	0.113***	0.0860***	0.127***
	(0.00396)	(0.00361)	(0.00484)
High Educ.	0.183***	0.142***	0.204***
	(0.00476)	(0.00446)	(0.00597)
Household income (excluding respondent)	0.0138***	0.0164***	0.0141***
	(0.000563)	(0.000514)	(0.000562)
Presence of self-employed in the household	0.0379***	0.0392***	0.0517***
	(0.00453)	(0.00507)	(0.00495)
Single	0.0403***	0.0297***	0.0976***
	(0.00368)	(0.00482)	(0.00467)
Number of children	-0.0330***	0.0180***	-0.0760***
	(0.00172)	(0.00194)	(0.00291)
Adjusted R^2	0.085	0.063	0.099
Observations	1831494	830806	1000688

Notes: The dependent variable is whether or not the individual is employed. All regressions include country-year fixed effects. Standard errors clustered by country/year in parentheses. Notation for statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Elasticity of hours worked: Individual determinants

	(1) No Mills	(2) Mills	(3) Mills by Sex	(4) Mills	(5) Mills
Hourly wage	0.0225***	0.00858	0.00548	0.00419	-0.0311***
	(0.00603)	(0.00665)	(0.00692)	(0.00654)	(0.00739)
Female	-0.524***	-0.481***	-0.423***	-0.492***	-0.437***
	(0.0366)	(0.0344)	(0.0357)	(0.0336)	(0.0324)
Hourly wage x Female	0.119***	0.116***	0.0987***	0.116***	0.0987***
	(0.0129)	(0.0126)	(0.0132)	(0.0126)	(0.0120)
Mills ratio		-0.678***		-0.508***	-0.478***
		(0.0557)		(0.0708)	(0.0660)
Mills ratio by sex			-1.072***		
			(0.0659)		
Medium Educ.				0.0159***	0.00730**
				(0.00353)	(0.00366)
High Educ.				0.0291***	0.00704
				(0.00617)	(0.00615)
Low skill - Capital int.					-0.0970***
					(0.00745)
Low skill - Labour int.					-0.122***
					(0.00934)
Medium skill - Agr. manufacturing					0.0393***
					(0.00654)
Medium skill - Capital int. services					0.00740
					(0.00517)
Medium skill - Labour					0.00595
					(0.00511)
High skill - Agr. manufacturing					0.103***
					(0.00644)
High skill - Capital int. services					0.0382***
					(0.00656)
High skill - Labour int. services					0.0816***
					(0.00651)
Public sector					-0.0149***
					(0.00313)
Adjusted R^2	0.146	0.150	0.162	0.151	0.175
Observations	1339479	1339479	1339479	1339479	1316238

Notes: The dependent variable are hours worked. All regressions include country-year fixed effects. Coefficient on age, age squared and foreing born not reported. Standard errors clustered by country/year in

Table 4: Elasticity of hours worked: Individual and country-level determinants I

	(1) Basic	(2) No Kaitz index	(3) Including jobs	(4) Only significant	(5) Counrtyxyear dummie
Union density	0.00561***	0.00321**	0.00224	0.00494***	0.0131***
	(0.00149)	(0.00148)	(0.00138)	(0.00130)	(0.00117)
Union den.xWage	-0.00135**	0.000172	-0.000464	-0.00112**	-0.00148***
	(0.000554)	(0.000579)	(0.000504)	(0.000434)	(0.000418)
EPL Permanent	-0.0625*	-0.0777**	-0.0503	-0.0594***	-0.324***
	(0.0344)	(0.0366)	(0.0323)	(0.0192)	(0.0135)
EPL Per.xWage	0.00163	0.0103	-0.00665		
	(0.0140)	(0.0160)	(0.0134)		
EPL Temporary	0.0980***	0.120***	0.0952***	0.0959***	1.152***
	(0.0211)	(0.0227)	(0.0199)	(0.00822)	(0.0620)
EPL Tem.xWage	-0.0496***	-0.0633***	-0.0453***	-0.0486***	-0.0469***
	(0.00858)	(0.00915)	(0.00817)	(0.00264)	(0.00287)
Minimum wage	0.194***		0.175***	0.189***	0.607***
	(0.0456)		(0.0408)	(0.0433)	(0.0676)
Min.wagexWage	-0.0958***		-0.0892***	-0.0936***	-0.108***
	(0.0192)		(0.0173)	(0.0178)	(0.0203)
Unemp. Benefit	-0.00342***	-0.00586***	-0.00335***	-0.00324***	-0.0116***
	(0.000867)	(0.00105)	(0.000850)	(0.000817)	(0.000943)
Un.Ben.xWage	0.000903**	0.00189***	0.00107***	0.000852**	0.000670*
	(0.000358)	(0.000429)	(0.000358)	(0.000339)	(0.000351)
Parental leave	-0.00121**	-0.00152***	-0.000349	-0.00105**	-0.00121***
	(0.000534)	(0.000577)	(0.000525)	(0.000491)	(0.000445)
Par.Leav.xWage	0.000535***	0.000644***	0.000231	0.000477**	0.000469**
	(0.000204)	(0.000228)	(0.000198)	(0.000188)	(0.000189)
Adjusted R^2	0.158	0.158	0.183	0.158	0.158
Observations	1323746	1323746	1300505	1323746	1323746

Notes: The dependent variable are hours worked. All regressions include individual determinants (age, foreign born, level of education) and country and year fixed effects. Standard errors clustered by country/year in parentheses. Notation for statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Elasticity of hours worked: Individual and country-level determinants II

	(1) Basic	(2) No Kaitz index	(3) Including jobs	(4) Only significant	(5) Counrtyxyear dummie
Union density	0.00561***	0.00321**	0.00224	0.00494***	0.0131***
	(0.00149)	(0.00148)	(0.00138)	(0.00130)	(0.00117)
Union den.xWage	-0.00135**	0.000172	-0.000464	-0.00112**	-0.00148***
	(0.000554)	(0.000579)	(0.000504)	(0.000434)	(0.000418)
EPL Permanent	-0.0625*	-0.0777**	-0.0503	-0.0594***	-0.324***
	(0.0344)	(0.0366)	(0.0323)	(0.0192)	(0.0135)
EPL Per.xWage	0.00163	0.0103	-0.00665		
	(0.0140)	(0.0160)	(0.0134)		
EPL Temporary	0.0980***	0.120***	0.0952***	0.0959***	1.152***
	(0.0211)	(0.0227)	(0.0199)	(0.00822)	(0.0620)
EPL Tem.xWage	-0.0496***	-0.0633***	-0.0453***	-0.0486***	-0.0469***
	(0.00858)	(0.00915)	(0.00817)	(0.00264)	(0.00287)
Minimum wage	0.194***		0.175***	0.189***	0.607***
	(0.0456)		(0.0408)	(0.0433)	(0.0676)
Min.wagexWage	-0.0958***		-0.0892***	-0.0936***	-0.108***
	(0.0192)		(0.0173)	(0.0178)	(0.0203)
Unemp. Benefit	-0.00342***	-0.00586***	-0.00335***	-0.00324***	-0.0116***
	(0.000867)	(0.00105)	(0.000850)	(0.000817)	(0.000943)
Un.Ben.xWage	0.000903**	0.00189***	0.00107***	0.000852**	0.000670*
	(0.000358)	(0.000429)	(0.000358)	(0.000339)	(0.000351)
Parental leave	-0.00121**	-0.00152***	-0.000349	-0.00105**	-0.00121***
	(0.000534)	(0.000577)	(0.000525)	(0.000491)	(0.000445)
Par.Leav.xWage	0.000535***	0.000644***	0.000231	0.000477**	0.000469**
	(0.000204)	(0.000228)	(0.000198)	(0.000188)	(0.000189)
Adjusted R^2	0.158	0.158	0.183	0.158	0.158
Observations	1323746	1323746	1300505	1323746	1323746

Notes: The dependent variable are hours worked. All regressions include individual determinants (age, foreign born, level of education) and country and year fixed effects. Standard errors clustered by country/year in parentheses. Notation for statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Counterfactual Earnings Inequality, changing Institutions - OLD

	Actual I_y		**Counterfactual I_y**					
			EPL		Maternity leave		Union density	
Country	Year	Level	Level	% Change	Level	% Change	Level	% Change
US	1989-1991	0.177	0.176	-0.137	0.176	-0.471	0.176	-0.250
	1992-1994	0.189	0.189	-0.609	0.188	-0.855	0.189	-0.649
	1995-1997	0.221	0.220	-0.489	0.220	-0.559	0.219	-0.727
	1998-2000	0.223	0.223	-0.089	0.223	-0.159	0.222	-0.602
	2001-2003	0.233	0.233	0.086	0.233	-0.084	0.231	-0.788
	2004-2006	0.228	0.227	-0.623	0.227	-0.563	0.226	-1.199
	2007-2009	0.235	0.237	1.163	0.238	1.348	0.234	-0.306
	2010-2012	0.247	0.248	0.714	0.249	1.123	0.246	-0.356
UK	1989-1991	0.255	0.260	2.172	0.260	2.268	0.258	1.238
	1992-1994	0.260	0.261	0.503	0.261	0.510	0.259	-0.388
	1995-1997	0.252	0.251	-0.321	0.252	-0.099	0.249	-1.355
	1998-2000	0.233	0.233	-0.139	0.233	-0.054	0.230	-1.344
	2001-2003	0.230	0.229	-0.727	0.229	-0.658	0.226	-2.034
	2004-2006	0.223	0.220	-1.368	0.221	-1.253	0.217	-2.648
	2007-2009	0.228	0.226	-1.185	0.226	-0.878	0.222	-2.987
	2010-2012	0.255	0.254	-0.165	0.256	0.575	0.249	-2.228
DE	1989-1991	0.179	0.178	-0.653	0.179	-0.327	0.181	1.197
	1992-1994	0.174	0.173	-0.689	0.173	-0.635	0.176	0.978
	1995-1997	0.151	0.150	-0.539	0.151	0.118	0.153	1.147
	1998-2000	0.170	0.166	-2.174	0.168	-1.175	0.168	-0.820
	2001-2003	0.197	0.189	-3.946	0.191	-2.800	0.190	-3.157
	2004-2006	0.211	0.200	-5.261	0.203	-3.751	0.202	-4.230
	2007-2009	0.238	0.228	-4.323	0.232	-2.663	0.229	-3.634
	2010-2012	0.237	0.227	-4.414	0.231	-2.800	0.228	-3.654
FR	1989-1991	0.112	0.116	2.851	0.115	2.772	0.116	3.321
	1992-1994	0.129	0.130	0.870	0.130	0.697	0.130	0.917
	1995-1997	0.129	0.130	1.120	0.130	1.551	0.130	1.148
	1998-2000	0.134	0.135	1.202	0.136	1.896	0.136	1.474
	2001-2003	0.138	0.140	1.652	0.141	2.430	0.140	1.470
	2004-2006	0.142	0.145	1.999	0.146	2.755	0.145	2.002
	2007-2009	0.125	0.128	2.358	0.129	3.055	0.127	1.937
	2010-2012	0.132	0.133	0.883	0.134	1.623	0.132	0.388

Note: values have been computed for each year and the averaged over a period of three years.

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Appendices

A Data Appendix

A.1 Individual-level Data

This appendix provides information on the individual level data as well as the classification of industries and occupations.

Table A.1: Summary statistics for the main variables

		Y		W		H		
Year	Country	Mean	SD	Mean	SD	Mean	SD	N
1995	US	494.86	371.38	12.33	8.03	38.38	10.81	13,476
	UK	253.13	190.54	6.53	3.99	37.24	14.46	4,556
	DE	405.54	225.70	10.50	5.90	39.22	10.74	6,813
	FR	304.90	187.20	8.31	4.86	36.91	9.17	55,891
2002	US	648.80	496.78	16.14	10.69	38.43	10.53	14,299
	UK	331.53	241.18	8.74	5.35	36.89	13.10	8,186
	DE	547.64	396.69	13.91	8.15	38.18	12.26	10,876
	FR	347.68	221.55	9.92	5.74	35.05	8.61	56,892
2009	US	792.34	589.84	19.82	12.93	38.20	10.59	12,804
	UK	420.99	316.80	11.39	7.01	35.65	13.42	22,618
	DE	568.77	417.85	14.54	8.56	37.72	12.68	9,016
	FR	403.93	249.14	10.93	5.53	36.47	9.56	8,229
2016	US	913.37	677.94	22.78	15.24	38.60	10.41	12,588
	UK	481.81	347.06	13.07	7.91	35.91	13.14	18,170
	DE	599.09	457.39	16.08	9.52	35.60	12.71	12,658
	FR	442.79	285.00	12.24	6.66	35.75	9.62	8,041

Table A.2: Classification of occupations

Classification	Goos et al. (2009) ref.year=1993
8 top-paying occupations	
	corp. managers
	eng. profess.
	life science profess.
	other profess.
	small ent. managers
	eng. associate profess.
	other associate profess.
	life sc. ass. profess.
9 middling-paying occupations	
	drivers plant oper.
	stat. plant oper.
	metal and trade workers
	precision trade workers
	office clerks
	customer service clerks
	extraction workers
	machine operators
	other craft workers
4 bottom-paying occupations	
	personal services
	constr. transports
	models, demonstrators
	sales and elementary occ.

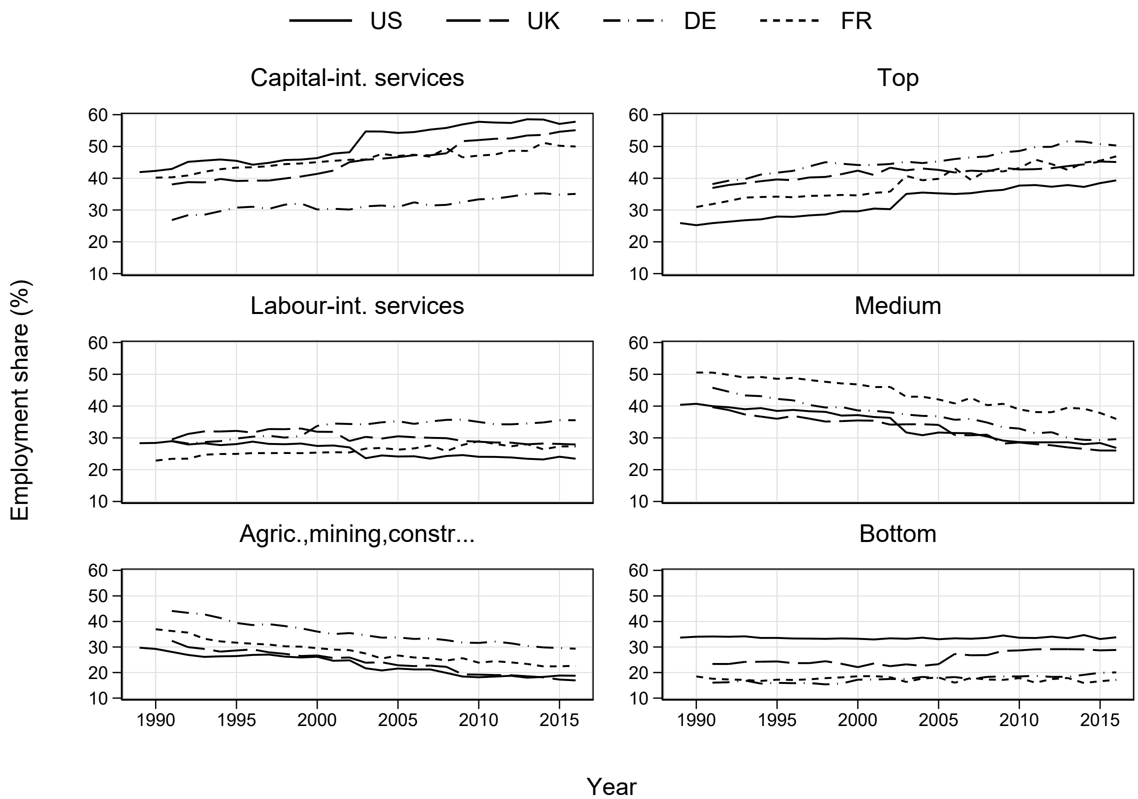
Note: occupations are classified referring to the two digit-level international standard classification of occupations (ISCO) variable.

Table A.3: Classification of industries

Our classification	Autor and Salomons (2017)
Agriculture, mining, construction and manufacturing	(1) agriculture, mining, construction: industries C, E, F (2) manufacturing: industries 15 to 37
Capital-intensive services	(3) education and health services: industries M to N (4) capital-intensive (high-tech) services: industries 64, J, and 71 to 74
Labour-intensive services	(5) labour-intensive (low-tech) services industries 50 to 52, H, 60 to 63, 70 and O

Note: industries are classified referring to the two digit-level standard industry classification (SIC) variable. The distinction between high- and low-tech services is obtained from the OECD.

Figure A.1: Employment Shares by Industry and Occupation



Note: employment is measured as number of workers. Employment share = employed + self-employed.

A.2 Country-level data

The variables that we use as proxy of the supply side of the labour market are:

- EPL temporary contracts: employment protection indicator for temporary contracts
- Union density: union density indicator obtained from administrative data for France, Germany and the UK, and from survey data for US Website
- Weeks of paid leave: concerns parental leave Website
- The Kaitz index: ratio of the nominal legal minimum wage to median wage adjusted for the industry-level coverage

The indicators of the demand side of the labour market that we focus on are:

- Output volatility: information on output variability, it corresponds to the coefficient of variation computed over a 5-year moving average centered on the relevant year. Website
- Openness: information on trade openness covering the period 1995-2011. It is computed as export+import/GDP[28] Website
- ICT: information and communication technologies

All variables vary at the country×year level.

[28] They were backward and forward imputed using the rates of change of analogous measures obtained from another Dataset: Bilateral Trade in Goods by Industry and End-use (BTDIxE), ISIC Rev.4, which contains import and export by sector (in US dollars).

Table A.4: Summary statistics for aggregate variables

Country	Variable	Mean	SD	Max	Min	N
US						
	Mean age	36.04	1.46	38.69	34.07	31
	Mean high education share	58.53	5.37	66.80	47.53	31
	Union density	12.55	1.81	15.90	10.10	31
	EPL permanent	0.09	0.00	0.09	0.09	31
	EPL temporary	0.25	0.00	0.25	0.25	31
	Kaitz index	0.27	0.03	0.32	0.22	31
	Unemployment benefit	74.54	6.98	81.00	53.70	31
	Length parental leave	0.00	0.00	0.00	0.00	31
	Trade openess	24.83	3.50	30.79	19.42	31
	Import	13.76	2.38	17.40	10.13	28
	Investment	21.02	1.29	23.14	18.38	31
	ICT equipment	3.14	0.37	4.09	2.49	31
	Investment in intellectual property	4.86	0.45	5.75	4.09	31
	Output volatility	0.24	0.05	0.35	0.18	29
UK						
	Mean age	47.58	1.16	49.45	45.50	26
	Mean high education share	30.27	9.54	46.16	18.02	26
	Union density	29.52	4.52	39.80	23.70	26
	EPL permanent	1.43	0.08	1.51	1.35	26
	EPL temporary	0.32	0.07	0.38	0.25	26
	Kaitz index	0.38	0.03	0.44	0.33	18
	Unemployment benefit	59.38	1.31	62.90	58.00	26
	Length parental leave	27.31	9.83	39.00	18.00	26
	Trade openess	53.40	4.57	62.38	45.07	26
	Import	27.37	2.45	31.67	22.73	26
	Investment	17.51	1.15	20.68	15.60	26
	ICT equipment	2.79	0.41	3.52	2.24	26
	Investment in intellectual property	3.90	0.66	5.57	3.31	26
	Output volatility	0.20	0.03	0.26	0.16	26
DE						
	Mean age	49.05	1.32	51.03	46.76	27
	Mean high education share	25.30	2.40	29.09	19.73	27
	Union density	23.21	5.49	36.00	16.70	27
	EPL permanent	2.59	0.03	2.60	2.50	27
	EPL temporary	1.77	0.89	3.25	1.00	27
	Kaitz index	0.43	0.01	0.43	0.42	3
	Unemployment benefit	92.10	1.95	98.30	90.00	27
	Length parental leave	75.07	23.58	109.30	58.00	27
	Trade openess	66.27	16.49	86.51	40.58	27
	Import	31.04	6.92	40.21	20.26	26
	Investment	21.35	1.94	25.20	19.08	27
	ICT equipment	1.69	0.27	2.31	1.31	27
	Investment in intellectual property	3.11	0.30	3.68	2.66	27
	Output volatility	0.14	0.02	0.17	0.12	27
FR						
	Mean age	45.09	2.80	47.74	38.65	28
	Mean high education share	28.34	7.48	40.99	16.33	28
	Union density	9.27	0.56	10.70	8.50	28
	EPL permanent	2.56	0.08	2.71	2.50	28
	EPL temporary	3.10	0.11	3.13	2.56	28
	Kaitz index	0.50	0.01	0.54	0.49	28
	Unemployment benefit	85.15	1.09	87.50	84.00	28
	Length parental leave	29.00	13.24	42.00	16.00	28
	Trade openess	52.26	6.87	61.75	39.91	28
	Import	25.76	3.83	31.16	19.11	27
	Investment	21.65	1.09	23.60	19.52	28
	ICT equipment	2.74	0.37	3.58	2.17	28
	Investment in intellectual property	4.52	0.42	5.45	3.97	28
	Output volatility	0.16	0.02	0.20	0.13	28

Figure A.2: Trends in labour market institutions

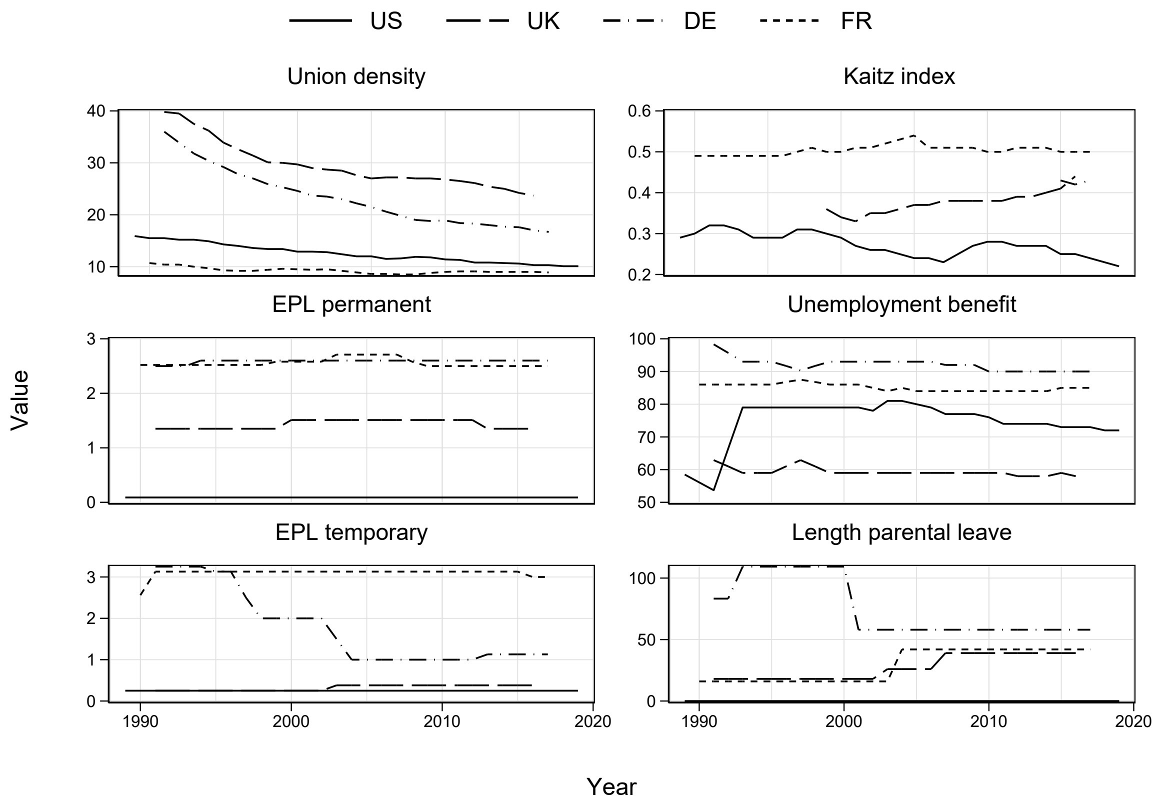
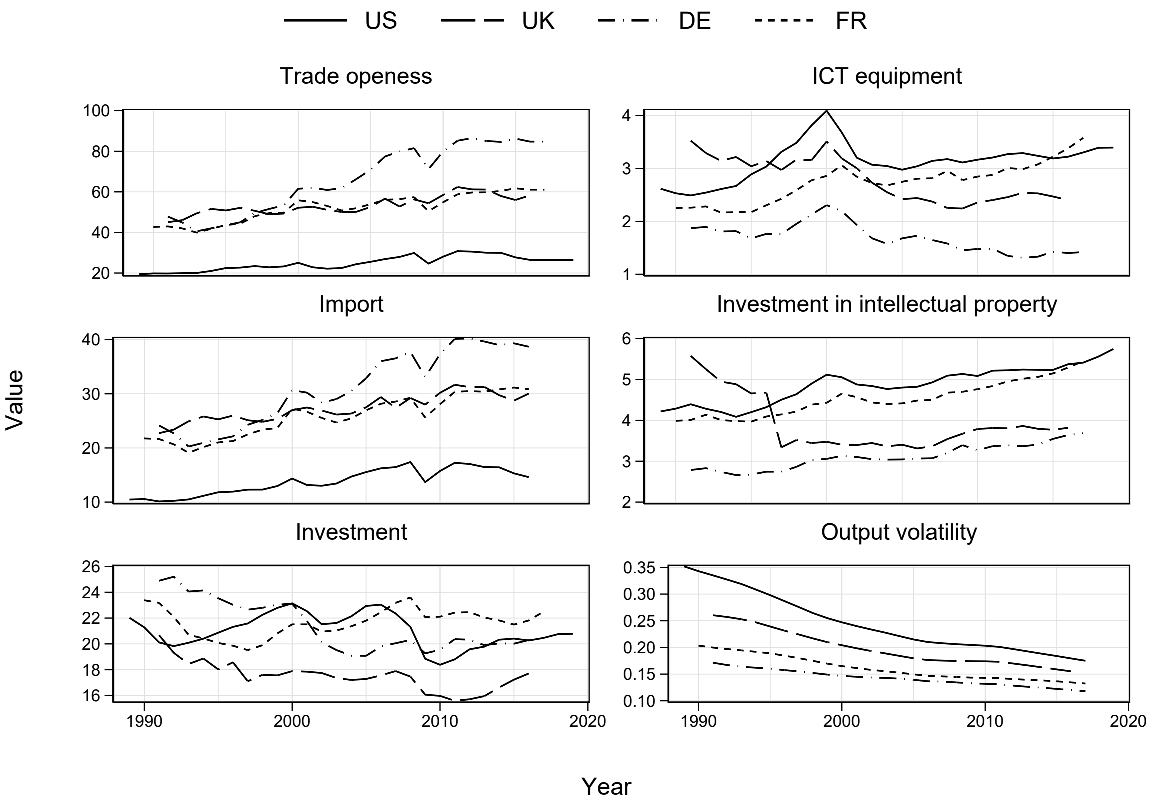


Figure A.3: Trends in macroeconomic variables



B Additional results

This appendix provides additional results mentioned in the text.

Figure B.1: Distribution of hours worked by country, years 1995-1999

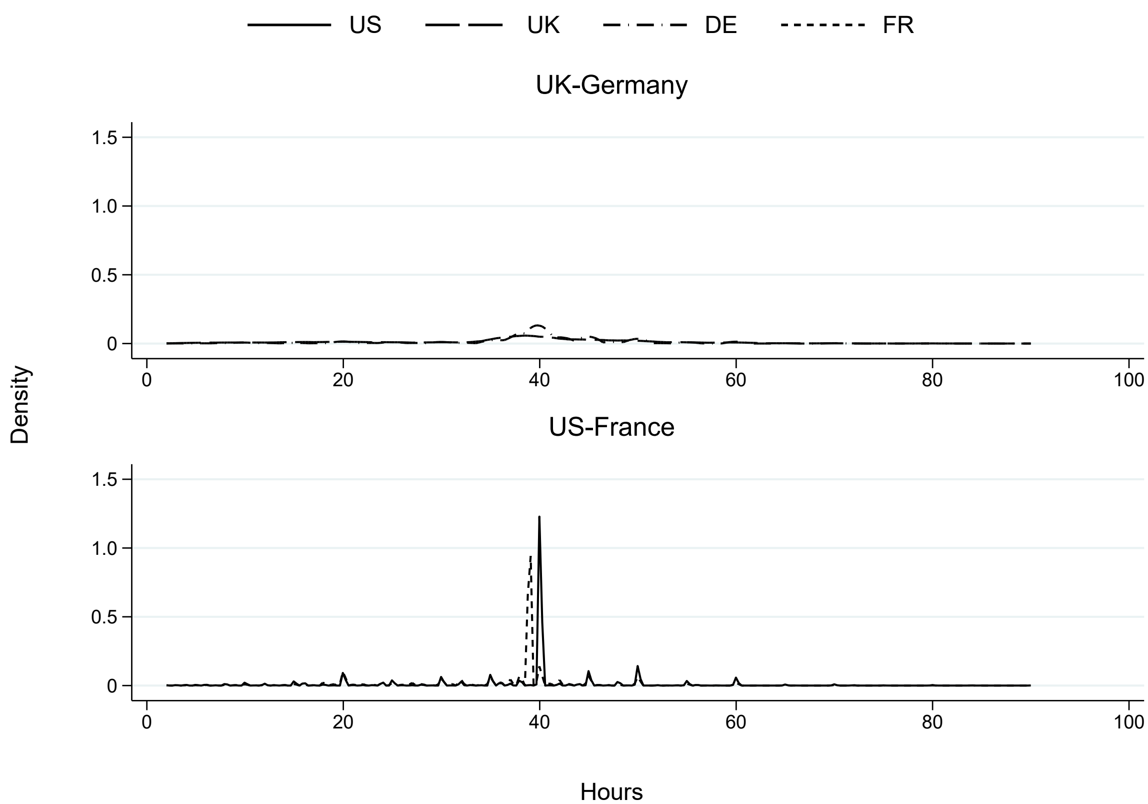


Table B.1: Decomposition of earnings inequality - US

Country	Year	MLD_Y	MLD_W	MLD_H	CorrTerm	Rel_W	Rel_H	Rel_Corr
US	1991	0.282	0.171	0.063	0.048	0.606	0.223	0.171
US	1992	0.281	0.170	0.063	0.048	0.606	0.224	0.170
US	1993	0.278	0.166	0.065	0.047	0.598	0.232	0.170
US	1994	0.286	0.179	0.064	0.042	0.628	0.224	0.147
US	1995	0.274	0.174	0.056	0.044	0.633	0.205	0.161
US	1996	0.271	0.168	0.059	0.044	0.618	0.219	0.163
US	1997	0.267	0.166	0.057	0.044	0.622	0.212	0.166
US	1998	0.274	0.174	0.054	0.046	0.637	0.197	0.166
US	1999	0.265	0.168	0.056	0.042	0.633	0.210	0.157
US	2000	0.269	0.172	0.054	0.044	0.639	0.199	0.162
US	2001	0.271	0.177	0.053	0.040	0.654	0.197	0.149
US	2002	0.275	0.178	0.054	0.043	0.647	0.198	0.155
US	2003	0.268	0.177	0.051	0.041	0.659	0.189	0.152
US	2004	0.275	0.177	0.054	0.044	0.642	0.198	0.160
US	2005	0.271	0.180	0.054	0.037	0.663	0.198	0.138
US	2006	0.270	0.180	0.051	0.038	0.668	0.190	0.142
US	2007	0.268	0.182	0.049	0.037	0.679	0.184	0.137
US	2008	0.268	0.179	0.050	0.039	0.669	0.186	0.146
US	2009	0.280	0.182	0.054	0.044	0.651	0.191	0.158
US	2010	0.283	0.181	0.058	0.045	0.638	0.204	0.158
US	2011	0.284	0.186	0.055	0.043	0.653	0.194	0.153
US	2012	0.285	0.188	0.053	0.043	0.661	0.187	0.152
US	2013	0.282	0.190	0.054	0.038	0.674	0.190	0.136
US	2014	0.280	0.184	0.054	0.042	0.657	0.193	0.150
US	2015	0.277	0.189	0.049	0.040	0.682	0.175	0.143
US	2016	0.282	0.192	0.051	0.038	0.681	0.182	0.137
US	2017	0.282	0.189	0.054	0.039	0.669	0.192	0.138
US	2018	0.274	0.184	0.052	0.038	0.672	0.190	0.138
US	2019	0.274	0.182	0.055	0.037	0.665	0.201	0.134

Table B.2: Decomposition of earnings inequality - UK

Country	Year	MLD_Y	MLD_W	MLD_H	CorrTerm	Rel_W	Rel_H	Rel_Corr
UK	1991	0.289	0.141	0.113	0.034	0.489	0.391	0.119
UK	1992	0.298	0.148	0.115	0.035	0.497	0.384	0.119
UK	1993	0.308	0.147	0.125	0.036	0.477	0.406	0.117
UK	1994	0.312	0.151	0.118	0.043	0.484	0.377	0.139
UK	1995	0.309	0.151	0.117	0.041	0.489	0.379	0.132
UK	1996	0.306	0.150	0.114	0.042	0.491	0.372	0.138
UK	1997	0.295	0.146	0.108	0.041	0.495	0.365	0.140
UK	1998	0.287	0.146	0.110	0.032	0.507	0.382	0.111
UK	1999	0.273	0.142	0.101	0.031	0.518	0.369	0.113
UK	2000	0.264	0.137	0.096	0.031	0.518	0.364	0.118
UK	2001	0.272	0.142	0.098	0.032	0.523	0.358	0.119
UK	2002	0.268	0.143	0.092	0.033	0.534	0.341	0.125
UK	2003	0.273	0.143	0.099	0.031	0.522	0.364	0.114
UK	2004	0.269	0.142	0.094	0.033	0.530	0.349	0.121
UK	2005	0.272	0.137	0.095	0.040	0.505	0.349	0.146
UK	2006	0.280	0.145	0.095	0.040	0.518	0.339	0.143
UK	2007	0.279	0.145	0.095	0.039	0.519	0.342	0.139
UK	2008	0.282	0.146	0.098	0.038	0.517	0.349	0.133
UK	2009	0.290	0.155	0.100	0.036	0.533	0.344	0.123
UK	2010	0.289	0.150	0.104	0.035	0.520	0.359	0.120
UK	2011	0.293	0.153	0.104	0.036	0.522	0.356	0.122
UK	2012	0.291	0.155	0.102	0.035	0.531	0.349	0.120
UK	2013	0.289	0.156	0.100	0.033	0.540	0.345	0.115
UK	2014	0.289	0.156	0.100	0.033	0.539	0.345	0.115
UK	2015	0.278	0.158	0.096	0.025	0.566	0.344	0.089
UK	2016	0.277	0.149	0.097	0.031	0.537	0.350	0.113

Table B.3: Decomposition of earnings inequality - Germany

Country	Year	MLD_Y	MLD_W	MLD_H	CorrTerm	Rel_W	Rel_H	Rel_Corr
DE	1991	0.211	0.158	0.053	-0.000	0.749	0.251	-0.000
DE	1992	0.187	0.142	0.051	-0.006	0.758	0.272	-0.030
DE	1993	0.183	0.135	0.052	-0.004	0.735	0.285	-0.020
DE	1994	0.176	0.122	0.053	0.001	0.694	0.298	0.008
DE	1995	0.193	0.138	0.063	-0.009	0.716	0.328	-0.044
DE	1996	0.191	0.132	0.058	0.000	0.692	0.306	0.002
DE	1997	0.193	0.125	0.057	0.011	0.647	0.295	0.058
DE	1998	0.200	0.137	0.063	-0.000	0.685	0.316	-0.000
DE	1999	0.218	0.137	0.069	0.011	0.631	0.317	0.052
DE	2000	0.230	0.138	0.075	0.018	0.599	0.324	0.077
DE	2001	0.241	0.142	0.081	0.018	0.590	0.337	0.073
DE	2002	0.256	0.147	0.083	0.026	0.573	0.325	0.102
DE	2003	0.261	0.149	0.083	0.029	0.569	0.320	0.111
DE	2004	0.264	0.149	0.085	0.030	0.565	0.323	0.112
DE	2005	0.268	0.157	0.086	0.024	0.587	0.322	0.091
DE	2006	0.273	0.162	0.080	0.031	0.593	0.293	0.114
DE	2007	0.272	0.157	0.088	0.027	0.578	0.325	0.098
DE	2008	0.276	0.155	0.084	0.037	0.562	0.305	0.133
DE	2009	0.271	0.156	0.082	0.032	0.578	0.304	0.118
DE	2010	0.292	0.163	0.097	0.033	0.558	0.331	0.111
DE	2011	0.286	0.163	0.091	0.032	0.572	0.317	0.111
DE	2012	0.288	0.156	0.094	0.039	0.541	0.325	0.134
DE	2013	0.296	0.160	0.095	0.041	0.541	0.320	0.139
DE	2014	0.296	0.156	0.097	0.043	0.528	0.328	0.144
DE	2015	0.290	0.157	0.094	0.039	0.540	0.325	0.135
DE	2016	0.286	0.149	0.095	0.042	0.521	0.332	0.147
DE	2017	0.284	0.150	0.097	0.036	0.530	0.342	0.128

Table B.4: Decomposition of earnings inequality - France

Country	Year	MLD_Y	MLD_W	MLD_H	CorrTerm	Rel_W	Rel_H	Rel_Corr
FR	1991	0.146	0.118	0.038	-0.010	0.811	0.260	-0.071
FR	1992	0.153	0.122	0.039	-0.009	0.800	0.257	-0.057
FR	1993	0.158	0.121	0.042	-0.006	0.770	0.268	-0.038
FR	1994	0.167	0.128	0.044	-0.005	0.769	0.262	-0.031
FR	1995	0.157	0.118	0.045	-0.006	0.751	0.284	-0.035
FR	1996	0.163	0.123	0.045	-0.006	0.758	0.279	-0.037
FR	1997	0.160	0.119	0.047	-0.005	0.741	0.292	-0.033
FR	1998	0.157	0.115	0.047	-0.005	0.731	0.298	-0.029
FR	1999	0.155	0.113	0.046	-0.005	0.733	0.298	-0.031
FR	2000	0.158	0.115	0.044	-0.001	0.726	0.279	-0.006
FR	2001	0.155	0.115	0.042	-0.002	0.741	0.272	-0.013
FR	2002	0.159	0.117	0.042	0.000	0.735	0.263	0.002
FR	2003	0.160	0.114	0.043	0.003	0.712	0.267	0.021
FR	2004	0.163	0.113	0.048	0.002	0.694	0.295	0.011
FR	2005	0.163	0.107	0.047	0.008	0.658	0.291	0.051
FR	2006	0.153	0.101	0.047	0.004	0.665	0.311	0.024
FR	2007	0.138	0.091	0.045	0.002	0.661	0.328	0.011
FR	2008	0.146	0.095	0.050	0.000	0.652	0.345	0.002
FR	2009	0.153	0.094	0.047	0.013	0.613	0.306	0.082
FR	2010	0.153	0.095	0.048	0.010	0.620	0.317	0.063
FR	2011	0.157	0.095	0.048	0.014	0.607	0.306	0.087
FR	2012	0.158	0.099	0.046	0.014	0.622	0.288	0.090
FR	2013	0.151	0.096	0.050	0.005	0.636	0.328	0.036
FR	2014	0.147	0.091	0.050	0.006	0.617	0.340	0.043
FR	2015	0.157	0.099	0.048	0.010	0.628	0.305	0.067
FR	2016	0.166	0.100	0.052	0.015	0.602	0.310	0.088
FR	2017	0.160	0.094	0.052	0.013	0.589	0.327	0.084