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The impact of minimum wages on income inequality in the EU

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JRC TECHNICAL REPORT

The Impact of Minimum Wages on Income Inequality in the EU

*JRC Working Papers on
Taxation and Structural
Reforms No 04/2023*

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Abstract

A number of studies documents that minimum wage policies have the potential to reduce income inequality. The recently adopted EU Commission's proposal for a Directive on adequate minimum wages was supported by a detailed analysis of the social impacts of hypothetical minimum wage levels in countries with a statutory minimum wage. This paper extends these country-level analyses by exploring the impact of minimum wage policies on EU-level income inequality. To our knowledge, this is the first study that uses a microsimulation model such as EUROMOD to assess the impact of EU-promoted policies on the distribution of income in the EU, beyond their national effects. Assuming no employment effects, static simulation results show that a hypothetical minimum wage corresponding to 60% of the national median wage would bring about a small but significant reduction in EU-level disposable income inequality (by 0.75% in 2019 as measured through the Gini index). This result stems primarily from a reduction in the within-country component of income inequality as the effect on inequality between countries is rather muted. The reduction in EU-level income inequality is the highest in disposable incomes, but some reduction is detectable also in market incomes. In turn, the withdrawal of social benefits because of higher minimum wages seems to neutralise part of this inequality reduction.

Keywords: Minimum wage, Microsimulation, European Union, Income inequality, EUROMOD

JEL code: H31, I32, J31.

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Executive summary

- The recently adopted Directive on adequate minimum wages in the EU has the objective to ensure that workers' earnings in the Union are sufficient to allow for a decent living, wherever they work. The Directive sets a framework and proposes a combination of policy measures to improve the adequacy and coverage of minimum wages.
- **Minimum wage policies have an impact on national income distributions across EU countries.** Thus, they also have the potential to influence the distribution of income across the overall EU population. As minimum wage variations affect differently the national bottom income distributions, they may influence and change the relative national positions in the EU distribution. In this sense, it is desirable that minimum wage floors set across EU countries with common principles contribute to reduce EU-level inequality.
- Building on the impact assessment accompanying the Commission's proposal for the Directive, we simulate the impact on EU-level inequality of minimum wage increases correspondent to 50%, 55% and 60% of the national median wages in the countries with a statutory minimum wage. Afterwards, we decompose the change in EU-level inequality into two components: within and between countries. We do this for three income concepts: market, gross and disposable incomes. To this end, we use the EU-wide microsimulation tool EUROMOD, which is unique in assessing in a coherent and comparable way the impact of EU-promoted policies. To the best of our knowledge, this is the first study that uses EUROMOD for analysing the impact of policies on EU-level inequality indices.
- **Simulation results indicate that increasing statutory minimum wages to 60% of national median wages reduces the EU-level Gini coefficient for disposable incomes by 0.75%.** Overall, inequality decline is primarily due to a reduction of within-country inequality while the effect on between-country inequality is negligible. Extending the analysis to market income, we find that this increase in statutory minimum wages brings about a smaller but significant reduction in market income inequality (-0.6%).
- **Our findings indicate that it is worth considering minimum wage policies in the policy toolkit to address EU-level income inequality,** in conjunction with more traditional inequality-reducing policy instruments. The small but significant EU-level inequality reduction triggered by increased minimum wage levels occurs mainly through the reduction of its within-country component. In turn, our results indicate that common principles in the minimum-wage setting mechanism across EU countries (similar Kaitz ratios) do not alter significantly inequality between countries.
- **This study may serve as a benchmark for those interested in examining the effect of EU policies on the EU-level income distribution.** All policy reforms promoted by the EU that have a heterogeneous impact on national income distributions are likely to have an impact on EU-level distribution. If the concerns for greater income convergence across countries and trust in supranational institutions are to be taken seriously, future assessments of EU policies may well extend the national analysis of their income effects to the supranational dimension with EUROMOD.

1 Introduction

In October 2022, the European Commission adopted a Directive on adequate minimum wages in the EU with the objective to ensure that workers' earnings in the Union are sufficient to allow for a decent living, wherever they work.¹ The Directive sets a framework and proposes a combination of policy measures to improve the adequacy and coverage of minimum wages.

In search of reasonable indicators of adequacy, the recent debate has largely focused on Kaitz indices, which express a relationship between minimum and median or average wages. Minimum wages should guarantee the satisfaction of the needs of workers and their families in the light of national economic and social conditions.² In this context, Grünberger et al. (2022) have analysed the impact of hypothetical minimum wage scenarios on a vast array of social outcomes at the national level, including wage and income inequality. Their scenarios include increases of statutory minimum wages to 50%, 55% and 60% of the median wage as well as 40%, 45% and 50% of the average wage, in line with the impact assessment accompanying the Commission's Proposal.³ Assuming that the employment effects of minimum wage policies are negligible,⁴ their results indicate that an increase in the minimum wage is expected to compress the wage distribution at the bottom. The magnitude of the wage-inequality reduction depends on the share of workers affected and the increase in the minimum wage level. In turn, family composition and the interaction of the tax-benefit system with the new level of minimum wage are crucial for determining the final impact on income distribution. Furthermore, they show that wage inequality varies significantly from country to country under these scenarios of minimum wage floors commonly set in relation to national wage benchmarks. For example, an increase of minimum wages to 60% of the median wage would lead to a reduction of at least 10% in wage inequality in only 12 Member States, while in others the inequality reduction is lower or nihil.

Therefore, if minimum wage policies have an impact on national income distributions across EU countries, they also have the potential to influence the distribution of income across the overall EU population that is a key dimension to evaluate the desirability of EU policies. As enshrined in the Treaties, improved living and working conditions should be promoted so as to achieve their upward convergence.⁵ In this sense, it is desirable that minimum wage floors set across EU countries with common principles (relatively to the general level of wages in each Member State) contribute to reducing EU-level inequality.

Despite a range of studies documenting the impact of commonly set minimum wage floors on country-level inequality, their inequality-reducing impact at the EU level cannot be predicted a priori. This is because inequality between EU citizens goes beyond the sum of country-level inequalities as it results from both within- and between-country components of inequality. Not only do rising minimum wages influence within-country income distributions, they may reshuffle inequality between countries. As they affect differently the national bottom income distributions, they may influence and change the relative national positions in the EU distribution. For instance, in a scenario

¹ Proposal for a Directive of the European Parliament and of the Council on adequate minimum wages in the European Union.

² Principle 6 of the European Pillar of Social Rights.

³ Impact Assessment accompanying the Proposal for a Directive of the European Parliament and of the Council on adequate minimum wages in the European Union, SWD(2020) 245 final.

[EUR-Lex - 52020SC0245 - EN - EUR-Lex \(europa.eu\)](#)

⁴ For an assessment of the employment effects of an introduction or an increase in the minimum wage level see Grünberger et al. (2022).

⁵ Art. 151 TFEU, ex. Art 136 TEC.

where increasing minimum wages benefitted relatively more high-income EU countries, the final effect at the EU level could, in theory, be dis-equalising because these minimum wage earners are in the middle upper part of the EU-level distribution. Conversely, if minimum wage earners who benefit more from the increase are located in relatively poorer EU countries, such an increase would result in a more equal EU distribution as these earners are in the bottom end of the EU distribution.

Against this background, this study builds on Grünberger et al. (2022) and aims to analyse the potential for statutory minimum wages to reduce EU-level income inequality. The contribution is twofold. First, we expand the country-specific analyses of the impact of hypothetical minimum wages on inequality in a supranational, EU-level dimension. Second, we use the EU-wide microsimulation tool, EUROMOD, to study in a coherent and comparable way the impact of EU-promoted policies, such as hypothetical minimum wage rises, on the distribution of income at the EU level, accounting for the complexities of tax-benefit systems in the EU. To the best of our knowledge, this is the first study that uses EUROMOD for analysing the impact of policies on EU-level inequality indices.

In particular, we simulate the impact on EU-level inequality of minimum wage increases correspondent to 50%, 55% and 60% of the national median wages in the countries with a statutory minimum wage.⁶ Afterwards, we decompose the change in EU-level inequality into two components: within and between countries. Reasonably, the inequality reduction is the highest for the most ambitious levels of minimum wage increase. Simulation results indicate that increasing statutory minimum wages to 60% of national median wages reduces the EU-level Gini coefficient for disposable incomes by 0.75%. Overall, inequality decline is primarily due to a reduction of within-country inequality while the effect on between-country inequality is very small, almost muted. We also extend the analysis to other income concepts such as market income and gross income and find that the most ambitious minimum wage increase brings about a small but significant reduction in market income inequality by 0.6%. In turn, inequality in gross incomes is the least affected among the three income concepts due to the withdrawal of benefits after the increase in minimum wage. For both market and gross incomes, the inequality reduction is also driven by the within-country inequality component.

The paper is structured as follows. Section 2 surveys the empirical studies related to EU-level inequality analyses and the impact of minimum wage policies on income inequality. Sections 3 and 4 illustrate the hypothetical minimum wage scenarios and the methodological approach adopted to simulate their impact on EU-level inequality. Section 5 discusses the results and its policy implications while Section 6 concludes.

⁶ This is in line with the exercise carried out in the Impact Assessment for the Commission's proposal for a Directive on adequate minimum wages, SWD(2020) 245 final. In the paper that documents the social impacts of hypothetical minimum wage floors, scenarios of minimum wage increases, correspondent to three levels of Kaitz ratios, are applied only to countries with an existing statutory minimum wage (Grünberger et al. 2022).

2 Literature Review

2.1 Income inequality at the EU level

Most research on income inequality in the EU area is limited to country-level analysis,⁷ essentially because tax-benefit systems, which represent the primary policy tool to contrast inequality, are in the remit of Member States. Moreover, reforms of tax-benefit systems take place mainly at the national level as they generally reflect national preferences.

However, as the mobility of the EU population has risen over the last decade (European Commission 2020a), it is reasonable to assume that EU citizens consider their income levels in comparison to EU-level incomes. In this context, the perception of inequality may go beyond national considerations. Likewise, an integrated European economic space requires that policies should aim, at least in the medium run, at pushing inequality in the Union down. Especially EU policies that might have different effects on income inequality across EU countries are also likely to affect overall EU-level inequality. In this regard, Salverda (2021) delineates a broad range of both national and EU policies with the perspective of a reduction of EU-wide inequality.

This is why some studies have recently estimated EU-level income inequality, following a research strand pioneered by Toni Atkinson (1998). From an empirical viewpoint, these estimates have been carried out with harmonised survey data or with administrative income data. For the former, many studies have documented pan-European inequality trends since the early 2000 (Heidenreich, 2016; Darvas, 2016; Brandolini, 2007; Dauderstädt and Keltek, 2014; Benczúr et al., 2017; Eurofound, 2017). More recently, Filauro and Parolin (2019) also evaluated pan-European inequality in market incomes and in disposable incomes to discuss the redistributive role of the EU welfare states and compare it with that in the US. In turn, Brandolini and Rosolia (2021) have estimated EU-level income inequality and discussed the macroregional trends (across EU areas) determining the general ones. For the latter, Blanchet et al. (2020) have carried out an admirable reconciliation of survey and administrative income data with national account statistics within the Distributional National Accounts (DINA) framework to discuss EU market income distribution and the EU tax-benefit redistributive power in comparison to the US.

Three main points can be highlighted from a broad overview of these studies. First, disposable incomes in the EU are as unequal as in the most unequal countries of the EU. Secondly, 20–30% of income inequality is explained by inequality between EU countries, as opposed to the US where the overwhelming source of inequality is within US States – around 99% as estimated by Filauro and Parolin (2019). Third, in the process shaping inequality, capital and labour incomes determine a very unequal market income distribution in the EU. However, the overall mitigation of tax-benefit systems on market income inequality is over 20% at the EU level, as computed with EU-SILC data (Filauro and Fischer, 2021). The reduction in inequality when moving from market to disposable income is due to the high degree of progressivity of tax-benefit systems in countries where the EU highest market incomes are concentrated, i.e. Nordic countries, Germany and France.

Moreover, EU-level income inequality can be considered as an indicator relevant in itself as its levels may influence trust in the EU institutions and intra-EU mobility decisions. Indeed, one of the predominant economic motives to trigger mobility decisions is presumed to be the level of wage inequality across countries, in particular the wage premium for the same job performed in a

⁷ See for example European Commission (2021), “Employment and Social Developments in Europe”, Annual Review.

different country. Although more focused on the degree of convergence in average income levels, a measure of between-country inequality may indirectly indicate diverging income levels and a higher propensity of cross-country mobility.

2.2 The impact of minimum wage policies on income inequality

There is a consolidated line of research on the impact of minimum wages on income-related outcomes, such as poverty or inequality, at the national level. The three factors that determine minimum wage (MW) increases to reduce income inequality, in the absence of employment effects, are: the level of compliance, the level at which the minimum wage is increased, and the household characteristics of MW earners. Hypothesising full compliance, previous empirical studies have assessed the inequality impact of minimum wages at the national level, mainly with microsimulation techniques.⁸ There are some studies that contend that minimum wage policies are not the optimal policy tool to reduce poverty and counter wage inequality (Burkhauser 2015). However, an empirical relation between the introduction or the increase of minimum wage levels and a subsequent wage inequality reduction has been documented in a number of studies. For example, with regard to wage inequality, Keese (1998) and Lucifora et al. (2005) show that minimum wages reduce wage inequalities in Europe. More recently, Garner et al. (2015) find that the presence of a statutory minimum wage reduces wage inequality significantly, as measured by the Gini coefficient and with a Theil decomposition in a sample of 18 European countries.

Similarly, other studies find that the erosion of minimum wages is correlated with considerable increases in overall inequality (Beramendi and Rueda 2014; Checchi and Garcia-Peñalosa 2008). Jaumotte and Osorio Buitron (2015) estimate a 2.4 % increase in the Gini coefficient of disposable incomes in the Netherlands due to a decrease of 16.5% in the minimum wage level over the period 1980-2010. In Romania, Militaru et al. (2019) using 2013 survey data, find that household disposable incomes become less unequal when the minimum wage increases. Dustmann et al. (2021) find that minimum wages introduced in Germany in 2015 improved the wages of low-wage workers without significantly lowering their employment prospects. Recently, the ILO Global Wage Report (2021) in a microsimulation exercise estimates the inequality-reducing impact of an increase in both the coverage and the level of the minimum wage.⁹ They find that, regardless of the inequality index used, minimum wage increases reduce income inequality in all EU countries analysed.

Finally, Grünberger et al. (2022) find that an increase in the minimum wage is expected to reduce wage inequality, depending on the share of workers affected and the amount of wage increase (Tables 1 and 2). They find that countries such as Czechia, Germany, Spain, Luxembourg, Poland, Slovakia and Estonia would record the highest reduction in wage inequality – around 20% for a minimum wage rise equal to 60% of the median wage. The degree to which this translates into a reduction in income inequality at the country level is mediated by household composition and tax-benefit interaction.

However, at the EU level, the impact of minimum wage rises on overall inequality depends on how much it triggers an upward shift of EU low-income households in the EU distribution. In other words,

⁸ Some studies have also applied quasi-experimental approaches such as differences-in-differences. However, we are less interested in a survey of these studies as we adopt a microsimulation approach.

⁹ Their hypothetical minimum wage corresponds to 67% of national median wage, just a little above our most ambitious scenario of MW increase equal to 60% of the national median wage.

households which may be low-income in the national distribution and can benefit from a minimum wage increase, may well not be low-income households in the EU distribution.¹⁰ Thus, the final impact of national increases of minimum wages on EU-level income distribution depends on the combination of within- and between-country inequality.

To date, no study has adopted microsimulation techniques to evaluate the impact of EU policies on the income distribution at the EU level. Thus, we contribute to this strand of research by using EUROMOD, a unique microsimulation model widely used for cross-country analysis of the impact of fiscal reforms on inequality, in a supranational framework to study the impact of EU-promoted policies, such as minimum wage policies, on EU-level inequality.

¹⁰ Households with minimum-wage earners in Luxembourg may be in the bottom of the national distribution but they are much higher up in the EU-level income distribution.

3 Hypothetical minimum wage scenarios

Following Grünberger et al. (2022), this paper analyses three hypothetical minimum wage (HMW) scenarios which are calculated as ratios of country-specific median and average gross wages, respectively. HMW levels are calculated as 50%, 55% and 60% ratios of median gross wages.¹¹ In order to calculate median wages, we use wage statistics of the year 2019 from Eurostat (for more details, see Grünberger et al. (2022)).

Overall, 21 EU Member States have statutory minimum wages set out in legislation. In six EU Member States (Austria, Cyprus, Denmark, Finland, Italy and Sweden) minimum wage protection is provided by collective agreements. We consider the impact of hypothetical increases in national minimum wages only in countries with a statutory minimum wage in place. In the six countries without statutory minimum wage, we do not change the wage structure in the course of this analysis.¹²

Table 1 shows the levels of statutory minimum wages and HMWs in EUR. In 2019, statutory minimum wages vary considerable across EU countries not only in absolute terms but also in relation to median and average wages. With 286 EUR, Bulgaria has the lowest monthly statutory minimum wage, while in Luxemburg the highest minimum wage of 2,071 EUR is paid. The ratios of the statutory minimum wage to median wages ranges from 42% in Estonia to 60% and 70% respectively in Bulgaria and Portugal. Consequently, in Bulgaria and Portugal none of the scenarios analysed in this study would increase the statutory MW. On the contrary, in Czechia, Germany, Estonia, Greece, Croatia, Ireland, Latvia, Malta and the Netherlands all HMWs are higher than the statutory minimum wage. Given the wage differences within the EU, the level of HMW varies considerably across countries too. While HMWs in Romania are below 500 EUR, the HMW in Luxemburg goes up to 2,302 EUR per month.

Table 1. Statutory minimum wages and hypothetical minimum wages

Countries	Statutory MW	Median wages	Ratio SMW/Median wage	Hypothetical MW		
				50%	55%	60%
Belgium	1,594	3,167	50.3%	1584	1,742	1,900
Bulgaria	286	477	60.0%	239	262	286

¹¹ In Grünberger et al. (2022) a second group of HMW is derived from average wages, taking the 40%, 45% and 50% ratios of the respective countries. Inequality impact based on these HMWs are not presented in the paper but are available upon request.

¹² This is because our analysis aims at simulating the impact of HWMs broadly following the thresholds simulated in the impact assessment associated to the Commission's proposal for a directive on adequate minimum wages. [EUR-Lex - 52020PC0682 - EN - EUR-Lex \(europa.eu\)](#)

Czechia	519	1,159	44.7%	580	638	695
Germany	1,557	3,360	46.3%	1,680	1,848	2,016
Estonia	540	1,272	42.5%	636	699	763
Greece	758	1,523	49.8%	761	837	914
Spain	1,050	1,903	55.1%	952	1,047	1,142
France	1,521	2,577	59.0%	1,288	1,417	1,546
Croatia	506	1,019	49.6%	510	561	611
Hungary	464	902	51.4%	451	496	541
Ireland	1,656	3,772	43.9%	1,886	2,074	2,263
Lithuania	555	1,075	51.6%	538	591	645
Luxembourg	2,071	3,837	54.0%	1,919	2,110	2,302
Latvia	430	941	45.7%	470	517	564
Malta	762	1,742	43.7%	871	958	1,045
Netherlands	1,616	3,324	48.6%	1,662	1,828	1,994
Poland	523	1,009	51.8%	505	555	606
Portugal	700	999	70.1%	499	549	599
Romania	446	805	55.5%	402	443	483
Slovenia	887	1,542	57.5%	771	848	925
Slovakia	520	1,029	50.5%	515	566	618

Source: Statutory minimum wages from Eurofound (2019). Hypothetical minimum wages are derived from Eurostat data on median and wages.

Note: Hypothetical minimum wages which are smaller than actual statutory minimum wages are marked in grey.

4 Data and methodology

4.1 Adjusting gross wages

We use information on individual wages and incomes from the “EU Survey on Income and Living Conditions” (EU-SILC). For each individual whose observed wage lies below the HMW, we increase the gross wage to the HMW. In case of part-time workers, the respective share of HMW is imputed, depending on the working time reported. The imputation of hypothetical minimum wages is done based on the hourly wage rate. For that, we convert both the observed wages (expressed in yearly terms in EU-SILC data) and the HMW levels (expressed in monthly terms) to hourly levels. A reliable calculation of hourly wages requires reliable data both on earnings and working time. Grünberger et al. (2022) show that especially information on working time in EU-SILC data is prone to measurement errors. The noise in the assessment of working time implies a measurement error in hourly wage data. If the working time reported in SILC is higher than the real time worked by the employee, this leads to an underestimation of the hourly wage. On the other hand, we overestimate hourly wages, if the recorded working time is lower than the real time in employment. This overestimation leads to an increase in the variance of hourly wages as it inflates the ratio of observations with an estimated hourly wage below the minimum wage. Similar to Grünberger et al. (2022), we adopt a set of correction methods to account for potential measurement errors in the calculation of hourly wages.

Based on the new hourly wages, we recalculate annual earnings given the working time recorded in the data. In this exercise, we assume full compliance to the hypothetical minimum wage legislation. Individuals that report other types of income, such as self-employment or pension income, do not receive a HMW, even if they report receiving employment income. Additionally, we assume that people younger than 18 years of age are not eligible for the HMW. Finally, it is important to note that we do not increase wages to HMW in countries in which the statutory minimum wage is higher than the HMW (see grey cells in Table 1).

Table 2 shows the shares of workers affected by each hypothetical minimum wage increase. In Estonia, Greece, Spain, Ireland, Luxemburg, Poland and Romania more than 20% of workers would be affected if the minimum wage is set to 60% of the median wage. In Czechia, Germany, Croatia, Hungary, Latvia, Malta and Slovakia the share of those affected would be between 10% and 20%. In Belgium, France, Netherlands and Slovenia less than 10% would be affected. As already mentioned above, in Bulgaria and Portugal there would be no effect, as the statutory wage is already higher than 60% of the median wage.

Table 2. Share of workers affected by hypothetical minimum wage scenarios

	Share of HMW earners		
	HMW		
	50%	55%	60%
Belgium		1.0%	2.8%
Bulgaria			

Czechia	5.3%	9.0%	11.4%
Germany	10.3%	14.0%	18.2%
Estonia	13.1%	16.5%	20.6%
Greece	19.8%	27.5%	34.4%
Spain			24.9%
France			9.0%
Croatia	7.2%	11.6%	17.1%
Hungary		7.7%	14.4%
Ireland	13.3%	19.2%	25.0%
Lithuania		4.1%	8.8%
Luxembourg		14.9%	20.4%
Latvia	7.1%	12.1%	16.3%
Malta	4.5%	8.0%	11.6%
Netherlands	3.4%	6.1%	9.0%
Poland		20.9%	26.6%
Portugal			
Romania			22.5%
Slovenia			7.0%
Slovakia		12.7%	18.0%

Source: Calculation based on EUROMOD input data from 2019. EUROMOD data have been processed as outlined in Section 4.1.

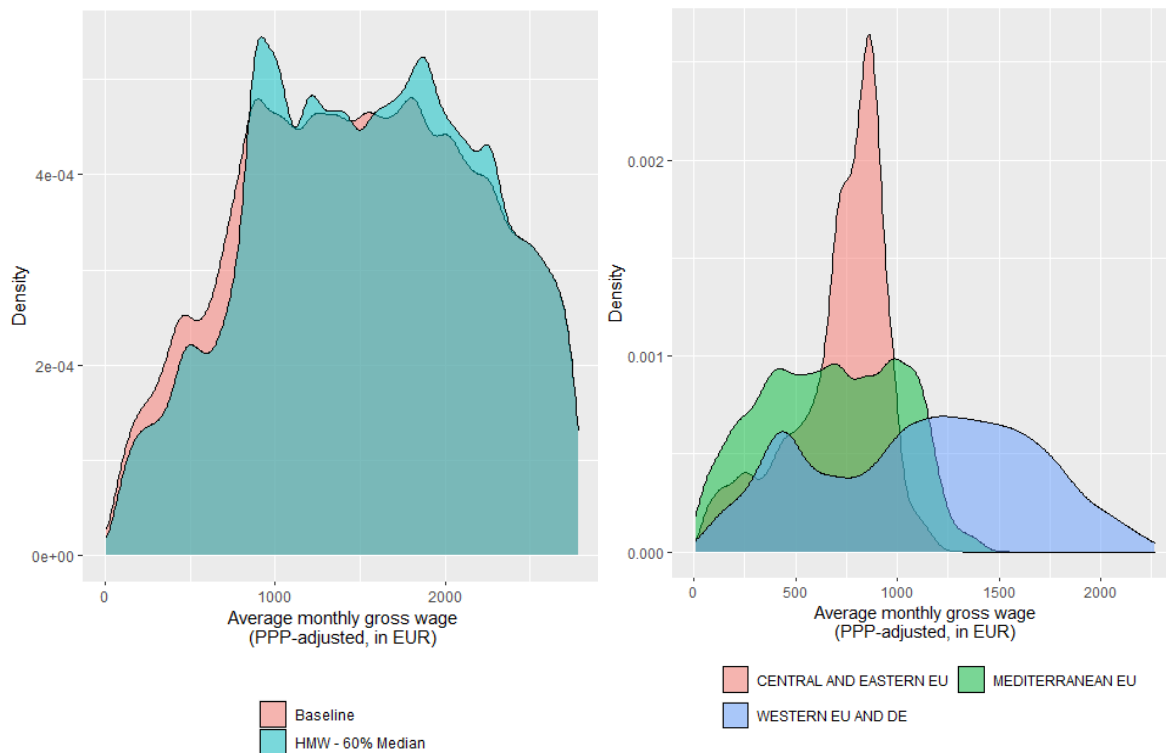
Note: Cases in which hypothetical minimum wages are smaller than actual statutory minimum wages are marked in grey.

To illustrate visually how an increase in minimum wage levels might determine a reduction in disposable income inequality, we respectively plot the EU-level distributions of wage and disposable income. We plot these distributions first for the sample of workers only and then for the overall population before and after the most ambitious HMW increase, i.e. 60% of the median wage. Moreover, we focus on the country position of the HMW earners in the EU-level distribution.

All the distributions presented in this section are representative of the EU population as they are obtained by using cross-sectional EU-SILC weights. To make the wage and income values comparable across countries, we apply purchasing power parity (ppp) rates.¹³ The average monthly gross wage is obtained by dividing yearly employment gross earnings by 12. Given the high heterogeneity in wage setting across countries, we expect EU wages to follow a multimodal distribution. In addition to wage differences between countries, levels of average monthly gross wages depend on working time and vary accordingly.

The distribution of average monthly gross wages in the EU after assigning a HMW corresponding to 60% of the national median income has several distinctive peaks in comparison to the distribution of observed survey data (Figure 1a).¹⁴ These peaks correspond to distinctive EU areas where workers receiving the HMW increase are located as illustrated in Figure 1b.

Figure 1: Gross wage distribution of EU workers before and after the HMW rise [panel a]; gross wage distribution of HMW earners by region [panel b]



Note: The distributions are based on kernel density estimates, probability density functions. The EU-wide distribution was corrected with purchasing power parities

The first peak, around 800 ppp-adjusted EUR, corresponds to the HMW earned by workers living in Central and Eastern European (CEE) countries. The other peaks correspond to the HMW increase

¹³ We adopt Eurostat ppp rates aggregated at the level of household final consumption expenditure (HFCE), available on the Eurostat website as [prc_ppp_ind]. The ppp rates are expressed in local currency because the EU-SILC income variables used as input data for EUROMOD are in local currency. For the sake of robustness we also apply GDP-based ppp rates and results shown in Section 5 do not change significantly (results available upon request).

¹⁴ Note that observations are not concentrated at the country-specific HMW levels of Table 1 when the yearly working time is low so that the level of average monthly wages can be below the HMW levels. Likewise, the average monthly wage can be bigger than the HMW, if the working time is higher than the regular full-time working hours in the countries (with a ceiling of 48 hours). For that reason the distribution of gross monthly wages ranges from 0 to almost 2,800 ppp-adjusted EUR.

earned by workers living in Mediterranean (MED) and Western European (WE) countries.¹⁵ More specifically, 9.1 million workers in WE countries would receive the HMW increase, followed by 6.3 million workers in CEE countries and 4.8 million workers in MED countries. The ppp-adjusted wages of MW earners in CEE countries are similar to those in the MED ones, although the former are much more concentrated around 800 ppp-adjusted EUR per month due to a low incidence of part-time work in CEE countries.

4.2 Calculating disposable income

We analyse the impact of HMW scenarios on EU-level inequality for different income concepts. The first income concept analysed is disposable income. Next, we analyse other income concepts like market income, comprising only capital and labour income sources, and gross income, comprising also social benefits. In this way, we can assess the redistributive role of EU tax-benefit systems in conjunction with the impact of HMW levels. The different income concepts of interest are described in Table A1.

For calculating changes in taxes and benefits related to each HMW scenario, we use the static microsimulation model EUROMOD. This model provides a comparative framework for EU countries that allows researchers to conduct cross-country analysis.¹⁶ EUROMOD takes into account the interaction between gross wage, taxes and benefits in each EU Member State. After increasing wages according to the HMW scenario, at the new level of earnings, EUROMOD calculates taxes, social insurance contributions and benefits, and consequently the disposable income of workers and their household members. For the simulations presented in this study we have used EUROMOD version I2.0+, which refers to the tax-transfer system of 30 June 2019. This version is based on microdata coming from EU-SILC surveys from 2017. Given that the income reference period of EU-SILC 2017 data is the year 2016, uprating factors are used to bring the income values from the income reference period to 2019.

The model provides only static results and does not account for behavioral reactions of the labour market that can occur in response to policy changes. For example, minimum wage increases may trigger job losses or induce workers to change their labour supply, which in turn would affect individuals' incomes. However, Grünberger et al. (2022) predict little impact of the minimum wage scenarios on employment.

When moving from gross wages to disposable incomes, applying tax-benefits rules in force, the EU workers' distribution appears more compressed [Figure 2a].¹⁷ The baseline distribution appears to have more workers with a disposable income below 600 ppp-EUR than the distribution of the HMW scenario. Instead, the distribution of the HMW scenario has more observations around 800 ppp-EUR and 1,500 ppp-EUR than the baseline distribution. Figure 2b helps to identify the geographical location of workers that experience an increase in disposable income as a result of the HMW rise as it includes only workers affected by the HMW increase.

¹⁵ The 21 EU countries with statutory minimum wages are clustered as follows:

-Central and Eastern (CEE) countries: Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

-Mediterranean (MED) countries: Greece, Malta, Portugal and Spain.

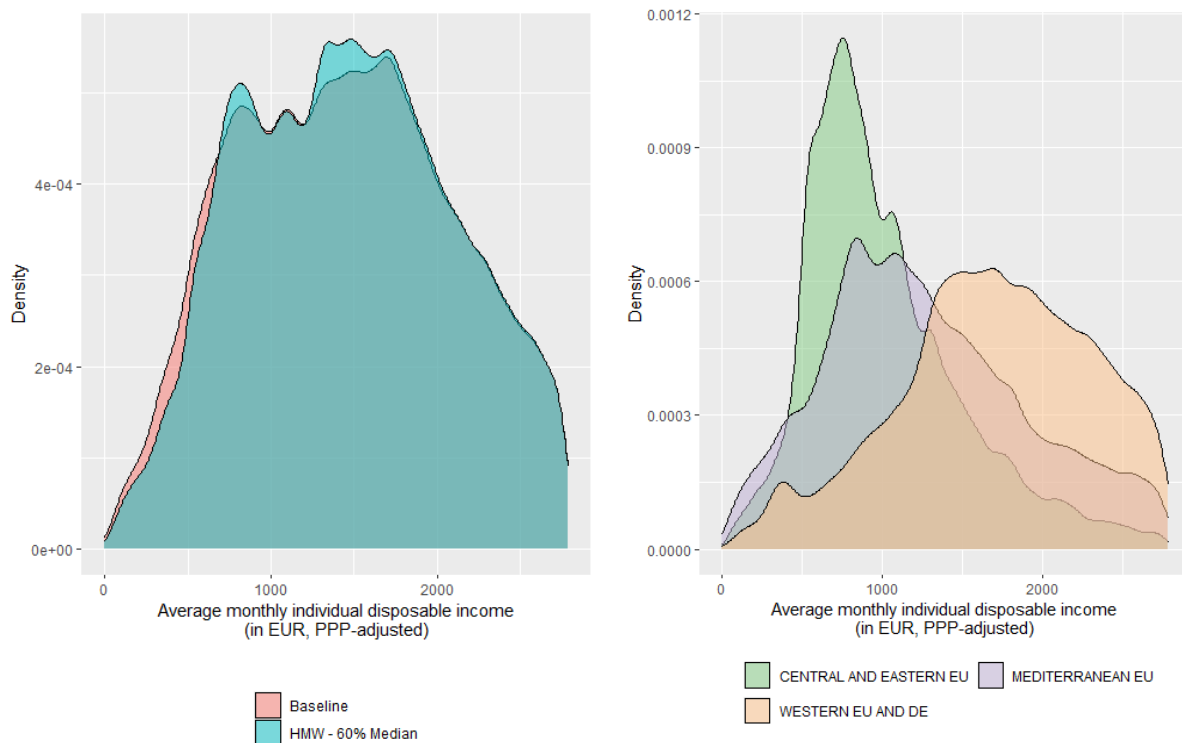
-Western (WE) countries: Belgium, France, Germany, Ireland, Luxembourg and the Netherlands.

¹⁶ See Sutherland (2001) and Sutherland and Figari (2013) for a more detailed description of EUROMOD.

¹⁷ All figures in the section are weighted with the cross-sectional EU-SILC weights to make it representative of the EU-27 population.

Two findings emerge from the comparison of the distribution of disposable income with the distribution of gross wages, as in Figure 1b. First, while disposable income of MW workers is higher in MED than in CEE countries (Figure 2b), gross wages were, all in all, of a similar level (Figure 1b). Secondly, the peak observed in the distribution of gross wages for the MW earners in WE countries almost fades out in the distribution of disposable income. Both findings suggest that in MED and WE countries, minimum wage earners are benefitting to a larger extent from the tax-benefit system than in CEE countries.¹⁸ Indeed, prior research documents that tax-transfer systems are generally more redistributive for low-wage workers in MED and WE countries than in CEE ones (European Commission 2020b).

Figure 2: Disposable income distribution of EU workers before and after the HMW increase [panel a]; disposable income distribution of HMW earners by region [panel b]



Note: The distributions are based on kernel density estimates, probability density functions. The EU-level distribution was corrected with purchasing power parities. Equivalised income.

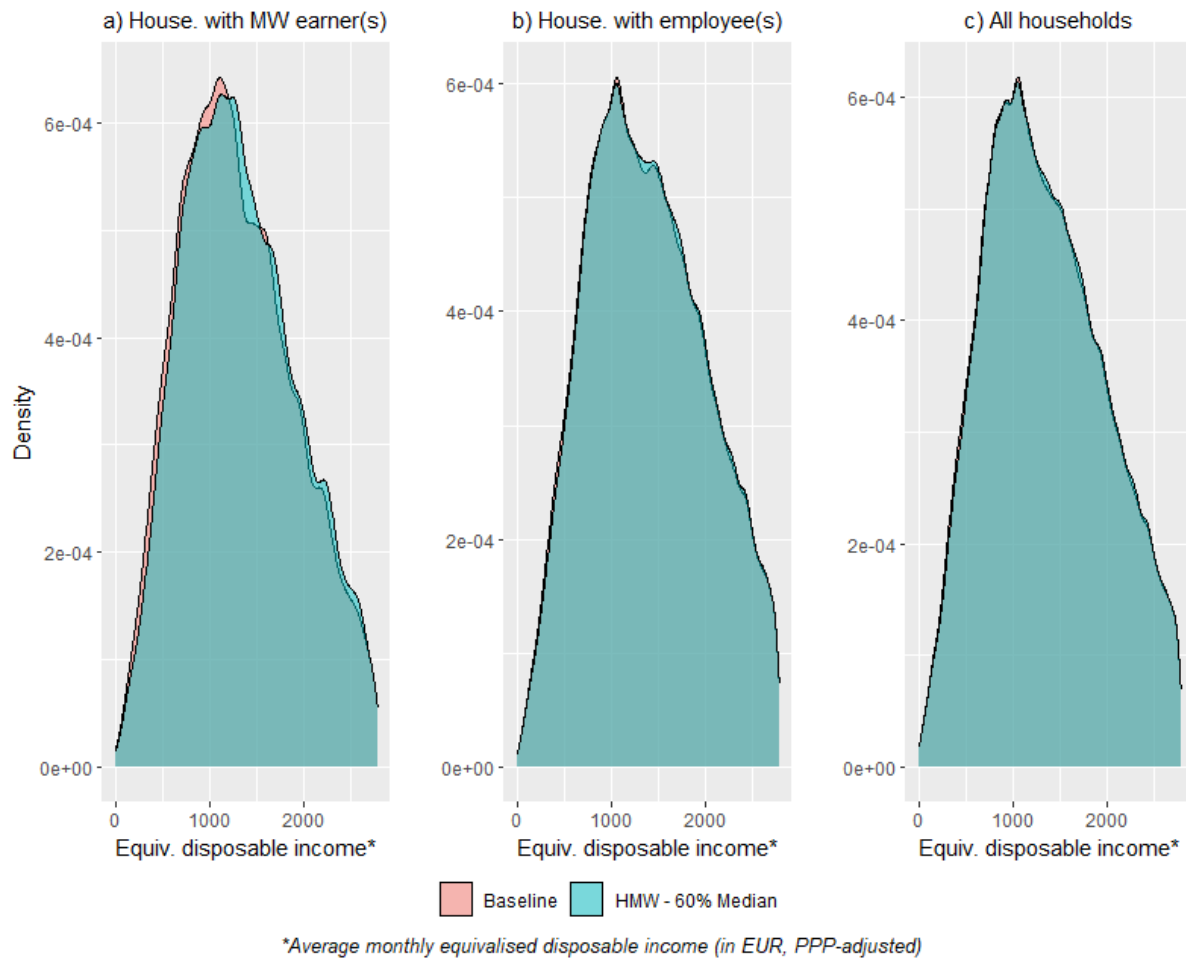
Finally, we look at the distribution of equivalised household disposable income in the EU calculated as the total household income divided by the modified-OECD equivalence.¹⁹ Furthermore, to better identify the impact of HMWs on the working-age population we consider three types of households: (1) households with at least one person earning the hypothetical minimum wage; (2) households with at least one employee; and (3) all households, irrespective of the occupational status of its members (Figure 3). Compared to the shift of the distribution of individual disposable income for workers-only after the HMW rise (Figure 2a), the shift in the equivalent household disposable

¹⁸ This visual inspection does not control the different role of household composition between MED, WE and CEE countries. Indeed, it might well be that MW earners are less likely to live in households with low work intensity in CEE countries, although this hypothesis requires further scrutiny.

¹⁹ We use the modified OECD equivalence scale which assigns each household member an equivalence value. It is a measure for per capita household income, considering the age-specific needs of household members. The first adult gets the value 1, the second adult and each subsequent person of at least 14 years of age gets the values 0.7. Finally, each child under 14 years of age gets the values 0.3.

income for households with at least one employee is visibly less pronounced (Figure 3b). This is because HMW earners are distributed among households and their income is pooled with the income of other household members. The increase in the HMW appears to have a more visible impact on equalized disposable household income for households with at least one MW earner (Figure 3a). The impact of a HMW increase becomes less visible when considering the population-representative income distribution due to the inclusion of pensioner households in the sample (Figure 3c). In fact, although the increase of the HMW to 60% of the median wage would affect 22 million workers, its impact on the household income distribution of the whole EU population seems relatively small. However, to complement the graphical evaluation, in Section 5 we estimate the impact of HWM increases on inequality measures for these different populations.

Figure 3: Disposable income of EU households. Three subpopulations



Note: The distributions are based on kernel density estimates, probability density functions. The EU-level distribution was corrected with purchasing power parities. Equivalised income.

4.3 Measures of inequality

The primary measure of inequality used in this study is the Gini coefficient. First, the reduction in EU-level income inequality after the HMW rise is measured using the Gini coefficient, although generalised entropy (GE) indices are computed for sensitivity analysis. Second, we compute the relative contribution of within-country and between-country inequality by exploiting the property of decomposition in non-overlapping groups respected by GE indices. As such, the Mean Logarithmic

Deviation (GEO) and the Theil index (GE1) are computed at the EU level and are decomposed as follows:

$$GE_{\alpha}(Y) = GE_{\alpha}^B(Y) + GE_{\alpha}^W(Y) \quad (1)$$

where:

$$GE_{\alpha}^W(Y) = \sum_{m=1}^M v_m GE_{\alpha}(Y^{(m)}) \quad (2)$$

where v_m is country m 's share of the total income; $GE_{\alpha}(Y^{(m)})$ is the inequality within country m and α represents the sensitivity of the index to differences in income shares along the income distribution.²⁰ In turn, $GE_{\alpha}^B(Y)$ is the between-country inequality, in which each individual is assigned the mean income of his/her country. We decompose the within- and between-contributions by country of current residence as reported in EU-SILC data. As such, the between-country component of the decomposition should be interpreted as inequality between the mean incomes of individuals residing in the different EU countries.

Tests of statistical significance are carried out to evaluate the differences between the inequality indices simulated after the HMW and those observed before the policy change.²¹

Some caveats are in order to interpret this simulation exercise. First and foremost, a limitation refers to the assumption of no employment and spillover effects; in addition to it, the hypothesis that minimum wages change overnight and the implication for convergence in the EU.

About the first caveat, there is a large number of studies that have recently documented empirically the employment effects consequential to minimum wage increases in many advanced economies. In general, research on the employment effects of minimum wages has not determined a consensual view as the variation of estimated employment effects across studies is very large (Neumark and Corella, 2021).

In turn, spillover effects may arise consequentially to a MW rise. It may be plausible that wages close to the new MW are affected by spillovers due to efficiency wage and/or reservation wage effects. However, these effects are empirically hard to quantify with household data, as testified by Autor et al. (2016) for the case of the US.

Finally, convergence in wages levels over time is not contemplated in this exercise. Hypothetical minimum wages are set in relation to national wage statistics, such as median or mean wages in year 2019, and do not account for potential convergence over time in median and mean wages.²²

²⁰ Although both indices belong to the generalised entropy class of indices, their algorithm of aggregation varies in the sensitivity to difference in income shares in different parts of the distribution, namely, the Theil index attributes more weight to income changes for high incomes in comparison to the MLD (Jenkins and Van Kerm 2009).

²¹ EU-SILC based simulation results are subject to uncertainty. Despite certain parameters derived in Euromod from official tax-benefit regulations, there may be other sources of uncertainty such as sample variations, i.e. the measured effect of the simulation depends on who is selected into the sample, or methodological choices on the outcome measure of interest. Disregarding the uncertainty from the uprating factor, we compute standard errors and t-test of significance using standard estimation commands for inequality indices (the DASP module), as recommended by Goedemé et al. (2013).

²² As a point-in-time minimum-wage-setting exercise, our simulation does not consider convergence in minimum wage levels, as documented recently by Eurofound (2021, pp.25-26).

Nominal wage convergence in itself mitigates inequality between Member States, but the hypothetical minimum wage set in relation to national statistics at a particular point in time does not consider previous trends and implicitly assumes that the adjustment of statutory minimum wages occur overnight.

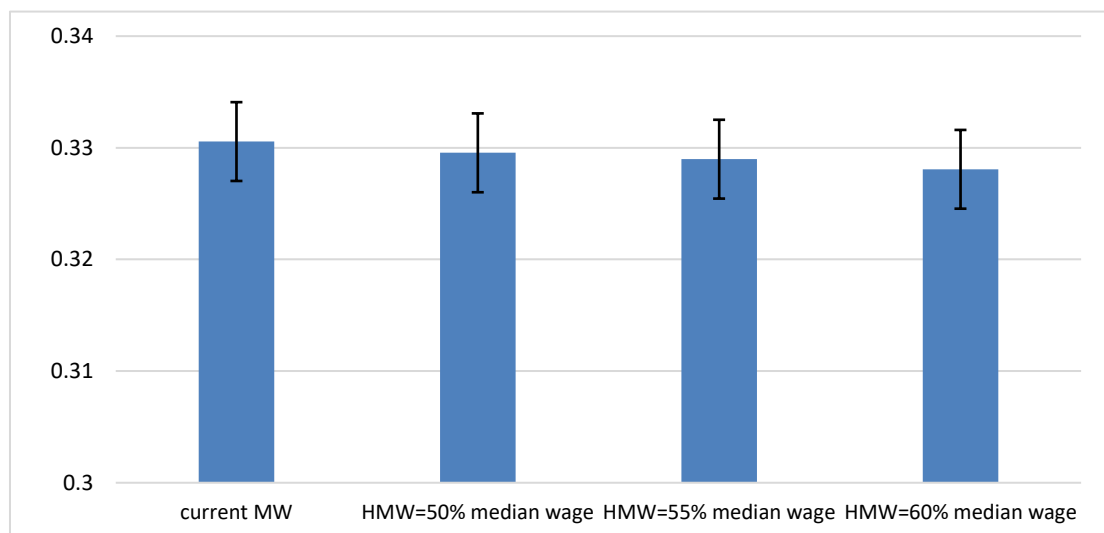
Addressing these limitations is beyond the scope of this day-after simulation of minimum wage rises with no behavioural response. Thus, we leave this as topic for further research.

5 Results

5.1 Inequality-reducing effect of rising hypothetical minimum wages (HMWs)

Inequality in disposable income in the EU as measured by the Gini coefficient is slightly above 33% in 2019.²³ In the EU countries with statutory minimum wages, increases in the HMW reduce EU-level inequality under all HMW scenarios. As expected, the higher the increase in the HMW, the larger the reduction in disposable income inequality (Figure 4). In detail, minimum wage floors correspondent to 50%, 55% and 60% of the national median wage would reduce the EU-wide Gini coefficient of disposable income relative to the baseline by, respectively, 0.31%, 0.5% and 0.75%.²⁴

Figure 4: EU-wide income inequality. Gini coefficient, disposable incomes 2019



Source: EUROMOD simulations.

Note: The “current” baseline reflects minimum wages in 2019. Simulations respectively for hypothetical minimum wages equal to 50%, 55% and 60% of the national median wage. Countries with actual minimum wages above the hypothetical scenarios were excluded.

Albeit of little magnitude, these inequality changes after the HWM increase are statistically significant (Table 3). It is consequential that for the distribution of working-age EU households, the HMW has a more pronounced beneficial effect in reducing inequality. Zooming in on the two subpopulations of EU households with a minimum wage earner or households with at least one employee, the reduction in disposable income inequality is a bit more pronounced after the HMW increase, for the former more than for the latter distribution. This reflects the visual intuitions of Figure 3 and, unsurprisingly, highlights that a potential increase in minimum wage levels in countries with a statutory minimum wage exerts larger inequality-reducing effect on the population of households more attached to the labour market.

²³ This figure might not be the same as in Filauro and Fischer (2021) or European Commission (2020b), due to the different input data used in this case, i.e. provided by EUROMOD. To find out more about the differences in inequality observed in EU-SILC UDB as opposed to EUROMOD estimates see Section 4.2 of Collado et al. (2021) or Kneeshaw et al. (2021).

²⁴ These figures are robust to both the use of different ppp and the adjustment strategy for low wage observations only in countries where the statutory minimum wage is lower than the HMW simulated. Sensitivity analyses are available upon request.

Table 3: Reduction in EU-wide inequality (%) simulated for different hypothetical minimum wages. Disposable income, 2019

Minimum wage level	Population	Gini (%) reduction	s.e	t - test	low (*100)	high (*100)
HMW=50% median wage	all EU households	0.31%	3.74E-05	26.965	0.00094	0.00108
HMW=55% median wage		0.48%	4.71E-05	33.520	0.00149	0.00167
HMW=60% median wage		0.76%	6.09E-05	40.814	0.00237	0.00261
HMW=50% median wage	EU households with at least an employee	0.35%	4.08E-05	27.784	0.00105	0.00121
HMW=55% median wage		0.55%	5.15E-05	34.899	0.00170	0.00190
HMW=60% median wage		0.88%	6.66E-05	42.880	0.00273	0.00299
HMW=50% median wage	EU households with at least a MW earner	0.50%	6.81E-05	25.035	0.00157	0.00184
HMW=55% median wage		0.81%	8.79E-05	31.021	0.00255	0.00290
HMW=60% median wage		1.29%	0.000114	38.055	0.00411	0.00456

Source: EUROMOD simulations.

Note: The baseline reflects the distribution of EU disposable incomes in 2019, with the observed minimum wages. Standard errors, t-test and confidence intervals refer to the difference between the Gini of the simulated distribution after the HMW and the baseline one. Countries with actual minimum wages above the hypothetical scenarios were excluded.

To understand the dynamics behind this reduction in EU-level inequality it is useful to look at the two components of within- and between-country inequality, which are computed from the inequality decomposition. Previous studies show that within-country inequality is responsible for around 75% of EU inequality while between-country inequality explains the remaining 25% (Filauro and Parolin 2019; Blanchet et al. 2020).

The inequality reduction after the HMW increase depends first on the change in inequality in each country, which affects the within-country inequality. Second, changes in country-specific average incomes affect between-country inequality.

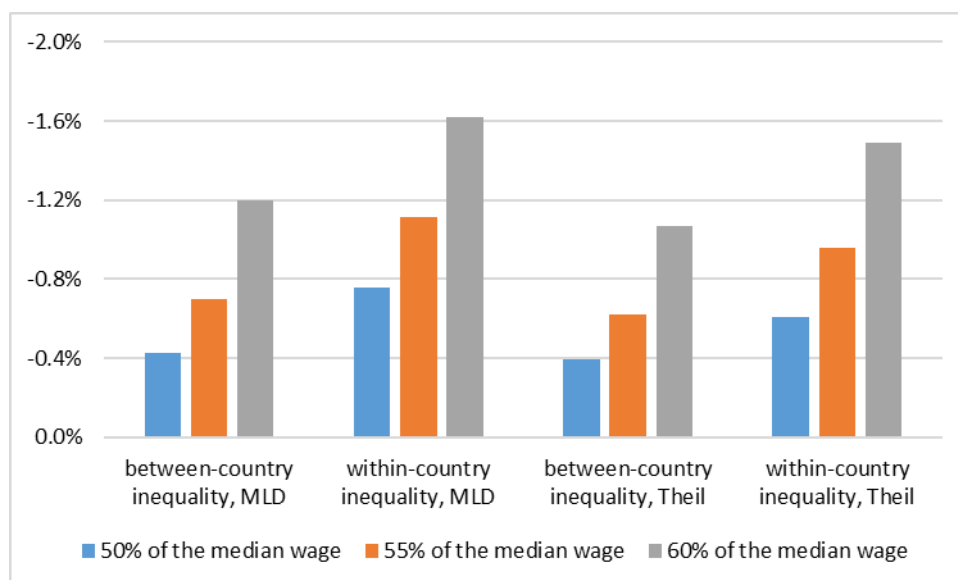
On the one hand, we expect within-country inequality to decrease because higher minimum wage floors have been shown to reduce gross wage inequality, or at least keep it constant, in all countries (Grünberger et al. 2021). Thus, lower wage inequality should normally result in a lower inequality in disposable income. This implies that within-country inequality of disposable income in the EU, i.e. the population-weighted average of country-level inequality indices, is also expected to decline as the HMW increases.

On the other hand, the impact of the HMW increase on between-country inequality is less clear-cut. The potential of a HMW increase to reduce between-country income inequality depends on the country-specific position of HMW earners and the magnitude of their HMW increase, along the EU distribution. For example, low-pay households in countries such as Germany and Luxembourg, whose income conditions would improve significantly due to higher HMW, might be located in the middle-upper part of the EU income distribution. In other words, if a higher HMW increases the average national income of richer countries more than the average income of poorer EU countries, this might place the latter countries in a worse situation and in this way magnify between-country inequality.²⁵

²⁵ Moreover, an on-going convergence in wage levels across Member States (not considered in this paper) may improve the impact of HMW increases on between-country inequality: indeed, should the ratio of minimum wages relative to average wages increase in poorer Member States, then the catching-up of the average wages to the EU average would trigger even larger increases in minimum wages (and other low wages). Ultimately, this could contribute to decrease between-country inequality.

As expected, the reduction in within-country inequalities is significant and increases as the HMW is set at higher levels (Figure 5). Thus, more generous HMWs have the potential to reduce within-country income inequality, triggering in this way a reduction in EU-level inequality.²⁶ Between-country inequality also declines under all three HMW scenarios, though less than within-country inequality, both in relative and in absolute terms (Figure 5 and Table A3).

Figure 5: EU-level inequality reduction, decomposition by country, disposable income, 2019.



Source: EUROMOD simulations.

Note: The baseline reflects the distribution of EU disposable incomes in 2019, with the observed minimum wages. Relative reduction in EU-level inequality (%) is simulated for different hypothetical minimum wages. Mean Logarithmic Deviation (MLD) and Theil indices. Countries with actual minimum wages above the hypothetical scenarios were excluded.

The indicators of between-country inequality measure the income differences between individuals based on the average income in each country. Therefore, a decline in between-country inequality implies some degree of convergence in average incomes across EU countries when the hypothetical minimum wage increases.²⁷ This might also be due to our strategy of simulating increases in the minimum wage only in Member States with statutory minimum wages.²⁸ However, albeit inequality-reducing, the general impact of a HMW increase on average incomes is very small across countries. This effect is in the range of [-20; +20] ppp EUR in terms of average annual disposable income in the most ambitious scenario of HMW equal to 60% of national median wage, as documented in Table A2.

²⁶ See Table A3 for the absolute inequality reduction in within- and between-country inequality as measure through the MLD and the Theil index.

²⁷ A reduction in between- and within-country inequality is robust to the inequality index chosen. The slight differences between the two indicators depend on the different algorithms behind its construction as the Theil index weighs relatively more income changes up the income distribution.

²⁸ The hypothetical minimum wage increase is not simulated for EU countries without a statutory minimum wage (Austria, Cyprus, Denmark, Finland, Italy, Sweden). The absence of income improvements for minimum-wage earners of these countries, some of which are in the upper part of the EU distribution, results in no increase in their national average income.

5.2 Tax-benefit interaction with minimum wages and impact on EU-level income inequality

The redistributive effect of tax-benefit systems in the EU, as measured by the inequality reduction from the distribution of market to disposable income, is generally high. Recent estimates from EU-SILC show that the inequality reduction in passing from market incomes, including public pensions, to disposable incomes amounts to slightly over 20% – a redistributive effect similar to that in France or Germany (Filauro and Fischer 2021).²⁹ Blanchet et al. (2020) assess the redistributive power of tax-benefit systems in Europe with their integrated DINA dataset and find it similar, although they argue that this effect is overestimated with survey data.³⁰

In all cases, the relatively high reduction in inequality attributable to tax-benefit systems is partly a result of the relative position of different EU countries in the EU distribution. Indeed, the largest market incomes in the EU distribution are those recorded in Nordic or high-income countries such as France or Germany. These market incomes are also those more subject to a substantial reduction after taxes due to the progressivity of their national tax systems. This is not the case for the largest market incomes observed in some Eastern European countries that are not at the top of the EU distribution. In fact, the slight progressivity of nearly flat-tax regimes in some Eastern European countries should not impair the overall redistributive effect at play in the EU distribution. Therefore, the compression of EU-level income distribution after taxes and transfers is partly due to national dynamics in the richer EU countries.

Our simulations indicate that an increase in HMW would reduce inequality in EU-level market incomes. The overall relative reduction in inequality for market income is lower than the reduction recorded for disposable income.³¹ In turn, this inequality reduction is greater than the inequality reduction recorded for gross incomes (Table A4), due to benefits withdrawal after household market incomes increased due to higher HMW. These findings are robust to different inequality indices. Unsurprisingly the inequality reduction is larger for the population of EU households with a stronger attachment to the labour market (Table A5). As in the case of disposable income, the reduction in the Gini coefficient for market and gross incomes increases as the HMW is set at a higher level (Figure 6).

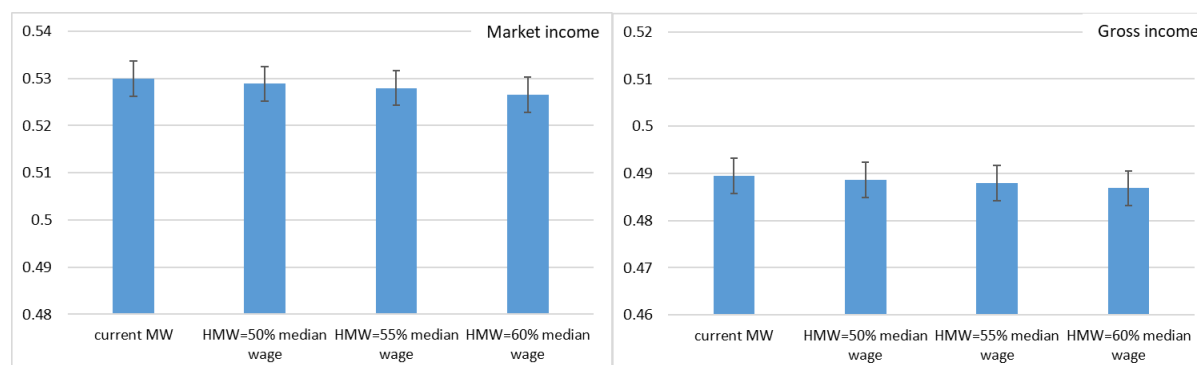
The dynamics for the inequality reduction in market and gross incomes follows the same explanation as for disposable incomes (Figure 7). A HMW increase is very likely to bring about a reduction in within-country market inequality. In many EU countries, the increase in market income for low-pay workers is actually higher than after the interaction of taxes and benefits (Grünberger et al. 2022) because benefits can be withdrawn and income taxes may rise after a HMW increase. Therefore, a reduction in market income inequality is expected as a consequence of a reduction in within-country inequality.

²⁹ Estimates obtained with equivalised household disposable incomes. The indicator used is the Gini index and the reduction in inequality is expressed as a % reduction.

³⁰ The overestimation of tax-benefits redistribution for EU-level incomes is due to two factors in Blanchet et al. (2020). On the one hand, survey data systematically underestimate top market incomes. On the other hand, many studies compare inequality indices of market incomes excluding pensions with disposable income, a large part of the redistributive power is due to pension income that converts the zero market incomes of pensioners into positive values in the disposable income distribution so magnifying the overall redistributive effect. However, their aggregate of reference is different from ours as they focus on Europe including non-EU countries.

³¹ This is the relative reduction in the various inequality indices adopted. The absolute reduction in Gini points is larger for the market income concept, however since inequality levels are very different, the relative reduction in inequality is higher for the disposable income concept (see Table A3).

Figure 6: EU-wide income inequality. Gini coefficient, market (left) and gross income (right), 2019



Source: EUROMOD simulations.

Note: The “current” baseline reflects minimum wages in 2019. Simulations respectively for hypothetical minimum wages equal to 50%, 55% and 60% of the national median wage. Countries with actual minimum wages above the hypothetical scenarios were excluded.

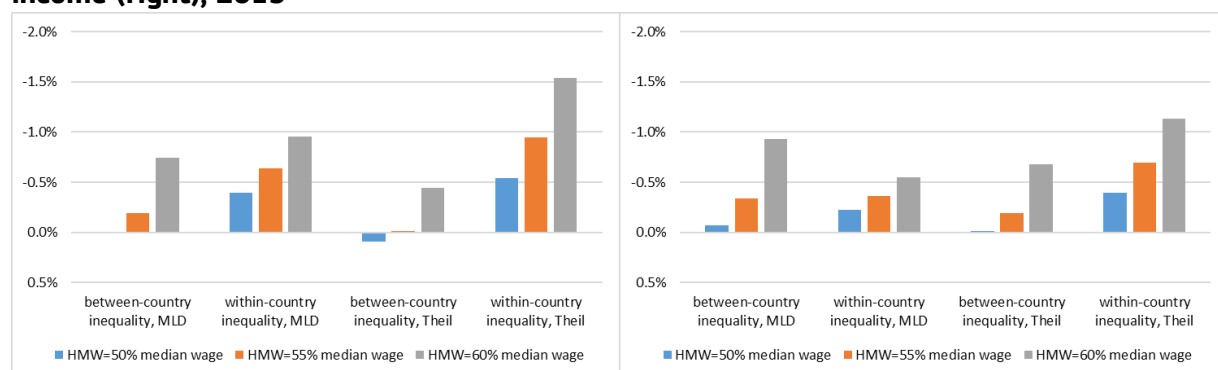
The dynamics for the between-country inequality is less unambiguous for market income. Indeed, the increase in market income for low-pay workers after the HMW increase may lead to a greater increase in the average market income in high-income EU countries, thus making EU market incomes more unequal. This might be the case especially because in high-income EU countries, characterised by more redistributive transfer systems, the average increase in market income might be higher than that in gross or disposable incomes.

For gross incomes as well, the impact of a HMW on between-country inequality is ambiguous in principle. This is because the withdrawal of transfers for HMW earners is likely to be more pronounced in Eastern European countries rather than in more redistributive countries such as Germany or Belgium, potentially increasing the differences in average gross incomes across EU countries.³²

Similarly to disposable income, the largest part of the reduction in EU-level inequality for market and gross incomes can be ascribed to the within-country component. Furthermore, the reduction in inequality measured on market and gross incomes is greater for more ambitious floors of HMW, up to respectively a 1.5% and above 1% reduction in the Theil index for a HMW corresponding to a 60% of national median wage. Finally, our simulations show that the between-country EU inequality also slightly decreases, at least in relative terms, as the HMW increases (Figure 7). The overall increase in average annual market incomes and gross incomes, after benefits, for all EU countries is contained within the range [+1; +35] ppp EUR (Table A2). Thus, the impact of HMW increases on the between-country inequality in both absolute and relative terms is almost negligible.

³² Moreover, the HMW increase affects a higher proportion of the respective labour force in Germany and Luxembourg than in other Eastern European countries.

Figure 7: EU-level inequality reduction, decomposition by country, market (left) and gross income (right), 2019



Source: EUROMOD simulations.

Note: The baseline reflects the distribution of EU disposable incomes in 2019, with the observed minimum wages. Relative reduction in EU inequality (%) is simulated for different hypothetical minimum wages. Mean Logarithmic Deviation (MLD) and Theil indices. Countries with actual minimum wages above the hypothetical scenarios were excluded.

6 Conclusions

There is a large debate on whether minimum wage policies are inequality-reducing policies. Sceptics of minimum wage policies argue that there are other labour policy tools to address inequality and relative poverty. Although it is documented that there are policies more effective than minimum wages to address market inequalities, nonetheless minimum wage policies may have positive effects on inequality reduction that should be taken into account.

The recently adopted Directive on adequate minimum wages in the EU has as a key objective the improvement of living conditions for low-pay workers. The associated impact assessment carried out a simulation of the impact of hypothetical minimum wages on national inequality. Building on this, we simulate the impact on EU-level inequality of minimum wage increases correspondent to 50%, 55% and 60% of the national median wage in the countries with a statutory minimum wage. To better understand the potential for statutory minimum wages to reduce EU-level income inequality, the impact of the HMW levels is simulated for the entire distribution of EU households and for the households with greater attachment to the labour market, such as those with at least one employee or at least one minimum wage earner.

The impact on EU-level inequality is then further decomposed into within- and between-country components for three income concepts: market, gross and disposable incomes. While the first income concept helps measure the effect of minimum wage policies on income inequality in an unambiguous way, the two subsequent concepts account for the complexities of tax-benefit systems by using a microsimulation model. To this end, we use the EU-wide microsimulation tool EUROMOD, which is unique in assessing in a coherent and comparable way the impact of EU-promoted policies.

Aware of the various limitations of this exercise, such as the absence of behavioural changes, employment and spillover effects, and ignoring recent cross-country average wage convergence, microsimulation results are nonetheless instructive.

Our findings indicate that higher minimum wages have the potential to make the distribution of income between EU households slightly more equal. This effect is small but significant, especially for the distribution of disposable income. Unsurprisingly, the inequality reduction is larger with respect to the sample of EU households with greater labour market attachment, especially for EU households with at least one minimum wage earner.

All in all, it is worth considering minimum wage policies in the policy toolkit to address EU-level income inequality, in conjunction with more effective instruments as recently analysed by Salverda (2021). In turn, the little EU-level inequality reduction triggered by increased minimum wage levels occurs mainly through the reduction of its within- rather than between-country component. Albeit indirectly, this evidence addresses the concern that sluggish wage convergence triggers workers to move from middle- to high-income EU countries. Our results indicate that greater harmonisation in the minimum-wage setting mechanism across EU countries (similar Kaitz ratios) does not alter significantly inequality between countries. This result holds also for the most ambitious minimum wage rises and for the specific subpopulation of EU households with a minimum wage earner. Thus, this simple simulation exercise plays down the objection that concerted, common principles for setting minimum wages at EU-level may result in larger cross-country mobility flows for minimum wage earners.

Finally, despite its limitations, this study may serve as a benchmark for those interested in examining the effect of EU policies on EU-level income distribution. As stated in the introduction, all

policy reforms promoted by the EU that have a heterogeneous impact on national income distributions are likely to have an impact on EU-level distribution. If the concerns for greater income convergence across countries and trust in supranational institutions are to be taken seriously, future assessments of EU policies may well extend the national analysis of their income effects to the supranational dimension with EUROMOD.

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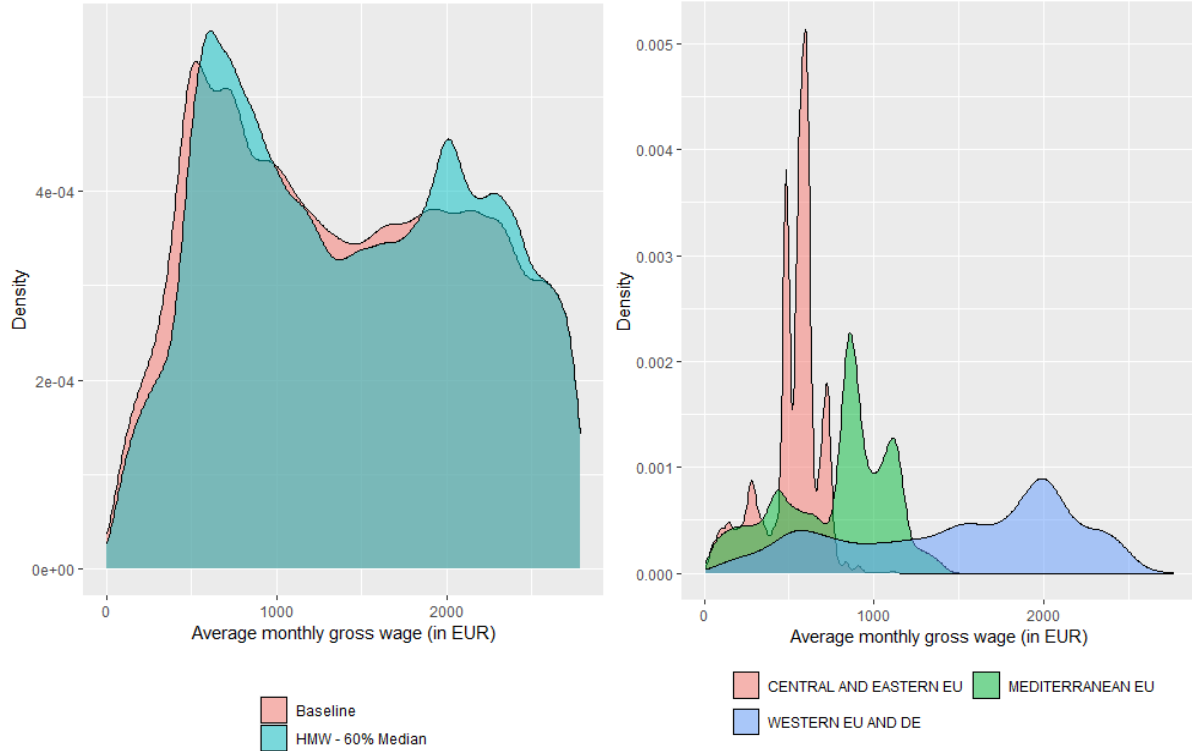
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Appendix

Figure A1: EU-wide gross wage distribution of all workers: before and after applying HMW [panel a]; gross wage distribution of HMW earners by region [panel b]



Note: The distributions are based on kernel density estimates, probability density functions.

Figure A1.a shows the EU-wide distribution of average monthly gross wages, before and after assigning a minimum wage of 60% of median wages. The average monthly gross wage is obtained by dividing yearly employment gross earnings by 12. Given the high heterogeneity in wage setting across countries, more than one peak is expected to appear in the distribution of wages. In fact, the wage distribution after assigning the HMW is trimodal, with peaks around 600 EUR, 2,000 EUR and 2,250 EUR. In addition to wage differences between countries, levels of average monthly gross wages depend on the working time and vary accordingly. As a consequence, observations are not concentrated at the country-specific HMW levels of Table 1. Instead, the level of average monthly wages can be close to zero if the yearly working time is low. Further, the average monthly wage can be higher than the HMW if the working time is more than the regular full-time working hours in the countries (with a ceiling of 48 hours). For that reason we observe minimum wage earners with wages from 0 to almost 2,800 EUR.

Figure A.1b shows the distribution of average gross wages for the sample of individuals receiving the HMW by geographical area: (1) Central and Eastern EU (6.3 Mio. workers), (2) Mediterranean EU (4.8 Mio. workers), and (3) Western EU including Germany (9.1 Mio. workers). The first peak in the distribution of gross wages of around 600 EUR is mainly due to the contribution of CEE countries like Poland, Slovakia, Croatia and Czechia. The second mode of around 2,000 EUR is driven by WE countries like Germany and Belgium. Most of HMW workers earn around 1,000 EUR in the Mediterranean EU countries. A third peak of around 500 EUR is observed in Mediterranean and Western EU countries mainly driven by part-time workers.

Table A1: Income concepts

Market income	Gross income	Disposable income
+ gross employee cash or near cash income	+ gross employee cash or near cash income	+ gross employee cash or near cash income
+ company car	+ company car	+ company car
+ gross cash benefits or losses from self-employment	+ gross cash benefits or losses from self-employment	+ gross cash benefits or losses from self-employment
+ income from rental of a property or land	+ income from rental of a property or land	+ income from rental of a property or land
+ regular inter-household cash transfers received	+ regular inter-household cash transfers received	+ regular inter-household cash transfers received
+ interests, dividends, profit from capital investments	+ interests, dividends, profit from capital investments	+ interests, dividends, profit from capital investments
+ income received by people aged under 16	+ income received by people aged under 16	+ income received by people aged under 16
+ pensions received from individual private plans	+ pensions received from individual private plans	+ pensions received from individual private plans
+ old-age benefits	+ old-age benefits	+ old-age benefits
+ survivor' benefits	+ survivor' benefits	+ survivor' benefits
	+ unemployment benefits	+ unemployment benefits
	+ sickness benefits	+ sickness benefits
	+ disability benefits	+ disability benefits
	+ education-related allowances	+ education-related allowances
	+ family/children related allowances	+ family/children related allowances
	+ social exclusion not elsewhere classified	+ social exclusion not elsewhere classified
	+ housing allowances	+ housing allowances
		- regular taxes on wealth
		- regular inter-household cash transfer paid
		- tax on income and social insurance contributions

Table A2: Monthly average income (ppp EUR) before and after simulating a minimum wage equivalent to 60% of the national median income. Various income concepts, 2019

	Average income (ppp EUR)			Absolute increase (ppp EUR) from baseline to 60% of the median wage		
	Baseline, disposable income	Baseline, market income	Baseline, gross income	disposable income	market income	gross income
BE	1774.3	1870.3	2055.6	0.7	1.1	1.1
BG	826.8	772.1	815.4	0.0	0.0	0.0
CZ	1249.0	1136.9	1187.5	5.9	7.4	7.2
DE	2021.1	2050.7	2192.9	15.5	28.3	26.8
EE	1223.0	1073.4	1202.4	20.0	25.1	24.9
EL	887.5	781.4	820.2	13.9	18.4	17.6
ES	1459.2	1303.1	1415.3	14.6	15.1	14.5
FR	1967.4	1800.7	1984.9	4.3	6.2	5.9
HR	880.4	816.5	853.2	5.9	7.5	7.5
HU	758.0	729.4	767.3	10.0	4.4	4.6
IE	1643.3	1713.3	1922.2	16.9	27.3	23.8
LT	1139.5	1241.8	1322.2	1.7	2.9	2.9
LU	2214.8	2137.3	2356.1	18.9	32.3	25.9
LV	923.2	914.5	986.1	6.7	9.4	9.4
MT	1663.3	1598.6	1669.1	6.3	8.5	8.2
NL	2016.0	2495.4	2727.7	-17.2	6.0	4.8
PL	1011.2	941.0	1040.8	9.8	15.4	14.7
PT	1088.5	981.3	1035.0	0.0	0.0	0.0
RO	628.2	656.4	684.2	6.3	11.5	11.4
SI	1374.1	1417.3	1565.5	-1.7	3.4	-0.5
SK	863.8	791.4	842.1	5.9	8.9	8.7

Source: EUROMOD simulations.**Note:** The baseline scenario reflects the distribution of EU disposable incomes in 2019, with the observed minimum wages. Countries with actual minimum wages above the hypothetical scenarios were excluded.

Table A3: Inequality in the EU. Observed and simulated inequality indices for different hypothetical minimum wages, 2019

Minimum wage level	Gini (%)	MLD*100	Theil*100	within-country inequality, MLD	between-country inequality, MLD	within-country inequality, Theil	between-country inequality, Theil	
current level (baseline)	33.06	20.19	19.24	15.28	4.91	14.91	4.33	disposable
50% of the median wage	32.95	20.05	19.13	15.16	4.89	14.82	4.31	
55% of the median wage	32.90	19.98	19.07	15.11	4.88	14.77	4.30	
60% of the median wage	32.81	19.88	18.97	15.03	4.85	14.69	4.28	
current level (baseline)	53.00	69.27	41.69	65.01	4.26	37.67	4.02	market
50% of the median wage	52.89	69.01	41.49	64.75	4.26	37.47	4.02	
55% of the median wage	52.80	68.84	41.33	64.60	4.25	37.32	4.02	
60% of the median wage	52.66	68.61	41.09	64.39	4.22	37.09	4.00	
current level (baseline)	48.94	61.25	39.05	56.23	5.02	34.38	4.67	gross
50% of the median wage	48.86	61.12	38.92	56.11	5.01	34.25	4.67	
55% of the median wage	48.79	61.03	38.81	56.03	5.00	34.14	4.66	
60% of the median wage	48.68	60.90	38.63	55.93	4.97	33.99	4.64	

Source: EUROMOD simulations.

Note: Inequality decomposition by country. Reduction in EU-level inequality (%) simulated for different HMWs. The baseline reflects the distribution of EU disposable incomes in 2019, with the observed minimum wages. Countries with actual minimum wages above the hypothetical scenarios were excluded.

Table A4: EU-level inequality reduction (%) simulated for different hypothetical minimum wages. Various inequality indices and income concepts, 2019

Minimum wage level	Gini	MLD	Theil	
50% of the median wage	-0.31%	-0.68%	-0.56%	disposable
55% of the median wage	-0.48%	-1.01%	-0.88%	
60% of the median wage	-0.75%	-1.52%	-1.39%	
50% of the median wage	-0.21%	-0.37%	-0.48%	market
55% of the median wage	-0.37%	-0.61%	-0.85%	
60% of the median wage	-0.63%	-0.94%	-1.43%	
50% of the median wage	-0.17%	-0.21%	-0.35%	gross
55% of the median wage	-0.31%	-0.36%	-0.63%	
60% of the median wage	-0.53%	-0.58%	-1.08%	

Source: EUROMOD simulations.

Note: The baseline reflects the distribution of EU disposable incomes in 2019, with the observed minimum wages. Countries with actual minimum wages above the hypothetical scenarios were excluded. All EU households.

Table A5: EU-level inequality reduction (%) simulated for different hypothetical minimum wages. Various income concepts and reference populations, 2019

	Income concept	Difference from the baseline (Gini points*100)	standard error	t	Confidence interval - low	Confidence interval - high	Household type
Hypothetical minimum wage=60%median wage	disposable income	0.249	6.09E-05	40.81	0.0024	0.0026	all EU households
	market income	0.336	7.42E-05	45.26	0.0032	0.0035	
	gross income	0.260	5.95E-05	43.74	0.0025	0.0027	
	disposable income	0.286	6.66E-05	42.88	0.0027	0.0030	EU households with at least an employee
	market income	0.385	8.24E-05	46.78	0.0037	0.0040	
	gross income	0.305	6.64E-05	45.86	0.0029	0.0032	
	disposable income	0.434	0.000114	38.06	0.0041	0.0046	EU households with at least a MW earner
	market income	0.673	0.000142	47.23	0.0064	0.0070	
	gross income	0.508	0.000114	44.56	0.0049	0.0053	
Hypothetical minimum wage=55%median wage	disposable income	0.158	4.71E-05	33.52	0.0015	0.0017	all EU households
	market income	0.199	0.000054	36.77	0.0019	0.0021	
	gross income	0.151	4.31E-05	34.99	0.0014	0.0016	
	disposable income	0.180	5.15E-05	34.90	0.0017	0.0019	EU households with at least an employee
	market income	0.227	6.03E-05	37.72	0.0022	0.0024	
	gross income	0.176	4.83E-05	36.40	0.0017	0.0019	
	disposable income	0.273	8.79E-05	31.02	0.0026	0.0029	EU households with at least a MW earner
	market income	0.399	0.000107	37.47	0.0038	0.0042	
	gross income	0.294	8.41E-05	34.96	0.0028	0.0031	
Hypothetical minimum wage=50%median wage	disposable income	0.101	3.74E-05	26.97	0.0009	0.0011	all EU households
	market income	0.110	3.75E-05	29.45	0.0010	0.0012	
	gross income	0.082	3.06E-05	26.90	0.0008	0.0009	
	disposable income	0.113	4.08E-05	27.78	0.0011	0.0012	EU households with at least an employee
	market income	0.126	0.000042	30.07	0.0012	0.0013	
	gross income	0.095	3.43E-05	27.80	0.0009	0.0010	
	disposable income	0.170	6.81E-05	25.04	0.0016	0.0018	EU households with at least a MW earner
	market income	0.224	7.54E-05	29.66	0.0021	0.0024	
	gross income	0.160	5.97E-05	26.84	0.0015	0.0017	

Source: EUROMOD simulations.

Note: The baseline reflects the distribution of EU disposable incomes in 2019, with the observed minimum wages. Standard errors, t-test and confidence intervals refer to the difference between the Gini of simulated distribution after the HMW and the baseline distribution. Countries with actual minimum wages above the hypothetical scenarios were excluded.

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