

# Wage inequality in Europe

The institutional and economic  
factors supporting workers

Wouter Zwysen

Working Paper 2024.05

etui.





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european trade union institute

**Wouter Zwysen** is a senior researcher at the European Trade Union Institute (ETUI) in Brussels, Belgium. [wzwysen@etui.org](mailto:wzwysen@etui.org)

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## **Abstract**

Much of the literature on wage inequality describes increases in wage inequality over time driven by seemingly unstoppable forces of technological change and globalisation, widening the gaps between workers and disadvantaging the lower paid. At the same time institutional protection has continued to decline. It is, however, not as clear that wage inequality is actually on a constant rise everywhere. First, the evidence from Europe is generally more mixed with an overall decline in wage inequality since the early 2000s and substantial variation between countries. Second, even in the United States there has recently been a reversal in the trend of rising wage inequality, likely to have been driven by the greater bargaining power of lower-paid workers.

This paper considers in detail the role played by the institutional as well as the economic factors that shape wage floors and protect workers at the low end of the wage distribution. Using detailed data from EU-SILC from 2007 to 2021, enriched with contextual data, it shows that wage inequality has indeed on average declined across the EU (1). This is primarily due to convergence between countries. In line with expectations, strong institutional support, such as statutory minimum wages with greater bite and a higher collective bargaining coverage rate, are associated with lower inequality and a better position for vulnerable workers (2). Multilevel analysis indicates that, over time, changes in these institutional settings and in the demand for workers – affecting their bargaining power – affect inequality at the country-industry level (3). This paper provides insights into aspects of European labour institutions and labour market factors that affect inequality and shows that wages, particularly at the bottom of the wage distribution, are supported by institutional factors through the state or collective actors, as well as affected by the demand for labour.

# 1. Introduction

Inequality is a key topic in social science and politics in much of the industrialised world, with good reason. There is a clear trend towards greater divergence between those making their income from labour and those making their income from capital, as exemplified by the declining labour share (Theodoropoulou 2019) and widening wealth inequality (Piketty 2014; Pfeffer and Waitkus 2021). In their seminal work, Wilkinson and Pickett (2011) highlight the negative association between inequality and societal welfare. Very recently, the ETUI edited a volume in which the issue of inequality lies at the heart of thinking on how to build a better society, with several prominent scholars making the case that tackling inequality is a first step towards addressing other problems (Arabadjieva et al. 2023). Policy-wise, the issue of inequality at work is seen as central and, in the new Minimum Wage Directive, the EU is aiming to address in-work poverty and low-wage work directly. Inequality is indeed a crucial issue and a problem in our societies.

However, inequality is also a complex issue covering different dimensions and on which policies and institutions already have a substantial impact. First, it is important to specify what type of inequality is meant – for instance, whether in terms of disposable household income or labour income. If the latter, there is a substantial difference whether annual earnings are considered rather than hourly earnings, abstracting from variations in the time spent working. This paper addresses specifically the extent to which hourly wages are unequally distributed; that is, prior to much state intervention and redistribution, and apart from the variation in how much time is spent working. Importantly, the extent to which wage inequality – a main component of pre-distributive income – affects inequality in household income of course depends very strongly on the tax and benefits system and, therefore, on redistribution (Raitano 2016). While these are strongly related (Dreger et al. 2015), the stronger welfare states in Europe clearly achieve a more equal outcome here than weaker regimes (Esping-Andersen 1989; Kranzinger 2020). Crucially though, the more equal the distribution of income from the start, the less effort and policy is needed afterwards.

Much of the literature on wage inequality has been devoted to describing increases in wage inequality over time, driven by seemingly unstoppable powers of technological change and globalisation, widening the gaps between workers and disadvantaging the lower paid (Autor et al. 2003; Michaels et al. 2013; Criscuolo et al. 2020; Zwysen 2021). At the same time, institutional

support for workers, through trade unions and collective agreements, has been declining, resulting generally in worse labour market outcomes (Western and Rosenfeld 2011; Schnabel 2013; Marinescu and Rosenfeld 2022; Tober 2022; Zwysen and Drahokoupil 2022). However, while there is an overall decline in collective bargaining coverage rates and in union density, there is substantial variation between countries in these processes (Müller et al. 2019; Waddington et al. 2023).

We should not lose sight of the extent to which existing policy and institutional factors already can and do make a difference in the extent to which inequality permeates society – particularly regarding wages. This variation becomes much clearer through comparative research.

It is indeed not so clear that wage inequality is actually on a constant rise everywhere. First, evidence from Europe is generally more mixed, with an overall decline in inequality since the early 2000s (Zwysen 2022) alongside substantial variation between countries (Dreger et al. 2015). Particularly in central and eastern Europe there seems to have been a sizeable decline in inequality even in the presence of digitalisation and globalisation (Pintera 2022). In detailed cross-national research on rising inequality, which is primarily driven by widening gaps between firms, there is sizeable country variation which points to the importance of the institutions that affect workers' bargaining power (Tomaskovic-Devey and Avent-Holt 2019; Criscuolo et al. 2020; Zwysen 2022).

Second, variation over time indicates that growing wage inequality is not inevitable. Just as inequality started rising sharply during the 80s and 90s, there is nothing necessary about its continuation. In a recent excellent paper, Aeppli and Wilmers (2022) highlight that, in the United States, a reversal seems to have taken place following the financial crisis which they attribute to a tight labour market providing greater bargaining power to workers.

These variations point particularly to the importance of workers' bargaining power. It is this bargaining power that has been eroded by changes in technology, globalisation and outsourcing, and greater wage setting power for firms (Langella and Manning 2021; Zwysen 2021, 2022; Araki et al. 2022). Such tensions can be particularly problematic for more vulnerable workers with lower individual bargaining power. This bargaining power is also directly affected by collective institutional support, which is still relatively high across Europe despite reductions especially during the period of austerity following the financial crisis (Müller et al. 2019). However, these are not the only contextual factors affecting workers' bargaining power: the rising demand for labour which, in many cases, outstrips supply at all levels of the skill distribution, leading to greater shortages, can support workers' positions (Aeppli and Wilmers 2022).

This paper delves deeper into the issue of wage inequality within Europe with a specific focus on the institutional and economic factors that can support workers, particularly the more vulnerable ones. The paper sets out first to



describe wage inequality across the EU27 from 2006 to 2021; and second to analyse the association between wage inequality and both the institutional factors – that is, minimum wages, collective agreement coverage and union density – and economic conditions which affect the demand for workers – that is, the unemployment rate and labour shortages – over time.

## 2. Conceptual framework

### 2.1 Background

In many industrialised economies wage inequality has risen sharply in the longer term, particularly since the 80s (Piketty 2014; OECD 2015). At the same time, the balance between labour and capital has changed with the labour share – the share of national income accruing to workers – declining over time (Dünhaupt 2017), with working lives becoming more fragmented in terms of job stability and types of work (Flecker 2010; Rubery 2015).

The literature points to different drivers of such changes, which have generally to do with a shift in the balance of power between employees and their employers. First, there has been an increase in the relative importance of financial services, also within companies, which changes the incentives of firms, possibly leading to more short-term profit making and higher inequality (Godechot 2012; Rubery 2015; Dünhaupt 2017; Godechot et al. 2023). Such financialisation creates a large shift in how larger companies operate and thereby in the world of work (Weil 2014). Second, technological change, as well as increasingly global value chains which have facilitated the outsourcing of domestic production and services to cheaper external labour, are associated with greater inequality and a possible polarisation of the workforce as those workers with jobs that are more automated or replaced lose out (Autor et al. 2003; Michaels et al. 2013; Goos et al. 2014). Third, and partly pushed by these trends, the productivity and profitability of firms has diverged, with some ‘superstar’ firms leaping ahead while others lag behind (Berlingieri et al. 2017; Autor et al. 2020; De Loecker et al. 2020). Such differences in market power are then partly passed through to workers through rent sharing (Card et al. 2017; Criscuolo et al. 2021; Zwysen 2022), further widening the differences between workers who benefit from this and those who do not. Indeed, inequality is consistently increasing more between firms than within them, reflecting the increasing importance of individual bargaining and choice of workplace (Barth et al. 2016; Tomaskovic-Devey and Avent-Holt 2019; Criscuolo et al. 2021; Zwysen 2022). Relatedly, there is increasing concentration in the labour market with monopsonous firms having the power to set wages and to reduce wages, particularly for more vulnerable workers (Araki et al. 2022; Marinescu and Rosenfeld 2022).

Such changes have in common that the bargaining power of workers, particularly for workers at risk of being automated or outsourced, has generally declined relative to their employers (Zwysen 2023b). As a result

there are widening differences between those workers who are able to obtain the better positions and those who are not, and between good and bad employers.

In light of these economic factors undermining workers' bargaining position, strong institutions can rebalance the scales (Kristal and Cohen 2017). Indeed, cross-national research indicates that, while the driving factors behind firm differences in pay setting are common across many countries, the extent to which pay inequality between firms is widening differs strongly between them (Criscuolo et al. 2020, 2021; Zwysen 2022). Tomaskovic-Devey and Avent-Holt (2019) point specifically to cross-national variation in union density, showing a much weaker increase in inequality in countries with stronger trade unions. While not studied here, there is strong variation between countries in the density of employer organisations. These have remained rather stable over time within countries and are generally better linked to whether collective agreements are concluded than union density (Visser 2013). Zwysen (2022) shows weaker increases in wage inequality between firms in settings with more impactful minimum wages and where there is stronger union density and stronger central-level collective agreements. In an innovative paper, Criscuolo et al. (2021) investigate how differences in firm productivity are passed through to workers and find that low-productivity firms are more able to pay their workers relatively little in settings where workers are less mobile and their bargaining position is therefore weaker. Moreover, in settings with more and more centralised collective agreement coverage, there are fewer differences between firms in pay at any level of productivity. While also beyond the scope of this paper, it is important to note that the wage policies taken by unions in collective bargaining differ strongly between countries. In the traditional Nordic approach to solidaristic wage policies, for instance, there is generally a demand for a relative increase in wages, as well as a fixed absolute wage increase for lower-paid workers, which directly affects wage inequality (Schulten 2002). Additionally, the state can directly intervene through statutory minimum wages, which are clearly associated with lower wage inequality as wage floors increase, as well as through spillover effects across the lower parts of the wage distribution leading to a compression of wages (Fortin et al. 2021; Haapanala et al. 2023). The relationship between these different institutions is not straightforward, as statutory minimum wages could be seen to limit the scope for collective negotiation – which, in several European countries such as the Nordics, sets minimum standards in addition.

Problematically, across much of the industrialised world, union density and collective agreement coverage are declining (Western and Rosenfeld 2011; Schnabel 2013; Marinescu and Rosenfeld 2022; Tober 2022; Zwysen and Drahokoupil 2022). While there is a general decline, there is substantial variation between countries and in the processes of variation over time. This is covered to a much greater extent in Waddington et al. (2023) and Vandaele (2019) for union density, and in Müller et al. (2019) for collective bargaining. Zwysen and Drahokoupil (2023) provide a description of trends in bargaining and the link with collective agreement premia over time. Such

a decline is clearly associated with greater inequality, as well as a weakening of the efficacy of these institutions (Kristal and Cohen 2017; Zwysen and Drahokoupil 2022). This means that some workers, particularly those with relatively less bargaining power, are increasingly losing out.

However, strong institutions are not the only factors that can affect workers' bargaining power. In their recent study, Aeppli and Wilmers (2022) document a recent decline in inequality across the United States. They contrast different possible explanations – including compositional changes, changes in minimum wages and changes in union density – and find that it is mainly put down to occupational and, to a lesser extent, firm premia increasing for lower-paid workers which they attribute to the tight labour market and the high demand for workers. This highlights that, in tight labour markets, inequality generally reduces as the differences between workers become less relevant (Zwysen 2016), and points more generally to the importance of the business cycle and other economic factors in affecting wage inequality.

The European Union struggles with similarly weakening institutions, as the share of workers covered by collective agreements is declining with time, as is union density (Zwysen and Drahokoupil 2022), while the pressures of globalisation and technological change continue along with the changes caused by the decarbonisation of the economy. Despite these structural factors that are found to increase wage inequality overall, there has also been evidence of declining wage inequality in several EU countries (ILO 2016; Zwysen 2022). Partly, this is the effect of the enlargement of the European Union as wages between the different countries converge (Filauro and Parolin 2019). In their fascinating comparison of the European Union and the United States, Filauro and Parolin (2019) find that inequality across the EU as a whole is lower than that of the United States and actually did not increase in the period 2006-2014 whereas that of the United States did. Second, the European Union still has relatively stronger institutions supporting workers than many other industrialised countries, despite a weakening during the austerity following the financial crisis. Third, labour shortages have increased strongly in the European Union and, through the demands of decarbonisation and digitalisation, are likely to rise further (Zwysen 2023a).

It is then important to consider the extent to which wage inequality has evolved over time in the current context of high labour shortages (Zwysen 2023a). Indeed, one of the key goals of the new Minimum Wage Directive is precisely to raise collective bargaining coverage and for Member States to provide action plans on how to achieve higher coverage rates, as well as to urge them to set adequate minimum wages (Müller and Schulten 2020, 2024).

## 2.2 Framework and expectations

This paper sets out to analyse variations in wage levels and inequality across the European Union. The main questions it addresses are, first, how wage inequality has changed in Europe over time; and, second, how the institutional and economic factors affecting workers' bargaining power drive such changes.

Different institutional and economic aspects that may affect the bargaining position of different workers and affect the spread of wages are taken into account. First, wages are expected to be relatively more compressed, with particularly lower wages increasing, for evident reasons, in the presence of more impactful minimum wages. In recent research Haapanala et al. (2023) find that wage floors are higher in the presence of stronger minimum wages. They similarly take a longer view on the prevalence of low wages, looking specifically at the impact of minimum wages. It is also important, however, to consider that a strong minimum wage may not always be as impactful as it depends on the level of adherence to the regulation (Garnero 2018).

Second, higher coverage by collective pay agreements would affect both the level of wages, generally increasing them compared to those not covered (Zwysen and Drahokoupil 2022), and their distribution, which is likely to be more compressed in countries and sectors with stronger collective bargaining coverage. Besides the extent of coverage, the level at which bargaining occurs and the extent to which agreements extend beyond the bargaining parties are expected to affect the wage distribution strongly. While decentralised or firm-level agreements should bring a larger premium to the workers covered versus those not covered, as they participate to a greater extent in the rents of the firm or workplace, a higher compression of wages is expected in the presence of multi-employer centralised bargaining at country or sectoral level, especially when agreements are extended (Denk et al. 2019; Garnero 2021; Zwysen and Drahokoupil 2023). This would smooth the wage differences between covered workplaces. In some instances collective agreements may include solidaristic mechanisms where wages are affected more at the bottom than over the rest of the wage distribution, as often happens in Nordic countries (Schulten 2002).

Third, union density would similarly affect the level and distribution of wages. There is a large literature on union premia indicating trade union members earn higher wages, although this is not always so clear-cut in Europe (Bratsberg and Ragan 2002; Bryson et al. 2020). Less clear is how union density affects the wage distribution as larger pay differences between union and non-union workers may raise inequality. However, one key mechanism in the European context is that stronger unions increase the efficiency of collective agreements, with these being extended more widely (Zwysen and Drahokoupil 2022). While not considered further in this paper, employer organisation density also crucially matters for collective bargaining agreements (Visser 2013).

Besides these institutional factors, workers' bargaining power depends strongly on the demand for labour – the higher the relative demand, the higher the bargaining power of workers relative to the employer (Zwysen 2016; Aeppli and Wilmers 2022). Currently there is high labour demand overall and shortages in many different positions, including many lower-skilled and generally lower-paid positions (Eurofound 2021; European Labour Authority 2023; Zwysen 2023a). While having become acute since the pandemic, labour shortages were already increasing steadily prior to 2020. This increases the bargaining power for relatively lower-paid workers in particular and would be expected to lead to relatively lower wage inequality overall and an improved position of more disadvantaged groups by sociodemographic background. This bargaining power is particularly important in the context of asymmetry in the labour market, where workers do not have as much information regarding appropriate wages as employers, and in the context of employers' monopsony power.

My expectation is that, first, wage inequality tends to be lower in cases where the bargaining power of workers is relatively higher due to greater multi-employer collective bargaining, generally stronger union density or a greater demand for labour. The impact of worker representation can be somewhat nuanced, as stronger union density and greater bargaining in the context of firm-level agreements may actually increase wage inequality as it exacerbates the differences between covered and non-covered workers through a greater union or coverage premium (Zwysen and Drahekoupil 2023). Second, I expect that these factors affect particularly the wage position of those workers with fewer resources themselves – those with generally lower education or other constraints. This would result in greater support at the bottom end of the wage distribution.

## 3. Data and methods

### 3.1 Variables

The data has been drawn from European Statistics on Income and Living Conditions (EU-SILC) from 2007 to 2022, an annual household survey carried out in the EU. It includes detailed information on income, including cash or near-cash income from labour income earned in the reference year – generally the previous calendar year.<sup>1</sup> The sample has been restricted to those aged 18 to 64, with non-missing information on gender, education and employment status of those who are currently employees and who received an income from labour in the reference year. I include only 25 EU Member States, excluding Croatia and Malta where not all years are available.

Wages are calculated as annual gross earnings divided by average hours worked. As EU-SILC records each month whether respondents worked as self-employed or as employees, and whether they worked part-time or full-time, it is possible to calculate the average hours spent working in each type of activity per country and use those averages to approximate hourly wages from annual earnings – assuming people worked the average amount of hours for their labour market status, country and year. The 1% lowest and 1% highest wages are dropped so as to limit outliers within each country and year. Wages are adjusted in two ways: first by purchasing power parity (ppp) in order to compare the spread of wages between countries; and second for the main analyses to real 2015 wages in order correctly to assess changes over time in real wages. Both deflators are obtained through Eurostat. As

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1. While EU-SILC is carried out in a harmonised way across countries, there are breaks over time which can result in results being difficult to compare. The key breaks, taken from EU-SILC quality reports, are: Belgium 2019, where a new questionnaire was introduced and administrative income data used; Germany, where there was a move to a microcensus in 2020; Denmark with an income revision also in 2020; Estonia, where income variables from 2014 are drawn from the register; France 2008, where there was a move to administrative data, and in 2020, where household income data was collected differently; Ireland in 2012 and 2020 as a result of a move to more administrative data; Italy in 2017, which changed to include more low-cash payments of the self-employed; Luxembourg in 2016, which covered the resident population better; Malta, which moved in 2020 to more administrative data; the UK in 2012, which redefined some survey instruments; and in Bulgaria 2016, where the sampling changed. In the country-figures this is dealt with by adjusting the change at the time of the break to 0 and working backwards for trends in inequality measures. For the analyses, robustness tests are carried out where the country dummies are separated into periods before and after the break in data.

wages refer to the previous year – or the previous 12 months in the case of Ireland – all results are shown for the reference year; that is, the year before the survey year.

The following institutional factors are included. First, data from Eurostat and OECD statistics on the presence of a minimum wage and the ratio of minimum wages to average wages (the Kaitz index) to capture the bite of the minimum wage. This is linked to data at country-year level. Second, weighted estimates are included of the share of employees covered by any collective pay agreement rather than none, and those covered by a sectoral or national multi-employer agreement (centralised) or by a firm or local unit level agreement (decentralised) rather than any other, drawn from the 2006, 2010, 2014 and 2018 waves of the European Structure of Earnings Survey (SES). This data is aggregated to country, 13 industry groupings<sup>2</sup> and year. Based on this data, the coverage rates in the years between waves are intrapolated as a linear function between the two averages. For 2019 to 2021, the assumption is that the change from 2014 to 2018 holds, and the data is then extrapolated. These shares are representative of employees by country-year-sector who work in establishments with at least ten employees. Union density is captured through the OECD AIAS ICTWSS dataset (6.1) which includes questions on union density for different large sectors. When data is missing, the closest value per country-sector is used going backwards and forwards two years. This is linked to data at country-year-industry level.

Economic conditions are captured through two variables: first, the unemployment rate by three-category education, gender and five-year age groups obtained from Eurostat (lfsa\_urgaed). This is linked to data at country-year and demographic level. Second, the job vacancy rate – the ratio of outstanding vacancies over all filled and unfilled jobs – obtained from Eurostat (jvs\_a\_rate\_r2 and jvs\_a\_nace1) and linked at the level of the 13 sectors and country-year to the data. While rough, these variables are intended to capture variation in the relative demand for a specific type of labour.

Further included is information on workers' demographics and work history in order to account for variations between workers that can affect their wages through constraints and experience: sex; age; whether they were born in

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2. The industries are categories from NACE Rev. 2: A (agriculture, forestry and fishing); B-E (mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; and water supply, sewage, waste management and remediation activities); F (construction); G (wholesale and retail trade and the repair of motor vehicles and motorcycles); H (transportation and storage); I (accommodation and food service activities); J (information and communications); K (financial and insurance activities); L-N (real estate activities; professional, scientific and technical activities; and administrative and support service activities); O (public administration and defence, including mandatory social security); P (education); Q (human health and social work activities); R-U (arts, entertainment and recreation; other service activities; activities of households as employers and undifferentiated goods and services activities of households for own use; and the activities of extraterritorial organisations and bodies).



the country of residence, another country in the EU or outside of the EU; their highest qualification level (at most lower secondary; upper secondary or post-secondary non-tertiary; and tertiary), whether they are cohabiting; whether a child lives in the household; the urbanity of the residence; the months spent working as a full-time employee; the months spent working as a part-time employee; hours worked in the main job; and industry. Table A1 shows the descriptive statistics of these variables.

## 3.2 Methods

The analysis consists of three main parts. First, it describes the trends in wage inequality – measured here as the variance of log wages – within the EU as a whole over time and then between countries. Second, it analyses the distribution of log real wages across the EU as a whole. This is done through recentred influence function (RIF) regressions where the unconditional statistic – in this case variance or percentile – is regressed on the variable of interest and control variables, as shown in Equation 1 (Firpo et al. 2009). The analysis is repeated for each institutional variable and carried out once without country dummies and once with them. The measures are introduced separately as they vary at limited higher levels – country, industry and year – and are strongly related to each other.  $X$  is a vector capturing the control variables (gender; age; age squared; gender by age (squared); country of birth; education level; cohabitation status; presence of a child in the household; urbanity; months worked as full-time or part-time; and hours worked). Year and industry fixed effects are also included. To capture the effects of the wage distribution, an analysis is run on different percentiles of the log real wage: that is, the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup>.

$$\text{Equation 1: } RIF(\text{Variance}) = \alpha + \beta * \text{Institution} + \gamma * X + \lambda_{\text{year}} + \iota_{\text{industry}} (+ \delta_{\text{country}}) + \varepsilon$$

$$\text{Equation 2: } RIF(\text{Percentile}) = \alpha + \beta * \text{Institution} + \gamma * X + \lambda_{\text{year}} + \delta_{\text{country}} + \iota_{\text{industry}} + \varepsilon$$

My expectation is that these institutions particularly affect workers with fewer resources or individual bargaining power. To capture this, Equation 3 sets out the way in which the log real wage is assessed directly on institutions, interacted with several key demographic variables: having non-tertiary qualifications; being a woman rather than a man; being born outside of the European Union; and being young (aged 30 or under).

$$\text{Equation 3: } \text{Log real wage} = \alpha + \beta_1 * \text{Institution} + \beta_2 * \text{Demographic} + \beta_3 * \text{Demographic} * \text{Institution} + \gamma * X + \lambda_{\text{year}} + \iota_{\text{industry}} + \delta_{\text{country}} + \varepsilon$$

All these analyses are carried out using weights to be representative of the EU as a whole and with standard errors clustered at country-industry-year level.

The second part of the analysis focuses specifically on the country level. The question to be answered here is slightly different as it deals with how the variation in institutional power also affects inequality specifically within countries. This is addressed using a multilevel approach differentiating the associations between institutional factors and inequality at country level and the variation in institutional factors and inequality within countries either over time or between industries. Data is first aggregated to the level of country (c), industry (j) and year (y), estimating a multilevel model on the variance of log real wages at this country-year-industry level with random effects at country level. A Mundlak correction model is used, with each variable introduced as its average at the higher (country) level and its deviation from that country at lower levels (industries and years) (Bell and Jones 2015). This specification captures the association between countries as well as the variation over time or between industries within a country. Equation 4 shows how it is estimated, with X' being a vector of controls of the average composition of an industry, country, year: the share of women; average age; the share of EU-born migrants; the share of migrants born in third countries; the share of low-qualified people; the share of high-qualified people; the share living in dense urban areas; the share living in rural urban areas; the share where urbanity is missing; average months worked full-time or part-time as an employee; and average hours worked. The data is weighted when aggregating to account for differential selection by personal characteristics, but in the analysis each country-year-industry has the same weight.

$$\begin{aligned} \text{Equation 4: } \text{Var}(\text{Log real wage})_{cyj} = & \alpha + \beta_1 * \overline{\text{Institution}_c} + \beta_2 * \\ & (\text{Institution}_{cyj} - \overline{\text{Institution}_c}) + \gamma_1 * (\bar{X}'_c) + \gamma_2 * (X'_{cyj} - \bar{X}'_c) + \lambda_{year} \\ & + \zeta_c + \varepsilon_{cyj} \end{aligned}$$

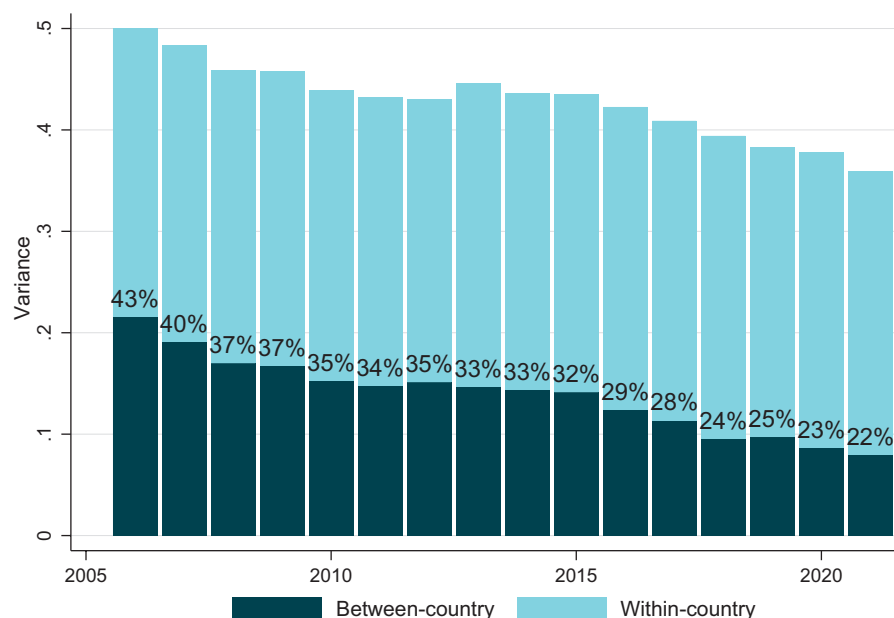
## 4. Results

### 4.1 Trends in wage inequality across the EU

Figure 1 shows the evolution of wage inequality across current EU Member States over time. Inequality is measured here as the variance, capturing the spread around the average, of wages. Wages are transformed into log wages so that large outliers, such as much higher wages, are smoothed and so that changes can be interpreted as relative differences. This measure of inequality declined sizeably from 2006 to 2012, then rose a little again until 2015 before declining, once again sizeably, from 2015 to 2021. In total, inequality dropped by 28% between 2006 and 2021. It is possible to separate this overall inequality into the part that is due to differences in average wages between countries (between-country) or the spread of wages within countries (within-country). Such a decomposition shows that the large decline in overall inequality within Europe is almost completely driven by differences in the average wage between EU Member States declining by 63%. On the other hand, inequality within the average country remained more or less stable, with a 2% reduction over time. While 43% of the differences in wages between workers across the EU could be accounted for by their country in 2006, this had declined to only 22% by 2021. This indicates a sizeable convergence over time in wage levels between countries, but it remains very high when comparing for instance to differences between states in the United States (Filauro and Parolin 2019).

This points to convergence between EU Member States being a crucial part of the overall decline in inequality across Europe. Figure 2 studies these evolutions in wages in more detail by splitting up the European Union into the Member States that had joined prior to 2004 (the EU15 minus the UK) and the newer Member States, primarily from central and eastern Europe. The top panel shows the wage distribution across these countries in 2006-2007 and 2020-2021. To account for the variation in the cost of living between different countries, wages are adjusted to purchasing power parity, meaning in theory that the wage is adjusted to indicate what basket of goods could be bought in the same year in different countries. The distribution shows this average adjusted wage for all workers in the older, and the newer, Member States ranked in 100 groups from the lowest to the highest. The bottom panel then shows the relative change over this period in ppp adjusted wages over the wage distribution.

Figure 1 Wage inequality across the EU is declining primarily because average wages between countries are converging



Note: variance of log hourly wages (ppp) in 25 EU Member States over time, with the share of the variance occurring between countries as the estimated explained variance (R squared) from a regression on the log wage with country fixed effects.

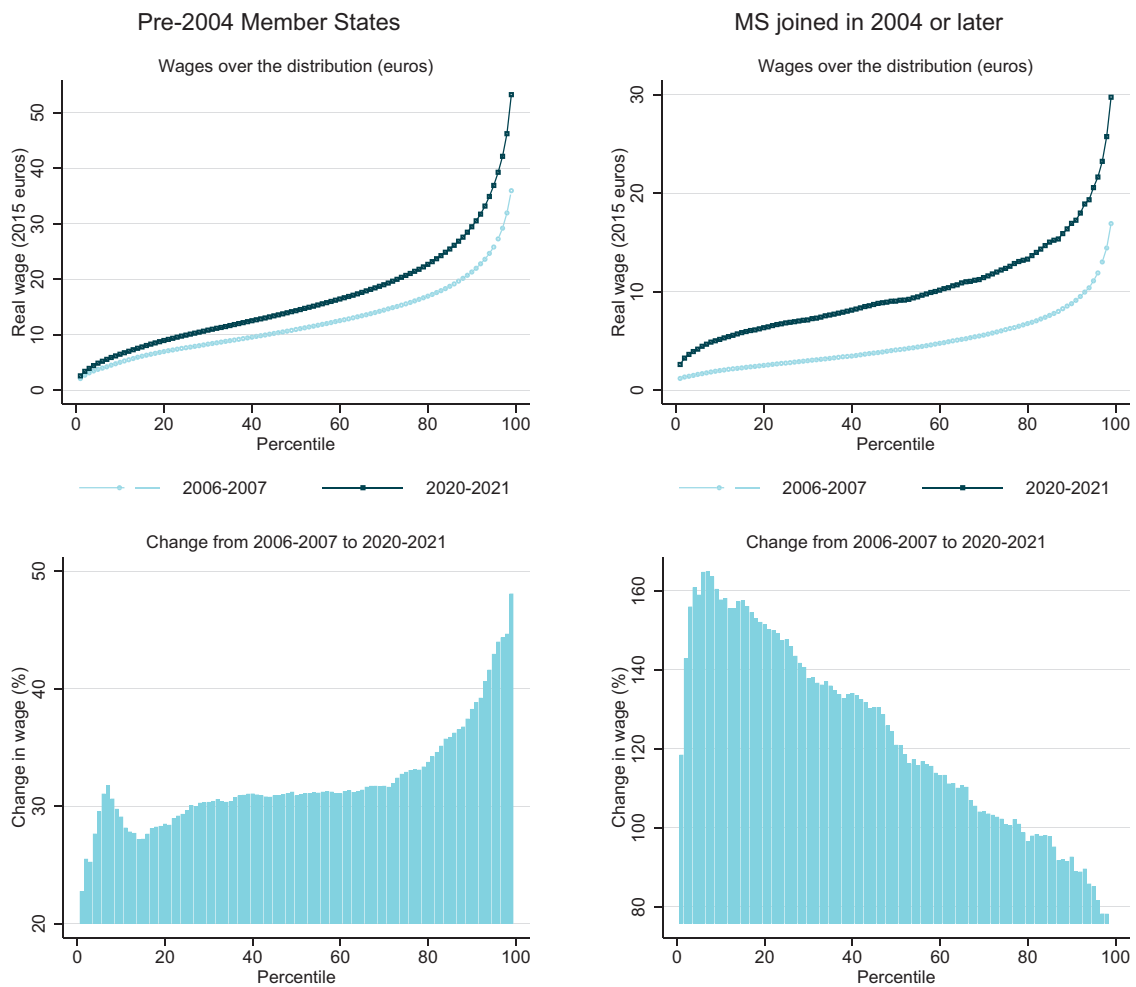
Source: EU-SILC 2007-2022.

This shows, first of all, that hourly wages are still substantially higher in the pre-2004 Member States than in the newer ones. Second, among the older Member States, wage inequality did increase as wages grew more on average at the higher ends of the wage distribution – median wages increased by around 30% from 2006-2007 to 2020-2021, whereas the highest 10% of wages increased by more than 40%. In the newer Member States, this is reversed. Wages did not only grow much more on average, with the median wage doubling in nominal, ppp adjusted, terms, but they also grew much more in the lower half of the wage distribution than in the top.

Declining wage inequality within the EU thus results mainly from much higher wage growth in the generally lower-paying central and eastern European countries that joined after 2004, and from declining wage inequality in those newer Member States. Explaining why wages have converged to such an extent is beyond the scope of this paper, although possible explanations are likely to include the opportunities linked with EU enlargement. As an example, demand for manufacturing workers in central and eastern European countries increased through greater investment in industries there such as, for instance, in the auto industry (Krzywdzinski 2017). Second, while trade unions are weak in many central and eastern European countries relative to northern and western Europe, there is some indication that they have strategically aimed for lower inequality, for instance through a focus on stronger national minimum wages (Martišková

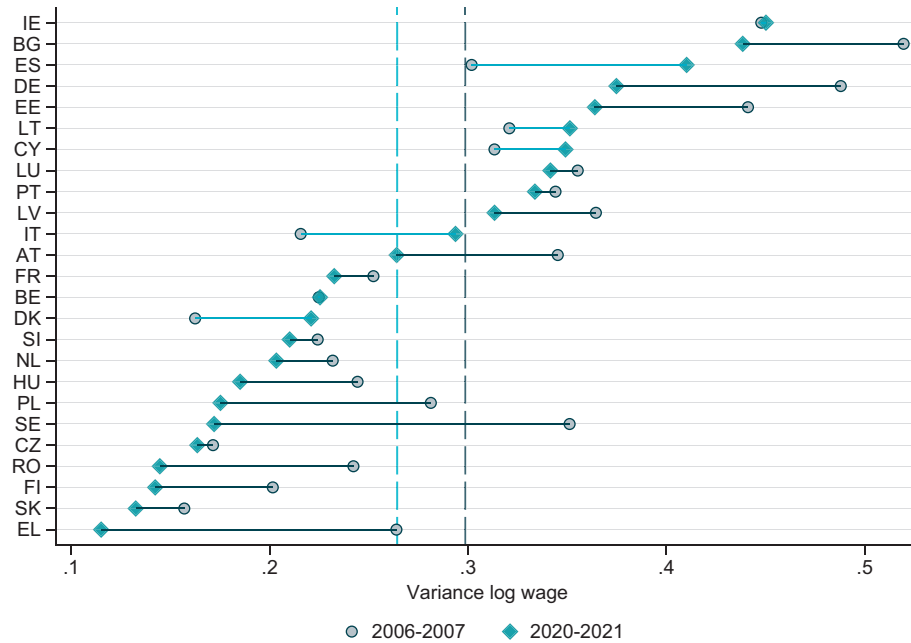
et al. 2021). Third, intra-EU mobility flows, which mainly go from central and eastern Europe to the richer older Member States, are still high and rising. These flows are generally, though by no means exclusively, composed of relatively lower-skilled workers (Zwysen and Akgüç 2023). As a result, the demand for these workers in the origin countries is likely to have increased, leading to higher wages. It also means there was a higher-paying outside option for many workers which is also associated with rising wages.

Figure 2 Wages grew much more at the bottom than the top in the newer Member States, but more at the top than the bottom in the older Member States



Note: hourly wage (ppp) over time in pre-2004 and post-2004 EU Member States, by percentile, by period of reference years.  
Source: EU-SILC 2007-2022.

Figure 3 Wage inequality is declining overall, with some exceptions

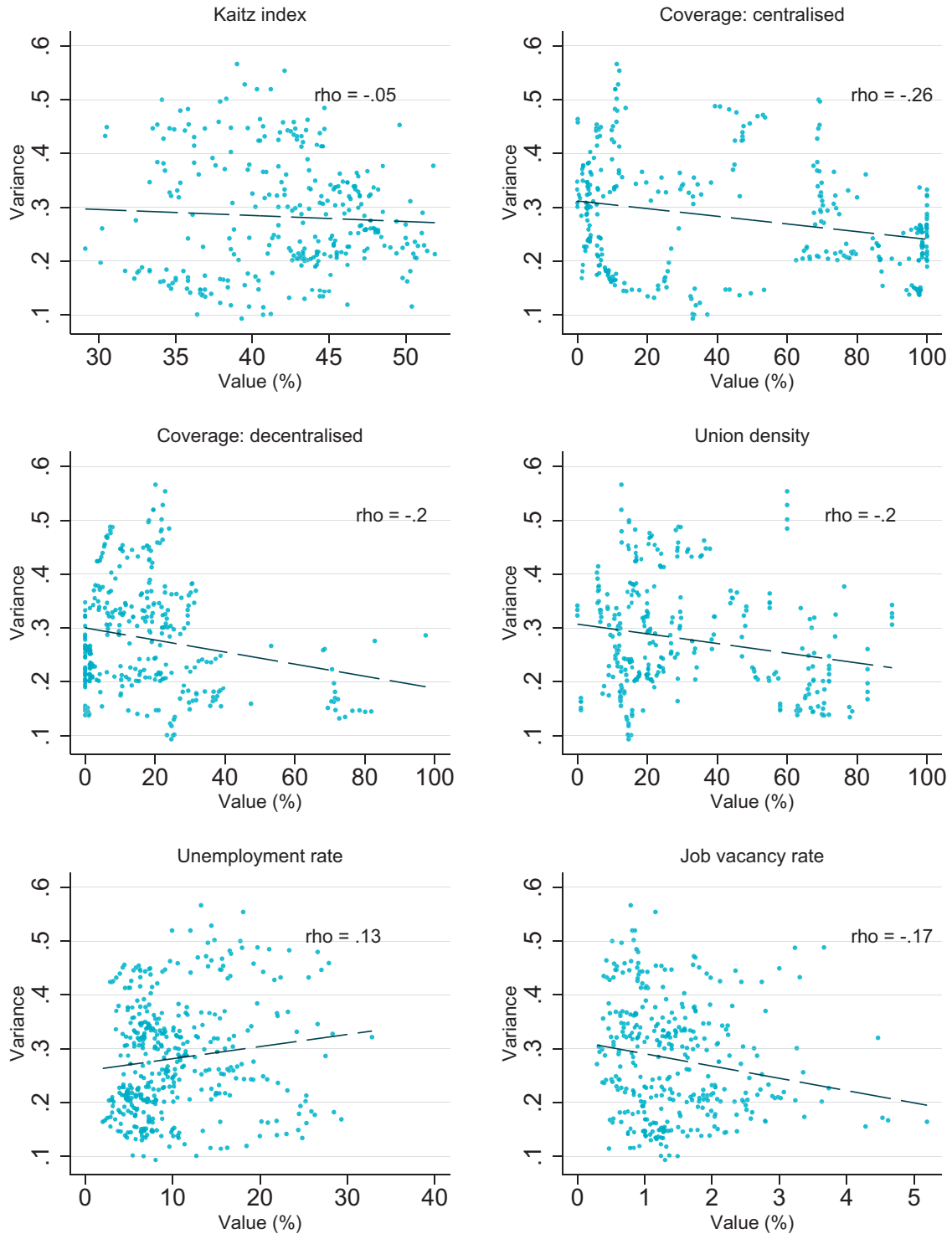


Note: variance of log hourly real wages in reference years 2006-2007 and 2020-2021 by country, reviewed for breaks in the data by adjusting backwards through time.  
Source: EU-SILC 2007-2022.

Figure 3 delves deeper into the changes in inequality, measured as the variance of log wages, by country. On average, wage inequality declined somewhat in the EU as a whole, but it did increase in seven of the 25 countries under study. The figure shows, first of all, that there is a sizeable variation in wage inequality between countries in 2020-2021. It is estimated to be highest overall in Ireland, Bulgaria, Spain, Germany and Estonia; and lowest in Greece, Slovakia, Finland, Czechia and Sweden. There is also wide variation in the trends over time. Wage inequality increased a great deal over time in Spain, Italy and Denmark, but also somewhat in Lithuania and Cyprus. On the other hand, inequality declined a great deal in Sweden, Greece, Germany and Romania.

The key question is whether there is some pattern in the variation between countries linked to their institutional or economic context. Figure 4 plots wage inequality against different indicators of institutional and economic factors. First, there seems to be very little relationship between the levels of the Kaitz index – indicating the ratio of the minimum wage to the mean wage in a country – and the level of variance. However, there is a moderate negative association between the extent to which workers are covered by centralised or decentralised pay agreements, as well as union density, and the variance of log wages. This indicates that the level of wage inequality is generally somewhat lower in countries where more workers are covered by any type of collective agreement and where union density is relatively higher. This is in line with

Figure 4 Relationship between institutional and economic factors and the variance of log real wages at country-year level



Note: correlation between country-year level variance of log hourly real wages and contextual factors at country-year level, adjusted for breaks.

Source: EU-SILC 2007-2022, supplemented with external data.

expectations on the institutional factors supporting worker representation being associated with a more compressed wage distribution. As expected, the variance of log wages is also somewhat negatively related to the job vacancy rate within a country and modestly positively to the unemployment rate. This means that, on average, wage inequality tends to be somewhat lower if there are more outstanding vacancies and if the unemployment rate is lower. Again this is consistent with a better bargaining position for workers being associated with more compressed wages. Of course, these correlations only link the average wage inequality in a country in a given year with the context, but do not account for any other characteristics of the country that may be relevant, such as the composition of its workforce, the industrial set-up or other institutional factors.

In summary, wage inequality in Europe has been declining strongly between countries, but has remained relatively stable within them. However, this hides a wide variation both in the levels and in the changes between countries. Descriptively, there is also a clear association between the level of inequality and the institutional factors related to worker representation and collective bargaining.

## **4.2 Economic and institutional factors affecting wage inequality**

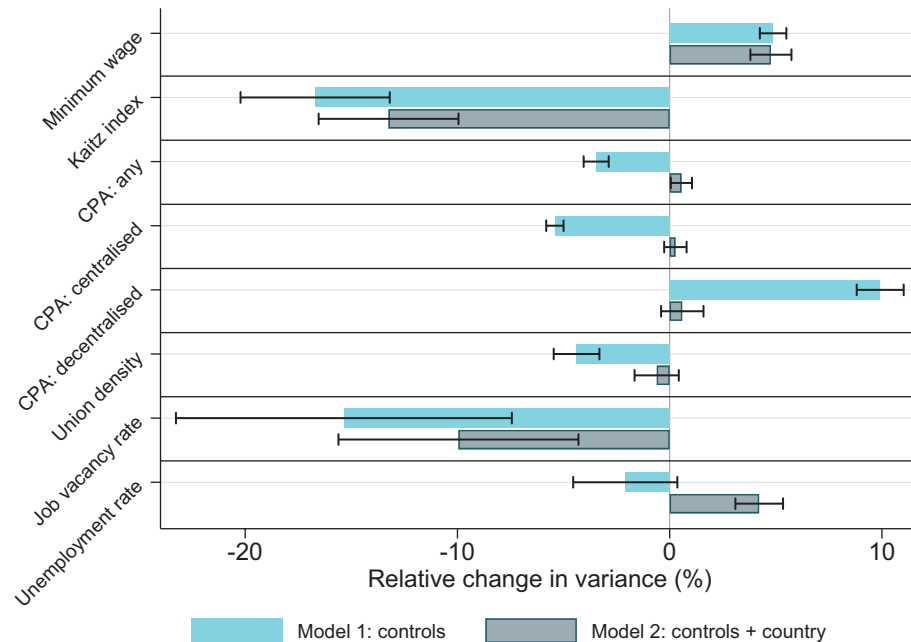
### **4.2.1 Wage inequality across Europe**

This section goes a step further and links the trends in wage inequality across Europe to institutional and economic factors in order to answer the main hypotheses on the links between these institutions and wage inequality.

Figure 5 shows the association between a change in the institutional or economic factors affecting wage floors and bargaining power and the variance of log real wages in relative terms. Full coefficients are shown in Table A2. The figure shows by what percentage the variance of log wages differs when the institutional or economic factor is a comparable amount higher. The first model accounts for workers' characteristics and indicators of their work as well as for trends over time; while in the second model country fixed effects are added so that the economic and institutional factors are allowed to change only within countries over time or between sectors. Practically, this means that the first model compares how the spread of wages varies with institutional and economic factors across similar workers from across the whole European Union; while the second compares how wages vary with institutional and economic factors within a country, comparing peoples' wages to those of their peers in the same country.



Figure 5 Wage disparity is generally lower where there is greater multi-employer bargaining, stronger statutory minimum wages and more labour shortages



Note: estimated impact with 95% C.I. on the variance of log wages (%) of one-tenth of the change from having no minimum wage to having one, with a five percentage point change in the other factors, estimated from a RIF regression controlling for gender, age squared, gender by age squared, migrant status, education, cohabitation status, living with a child in the household, urbanity, months of working full-time or part-time, hours worked, and sector and year fixed effects (Model 1); and country fixed effects (Model 2), weighted and with standard errors clustered at country-industry-year level.  
 Source: EU-SILC 2007-2022, supplemented with external data.

On average, the variance of log wages tends to be higher in those countries with a statutory minimum wage than those without. This can indicate that a statutory minimum wage is more often introduced<sup>3</sup> in those countries where this not arranged by collective agreement, and is therefore more likely in otherwise more unequal societies (Haapanala et al. 2023). However, the level of the minimum wage does have a very clear association with inequality, as a more biting minimum wage is strongly associated with a more compressed wage distribution. This is the case over the whole of the EU but also when analysing within countries, indicating that the strengthening of minimum wages is generally associated with a reduction in wage inequality within countries (Haapanala et al. 2023). Countries and sectors covered by collective pay agreements, specifically multi-employer agreements, generally also exhibit lower wage inequality. Similarly, a larger union density is associated with lower wage inequality. However, these associations fall away when accounting for time-constant country differences, meaning that, while it is generally the case that wage inequality is lower in countries with

3. As only Germany introduced a statutory minimum wage in the period under analysis, the results are not shown for a country having a minimum wage or not when country fixed effects are included.

stronger collective agreement coverage and higher union density, changes in these institutions within a country are less clearly associated with changes in its level of wage inequality. Finally, as expected, wage inequality is also generally lower in countries and sectors with a greater demand for labour, as measured by a higher job vacancy rate or a lower unemployment rate for the specific profile of workers, once accounting for country differences (Model 2 in Figure 5). This means that if, on average, the demand for a specific profile (unemployment rate) or specific sector (job vacancy rate) increases, the spread of wages within that group is generally lower, resulting in lower wage inequality.

On average then, there is a clear association between workers' bargaining power, both through economic and institutional sources, and the level of wage inequality. The focus is generally on institutional factors, but it is clear that economic conditions play an important role and matter especially in explaining trends within a country.

Figure 6 looks at the associations across the wage distribution in greater detail by identifying the association of a change in institutional and economic conditions along different percentiles of real wages across the EU, accounting also for country differences (Model 2). Specifically, this means looking at how a variation in these factors affects the real wage for workers who earn little, at the 10<sup>th</sup> or 25<sup>th</sup> percentiles;<sup>4</sup> for those whose earnings are at the median; and for the relatively higher earners at the 75<sup>th</sup> and 90<sup>th</sup> percentiles. Generally, in countries with a statutory minimum wage with greater bite, real wages within a country tend to be higher in the lower half of the wage distribution: wages at the 10<sup>th</sup> percentile are generally 15% higher and at the 25<sup>th</sup> percentile around 5% higher if the bite of the minimum wage is higher by 5 percentage points, meaning the whole wage distribution is more equal. Collective pay agreements have a limited impact across the wage distribution in these models as they are mostly associated with the spread of wages across countries. Decentralised pay agreements are associated with somewhat lower wages at the bottom of the distribution, while multi-employer agreements are associated with somewhat higher wages at the higher end of the distribution, as is higher union density. Finally, a higher job vacancy rate is associated with higher wages at the 10<sup>th</sup> percentile (6%) and the 25<sup>th</sup> percentile (around 4%), while a higher unemployment rate is associated with lower wages at the lower end of the wage distribution.

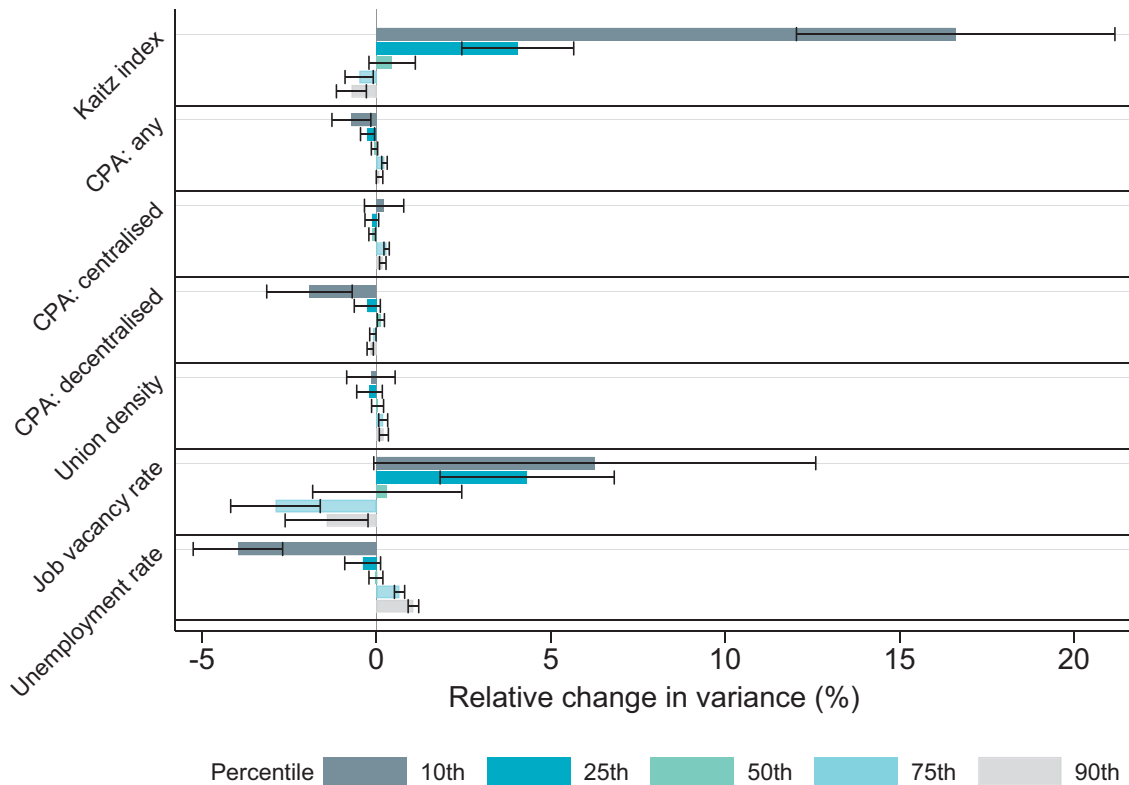
These analyses show how wage inequality changes overall. In the case of stronger minimum wages, it is because lower wages – although clearly not only the very lowest – are lifted spectacularly, while there is a minor reduction in the highest wages. On the other hand, an increase in collective

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4. A percentile is that point along the distribution where, if the dataset is ranked from the lowest to the highest, that percentage of people would have that percentile amount or less. This means that 10% of the whole workforce earns less than the 10<sup>th</sup> percentile of the wage; while 90% of the whole workforce earns less than the 90<sup>th</sup> percentile. The median is the 50<sup>th</sup> percentile – half of the population earns below and half above.

pay agreement coverage within countries is, on average, associated with somewhat higher wages at the higher end of the wage distribution, although the relationship is weak.

Figure 6 Associations of institutional and economic factors on log real wage percentiles



Note: estimated impact with 95% C.I. on percentiles of the log wage of a five percentage point change in the factors, estimated from a RIF regression controlling for gender, age squared, gender by age squared, migrant status, education, cohabitation status, living with a child in the household, urbanity, months of working full-time or part-time, hours worked and sector and year fixed effects, weighted and with standard errors clustered at country-industry-year level.  
Source: EU-SILC 2007-2022, supplemented with external data.

#### 4.2.2 Do institutional and economic factors support the wages of more vulnerable workers?

When considering whether these institutional and economic conditions support specifically the bargaining position of more vulnerable workers, it is important to consider heterogeneity in the association with wages. This section considers real wages, rather than the spread in wages, and analyses how these economic and institutional factors affect the relative wage of more disadvantaged groups. The question is whether the wages of particularly vulnerable workers – the lower educated, women, the young or migrants – rise relatively more in a context where there is a more impactful minimum wage, higher collective pay agreement coverage or union density, or a greater demand for their labour. Figure 7 shows how the impact of institutional or

economic factors on wages differs by demographic category. Full coefficients of the impact on categories are shown in Table A3.

The bite of the minimum wage relative to the average wage is indeed associated with generally higher wages for lower educated workers compared to university-educated workers, and for women compared to men. Third-country migrants also have relatively higher wages in countries where there is a statutory minimum wage, and where that minimum wage is more impactful, although the latter is not statistically significantly associated ( $p < 0.05$ ). Similarly, young workers benefit relative to older workers in countries with a statutory minimum wage. Generally, allowing for overall differences between countries, the inequalities by education, gender, age and migrant status tend to be somewhat lower where there is a statutory minimum wage with a relatively higher bite, although the bite primarily affects the lower educated and women.

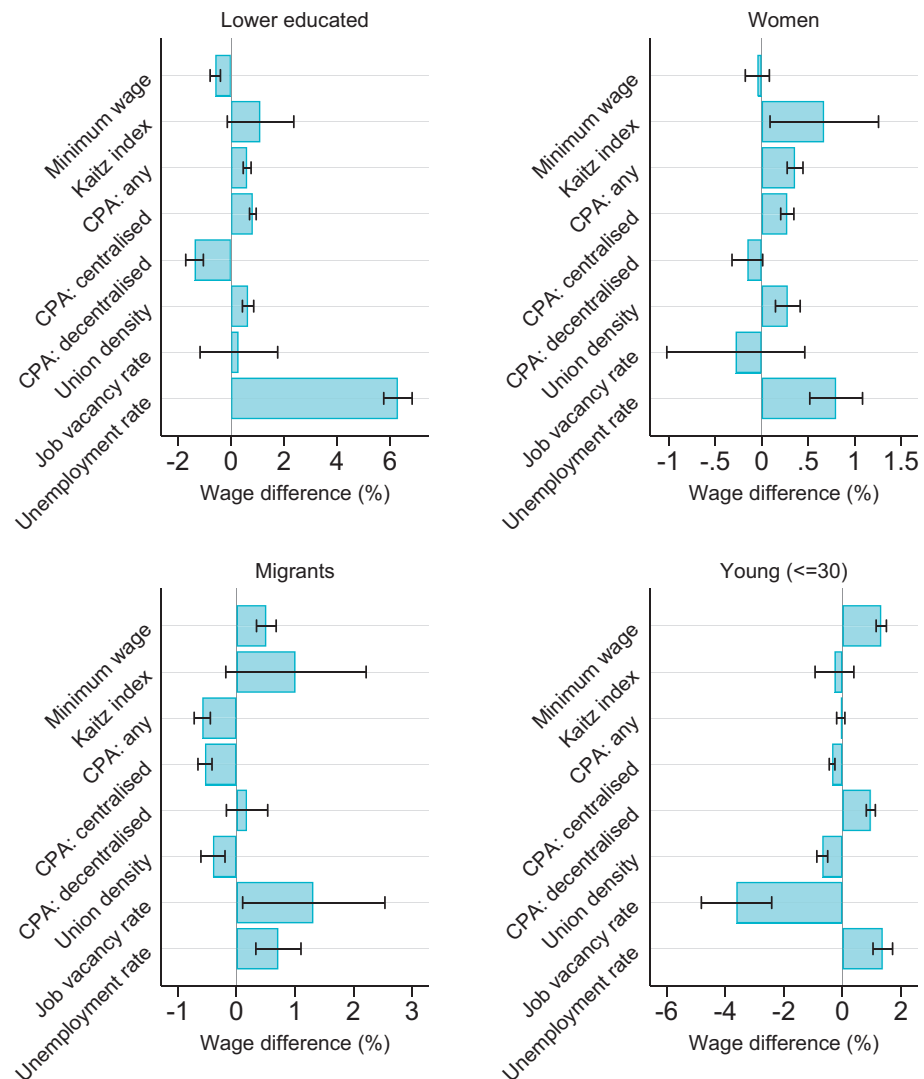
Collective pay agreement coverage is positively associated with the relative wages of lower-educated workers and women, but tends to be associated with relatively worse outcomes for third-country migrants. Similarly, stronger union density is associated with better outcomes on average for the lower educated and for women, but negatively associated with outcomes for third-country migrants and younger workers. This could indicate that those workers who are more on the periphery are excluded from more protected positions and that, to some extent, insider-outsider divisions are put in sharper contrast in the context of stronger trade unions and multi-employer collective agreements. Firm-level agreements are actually somewhat associated with relatively better outcomes for young workers. On the whole, while collective agreement coverage and particularly more centralised agreements are associated with better outcomes for women and the lower educated, they are less successful at improving outcomes for the young and for third-country migrants. This may reflect a general lower involvement with trade unions and may indicate more work is needed at being inclusive of all workers.

Finally, a higher job vacancy rate is not specifically associated with the wages of lower-educated workers, women or third-country migrants, but it is associated with relatively worse wages for young workers, meaning it benefits wages for older workers. A higher unemployment rate for their profile, on the other hand, is associated with relatively higher wages for lower-educated workers, women, third-country migrants and the young. This is likely to represent a selection effect – those disadvantaged workers who are employed during a downturn are different in some unobserved quantity, such as skills or motivation, and this is associated with their relatively positive outcome.

The results here, then, are somewhat mixed. First, a more impactful minimum does indeed benefit more vulnerable groups as it raises the wage of lower-educated workers, women, third-country migrants and younger workers relatively more than those of their more advantaged counterparts. Worker representation, in the form of multi-employer collective agreements and stronger trade unions, is also associated with better outcomes for lower-

educated workers and women on average, but does not benefit young workers or third-country migrants as much. This may reflect that these workers are not covered to the same extent and do not benefit from this protection as much, relative to state-wide interventions, or that they are more likely to be considered to be outsiders and to fall out of the scope of this bargaining. Firm-level agreements, however, generally benefit the wages of higher-educated and male workers, but also those of younger workers.

Figure 7 Do more vulnerable workers benefit relatively more from institutional and economic support?



Note: one-tenth of the change in going from having no minimum wage to having one, with a five percentage point change in other factors at a 95% C.I.. Estimated from log hourly real wages, controlling for migrant background, education, gender, age, cohabitation status, having a child, urbanity, working situation, with country fixed effects, weighted and with standard errors clustered at country-industry-year level. Shows the interaction between having non-tertiary qualifications; being female; being third-country migrants; and being young.

Source: EU-SILC 2007-2022, supplemented with external data.

### 4.2.3 Wage inequality at country level

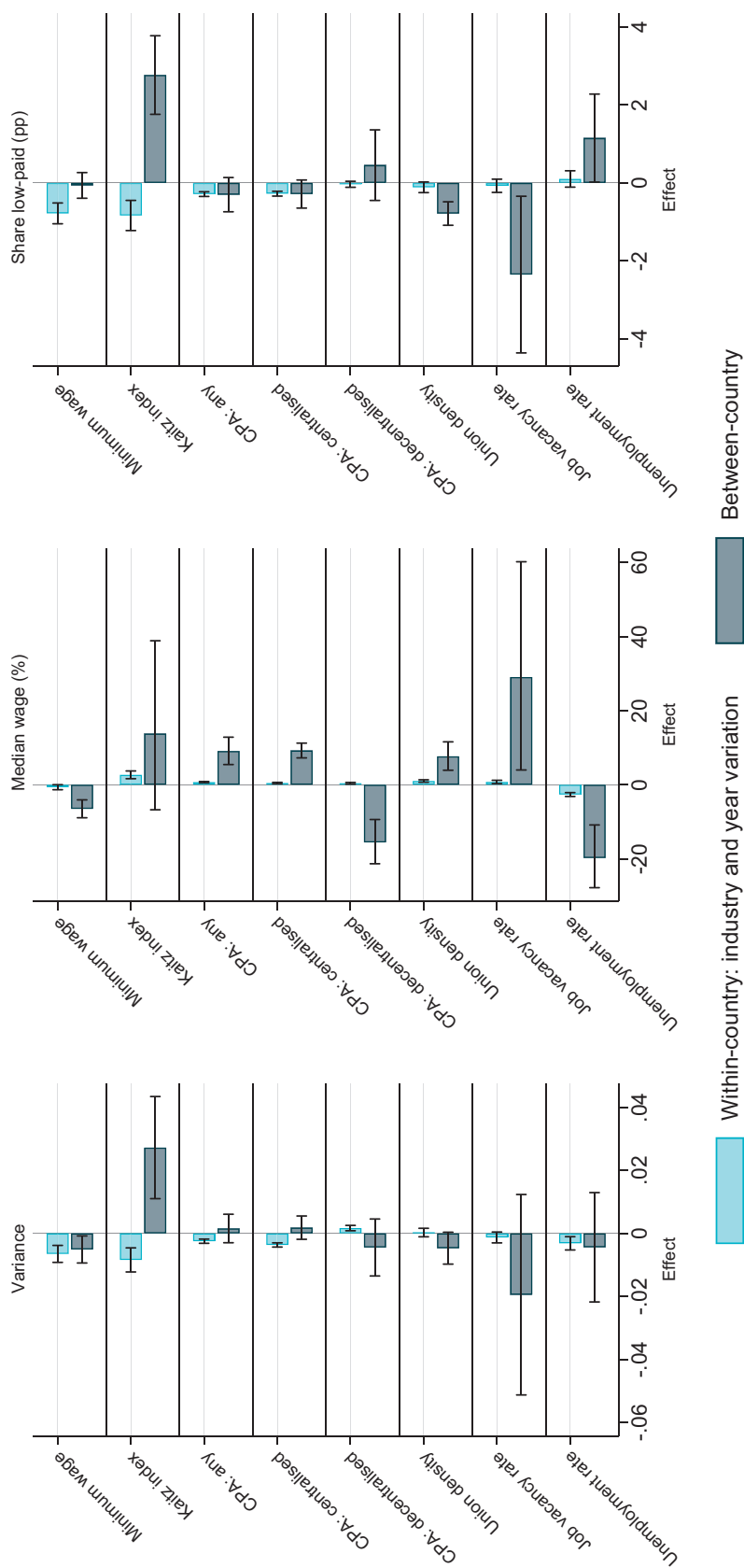
The analyses so far have focused on wage distributions across the whole of the EU. As many of these institutions should be seen within the context of a specific Member State, this paper now turns to considering directly through multilevel analysis the variation within and between countries in the variance of wages, levels of pay and the incidence of low pay. This type of analysis allows for a consideration of the impact of these factors as they vary between countries – meaning, for example, how the average coverage rate in a country is associated with the average variance or incidence of low pay – and within countries over years or sectors – meaning how the differences within a country in coverage are associated with differences in the variance or incidence of low pay. The estimates within a country give more of an idea of how inequality changes when the institutional factors change, as all those characteristics that are not controlled for and which are specific to a country, but do not change over time, are kept constant.

Figure 8 shows the estimated impact of institutional and economic factors on wage inequality, the median wage and the share of low-wage workers in a country-industry-year group. Full coefficients for the institutional and economic factors are shown in Table A4.

This analysis focuses specifically on the association between institutional and economic factors within countries between industries and over time, and between countries. It therefore differs from the previous analysis across the EU. Countries with a statutory minimum wage generally also have lower wage inequality and a somewhat lower median wage; while a change within a country in moving to a minimum wage – which in this case is only Germany – is associated with a reduction in the share of low-paid workers. This is in line with the evaluations of the minimum wage introduction in Germany (Bossler and Schank 2023). Importantly, the bite of the minimum wage has very different relations with wage inequality between and within countries. On average, countries with a more impactful minimum wage tend to have higher wage inequality and a higher share of low-paid workers, but this is likely to reflect the other characteristics of these countries. Within a country, changes in the minimum wage are associated with lower wage inequality and a lower share of low-paid workers, but also a slightly higher median wage. This is in line with the recent work by Haapanala et al. showing a clear association between rising minimum wages and better wages at the bottom (Haapanala et al. 2023).

Higher coverage by collective pay agreements in a sector or year within a country is associated with a generally lower variance of log wages and a lower share of low-paid workers, but not a lower median wage. This supports the notion that collective agreement coverage is associated with more equally distributed wages and with an increase in lower wage levels. As the median wage is not lower, and actually somewhat higher, in countries which are covered more by collective pay agreements, this indicates that wage levels are not reduced overall, but the distribution is more compressed and less unequal.

Figure 8 Effects within and between countries of different institutional and economic factors on variance, the median wage and the share of low-paid workers



Note: figure shows estimates and 95% C.I., estimated through a Mundlak corrected multilevel model at country level, with variation within countries over industry and year level, showing the variance, median wage and share of low-paid workers at country-industry-year level. The results are shown as one-tenth of the change from not having a minimum wage to having one and a five percentage point change for the other factors except for the job vacancy rate where a one percentage point change is taken. The models control for gender, age, country of birth, education, urbanity, months spent full-time or part-time employed, hours worked and the main sector of work.  
Source: EU-SILC 2007-2022, augmented with contextual data.

On average, wage inequality and the share of low-paid workers is lower in countries with a higher union density rate. There is also a weak association within countries where those sectors, or those years, in which union density is somewhat higher also have somewhat fewer low-paid workers. The biggest variation is, however, clearly between those countries with high and those with low union density rates.

Finally, the job vacancy rate within a country is associated with a relatively higher median wage, and between countries also a somewhat lower share of low-paid workers. The unemployment rate is associated with a lower median wage and somewhat lower variance.

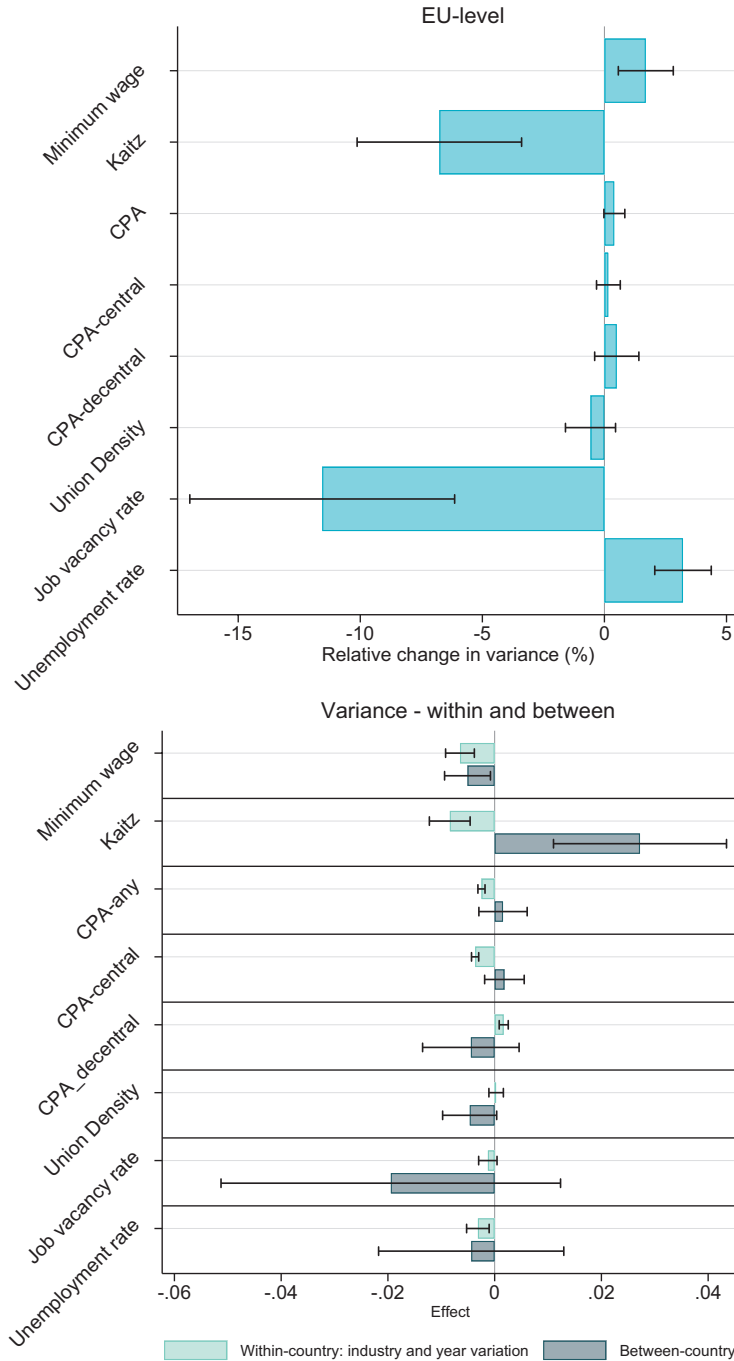
Overall, institutional factors do seem to matter more in explaining differences between countries than within them but, importantly, they clearly do also play a role within countries. These associations indicate that, within countries, stronger institutional protection of workers is associated with fewer low-paid workers and a lower variance of wages overall. This is the case for more impactful minimum wages and higher collective pay agreement coverage. The demand for labour, as measured by job vacancy rates and the unemployment rate, plays some role in explaining the variation between countries, but the variation therein over sectors and years explains little in terms of changes in wage inequality.

### **4.3 Robustness – accounting for breaks in the series**

While EU-SILC is a useful dataset on labour incomes in the EU, there have been changes to the measurement of different variables over time which can result in breaks in how income is measured. To account for this, the main analyses separating countries, as used in the fixed effects or multilevel models, are repeated in country-periods where the periods are defined by whether or not a break is present – resulting in 35 rather than 25 countries/levels. Figure 9 below shows, on the left, the RIF at the whole EU level on the variance of log wages; and, on the right, multilevel analysis on the variance of log wages. There are no significant or substantial differences with the results from the main analyses, indicating that the results are not driven by spurious changes in the coding of the income variables.



Figure 9 Accounting for breaks in the model



Note: the figure shows the results and 95% C.I. when separating countries into country-periods accounting for breaks in the collection of EU-SILC data. The results are shown as one-tenth of the change from not having a minimum wage to having one and a five percentage point change for the other factors except for job vacancy rate in the multilevel model (right) where a one percentage point change is taken. The left panel shows estimates from a RIF regression controlling for gender, age squared, gender by age squared, migrant status, education, cohabitation status, living with a child in the household, urbanity, months of working full-time or part-time and hours worked, with sector and year fixed effects and country fixed effects, weighted and with standard errors clustered at country-industry-year level. Source: EU-SILC 2007-2022, augmented with contextual data.

## 5. Discussion and limitations

This paper set out to study how wage inequality changed in the European Union between 2006 and 2021. Overall, it documents a decline in wage inequality, driven by greater convergence between Member States, and a stable, or even somewhat declining, level of wage inequality within the average EU country. This average hides substantial variation between Member States in the levels of and the trends in wage inequality, however. Part of this variation can be attributed to variations in institutional support as well as in the economic conditions supporting workers at the lower end of the wage distribution. In line with previous studies, a more impactful statutory minimum wage increases the wage floor where it is present (Haapanala et al. 2023). Further, higher coverage by, especially, multi-employer collective agreements is associated with higher wages, particularly at the lower end of the wage distribution. They are also associated with higher wages for vulnerable groups, such as lower-educated workers and women, but the association with wages for young or migrant workers is less clear. At the same time, workers in sectors with greater demand for labour tend to have higher wages and this, again, benefits otherwise lower-paid workers somewhat more. This points to both the economic conditions and the institutional factors that affect the bargaining position for otherwise more vulnerable workers supporting a reduction in wage inequality.

First, this paper focuses specifically on employees. By not including those who currently do not work, a better estimate of the actual distribution of wages can be obtained, but it does leave a selection issue where institutional support may also affect the probability of working in the first place. The extent to which there is a trade-off between employment and wages in, for instance, the raising of minimum wages is a related question, but is not addressed here.

Second, the paper considers inequality in the distribution of wages, but does not address variation in the time spent working, either by working fewer hours or by not working entire years. This earnings inequality is larger than the inequality in wages, but it reflects both individual choices in the time spent working and the constraints in terms of contracts offered and wage inequality. For that reason, this paper has focused only on the wage aspect. This choice may be particularly important as more vulnerable workers may face primarily insecurity in their employment, for example when being under-employed or employed on short, fixed-term contracts.

Third, this paper considers the associations of institutional and economic conditions with wages over the distribution, but these are not causal. It is possible that some of these policy choices, particularly the level of the minimum wage, have been taken precisely because of the level of wage inequality and, as such, the direction of the association may go from inequality to institutions. However, analyses on the variation within countries between sectors and over time are also carried out; these more specifically link the changes in these institutions to changes in inequality rather than cross-sectional associations.

## 6. Conclusion

Wage inequality, especially the issue of low wages for workers, is a crucial policy issue. Much of the reasoning behind the Minimum Wage Directive recently adopted by the European Commission specifically aims to provide decent living standards for all workers. This paper takes stock of the extent to which institutional support, such as minimum wages and collective agreement coverage, as well as the economic conditions affecting workers, already affects wage inequality and wages over the distribution.

Wage inequality across Europe has been declining somewhat. A first, really important, part in this across the European Union is the clear convergence in wages over time. Member States have become increasingly close to each other in average wage levels, although the variation between countries remains high. Partly this is likely to be due to the strong institutional support for lower-wage workers in the forms of wage floors as set by minimum wages and collective agreements; however, such support has been declining over time and has indeed been actively dismantled in some places during the period following the financial crisis. Partly, this also reflects recent economic conditions where the demand for workers is rising faster than supply, lifting their prospects. This has recently been particularly important for lower-paid workers in a range of occupations that are not necessarily highly skilled, as for instance with the case of essential workers during the pandemic in which it is now often difficult to fill vacancies. There is, however, substantial variation across countries and this paper highlights that the policy choices, as put forward in the Minimum Wage Directive – namely, increasing the bite of minimum wages and, even more so, strengthening collective bargaining coverage – can have a beneficial effect on levels of wage inequality, especially by helping more vulnerable workers at the bottom of the wage distribution who are increasingly left out.

These results indicate that, if the aim is to provide decent incomes for all workers and to reduce in-work poverty, the twin aims of increasing collective agreement coverage and raising the minimum wage to a higher level are likely to make a contribution. Beyond the institutional set-up, lower-earning workers are also helped to some extent by a tight labour market and high labour shortages which result in generally greater wage increases at the bottom of the wage distribution. Both factors – the importance of institutional support for workers with lower bargaining power and higher demand for labour that increases their bargaining position – indicates that, in our economy overall, the bargaining position of workers at the lower end of the distribution is weak and in need of support. These results also indicate that decisions to reduce collective bargaining and minimum wages, as was done following the financial crisis, are harmful in terms of wage equality.

## References

- Aeppli C. and Wilmers N. (2022) Rapid wage growth at the bottom has offset rising US inequality, *Proceedings of the National Academy of Sciences*, 119 (42), e2204305119. <https://doi.org/10.1073/pnas.2204305119>
- Arabadjieva K., Countouris N., Fabris B.L. and Zwysen W. (eds.) (2023) *Transformative ideas - ensuring a just share of progress for all*, ETUI. <https://www.etui.org/publications/transformative-ideas-ensuring-just-share-progress-all>
- Araki S., Bassanini A., Green A. and Marcolin L. (2022) Monopsony and concentration in the labour market, in OECD (ed.) *OECD Employment Outlook 2022: Building back more inclusive labour markets*, OECD Publishing, 132–199. <https://doi.org/10.1787/0ecab874-en>
- Autor D., Dorn D., Katz L.F., Patterson C. and Van Reenen J. (2020) The fall of the labor share and the rise of superstar firms, *The Quarterly Journal of Economics*, 135 (2), 645–709. <https://doi.org/10.1093/qje/qjaa004>
- Autor D.H., Levy F. and Murnane R.J. (2003) The skill content of recent technological change: An empirical exploration, *The Quarterly Journal of Economics*, 118 (4), 1279–1333. <https://doi.org/10.1162/003355303322552801>
- Barth E., Bryson A., Davis J.C. and Freeman R. (2016) It's where you work: Increases in the dispersion of earnings across establishments and individuals in the United States, *Journal of Labor Economics*, 34 (S2), S67–S97. <https://doi.org/10.1086/684045>
- Bell A.J.D. and Jones K. (2015) Explaining fixed effects: Random effects modeling of time-series cross-sectional and panel data, *Political Science Research and Methods*, 3 (1), 133–153. <https://doi.org/10.1017/psrm.2014.7>
- Berlingieri G., Blanchenay P. and Criscuolo C. (2017) *The great divergence(s)*, OECD Science, Technology and Industry Policy Papers 39, OECD Publishing. <https://doi.org/10.1787/953f3853-en>
- Bosler M. and Schank T. (2023) Wage inequality in Germany after the minimum wage introduction, *Journal of Labor Economics*, 41 (3), 565–897. <https://doi.org/10.1086/720391>
- Bratsberg B. and Ragan J.F. (2002) Changes in the union wage premium by industry, *ILR Review*, 56 (1), 65–83. <https://doi.org/10.1177/001979390205600104>
- Bryson A., Dale-Olsen H. and Nergaard K. (2020) Gender differences in the union wage premium? A comparative case study, *European Journal of Industrial Relations*, 26 (2), 173–190. <https://doi.org/10.1177/0959680119840572>
- Card D., Cardoso A.R., Heining J. and Kline P. (2017) Firms and labor market inequality: Evidence and some theory, *Journal of Labor Economics*, 36 (S1), S13–S70. <https://doi.org/10.1086/694153>
- Criscuolo C. et al. (2020) *Workforce composition, productivity and pay: The role of firms in wage inequality*, IZA Discussion Paper Series 13212, Institute of Labor Economics.
- Criscuolo C. et al. (2021) *The firm-level link between productivity dispersion and wage inequality: A symptom of low job mobility*, OECD Economics Department Working Papers 1656, OECD Publishing. <https://doi.org/10.1787/4c6131e3-en>
- De Loecker J., Eeckhout J. and Unger G. (2020) The rise of market power and the macroeconomic implications, *The Quarterly Journal of Economics*, 135 (2), 561–644. <https://doi.org/10.1093/qje/qjz041>

- Denk O., Garnero A., Hijzen A. and Martin S. (2019) The role of collective bargaining systems for labour market performance, in OECD (ed.) *Negotiating our way up: Collective bargaining in a changing world of work*, OECD Publishing, 108–115. <https://doi.org/10.1787/1fd2da34-en>
- Dreger C., López-Bazo E., Ramos R., Royuela V. and Suriñach J. (2015) Wage and income inequality in the European Union, European Parliament. [https://www.europarl.europa.eu/thinktank/en/document/IPOL\\_STU\(2015\)536294](https://www.europarl.europa.eu/thinktank/en/document/IPOL_STU(2015)536294)
- Dünhaupt P. (2017) Determinants of labour's income share in the era of financialisation, *Cambridge Journal of Economics*, 41 (1), 283–306. <https://www.jstor.org/stable/44488728>
- Esping-Andersen G. (1989) *The three worlds of welfare capitalism*, Polity Press.
- Eurofound (2021) *Tackling labour shortages in EU Member States*, Publications Office of the European Union.
- European Labour Authority (2023) *EURES report on labour shortages and surpluses 2022*, Publications Office of the European Union. <https://doi.org/10.2883/50704>
- Filastro S. and Parolin Z. (2019) Unequal unions? A comparative decomposition of income inequality in the European Union and United States, *Journal of European Social Policy*, 29 (4), 545–563. <https://doi.org/10.1177/0958928718807332>
- Firpo S., Fortin N.M. and Lemieux T. (2009) Unconditional quantile regressions, *Econometrica*, 77 (3), 953–973. <https://doi.org/10.3982/ECTA6822>
- Flecker J. (2010) Fragmenting labour: Organisational restructuring, employment relations and the dynamics of national regulatory frameworks, *Work Organisation, Labour and Globalisation*, 4 (1), 8–23. <https://doi.org/10.13169/workorglaboglob.4.1.0008>
- Fortin N.M., Lemieux T. and Lloyd N. (2021) Labor market institutions and the distribution of wages: The role of spillover effects, Working Paper 28375, National Bureau of Economic Research. <https://doi.org/10.3386/w28375>
- Garnero A. (2018) The dog that barks doesn't bite: Coverage and compliance of sectoral minimum wages in Italy, *IZA Journal of Labor Policy*, 7, 3. <https://doi.org/10.1186/s40173-018-0096-6>
- Garnero A. (2021) The impact of collective bargaining on employment and wage inequality: Evidence from a new taxonomy of bargaining systems, *European Journal of Industrial Relations*, 27 (2), 185–202. <https://doi.org/10.1177/0959680120920771>
- Godechot O. (2012) Is finance responsible for the rise in wage inequality in France?, *Socio-Economic Review*, 10 (3), 447–470. <https://doi.org/10.1093/ser/mws003>
- Godechot O. et al. (2023) Ups and downs in finance, ups without downs in inequality, *Socio-Economic Review*, 21 (3), 1601–1627. <https://doi.org/10.1093/ser/mwac036>
- Goos M., Manning A. and Salomons A. (2014) Explaining job polarization: Routine-biased technological change and offshoring, *American Economic Review*, 104 (8), 2509–2526. <https://doi.org/10.1257/aer.104.8.2509>
- Haapanala H., Marx I. and Parolin Z. (2023) Decent wage floors in Europe: Does the minimum wage directive get it right?, *Journal of European Social Policy*, 33 (4), 421–435. <https://doi.org/10.1177/09589287231176977>

- ILO (2016) Global wage report 2016/17: Wage inequality in the workplace, ILO.
- Kranzinger S. (2020) The decomposition of income inequality in the EU-28, *Empirica*, 47 (3), 643–668. <https://doi.org/10.1007/s10663-019-09450-9>
- Kristal T. and Cohen Y. (2017) The causes of rising wage inequality: The race between institutions and technology, *Socio-Economic Review*, 15 (1), 187–212. <https://doi.org/10.1093/ser/mww006>
- Krzywdzinski M. (2017) Automation, skill requirements and labour-use strategies: High-wage and low-wage approaches to high-tech manufacturing in the automotive industry, *New Technology, Work and Employment*, 32 (3), 247–267. <https://doi.org/10.1111/ntwe.12100>
- Langella M. and Manning A. (2021) Marshall lecture 2020: The measure of monopsony, *Journal of the European Economic Association*, 19 (6), 2929–2957. <https://doi.org/10.1093/jeea/jvab039>
- Marinescu I.E. and Rosenfeld J. (2022) Worker power and economic mobility: A landscape report, Urban Institute WorkRise. <https://www.workrisenetwork.org/sites/default/files/2022-08/correctedworker-power-economic-mobility-landscape-report.pdf>
- Martišková M., Kahancová M. and Kostolný J. (2021) Negotiating wage (in)equality: Changing union strategies in high-wage and low-wage sectors in Czechia and Slovakia, *Transfer*, 27 (1), 75–96. <https://doi.org/10.1177/1024258921995363>
- Michaels G., Natraj A. and Van Reenen J. (2013) Has ICT polarized skill demand? Evidence from eleven countries over twenty-five years, *The Review of Economics and Statistics*, 96 (1), 60–77. [https://doi.org/10.1162/REST\\_a\\_00366](https://doi.org/10.1162/REST_a_00366)
- Müller T. and Schulten T. (2020) The European minimum wage on the doorstep, Policy Brief 2020.01, ETUI. <https://www.etui.org/publications/policy-briefs/european-economic-employment-and-social-policy/the-european-minimum-wage-on-the-doorstep>
- Müller T. and Schulten T. (2024) The European directive on adequate minimum wages: A milestone for EU social policymaking, in Vanhercke B., Sabato S., and Spasova S. (eds.) *Social policy in the European Union - state of play 2023*, ETUI [forthcoming].
- Müller T., Vandaele K. and Waddington J. (eds.) (2019) *Collective bargaining in Europe: Towards an endgame*. Volume I, II, III and IV, ETUI. <https://www.etui.org/publications/books/collective-bargaining-in-europe-towards-an-endgame-volume-i-ii-iii-and-iv>
- OECD (2015) *In it together: Why less inequality benefits all*, OECD Publishing. <https://doi.org/10.1787/9789264235120-en>
- Pfeffer F.T. and Waitkus N. (2021) The wealth inequality of nations, *American Sociological Review*, 86 (4), 567–602. <https://doi.org/10.1177/00031224211027800>
- Piketty T. (2014) *Capital in the twenty-first century*, Harvard University Press.
- Pintera J. (2022) Skill-bias and wage inequality in the EU new Member States: Empirical investigation, Working Papers IES 2022/26, Charles University Prague, Faculty of Social Sciences, Institute of Economic Studies. [https://ideas.repec.org/p/fau/wpaper/wp2022\\_26.html](https://ideas.repec.org/p/fau/wpaper/wp2022_26.html)
- Raitano M. (2016) Income inequality in Europe since the crisis, *Intereconomics*, 51 (2), 67–72. <https://doi.org/10.1007/s10272-016-0579-x>
- Rubery J. (2015) Change at work: Feminisation, flexibilisation, fragmentation and financialisation, *Employee Relations*, 37 (6), 633–644. <https://doi.org/10.1108/ER-04-2015-0067>

- Schnabel C. (2013) Union membership and density: Some (not so) stylized facts and challenges, *European Journal of Industrial Relations*, 19 (3), 255–272. <https://doi.org/10.1177/0959680113493373>
- Schulten T. (2002) A European solidaristic wage policy?, *European Journal of Industrial Relations*, 8 (2), 173–196. <https://doi.org/10.1177/095968010282004>
- Theodoropoulou S. (2019) Convergence to fair wage growth? Evidence from European countries on the link between productivity and real compensation growth, 1970–2017, Working Paper 2019.07, ETUI. <https://www.etui.org/publications/working-papers/convergence-to-fair-wage-growth-evidence-from-european-countries-on-the-link-between-productivity-and-real-compensation-growth-1970-2017>
- Tober T. (2022) European institutional integration, trade unions and income inequality, *Socio-Economic Review*, 20 (1), 351–371. <https://doi.org/10.1093/ser/mwz053>
- Tomaskovic-Devey D. and Avent-Holt D. (2019) *Relational inequalities: An organizational approach*, Oxford University Press. <https://doi.org/10.1093/oso/9780190624422.001.0001>
- Vandaele K. (2019) *Bleak prospects: Mapping trade union membership in Europe since 2000*, ETUI. <https://www.etui.org/publications/books/bleak-prospects-mapping-trade-union-membership-in-europe-since-2000>
- Visser J. (2013) *Wage bargaining institutions - from crisis to crisis*, Economic Papers 488, European Commission.
- Waddington J., Müller T. and Vandaele K. (eds.) (2023) *Trade unions in the European Union: Picking up the pieces of the neoliberal challenge*, Peter Lang. <https://www.peterlang.com/document/1303070>
- Weil D. (2014) *The fissured workplace: Why work became so bad for so many and what can be done to improve it*, Harvard University Press.
- Western B. and Rosenfeld J. (2011) Unions, norms, and the rise in U.S. wage inequality, *American Sociological Review*, 76 (4), 513–537. <https://doi.org/10.1177/0003122411414817>
- Wilkinson R. and Pickett K. (2011) *The spirit level: Why greater equality makes societies stronger*, Bloomsbury Publishing.
- Zwysen W. (2016) Crowding out of disadvantaged young adults in Germany: Background matters depending on local labour market, *European Sociological Review*, 32 (5), 662–674. <https://doi.org/10.1093/esr/jcw023>
- Zwysen W. (2021) Performance pay across Europe: Drivers of the increase and the link with wage inequality, Working Paper 2021.06, ETUI. <https://www.etui.org/publications/performance-pay-across-europe>
- Zwysen W. (2022) Global and institutional drivers of wage inequality between and within firms, *Socio-Economic Review*, 21 (4), 2043–2068. <https://doi.org/10.1093/ser/mwac054>
- Zwysen W. (2023a) *Labour shortages - turning away from bad jobs*, Policy Brief 2023.03, ETUI. <https://www.etui.org/publications/labour-shortages-turning-away-bad-jobs>
- Zwysen W. (2023b) *Working apart: Polarisation driven by widening firm gaps and outsourcing*, Working Paper 2023.03, ETUI. <https://www.etui.org/publications/working-apart-polarisation-driven-widening-firm-gaps-and-outsourcing>



- Zwysen W. and Akgüç M. (2023) Analysing the flows and labour market outcomes of short-term mobile workers in the EU, Working Paper 2023.07, ETUI. <https://www.etui.org/publications/analysing-flows-and-labour-market-outcomes-short-term-mobile-workers-eu>
- Zwysen W. and Drahekoupil J. (2022) Are collective agreements losing their bite? Collective bargaining and pay premia in Europe, 2002-2018, Working Paper 2022.07, ETUI. <https://www.etui.org/publications/are-collective-agreements-losing-their-bite>
- Zwysen W. and Drahekoupil J. (2023) Collective bargaining and power: Wage premium of collective agreements in Europe 2002–2018, British Journal of Industrial Relations. <https://doi.org/10.1111/bjir.12777>

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## Appendix

Table A1 Descriptive statistics of EU-SILC

	N	Average	Standard deviation	Minimum	Maximum
Real gross hourly wage	2486324	13.17	9.68	0.119587	125.7252
Gross wage (ppp)	2486324	12.72	8.26	0.2667	88.90087
Low wage (below 60% of median)	2486324	0.14	0.35	0	1
Median wage per country-year	2486324	12.02	5.74	1.203933	32.36025
Statutory minimum wage observed	2486324	0.69	0.46	0	1
Kaitz index (mean)	1859211	42.38	5.19	29.1	51.9
Collective pay agreement	2002661	73.28	30.62	0	100
Centralised collective pay agreement	2002661	58.89	38.05	0	100
Decentralised collective pay agreement	2002661	14.43	21.83	0	99.84519
Union density	1630781	22.32	16.33	0	96.86585
Job vacancy rate	2019603	1.52	1.44	0	23.13333
Unemployment rate	2480938	11.24	9.00	0.6	89
Dummy: women	2486324	0.48	0.50	0	1
Age	2486324	41.34	11.09	18	64
Country of birth: majority	2486324	0.91	0.29	0	1
Country of birth: EU	2486324	0.03	0.16	0	1
Country of birth: non-EU	2486324	0.07	0.25	0	1
Education: low	2486324	0.51	0.50	0	1
Education: intermediate	2486324	0.28	0.45	0	1
Education: high	2486324	0.21	0.41	0	1
Urbanity: dense	2486324	0.39	0.49	0	1
Urbanity: intermediate	2486324	0.26	0.44	0	1
Urbanity: rural	2486324	0.23	0.42	0	1
Urbanity: missing	2486324	0.12	0.32	0	1
Months worked: full-time employee	2486324	9.83	4.41	0	12
Months worked: part-time employee	2486324	1.77	4.15	0	12
Hours worked	2486324	38.10	8.67	1	99
Primary sector	2486324	0.02	0.13	0	1
Industry sector	2486324	0.21	0.41	0	1
Construction	2486324	0.06	0.25	0	1
Private services	2486324	0.36	0.48	0	1
Public services	2486324	0.34	0.48	0	1
AT	2486324	0.02	0.15	0	1
BE	2486324	0.03	0.16	0	1
BG	2486324	0.02	0.14	0	1
CY	2486324	0.00	0.05	0	1
CZ	2486324	0.03	0.16	0	1
DE	2486324	0.23	0.42	0	1
DK	2486324	0.01	0.10	0	1
EE	2486324	0.00	0.06	0	1
EL	2486324	0.02	0.13	0	1
ES	2486324	0.10	0.30	0	1
FI	2486324	0.01	0.11	0	1

	N	Average	Standard deviation	Minimum	Maximum
FR	2486324	0.15	0.35	0	1
HU	2486324	0.02	0.15	0	1
IE	2486324	0.01	0.10	0	1
IT	2486324	0.12	0.33	0	1
LT	2486324	0.01	0.09	0	1
LU	2486324	0.00	0.04	0	1
LV	2486324	0.01	0.07	0	1
NL	2486324	0.02	0.15	0	1
PL	2486324	0.08	0.27	0	1
PT	2486324	0.03	0.16	0	1
RO	2486324	0.04	0.20	0	1
SE	2486324	0.02	0.12	0	1
SI	2486324	0.01	0.07	0	1
SK	2486324	0.01	0.12	0	1

Note: \*, p<0.1, \*\*, p<0.05, \*\*\*, p<0.01.  
Source: EU-SILC 2007-2022.

Table A2 Coefficients of institutional and economic factors on variance of log real wages

VARIABLES	Minimum wage present	Kaitz index	Collective pay agreement coverage	CPA - centralised	CPA - decentralised	Union density	Job vacancy rate	Unemployment rate (demographic)
Minimum wage present	0.334*** (0.0218)							
Kaitz index		-0.0252*** (0.00271)						
Collective pay agreement coverage			-0.00485*** (0.000421)					
CPA - centralised				-0.00757*** (0.000292)				
CPA - decentralised					0.0139*** (0.000791)			
Union density						-0.00519*** (0.000650)		
Job vacancy rate							-0.0243*** (0.00639)	
Unemployment rate (demographic)								-0.00287* (0.00171)
Women	-0.140*** (0.0374)	-0.0675 (0.0464)	-0.134*** (0.0413)	-0.0426 (0.0381)	-0.0921** (0.0380)	-0.221*** (0.0421)	-0.0884* (0.0456)	-0.191*** (0.0390)
Age	-0.0162*** (0.00189)	-0.00892*** (0.00231)	-0.0135*** (0.00206)	-0.0108*** (0.00192)	-0.0182*** (0.00182)	-0.0310*** (0.00195)	-0.00723*** (0.00235)	-0.0220*** (0.00262)
Age squared	0.000292*** (2.08e-05)	0.000227*** (2.55e-05)	0.000255*** (2.26e-05)	0.000226*** (2.14e-05)	0.000315*** (2.05e-05)	0.000430*** (2.12e-05)	0.000195*** (2.58e-05)	0.000343*** (2.74e-05)

VARIABLES	Minimum wage present	Kaitz index	Collective pay agreement coverage	CPA - centralised	CPA - decentralised	Union density	Job vacancy rate	Unemployment rate (demographic)
Women * age	0.0135*** (0.00195)	0.00992*** (0.00237)	0.0138*** (0.00221)	0.00824*** (0.00200)	0.0104*** (0.00200)	0.0163*** (0.00219)	0.0112*** (0.00238)	0.0170*** (0.00215)
Women * age squared	-0.000203*** (2.27e-05)	-0.000167*** (2.71e-05)	-0.000211*** (2.57e-05)	-0.000150*** (2.34e-05)	-0.000166*** (2.32e-05)	-0.000221*** (2.49e-05)	-0.000185*** (2.74e-05)	-0.000243*** (2.59e-05)
Born in EU	-0.183*** (0.0111)	-0.126*** (0.0122)	-0.142*** (0.0136)	-0.0622*** (0.0101)	-0.0975*** (0.0104)	-0.0916*** (0.0112)	-0.143*** (0.0131)	-0.188*** (0.0117)
Born in third country	-0.183*** (0.00867)	-0.186*** (0.0106)	-0.179*** (0.0111)	-0.115*** (0.00758)	-0.116*** (0.00737)	-0.105*** (0.00902)	-0.202*** (0.0111)	-0.211*** (0.0103)
Intermediate educated	0.0684*** (0.0128)	0.0693*** (0.0164)	0.0319** (0.0142)	-0.0400*** (0.0130)	0.0286** (0.0139)	0.0336** (0.0152)	0.0954*** (0.0156)	0.0567*** (0.0181)
High educated	0.124*** (0.0195)	0.213*** (0.0256)	0.129*** (0.0218)	0.0801*** (0.0223)	0.133*** (0.0213)	0.0832*** (0.0191)	0.210*** (0.0259)	0.119*** (0.0272)
Cohabitation status	-0.0981*** (0.0166)	-0.0916*** (0.0157)	-0.103*** (0.0190)	-0.0998*** (0.0162)	-0.0736*** (0.0113)	-0.0239** (0.0107)	-0.0940*** (0.0188)	-0.0844*** (0.0169)
Child in household	0.0777*** (0.00641)	0.0884*** (0.00629)	0.0971*** (0.00771)	0.0941*** (0.00691)	0.0760*** (0.00497)	0.0619*** (0.00517)	0.103*** (0.00781)	0.0902*** (0.00696)
Intermediately populated	-0.0283*** (0.00655)	-0.0117 (0.00821)	-0.0631*** (0.00867)	-0.0323*** (0.00722)	-0.0355*** (0.00821)	-0.00281 (0.00688)	-0.0365*** (0.0101)	-0.0746*** (0.00792)
Rural	0.132*** (0.00974)	0.124*** (0.0103)	0.137*** (0.0112)	0.108*** (0.00941)	0.108*** (0.00999)	0.107*** (0.0110)	0.137*** (0.0105)	0.137*** (0.0101)
Urbanity missing	-0.0713*** (0.0239)	0.151*** (0.0252)	-0.0645** (0.0285)	-0.0257 (0.0312)	0.174*** (0.0257)	-0.0599*** (0.0228)	0.0566** (0.0280)	-0.0377 (0.0263)
Months full-time employee	-0.0235*** (0.00158)	-0.0256*** (0.00171)	-0.0243*** (0.00169)	-0.0252*** (0.00148)	-0.0269*** (0.00131)	-0.0286*** (0.00149)	-0.0206*** (0.00182)	-0.0250*** (0.00142)
Months part-time employee	-0.0121*** (0.00160)	-0.00838*** (0.00177)	-0.0148*** (0.00168)	-0.0128*** (0.00157)	-0.0137*** (0.00159)	-0.0211*** (0.00167)	-0.00918*** (0.00194)	-0.0167*** (0.00153)
Hours worked	0.0116*** (0.000493)	0.0146*** (0.000570)	0.0116*** (0.000518)	0.00997*** (0.000492)	0.0104*** (0.000501)	0.00632*** (0.000543)	0.0117*** (0.000582)	0.0119*** (0.000490)
NACE Rev.2: B-E	-0.109 (0.0684)	-0.0509 (0.0730)				-0.185*** (0.0647)	-0.348*** (0.0948)	-0.133* (0.0721)
NACE Rev.2: F	-0.241*** (0.0710)	-0.181** (0.0730)	-0.117** (0.0568)	-0.0576 (0.0452)	-0.00606 (0.0421)	-0.302*** (0.0778)	-0.435*** (0.0969)	-0.245*** (0.0732)
NACE Rev.2: G	-0.168** (0.0711)	-0.127* (0.0757)	-0.0818 (0.0615)	-0.0481 (0.0521)	0.0546 (0.0448)	-0.194** (0.0762)	-0.395*** (0.0964)	-0.185** (0.0742)
NACE Rev.2: H	-0.271*** (0.0659)	-0.218*** (0.0691)	-0.143*** (0.0532)	-0.149*** (0.0465)	-0.168*** (0.0413)	-0.352*** (0.0641)	-0.503*** (0.0923)	-0.283*** (0.0690)
NACE Rev.2: I	-0.221*** (0.0686)	-0.218*** (0.0762)	-0.0900 (0.0566)	-0.00458 (0.0484)	0.0832* (0.0462)	-0.243*** (0.0691)	-0.437*** (0.0956)	-0.226*** (0.0710)
NACE Rev.2: J	-0.180*** (0.0679)	-0.102 (0.0741)	-0.101** (0.0502)	-0.102** (0.0448)	-0.0605 (0.0464)	-0.225*** (0.0623)	-0.341*** (0.0960)	-0.209*** (0.0686)
NACE Rev.2: K	-0.125** (0.0624)	-0.0410 (0.0691)	-0.0141 (0.0443)	0.0691* (0.0375)	0.105*** (0.0403)	-0.214*** (0.0614)	-0.317*** (0.0907)	-0.172*** (0.0631)
NACE Rev.2: L-N	-0.245*** (0.0628)	-0.193*** (0.0668)	-0.160*** (0.0458)	-0.0967** (0.0380)	-0.0209 (0.0360)	-0.294*** (0.0626)	-0.426*** (0.0903)	-0.277*** (0.0647)
NACE Rev.2: O	-0.329*** (0.0629)	-0.250*** (0.0667)	-0.111** (0.0520)	-0.0207 (0.0510)	-0.0287 (0.0452)	-0.286*** (0.0639)	-0.508*** (0.0906)	-0.353*** (0.0645)

VARIABLES	Minimum wage present	Kaitz index	Collective pay agreement coverage	CPA - centralised	CPA - decentralised	Union density	Job vacancy rate	Unemployment rate (demographic)
NACE Rev.2: P	-0.290*** (0.0638)	-0.222*** (0.0653)	-0.140*** (0.0480)	-0.0301 (0.0392)	-0.0161 (0.0385)	-0.228*** (0.0649)	-0.498*** (0.0894)	-0.314*** (0.0652)
NACE Rev.2: Q	-0.334*** (0.0621)	-0.264*** (0.0648)	-0.210*** (0.0462)	-0.159*** (0.0400)	-0.166*** (0.0374)	-0.337*** (0.0612)	-0.527*** (0.0889)	-0.367*** (0.0635)
NACE Rev.2: R-U	-0.202*** (0.0636)	-0.187*** (0.0693)	-0.114** (0.0490)	-0.0635 (0.0409)	-0.00878 (0.0376)	-0.172*** (0.0636)	-0.422*** (0.0905)	-0.230*** (0.0658)
2007	-0.0349 (0.0816)	-0.0979 (0.0895)	-0.0687 (0.0962)	-0.0573 (0.0768)	-0.0412 (0.0687)	0.0139 (0.0680)	-0.0236 (0.116)	-0.0431 (0.0834)
2008	-0.0718 (0.0778)	-0.123 (0.0871)	-0.116 (0.0936)	-0.0988 (0.0765)	-0.0552 (0.0686)	0.000975 (0.0648)	-0.217** (0.100)	-0.0803 (0.0794)
2009	-0.0129 (0.0811)	-0.0153 (0.0924)	-0.0553 (0.0986)	-0.0279 (0.0801)	0.0364 (0.0688)	0.00894 (0.0609)	-0.0163 (0.126)	-0.0116 (0.0844)
2010	-0.0292 (0.0800)	-0.0474 (0.0911)	-0.0964 (0.0945)	-0.0557 (0.0779)	0.0230 (0.0676)	0.250*** (0.0867)	-0.0481 (0.121)	-0.0261 (0.0833)
2011	-0.0349 (0.0809)	-0.0449 (0.0950)	-0.104 (0.0960)	-0.0658 (0.0789)	0.0189 (0.0685)	0.149* (0.0804)	-0.147 (0.110)	-0.0346 (0.0848)
2012	-0.0150 (0.0830)	-0.0136 (0.0982)	-0.0895 (0.0989)	-0.0537 (0.0815)	0.0356 (0.0705)	0.102 (0.0757)	-0.124 (0.113)	-0.0111 (0.0878)
2013	-0.0766 (0.0822)	-0.103 (0.100)	-0.141 (0.0985)	-0.0581 (0.0824)	-0.0160 (0.0718)	0.104 (0.0750)	-0.232** (0.115)	-0.0880 (0.0866)
2014	-0.0714 (0.0841)	-0.129 (0.0998)	-0.141 (0.0974)	-0.0642 (0.0811)	-0.0721 (0.0714)	0.112 (0.0738)	-0.269** (0.115)	-0.0956 (0.0874)
2015	-0.162** (0.0813)	-0.210** (0.0892)	-0.154 (0.0945)	-0.0769 (0.0786)	-0.0799 (0.0693)	0.0470 (0.0682)	-0.283** (0.112)	-0.110 (0.0840)
2016	-0.198*** (0.0756)	-0.233*** (0.0827)	-0.189** (0.0880)	-0.106 (0.0723)	-0.108* (0.0636)	0.0141 (0.0620)	-0.366*** (0.104)	-0.147* (0.0779)
2017	-0.240*** (0.0726)	-0.256*** (0.0797)	-0.232*** (0.0849)	-0.148** (0.0697)	-0.147** (0.0625)	0.00470 (0.0626)	-0.404*** (0.102)	-0.190** (0.0746)
2018	-0.280*** (0.0690)	-0.295*** (0.0763)	-0.274*** (0.0813)	-0.189*** (0.0673)	-0.186*** (0.0613)	-0.00653 (0.0607)	-0.443*** (0.0993)	-0.232*** (0.0709)
2019	-0.269*** (0.0709)	-0.234*** (0.0775)	-0.258*** (0.0833)	-0.181*** (0.0699)	-0.171*** (0.0660)	-0.0151 (0.0624)	-0.417*** (0.103)	-0.221*** (0.0729)
2020	-0.311*** (0.0681)	-0.194** (0.0755)	-0.306*** (0.0810)	-0.220*** (0.0682)	-0.160** (0.0670)	-0.0402 (0.0591)	-0.448*** (0.102)	-0.252*** (0.0701)
2021	-0.336*** (0.0676)	-0.245*** (0.0756)	-0.333*** (0.0805)	-0.246*** (0.0680)	-0.186*** (0.0672)	-0.0706 (0.0579)	-0.459*** (0.101)	-0.277*** (0.0695)
Constant	0.730*** (0.0987)	1.709*** (0.149)	1.219*** (0.110)	1.247*** (0.0868)	0.610*** (0.0771)	1.412*** (0.0947)	1.154*** (0.143)	1.141*** (0.118)
Observations	2,486,324	1,859,211	2,002,661	2,002,661	2,002,661	1,630,781	2,019,603	2,480,938
R-squared	0.064	0.067	0.064	0.129	0.136	0.040	0.051	0.040

Note: \*: p<0.1, \*\*: p<0.05, \*\*\*: p<0.01.  
Source: EU-SILC 2007-2022.

Table A3 Effects of institutional or economic factors on log real wage by demographics

Log wage		Lower educated	Female	Migrant	Young (<30)
Have minimum wage N=2,486,324	Main demographic effect	-0.253*** (0.00908)	-0.139*** (0.00540)	-0.180*** (0.00734)	-0.0621*** (0.00666)
	Main effect driver	0.124*** (0.0205)	0.0682*** (0.0160)	0.0573*** (0.0147)	0.0622*** (0.0150)
	Interaction	-0.0665*** (0.0120)	-0.00467 (0.00662)	0.0371*** (0.00931)	0.0508*** (0.00851)
Kaitz index N=1,859,211	Main demographic effect	-0.527*** (0.0524)	-0.203*** (0.0256)	-0.215*** (0.0547)	0.0336 (0.0284)
	Main effect driver	0.00315* (0.00161)	0.00576*** (0.00136)	0.00634*** (0.00134)	0.00621*** (0.00134)
	Interaction	0.00467*** (0.00117)	0.00134** (0.000592)	0.00158 (0.00126)	0.00201* (0.00121)
Collective agreement N=2,002,661	Main demographic effect	-0.448*** (0.0124)	-0.196*** (0.00658)	-0.0604*** (0.0132)	-0.0519*** (0.0119)
	Main effect driver	-0.00158*** (0.000205)	-0.000540*** (0.000176)	-0.000102 (0.000171)	-7.45e-05 (0.000172)
	Interaction	0.00189*** (0.000148)	0.000719*** (8.65e-05)	-0.00118*** (0.000155)	-0.00117*** (0.000142)
Union density N=1,630,781	Main demographic effect	-0.359*** (0.00710)	-0.150*** (0.00404)	-0.127*** (0.00815)	0.0683*** (0.00679)
	Main effect driver	-0.00138*** (0.000404)	0.000437 (0.000340)	0.000758** (0.000341)	0.000770** (0.000340)
	Interaction	0.00202*** (0.000206)	0.000562*** (0.000135)	-0.00105*** (0.000236)	-0.000806*** (0.000210)
CPA - centralised N=2,002,661	Main demographic effect	-0.438*** (0.00910)	-0.175*** (0.00477)	-0.0802*** (0.0111)	0.0785*** (0.00597)
	Main effect driver	-0.00143*** (0.000194)	-9.12e-05 (0.000183)	0.000238 (0.000181)	0.000272 (0.000181)
	Interaction	0.00210*** (0.000117)	0.000552*** (7.21e-05)	-0.00102*** (0.000136)	-0.000709*** (9.95e-05)
CPA - decentralised N=1,630,781	Main demographic effect	-0.275*** (0.00724)	-0.138*** (0.00348)	-0.150*** (0.00588)	0.00591 (0.00492)
	Main effect driver	0.00173*** (0.000305)	-0.000554* (0.000288)	-0.000685** (0.000277)	-0.000710** (0.000277)
	Interaction	-0.00293*** (0.000256)	-0.000308* (0.000169)	-0.000366 (0.000414)	0.00193*** (0.000156)
Job vacancy rate N=2,019,603	Main demographic effect	-0.316*** (0.00846)	-0.151*** (0.00431)	-0.156*** (0.00914)	0.0601*** (0.00678)
	Main effect driver	0.00143 (0.00352)	0.000315 (0.00280)	-0.000575 (0.00249)	-0.000871 (0.00250)
	Interaction	-0.00128 (0.00310)	-0.00141 (0.00190)	0.00363 (0.00348)	0.00652** (0.00306)

Log wage		Lower educated	Female	Migrant	Young (<30)
Unemployment rate N=2,480,938	Main demographic effect	-0.362*** (0.00609)	-0.161*** (0.00410)	-0.177*** (0.00791)	-0.00212 (0.00592)
	Main effect driver	-0.0131*** (0.000829)	-2.11e-05 (0.000457)	0.000719* (0.000420)	0.000721* (0.000420)
	Interaction	0.0116*** (0.000703)	0.00160*** (0.000287)	0.00188*** (0.000463)	0.00143*** (0.000390)

Note: controlling for demographic and work characteristics, includes weights.

\*: p<0.1, \*\*: p<0.05, \*\*\*: p<0.01.

Source: EU-SILC 2007-2022.

Table A4 Within-country and between-country effects of institutional and economic factors on wage inequality and levels

	Variance log wage		Median wage		Low wage	
	Deviation from country-average	Average	Deviation from country-average	Average	Deviation from country-average	Average
Minimum wage present	-0.0650*** (0.0137)	-0.0508** (0.0219)	-0.0683** (0.0348)	-0.676*** (0.132)	-0.0782*** (0.0136)	-0.00642 (0.0168)
Kaitz index	-0.00168*** (0.000390)	0.00545*** (0.00165)	0.00525*** (0.00104)	0.0258 (0.0203)	-0.00167*** (0.000394)	0.00554*** (0.00103)
Unemployment rate (demographic)	-0.000629*** (0.000216)	-0.000879 (0.00177)	-0.00538*** (0.000541)	-0.0441*** (0.0108)	0.000204 (0.000214)	0.00230** (0.00115)
Collective pay agreement coverage	-0.000494*** (6.77e-05)	0.000314 (0.000461)	0.00137*** (0.000175)	0.0174*** (0.00346)	-0.000575*** (6.12e-05)	-0.000603 (0.000448)
Centralised agreement	-0.000731*** (6.86e-05)	0.000366 (0.000378)	0.000892*** (0.000180)	0.0176*** (0.00186)	-0.000553*** (6.26e-05)	-0.000571 (0.000368)
Decentralised agreement	0.000340*** (8.65e-05)	-0.000892 (0.000922)	0.000776*** (0.000225)	-0.0339*** (0.00721)	-7.08e-05 (7.87e-05)	0.000911 (0.000924)
Union density	5.56e-05 (0.000138)	-0.000937* (0.000517)	0.00199*** (0.000324)	0.0148*** (0.00363)	-0.000226 (0.000138)	-0.00157*** (0.000307)
Job vacancy rate	-0.00128 (0.000878)	-0.0195 (0.0162)	0.00744*** (0.00225)	0.255** (0.110)	-0.000738 (0.000864)	-0.0235** (0.0103)

Note: estimated through a Mundlak corrected multilevel model at country level, with variation within countries over industry and year level, showing the variance, median wage and share of low-paid workers at country-industry-year level. Results are shown as one-tenth of the change from not having a minimum wage to having one and a five percentage point change for the other factors except for the job vacancy rate, where a one percentage point change is taken. The models control for gender, age, country of birth, education, urbanity, months spent full-time or part-time employed, hours worked and main sector of work.

\*: p<0.1, \*\*: p<0.05, \*\*\*: p<0.01.

Source: EU-SILC 2007-2022, supplemented by external data.





**European  
Trade Union Institute**  
Bd du Jardin Botanique, 20  
1000 Brussels  
Belgium  
etui@etui.org  
www.etui.org