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THE EVOLUTION OF **INEQUALITY OF OPPORTUNITY** IN THE **EU**



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The Evolution of Inequality of Opportunity in the EU

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Abstract

This paper analyses the effect of inherited individual circumstances such as gender, family background, foreign background and health status, on individual earnings in the EU. By using three waves of the EU Statistics on Income and Living Conditions (2005, 2011, 2019) this study documents the extent, evolution, and sources of inequality of opportunity in earnings across 27 EU countries. The analysis is carried out both at the country level and at the pan-EU level, treating the European Union as a single entity and considering the EU country of origin as an additional individual circumstance. The cross-country analysis reveals that, on average, approximately 40% of earnings inequality is explained by pre-determined individual circumstances, although with pronounced differences across countries, both in terms of levels and trends. Gender and parental education emerge as the most relevant individual circumstances in most countries. Pan-European inequality of opportunity, estimated through a multilevel model, appears to be much higher than any other country specific estimates. In 2019, about 60% of EU earnings inequality was explained by individual circumstances, despite a clearly decreasing trend in the last 15 years. Inequality in EU earnings explained by differences between countries declined by over 50% in 2019 compared to 2005, indicating a significant process of convergence within Europe that has reduced the role of country of origin in determining individual earnings at the EU level.

JEL Classification: D31, D63, J31, O15.

Keywords: inequality, equality of opportunity, earnings, labour market, Europe.

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1. Introduction

Economic inequality constitutes a key barrier to sustainable and inclusive economic growth. Policies that focus solely on growth, without considering their distributional impact, or do not remove obstacles to participation in growth opportunities run the risk of delivering results that are not necessarily fair or inclusive.

The EU is one of the most equal regions in the world in terms of economic outcomes. However, both long-term and new forms of inequalities, such as digital inequalities, characterize the region. Specific features of these inequalities may create social tensions and generate divides in existing social contracts.¹ Understanding the various kinds and sources of inequality is a necessary step toward the implementation of policies that can foster sustained and inclusive growth in EU Member States.

The perspective of inequality of opportunities may shed light on persistent and rising distributional tensions in Europe, for instance those arising between individuals from different parental backgrounds or across different generations. In fact, there is a rooted consensus on the argument that not all inequalities are the same. In particular, it has been convincingly argued (see World Bank, 2006; Ferreira et al. 2018; Marrero and Rodriguez 2014) that the degree of inequality caused by differences at birth (such as gender, ethnicity, or parental background) or, more in general by factors beyond individual control, may be particularly correlated to low growth, more so than other effort-based inequalities. The existence of inequality traps, which systematically exclude some groups of the population from participating in economic activity or accessing good-quality jobs, is harmful to growth. These traps discourage effort and investment by individuals, provoke a loss of productive potential, contribute to social and institutional instability and create fiscal costs. Moreover, inequalities due to initial conditions (the so-called inequalities of opportunities) may be less acceptable from an ethical point of view than inequalities generated by individual choices and efforts.

Therefore, given individual outcomes (such as incomes, earnings, education), it is useful to distinguish between inequality of opportunity, i.e. inequality of outcomes due to exogenous circumstances, and inequality due to effort and personal responsibility.

After the seminal and influential contributions by Fleurbaey (1994, 2008) and Roemer (1993, 1998), a rich literature has flourished in the past two decades, proposing different approaches

¹ See for instance Bussolo et al. (2018) for a recent analysis of distributional tensions in Europe along these lines.

and methodologies to measure the degree of inequality of opportunity in different dimensions of well-being, time periods, and countries (see reviews in Ferreira and Peragine 2016 and Ramos and Van de Gaer 2016).

Box 1: Inequality of opportunity: the measurement framework in the EU

The European Union supports and complements the Member States' activities in the domain of social inclusion and social protection. In this regard the Social Protection Committee has proposed and adopted indicators to monitor trends in these areas. The portfolio of EU social indicators in the specific case of inequality of opportunity include three indicators:

- [the gap](#) (in percentage points) in the percentage of PISA low achievers for 15-year-olds by socio-economic status (bottom versus top quartile of the index of economic, social and cultural status).
- [the gap](#) in at-risk-of-poverty rates between the children (for the age cohort: less than 18 years old) of low-educated versus those of high-educated parents.
- the Gini coefficient for children, defined as the population under 18 years old.

These indicators monitor the disadvantages for current children stemming from different parental background both from an education and income perspective. Therefore, they have the advantage of identifying current inequalities among children and inspiring timely policy action. Our analysis complements this real-time approach by looking at how some personal characteristics are penalised by the labour market and so contribute to labour earnings inequality among current workers. Thus, these circumstances faced at an early age, such as different parental backgrounds, refer to past episodes.

Following the most recent research, this study aims to examine the magnitude and evolution of inequality of opportunity in earnings in the European Union adopting two different approaches: a standard country specific approach, in which inequality of opportunity is measured for each country separately, and a 'global' approach, that treats the EU population as a whole and considers country of origin as a circumstance, following Milanovic's strand of research (2011, 2015, 2016). The paper also aims to identify the drivers of inequality of opportunity by analysing the role played by different circumstances, and their cumulative effect, in explaining existing economic inequalities in Europe.

Previous analyses of inequality of opportunity in 25 EU countries, based on the EU-Statistics on Income and Living Conditions (EU-SILC) conducted in 2005 and 2011 (see, among others, Checchi et al., 2016; Ramos and Van de Gaer 2010; Palmisano and Peragine 2022) show that the country ranking based on inequality of opportunity indicators only partially confirms the standard country ranking based on income inequality, where Nordic countries face the lowest and Mediterranean and Anglo-Saxons the highest income inequality. Trends in income

inequality and inequality of opportunity also follow different trajectories: income inequality exhibits larger cyclical fluctuations in comparison to inequality of opportunity. Comparing the changes over time of the inequality measures, they also show that the 2005 survey (recording information on 2004 incomes) reflects a period of substantial growth, while the 2011 survey (data referred to 2010 incomes) is significantly affected by the consequences of the financial crisis, leading to a general trend of declining values (due to the wage distribution compressed in the wake of the crisis). It is also interesting to note that in a few countries inequality of opportunity has remained almost stable over the time interval (Czech Republic, Poland, and Hungary, but also Finland and Slovenia to a lesser extent). This may suggest that inequality of opportunity measures capture underlying mechanisms of income generation, which are deeply rooted in the countries' social systems and therefore do not change considerably over short intervals of time. This previous evidence emphasises the need for a longer time perspective in the analysis of country-specific inequality of opportunity.

Moreover, it is important to study if the financial crisis has exacerbated the degree of inequality of opportunity as observed in the labour market. The financial crisis, by reducing the available jobs, may have affected disproportionately those individuals who have a poorer endowment of hard and soft skills (from formal school qualifications to networking abilities); characteristics which, in turn, may be influenced by individual circumstances at birth, primarily by parental background. The release of the 2019 wave of the EU-SILC survey, containing an ad-hoc module on intergenerational transmission of disadvantages (as in the 2005 and 2011 waves), provides an opportunity to analyse inequality of opportunity in the EU countries over a 14-year period.

Beyond the national analysis, there are various reasons to analyse inequality of opportunity at the EU level. First, a pan-European perspective on inequality represents 'a significant move towards viewing the European Union as a social entity' (Atkinson 1998, p. 29). Secondly, the perception of fair economic outcomes may also depend on the European dimension. In an increasingly interconnected economic space where traditional and social media cross national borders, the reference group for well-being comparison is not necessarily the national one, especially for outcomes in the labour market. Third, both market and redistributive policy levers that determine individual economic outcomes and their distribution increasingly depend on EU policies in many areas.

This study describes in detail the methods and data used to produce some of the estimates of inequality of opportunity presented in the Employment and Social Developments in Europe 2022 Annual Review (2022, Chapter 4). The estimates presented contribute to the previous

research on inequality of opportunity in two ways. First, comparable indicators of inequality of opportunity in earnings are provided over a 14-year time span (2005-2019) for all EU countries, thus expanding on previous available evidence. Moreover, the specific contribution of each circumstance to inequality of opportunity is quantified in addition to the overall effect of circumstances.

Second, the pan-EU approach, as a complement to the standard cross-country approach, enables us to analyse inequality of opportunity in the EU as a single entity for the first time, taking into account the country-varying role of circumstances and the role of country of origin. The analysis of inequality of opportunity from a supranational perspective uncovers the role of individual responsibility as opposed to external circumstances in shaping unequal earnings from a pan-European perspective and places special emphasis on the different endowments of opportunities derived from specific countries.

The rest of the paper is structured as follows. Section 2 presents the theoretical model of inequality of opportunity and the empirical model used to estimate it, including the framework for the analysis of inequality of opportunity in the EU as a whole. Section 3 describes the data used in the analysis and the data selection criteria. Section 4 provides the empirical results and discusses them. Section 5 concludes.

2. The measurement model

Consider a distribution of income \mathbf{Y} in a given population. Suppose that all determinants of the individual income Y , including different forms of luck, can be classified into either a set of circumstances C that lie beyond individual responsibility, belonging to a finite set Ω , or as responsibility characteristics, summarized by a variable E , denoting effort, belonging to the set Θ . Following Peragine (2002) and Ferreira and Peragine (2016), the simplified outcome-generating process can be described by a function $g: \Omega \times \Theta \rightarrow \mathbb{R}$ such that:

$$Y = g(C, E) \tag{1}$$

In this model, income is exclusively determined by circumstances and effort, such that all individuals with the same circumstances and the same effort obtain the same income. The source of unfairness in this model is given by the effect that circumstance variables have on individual outcomes. Hence, the main methodological challenge for the measurement of inequality of opportunity – IOp henceforth - is quantifying this unfair part of income inequality. This is usually done in empirical studies by constructing a suitable counterfactual distribution, \mathbf{Y}^C , that is able by construction to capture the variability of income uniquely arising from the

differences in the circumstance variables, C , while ignoring the differences resulting from different efforts E . The measure of absolute IOp is then determined by the inequality in the counterfactual distribution \mathbf{Y}^C , which represents income inequality as if it were uniquely determined by circumstances. It is also common practice in prior research to provide estimates of relative IOp as the ratio between absolute IOp and income inequality. The estimate of relative IOp approximates the proportion of unfair inequality: for a given inequality index I , the relative measure is then $I(\mathbf{Y}^C)/I(\mathbf{Y})$.

Different definitions of the counterfactual distribution \mathbf{Y}^C and hence different measures have been proposed in previous studies (see Ferreira and Peragine, 2016; Ramos and Van de Gaer, 2016). They express different and sometimes conflicting views on inequality of opportunity and in fact the rankings they generate may differ. In addition to normative considerations, the choice of the methodology to adopt should also reflect data availability: in fact, the informational requirements of the different approaches are quite different. Moreover, both non-parametric (Checchi and Peragine, 2010) and parametric (Ferreira and Gignoux, 2011) methods have been proposed in the literature in order to construct the counterfactual distribution \mathbf{Y}^C and implement the model above.

In this project we adopt an ex-ante parametric setup.² The income-generating process can be written as:

$$Y_i = bC_i + cE_i + u_i \quad (2)$$

with u_i being a white noise. It assumes a linear and additive relationship between income Y_i and the circumstance/effort variables. As recognized by the literature (see for example Roemer 1998), effort can itself be partially determined by the existing social circumstances, as below:

$$E_i = dC_i + v_i \quad (3)$$

with v_i being another white noise uncorrelated with u_i . Hence, the income generating process in equation (1) can actually be reformulated as a reduced form equation, as follows:

$$Y_i = bC_i + c(dC_i + v_i) + u_i = (b + cd)C_i + (cv_i + u_i) = \beta C_i + \epsilon_i \quad (4)$$

From the OLS estimates of equation (4), one obtains the counterfactual distribution \hat{Y}_i , where $\hat{Y}_i = \hat{\beta}C_i$. Inequality of opportunity is then measured as the value of a given inequality index

² The literature has developed two different approaches to measure inequality of opportunity, namely the “ex ante” and the “ex post” approaches: see Fleurbaey and Peragine (2011) for a discussion. In the present report we adopt the ex ante approach, which is by large the most widely used methodology in the empirical literature, for reasons of data availability. The approach is parametric because a linear model is estimated to assess the impact of circumstance variables on earnings.

$I(\cdot)$ applied to the distribution of the predicted values \hat{Y}_i . Thus, after obtaining the absolute indicator of inequality of opportunity $I(\hat{Y})$, the indicator of relative inequality of opportunity is expressed as the ratio between absolute inequality of opportunity and inequality as observed: $I(\hat{Y})/I(Y)$. In this paper, two different inequality indices are used, namely the Gini coefficient (GINI) and the mean log deviation (MLD), the latter satisfying desirable decomposition properties.

The empirical application of the model described so far involves several methodological choices, which include the selection of the sample, the selection of variables to be used, both as outcome and as circumstances, and the transformation of the variables. The choices above should be guided by the objectives of the analysis and the need to ensure cross-country comparability.

2.1 Measurement in the pan-EU analysis

Further considerations come into play when the analysis of IOP is carried out adopting a pan-European perspective. Beyond individual effort and circumstances (whose details are provided in Section 3) that determine the individual position in the national income distribution, the position of the various EU countries along the EU-wide distribution is an additional circumstance. In other words, country of origin should be thought of as a circumstance *per se* in the pan-EU context.³

To address these considerations, a multilevel model is particularly fit to estimate the counterfactual income distribution determined by circumstances. The primary advantage of this approach is its ability to model data with a complex structure, e.g., individuals nested within countries, to model dependent data (Snijders and Bosker 1999).⁴ In a multilevel framework it is possible to model individual income as dependent on country of origin and a set of individual circumstances, with a country-varying effect. Hence, multilevel models can partition the overall variance in EU incomes into the individual level (within countries) and the cluster level (between countries). Given that EU individuals in our case are clustered within countries, it can be determined at which level – between countries or between individuals within countries – the unexplained variation in EU incomes lies.

³ Country of origin is considered as the country where one is born. The definition and data availability of this variable are discussed in the next section.

⁴ This type of models is particularly applicable in research on the EU socio-economic outcomes since part of the variability in these distributions at the EU-level is likely to take place at the Member State level. Indeed, observations belonging to the same cluster, a EU country in our case, are likely to be positively correlated.

This multilevel framework is useful for assessing the role of country of origin. A parameter specific to multilevel models is the intra-class correlation coefficient (ICC). The ICC explains how much of the overall variance in EU incomes is due to variation between clusters (countries) rather than at individual level:

$$ICC = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_\varepsilon^2} = \frac{\text{cluster variance}}{\text{total variance}} \quad (5)$$

where $ICC \in [0, 1]$ is the ratio between cluster variance and total variance, denoting the degree of homogeneity of units belonging to the same cluster (EU countries).⁵ For example, if the effect of country of origin decreased over time, the ICC would decline, indicating a reduced premium/penalty based on the country of origin in determining individual income levels across the EU, i.e. an approximation of convergence between EU countries. Subsequently, a multilevel regression model with random intercepts and random slopes of the circumstance variables is estimated as if EU incomes depended solely on external circumstances, where $\hat{Y}_{i,j}$ with $j = 1, \dots, 27$. The circumstance variables used in the pan-EU analysis are the same as in the country-specific analysis and are discussed in the next Section. The significance of these variables has been tested against the baseline ‘null’ model with likelihood ratio tests.⁶

For sensitivity purposes, the counterfactual distribution of income in equation (4) is estimated also with an OLS model with country fixed effects, expressed as country intercepts, to control for the differential country-of-origin impact in influencing individual incomes. This strategy appears less accurate than a multilevel model in taking into account the country-varying effect of various circumstances and, as a result, is expected to produce lower estimates of inequality of opportunity at the EU level.⁷

3. Data

We use data from the 2005, 2011, and 2019 waves of the EU-SILC, an annual survey conducted by National Statistics Institutes across the EU collecting information on the income and living

⁵ We compute the ICC first in a ‘null’ model without regressors or country-varying intercepts, where the model contains just one fixed term - the mean of the dependent variable – both as a first step to justify the need for a multilevel model and to approximate the country-of-origin effect with the estimated ICC. A value of ICC equal to zero implies that variability in the outcome variable takes place uniquely at the individual level (no cluster effect). A value of ICC significantly differently from 0 implies that clustering at country level affects the intercept (mean) of EU earnings. The ICC for the random-intercept and the random-intercept, random-slope model is available on request. It should be in theory interpreted as conditional on random-effects covariates being equal to 0, which makes it less useful for our purposes.

⁶ Likelihood ratio tests available upon request for the different specifications of the model: from the null to the full, where all circumstance variables defined below are included.

⁷ Moreover, observations from the same cluster, i.e. within the same country, are more similar to each other than observations from different clusters. Thus, statistical methods on these *hierarchical* data that assume independence should not be used because estimates of variance, and therefore p-values, are incorrect.

conditions of households in the EU. The survey contains harmonised information on a large number of individual and household characteristics as well as specific information on poverty and social exclusion. We use the 2005, 2011, and 2019 waves since they include an *ad-hoc* module on the intergenerational transmission of disadvantages, which provides information on individuals' circumstances.⁸ Respondents between the ages of 25-60 provided additional information about their parents' social and economic situation during their teenage years (in particular around the age of 14). These additional modules report also information on educational attainment, occupation of respondent's mother and father and family composition.

Our analysis focuses on the current EU-27 countries— namely, Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherland, Poland, Portugal, Romania, Sweden, Slovenia, Slovak Republic. The main advantage of EU-SILC is the relatively large number of countries covered, thus, allowing for cross-country analysis of inequalities. Cyprus, Croatia, Malta, and Romania did not participate to the survey in 2005.

Our analysis has a double focus. First, it explores country-specific changes in the distribution of the opportunities that are available to individuals as a pure result of the labour market. Second, it investigates changes in the distribution of opportunities from a pan-EU perspective. From a policy point of view, the role for the EU to reduce inequality of opportunity in earnings⁹ is two-fold: the more direct role is to reduce earnings disparities between countries so that being born in a country should less and less affect the individual position in the EU earnings distribution. Secondly, an indirect role consists of harmonically reducing the impact that external circumstances have on earnings inequality across EU countries,¹⁰ especially, as labour earnings constitute the main income source in all EU countries (Filauro and Fulvimari 2021). For both the cross-country and pan-EU analysis, the mincerian equation of earnings has the ppp-corrected (log of) annual gross earnings and self-employment income as dependent variable.¹¹ Students, retired and the economically inactive are excluded from the analysis. Gross

⁸ For further information on the EU-SILC *ad-hoc* modules: <https://ec.europa.eu/eurostat/web/income-and-living-conditions/database/modules>.

⁹ Previous estimates of EU-level labour income inequality have been carried out with the intention to set a standard to study EU labour market trends as a whole (Brandolini et al. 2011), in the light of the EU founding principles and EU strategy to create an integrated labour market.

¹⁰ Despite these competences being mostly in the remit of Member States (labour market regulation, education policies, anti-monopoly policies), they are discussed and concerted to some extent with the EU level. Moreover in a highly integrated Union, wages are determined by how national markets are regulated and by the differences in the sectoral, demographic and skill composition.

¹¹ Income values have been previously converted into local currencies for countries not in the Eurozone to follow EUROSTAT's prescriptions as to how to convert income values into a PPP standard. The log transformation drops

wages and self-employed income gross of social contributions and before the redistributive intervention of income taxes happen to be the concepts more largely available for EU countries in all EU-SILC waves. To ensure comparability over time, net wages are transformed into gross wages for Italy and Spain, which reported only the net concept in 2005.¹² The choice of gross earnings, rather than net, is also motivated by our focus on the functioning of the labour markets in Europe.¹³

In line with prior research the variables capturing individual circumstances are: gender, foreign background, health status, parental education, parental occupation, family composition when the individual was a teenager and age.¹⁴

Gender and foreign background are coded into two categories. Gender is coded as: 1) male; 2) female. Foreign background is coded in terms of country of birth as: 1) native; 2) non-native. Health status is coded as: 1) limited or strongly limited by health conditions; 2) not limited.

The remaining three circumstances are coded into the same number of categories to limit the bias in our estimates due to the different categorizations. Parental education is coded into the following five categories: 1) both parents with no or medium/low education; 2) at least one parent with upper secondary education; 3) both parents with upper secondary education; 4) at least one parent with high education; 5) both parents with high education. Parental occupation is coded into the following five categories: 1) the occupation of both parents is unknown or neither of the parents was working; 2) at least one parent was working as blue collar; 3) both parents were working as blue collars; 4) at least one parent was working as a white collar; 5) both parents were working as white collars. Family composition is coded into the following three categories: 1) living with both parents; 2) living with only one parent; 3) living without parents.

automatically earnings lower than 1, that is, especially the unemployed in the sample. Annual wages and self-employment income are used as main variable. Part-timers are excluded.

¹² Overall, five countries did not report gross wages in 2005: Greece, Italy, Latvia, Portugal and Spain. For the most populous countries (Italy and Spain) we correct net into gross wages. The procedure of adjustment is explained in Appendix B. Due to problems in interpreting the national fiscal regimes we could not transform net wages for Greece, Latvia and Portugal. For those countries, we adopt net wages in 2005. This is likely to lead to an overestimation of EU-wide labour earnings inequality in 2005 as those countries tend to be lower-income countries in the EU distribution.

¹³ In fact, in a companion paper (Filauro, Palmisano, Peragine, forthcoming), we compare gross and net incomes in order to study the redistributive effect of the different fiscal regimes in Europe in terms of inequality of opportunity. Moreover wages net of social contributions and income taxes might be the dimension of relevance in the mind of EU mobile workers when deciding to move within the EU.

¹⁴ Age is included to take into account the different cohorts of individuals, hence the set of exogenous (political, social, economic) factors that may have affected in a different ways the different cohorts; however, we are aware that, working on cross section data, this variable will also capture the age effect, that is the inequality due to the life cycle, and it is not possible to distinguish between the two effects. One should consider this *caveat* when interpreting the results.

To ensure cross-country comparability, the same model specification is used for all countries. To make indicators of inequality of opportunity comparable over the entire period, results for 2011 and 2019 are reported for the EU-27 as a whole as well as for a smaller EU aggregate, marked with asterisk. In this EU aggregate countries unavailable in EU-SILC in 2005, or not yet in the EU, were removed, specifically Romania, Bulgaria, Malta, and Croatia.

4. Results

4.1 Inequality of opportunity in earnings: a cross-country perspective

Tables 1 and 2 present estimates of total inequality and inequality of opportunity in labour earnings for the entire full-time working population aged between 25 and 60, in the 27 EU countries. These estimates are derived using the mean logarithmic deviation (MLD) and the Gini coefficient respectively. The MLD is often preferred because it satisfies perfect subgroup decomposability (see Checchi and Peragine, 2010); however, the Gini coefficient, while not perfectly decomposable, is characterized by a generally smaller sampling variance and limited sensitivity to very high income values.¹⁵ This latter characteristic explains the much larger values of relative inequality of opportunity obtained with the Gini coefficient, when compared to the MLD. In fact, the average Gini relative inequality of opportunity in the EU is about 40%; while the average MLD relative inequality of opportunity is around 13%. As most of empirical research to date has used the mean log deviation, to increase comparability in the sequel of the paper we use the MLD.

It is worth noting though that, while the choice of the index has a significant impact of the magnitude of inequality of opportunity, the ranking of countries does not change much.

The estimates of earnings inequality and IOp in for 2019 reveal significant variation across EU countries. Concerning earnings inequality, Spain appears as the most unequal country with a value of the MLD of 0.0047, followed closely by Bulgaria (0.0045). Conversely, Slovakia stands out as the country with the lowest earnings inequality as measured by the MLD (0.0011 in 2019). Moving from earnings to opportunity inequality, Cyprus ranks as the most unequal country with an IOp index of 0.0007, whereas Finland and Malta show the lowest level of IOp - equal to 0.0001 - in the EU-27 comparison. Cyprus is also the country where unequal opportunity in the labour market matters the most in the determination of total inequality (about 26%) as compared to the other countries. In Eastern European countries, particularly Latvia and

¹⁵ See Brunori et al. (2019) for a comparison between Gini and MLD to measure inequality of opportunity.

Estonia, inequalities attributable to circumstances explain the smallest part of earnings inequality (about 5%).

Table 1. Total inequality and inequality of opportunity in Europe, MLD

Countries	2019			2011			2005		
	Total inequality	Absolute IOp	Relative IOp	Total inequality	Absolute IOp	Relative IOp	Total inequality	Absolute IOp	Relative IOp
Austria	0.0022	0.0003	13.63%	0.0028	0.0004	14.29%	n.a.	n.a.	n.a.
Belgium	0.0023	0.0003	13.04%	0.0011	0.0002	18.18%	0.0014	0.0001	7.14%
Bulgaria	0.0045	0.0006	13.33%	0.0029	0.0004	13.79%	n.a.	n.a.	n.a.
Cyprus	0.0027	0.0007	25.93%	0.0027	0.0008	29.63%	n.a.	n.a.	n.a.
Czechia	0.0017	0.0004	23.53%	0.002	0.0004	20.00%	0.0023	0.0003	13.04%
Germany	0.0014	0.0002	14.29%	0.0015	0.0002	13.33%	0.0022	0.0001	4.54%
Denmark	0.0033	0.0002	6.06%	0.0013	0.0001	7.69%	0.0027	0.0001	3.70%
Estonia	0.0034	0.0002	5.88%	0.0032	0.0004	12.50%	0.0043	0.0005	11.63%
Spain	0.0047	0.0006	12.77%	0.0036	0.0005	13.89%	n.a.	n.a.	n.a.
Finland	0.0013	0.0001	7.69%	0.0012	0.0001	8.33%	0.0025	0.0001	4.00%
France	0.0017	0.0002	11.76%	0.0023	0.0002	8.70%	0.0021	0.0002	9.52%
Greece	0.0014	0.0002	14.29%	0.0015	0.0003	20.00%	n.a.	n.a.	n.a.
Croatia	0.0022	0.0003	13.64%	0.0018	0.0003	16.67%	n.a.	n.a.	n.a.
Hungary	0.0032	0.0002	6.25%	0.0025	0.0003	12.00%	0.0043	0.0004	9.30%
Ireland	0.0015	0.0002	13.33%	0.0015	0.0002	13.33%	0.0021	0.0002	9.52%
Italy	0.0025	0.0003	12.00%	0.0019	0.0003	15.79%	n.a.	n.a.	n.a.
Lithuania	0.0036	0.0003	8.33%	0.0052	0.0004	7.69%	0.0044	0.0004	9.09%
Luxembourg	0.0019	0.0004	21.05%	0.0017	0.0005	29.41%	0.0021	0.0005	23.81%
Latvia	0.0041	0.0002	4.88%	0.0054	0.0003	5.56%	n.a.	n.a.	n.a.
Malta	0.0016	0.0001	6.25%	0.0015	0.0001	6.67%	n.a.	n.a.	n.a.
Netherlands	0.0012	0.0002	16.67%	0.002	0.0002	10.00%	0.0021	0.0002	9.52%
Poland	0.0023	0.0002	8.70%	0.0028	0.0002	7.14%	0.0055	0.0004	7.27%
Portugal	0.0021	0.0003	14.29%	0.0025	0.0004	16.00%	n.a.	n.a.	n.a.
Romania	0.0012	0.0002	16.67%	0.0017	0.0002	11.76%	n.a.	n.a.	n.a.
Sweden	0.0019	0.0002	10.53%	0.0035	0.0002	5.71%	0.0038	0.0003	7.89%
Slovenia	0.0022	0.0003	13.64%	0.0022	0.0003	13.64%	0.0029	0.0002	6.90
Slovak Republic	0.0011	0.0002	18.18%	0.002	0.0002	10.00%	0.0031	0.0002	6.45%

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: mean log deviation as inequality index. Absolute IOp is inequality in earnings as if they depended solely on circumstances. Relative IOp is the ratio between absolute IOp and total inequality.

Table 2. Total inequality and inequality of opportunity in Europe, GINI coefficient

Countries	2019			2011			2005		
	Total inequality	Absolute IOp	Relative IOp	Total inequality	Absolute IOp	Relative IOp	Total inequality	Absolute IOp	Relative IOp
Austria	0.031	0.0142	45.81%	0.0338	0.0162	47.93%	n.a.	n.a.	n.a.
Belgium	0.0288	0.0134	46.53%	0.0239	0.0114	47.70%	0.0274	0.0096	35.04%
Bulgaria	0.0487	0.0203	41.68%	0.0394	0.0151	38.32%	n.a.	n.a.	n.a.
Cyprus	0.0388	0.0213	54.90%	0.0385	0.0229	59.48%	n.a.	n.a.	n.a.
Czechia	0.0299	0.0155	51.84%	0.0321	0.0152	47.35%	0.0351	0.0147	41.88%
Germany	0.0271	0.0109	40.22%	0.0287	0.0104	36.24%	0.0314	0.0094	29.94%
Denmark	0.0281	0.0106	37.72%	0.0233	0.0081	34.76%	0.0283	0.0089	31.45%
Estonia	0.0406	0.019	46.80%	0.0419	0.0164	39.14%	0.0475	0.0176	37.05%
Spain	0.0457	0.0193	42.23%	0.0404	0.0172	42.57%	n.a.	n.a.	n.a.
Finland	0.025	0.0089	35.6%	0.0246	0.0081	29.89%	0.0314	0.0096	30.57%
France	0.028	0.0112	40.00%	0.03	0.0124	41.33%	0.0321	0.0105	32.71%
Greece	0.0274	0.0121	44.16%	0.0271	0.0143	52.76%	n.a.	n.a.	n.a.
Croatia	0.0331	0.126	26.27%	0.0317	0.0126	39.75%	n.a.	n.a.	n.a.
Hungary	0.0405	0.0107	26.42%	0.0371	0.0132	35.58%	0.0465	0.0159	34.19%
Ireland	0.0301	0.0109	36.21%	0.0294	0.0125	42.52%	0.0343	0.0104	30.32%
Italy	0.0352	0.0142	40.34%	0.0302	0.0138	45.70%	n.a.	n.a.	n.a.
Lithuania	0.042	0.0148	35.24%	0.0514	0.0151	29.38%	0.0507	0.0159	31.36%
Luxembourg	0.0331	0.0162	48.94%	0.0313	0.018	57.51%	0.0343	0.018	52.48%
Latvia	0.0421	0.0127	30.17%	0.0516	0.0137	26.55%	n.a.	n.a.	n.a.
Malta	0.0292	0.0097	33.22%	0.0276	0.0075	27.17%	n.a.	n.a.	n.a.
Netherlands	0.0262	0.0116	44.27%	0.0272	0.013	47.79%	0.0301	0.0115	38.20%
Poland	0.0344	0.0115	33.43%	0.0381	0.0119	31.23%	0.052	0.0154	29.62%
Portugal	0.035	0.0139	39.71%	0.0377	0.0148	39.26%	n.a.	n.a.	n.a.
Romania	0.0267	0.0103	38.58%	0.0316	0.012	37.97%	n.a.	n.a.	n.a.
Sweden	0.0258	0.0121	46.90%	0.032	0.0119	37.19%	0.034	0.0127	37.36%
Slovenia	0.0324	0.0126	38.89%	0.0336	0.0129	38.39%	0.0372	0.0108	29.03%
Slovak Republic	0.0242	0.0107	44.21%	0.0299	0.0109	36.45%	0.0365	0.0126	34.52%

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: Gini coefficient as inequality index. Absolute IOp is inequality in earnings as if they depended solely on circumstances. Relative IOp is the ratio between absolute IOp and total inequality.

The trend in earnings inequality (Figure 1) and inequality of opportunity (Figure 2) between 2005, 2011, and 2019 also varies across countries and is marked by distinct changes.

Figure 1. Inequality in earnings, working age population, MLD (*100)



Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: A value below (above) the 45° line indicates that the country in question experienced a reduction (increase) in inequality.

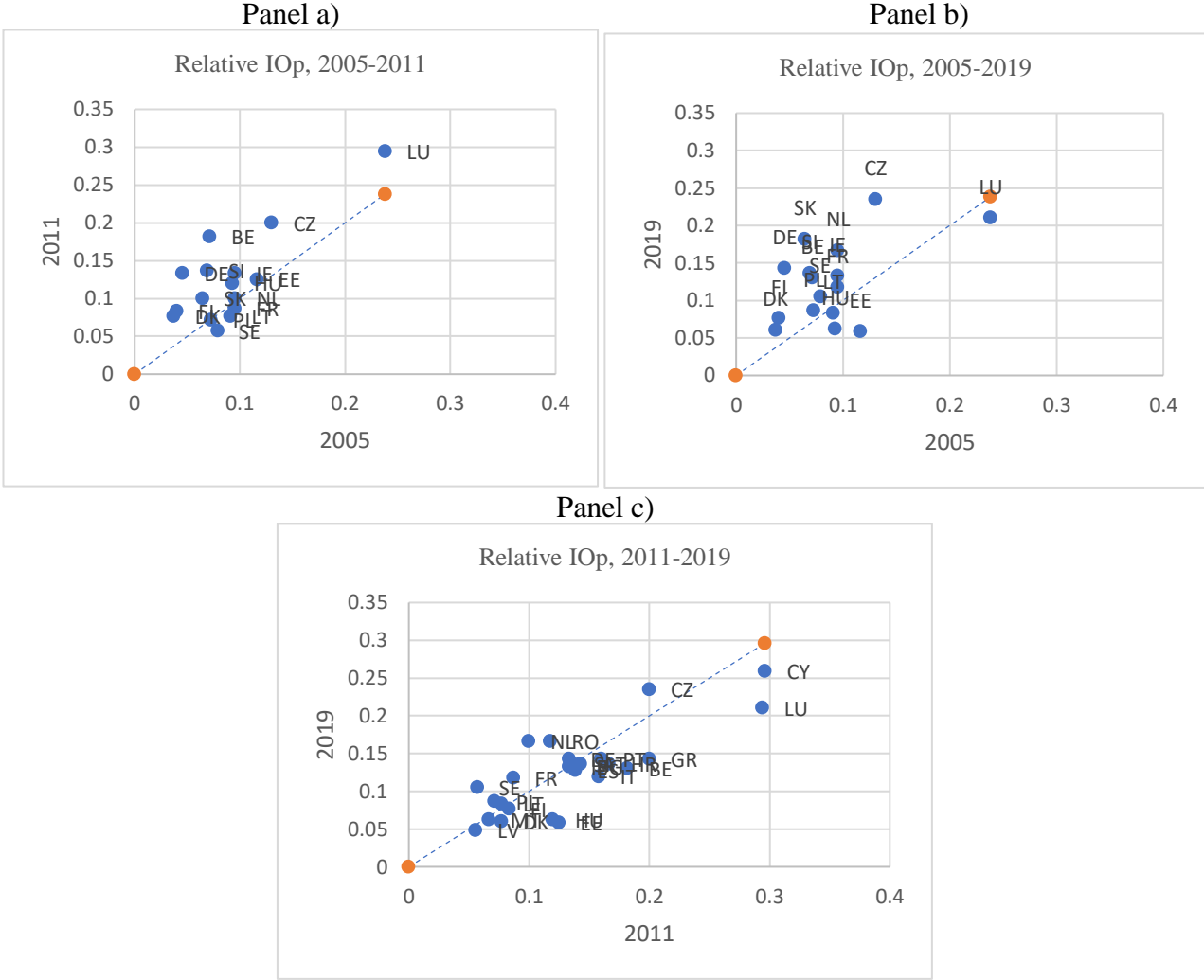
From 2005 to 2011, earnings inequality in many countries decreased (those below the 45 degree line), especially for eastern European countries, except for Lithuania that, instead, experienced an increase in inequality (see Figure 1, Panel a).¹⁶ Poland, followed by Hungary, is the country experiencing the highest reduction (indicated by the highest distance to the 45 degree line). More variation arises when 2011 estimates of earnings inequality are compared to the 2019 ones. It is worth noticing the sizable increase in inequality that occurred in Denmark, Bulgaria, Belgium and Spain (see Figure 1, Panel c). By contrast, a significant reduction took place in Sweden, Lithuania and Latvia. Thus, the trend that arises when considering the horizon 2005-

¹⁶ Bulgaria, Croatia, Malta and Romania unavailable in EU-SILC in 2005.

2019 is the result, on one side of the increase in inequality that affected some countries in 2011-2019 and, on the other side of the reduction that affected other countries in 2005-2011.

In turn, the trend of inequality of opportunity followed different dynamics compared to earnings inequality (Figure 2).

Figure 2. Relative inequality of opportunity in earnings, working age population



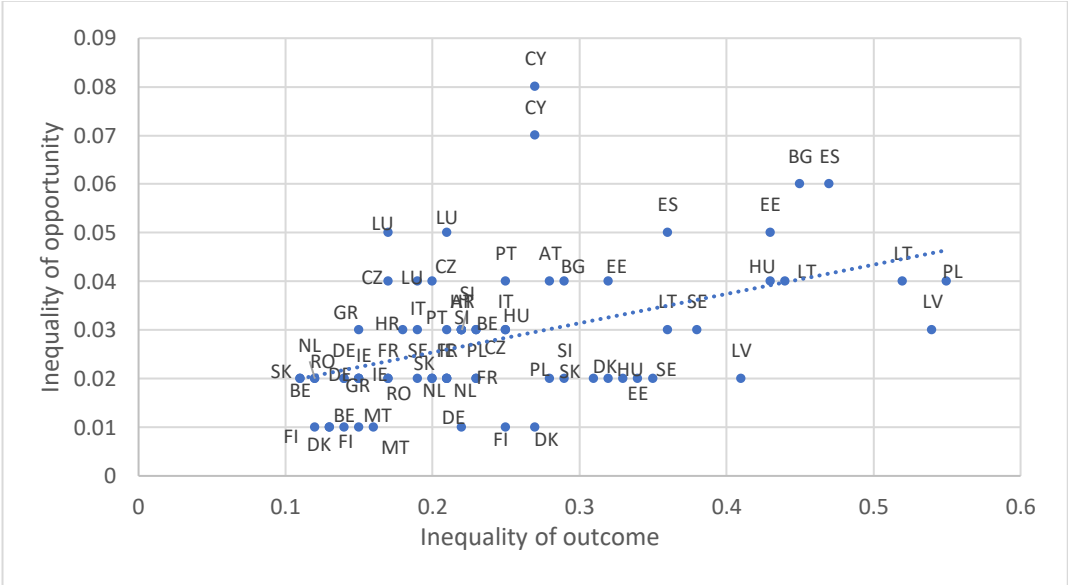
Source: Our elaborations based on EU-SILC 2005-2011-2019.
 Note: A value below (above) the 45° line indicates that the country in question experienced a reduction (increase) in inequality.

First, there is less stability over time. In fact, from 2005 to 2019, most countries experienced an increase in the share of earnings inequality due to unequal opportunities. There are only four exceptions to this increasing trend: Luxembourg, Estonia, Lithuania, and Hungary. The trend between 2005 and 2019 can be explained by the different evolution of absolute inequality of opportunity and earnings inequality: i.e., while absolute IOp remained mostly stable, earnings inequality decreased in many countries. Slovakia, Czech Republic, Germany, and the Netherlands are the countries that experienced the highest increase between 2005 and 2019.

Estonia and Hungary are positioned at the other extreme, having experienced a reduction, although less sizable, in IOp. The remaining countries faced a small increase. Most of the increase took part in the first part of the period under analysis. In fact, most countries experienced a reduction of relative IOp from 2011 to 2019, somewhat offsetting the initial increase. Thus, the economic and financial crisis that took place in 2008 generated the most visible impact on relative IOp in the short run, while this effect seems to have vanished out over a longer period. This effect can be interpreted as follows: during a crisis period, absolute inequality of opportunity is unlikely to change much, as it is the result of inequalities in earnings due to circumstances experienced long ago, whose differential remuneration in the labour market change very slowly. Conversely, earnings inequality is sensitive to the business cycle, so that relative inequality of opportunity, i.e. the fraction of earnings inequality explained by circumstances, is likely to rise in a recession. In turn, effective policies to reduce the role of circumstance on earnings inequality are more likely to take place in the long run and be observable during periods of economic growth.

Figure 3 establishes a relationship between inequality of opportunity and earnings inequality, somewhat resembling the Great Gatsby Curve introduced by Corak (2013), which focused on the relationship between income inequality and intergenerational income mobility. A firmly positive relationship stands out between the two distributional phenomena (correlation coefficient= 0,449) so that it is more common to find higher inequality of opportunity in countries characterized by higher earnings inequality.

Figure 3. Earnings inequality and absolute IOp in earnings, 2005-2011-2019, working-age population, MLD (*100)



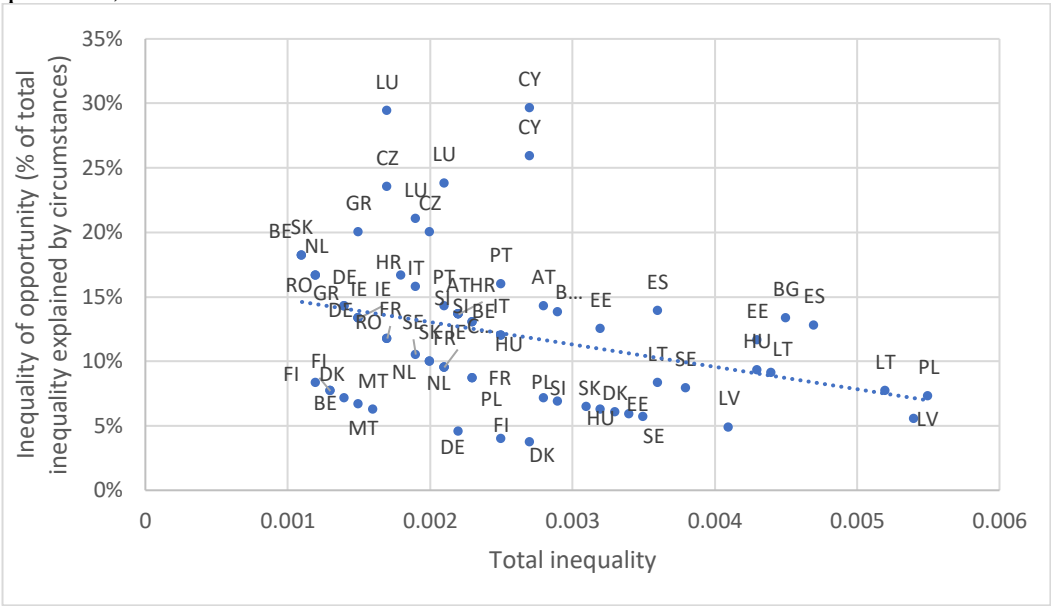
Source: Our elaborations based on EU-SILC 2005-2011-2019.

A number of possible mechanisms might drive this correlation. One possibility is the idea that today's outcomes of parents shape tomorrow's opportunities of their children: large earnings disparities among current workers are likely to imply bigger gaps in the quality of education, or access to well-paid jobs in the future, among their children. Naturally, today's inequality of opportunity among individuals can also influence tomorrow's earnings inequality: if the set opportunity differs pronouncedly among children at birth, then individual outcomes later in the labour market are also likely to be unequal. Clearly, inequalities in earnings and opportunities are both endogenously determined and at this aggregate level of analysis no claim of causality can be made, even though the correlation detected reflects real underlying economic processes. Figure 3 also reveals that two clusters can be identified. The first is represented by the group of countries with lower level of inequality and IOp, mostly northern European countries. In this case, in fact, a weakly negative relationship arises. The second cluster is represented by those countries characterised by elevated earnings inequality and IOp, mostly Baltic, some Eastern country and Spain.

Interestingly, when earnings inequality is plotted against relative IOp (Figure 4), the above-mentioned relationship is reverted (correlation coefficient= -0,329), implying that the value of earnings inequality cannot be used to predict the portion that can be explained by the circumstances included in the model (gender, parental education, parental occupation, family composition, disability status, foreign background). This new evidence suggests that the impact of circumstances in determining overall inequality can be high or low, regardless of the level of total earnings inequality.¹⁷ This evidence also underscores to the need of distinguishing between the two types of inequality: effort- vs circumstance-driven.

¹⁷ This could be due to the denominator effect: as absolute IOp is more stable, thus increase in earnings inequality reduces the relative IOp.

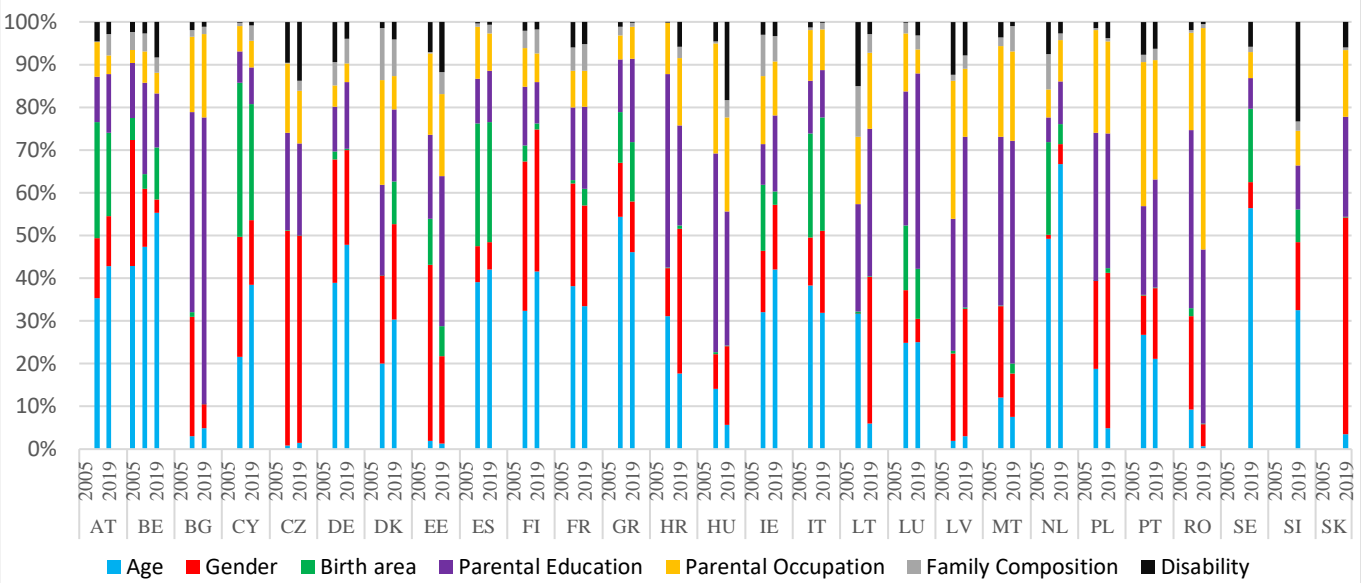
Figure 4. Earnings inequality and relative IOp in labour earnings, 2005-2011-2019, working age population, MLD



Source: Our elaborations based on EU-SILC 2005-2011-2019.

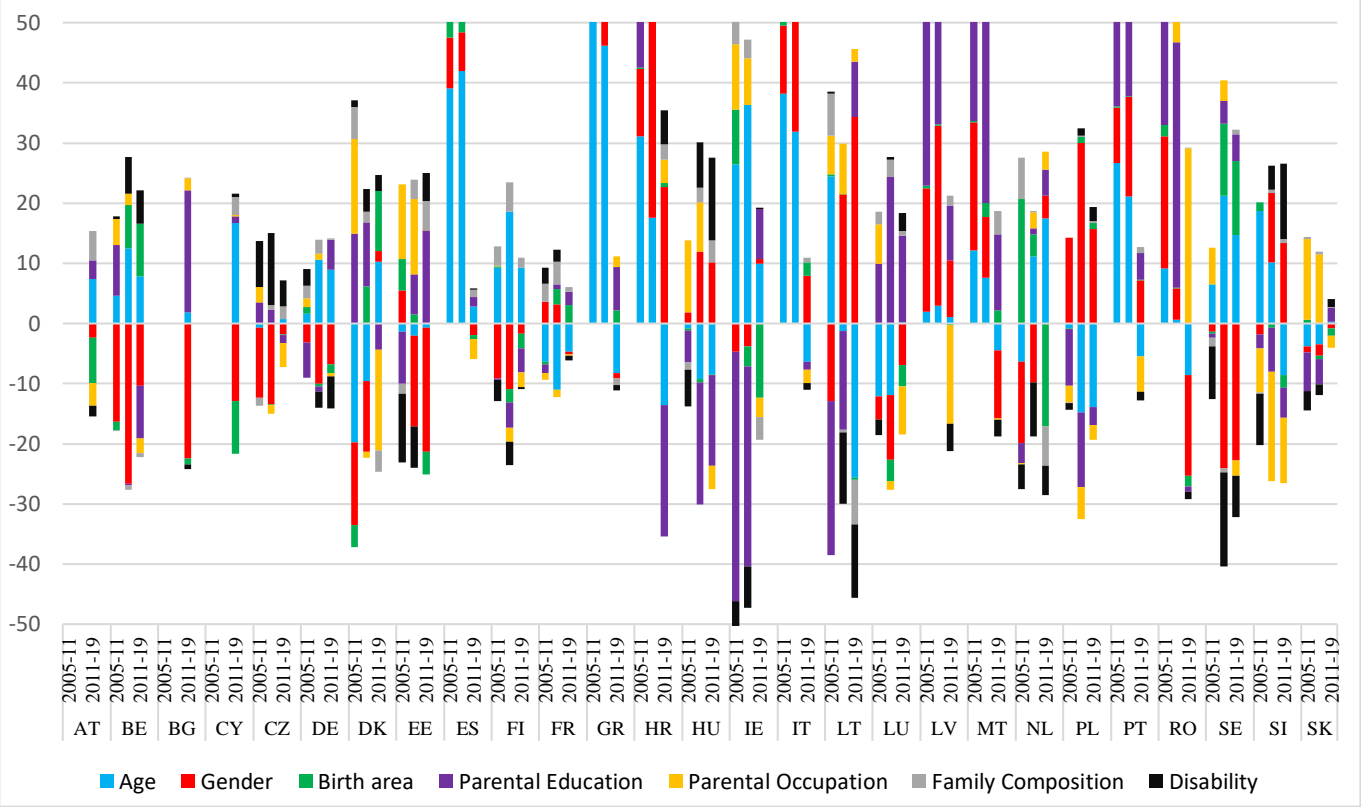
Figure 5 reports the sources of inequality of opportunity for each country. In almost all countries gender contributes the most to IOp. On average – apart from age which is more a control than a circumstance (see footnote 14) – parental education and parental occupation are the other most relevant drivers of IOp. For instance, parental education accounts for as much as 67% of inequality of opportunity in Bulgaria as opposed to less than 8% in Sweden in 2019. In turn, physical limitations and family composition appear to be the least harmful circumstances in terms of earnings inequality. The contribution of circumstances is similar across the periods considered (see Figure 6). The results of the decomposition by source of inequality of opportunity are very robust to the survey year (see Table A1, Table A2 and Table A3 in the Appendix).

Figure 5. Contribution of circumstances in absolute IOP in gross labour earnings, full time working individuals



Source: Our elaborations based on EU-SILC 2005-2011-2019.

Figure 6. Variation in the contribution of circumstances between 2005 and 2011, 2005 and 2019, 2011 and 2019 for IOP in earnings, full time working individuals



Source: Our elaborations based on EU-SILC 2005-2011-2019.

The contribution of parental occupation and education are those that changed most and, surprisingly, moved in the opposite direction. The contribution of parental occupation increased

whereas the contribution of parental education decreased. Since these are very relevant circumstances, this compensating effect might explain why IOp remained rather stable in the majority of countries. The contribution of foreign background, as approximated by birth area, and family composition also varied but to a lower extent, whereas the contribution of gender was more stable. Thus, the effect of the financial crisis in terms of variation of the contribution of circumstances is quite uniform in the short (2005-2011) and long run (2005-2019). On the one hand the impact of parental education has been reducing, mainly as a result of a long-lasting expansion of education policies, which might have limited the negative impact of the crisis. On the other hand, the crisis seems to have worsened the impact of parental occupation, which mostly determines the amount of monetary (and non-monetary) resources parents can devote to their children to ensure them a better future and better outcome prospects.

4.2 Inequality of opportunity in earnings: a pan-European perspective

The fraction of inequality in EU earnings that takes place at the country level is summarised by the intraclass correlation coefficient (ICC). This parameter of the model summarises the power of country of origin in determining earnings inequality at the EU level in 2005, 2011, and 2019 as illustrated in Table 3.

Table 3. Intraclass correlation coefficient, (log) earnings, EU-wide distribution

Year	ICC	Standard errors	Confidence interval		Sample	Countries
2005	53.3%	0.073	0.390	0.671	120,431	23
2011	39.7%	0.065	0.279	0.529	135,710	27
2019	27.7%	0.055	0.184	0.395	141,937	27
2011*	33.6%	0.066	0.221	0.474	119,605	23
2019*	26.2%	0.057	0.166	0.388	122,786	23

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: Standard errors for the absolute IOp in parentheses. (*) EU aggregate composed of 23 countries as in 2005 for the comparison over time. Full-time workers.

In 2019, approximately 27.7% of the observed variation in earnings in the EU occurred at the country level.¹⁸ This means that over one fourth of variance in EU earnings can be attributed to the country of origin. To put this figure in time perspective, it is worth noticing that the effect of country of origin on EU earnings in 2019 has declined by over 50% compared to 2005 (from 53.3% to 26.2%).¹⁹ This result confirms earlier research that pointed toward convergence in EU

¹⁸ This intraclass correlation coefficient (ICC) is computed on a sample where observations with missing information about circumstance variables were dropped. Results computed in the full sample of the EU full-time workers are available upon request.

¹⁹ This is for the EU aggregate excluding Bulgaria, Croatia, Malta and Romania as they were not available in EU-SILC 2005.

earnings across EU countries (Brandolini and Rosolia 2019). The country-of-origin penalty (or premium) in the EU declined markedly, especially between 2005 and 2011, before the 2008-2009 financial crisis fully deployed its effects. Moreover, for the entire EU-27 aggregate, the reduction from 39.7% to 27.7% from 2011 to 2019 is indicative of a general convergence in earnings as a result of the overall catching-up process of the least affluent EU countries. In all cases, the large significant effect of the country clustering in all years indicates that a multilevel model is recommended to model EU earnings.

Table 4 presents the impact of individual circumstances on EU earnings in the multilevel model. The impact of circumstances on EU earnings, as approximated by the sign and magnitude of the coefficients of the multilevel model, aligns with general expectations and previous research.²⁰ This is also consistent with recent evidence that shows different effects of these covariates on labour income across countries (Checchi et al. 2016).

In the next step, the circumstance-determined labour earnings distribution in the EU, \hat{Y}_{EU} , is approximated with the estimates of the fitted random-intercept, random-slope multilevel model. Then, the associated inequality index is computed $I(\hat{Y}_{EU})$, corresponding to the index of absolute inequality of opportunity. The EU-wide absolute index of IOp is similar to the absolute IOp indices presented in Table 1 at country level. Finally, the relative indices of inequality of opportunity in the EU are obtained as $I(\hat{Y}_{EU})/I(Y_{EU})$, after the estimate of inequality indices for the EU-wide labour earnings distribution ($I(Y_{EU})$).²¹

Results reported in Table 5 indicate that in 2019, the inequality of opportunity index in the EU stood at around 28%. Its interpretation suggests that circumstances in the EU distribution of labour earnings account for 28% of inequality among European Union's full-time workers, taking into account the different country-specific role of different circumstances.²² This result confirms our expectations that the inequality of opportunity index is remarkably higher in the EU than on average between EU countries (around 13%) in 2019.²³ This is a key result in the development of the inequality-of-opportunity research agenda as it quantifies the role of

²⁰ All the country-varying circumstance variables in the fixed part of the model are significant to different model specifications of the variance and covariance structure. Moreover, results on the impact of circumstances in the OLS model with country fixed effects are shown for robustness in Table A4. However, no change in the direction of the coefficient is detectable, only slight variations in the magnitude.

²¹ This is done both for the generalised entropy class of indices, such as the Theil or the Mean Logarithmic deviation, and the Gini coefficient. Results for the Theil index are not shown but available upon request.

²² This is only a lower bound estimate of inequality of opportunity as the circumstances included in the model are only an observable subset of the different circumstances at play in the earnings determination.

²³ Unweighted average between EU countries, estimate derived from Table 1. This is also confirmed in Table A5 where the EU indicator of IOp is estimated in a counterfactual distribution obtained in an OLS framework with country fixed effects.

circumstances from a pan-EU perspective. Inequality of opportunity in the EU appeared much higher in 2005, i.e. excluding Romania, Bulgaria, Croatia and Malta (due to data unavailability).

Table 4. Impact of circumstances on individual (log)labour earnings in the EU, output of a multilevel model

	2005		2011		2019	
Female	-0.230	***	-0.204	***	-0.200	***
Parental education						
One secondary	0.159	***	0.124	***	0.109	***
Both secondary	0.223	***	0.186	***	0.168	***
One tertiary	0.309	***	0.260	***	0.246	***
Both tertiary	0.373	***	0.337	***	0.337	***
Parental occupation						
One blue collar	-0.013		-0.006		-0.039	*
Both blue collar	-0.067	***	-0.050	***	-0.080	***
One high	0.044	***	0.101	***	0.049	***
Both high	0.058	***	0.137	***	0.076	***
Family composition						
Only one parent	-0.033	***	-0.044	***	-0.056	***
Without parents	-0.050	***	-0.050	***	-0.063	***
Physical limitation	-0.166	***	-0.157	***	-0.148	***
Migrant	-0.116	***	-0.175	***	-0.149	***
Age	0.010	***	0.013	***	0.012	***
Constant	9.277	***	9.272	***	9.518	***
Observations	120,431		119,669		122,786	
Countries	23		23		23	

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Country-varying intercepts and slopes are estimated as random coefficient in all models. Baseline for parental occupation: elementary; for parental education: primary. Output robust to different specifications of the variance-covariance matrix. Full-time workers.

In 2005, the relative IOp amounted to about 41.3%, while the same index stood at 25.2% in a 2005-composition EU in 2019. Thus, in time perspective, the role of circumstances in the EU distribution of labour earnings has considerably declined, and this reduction has most notably taken place between 2005 and 2011. The absolute IOp decreased by over 50% between 2005 and 2019. This reduction is the result of both a decline in the country-of-origin effect in determining EU earnings inequality, due to earnings convergence across countries as captured by the reduction in ICC, and a general reduction in the role of circumstances on labour earnings, albeit not necessarily homogeneous across EU countries (as seen in section 4.1).

Table 5. EU-wide inequality of opportunity indices, (log) labour earnings

	Counterfactual distribution: Multilevel model					
		2005	2011	2019	*2011	*2019
Gini coefficient	Absolute Iop	0.0307 (0.000487)	0.0320 (0.000378)	0.0252 (0.000153)	0.0251 (0.00037)	0.0231 (0.000163)
	Relative Iop	67.4%	67.0%	59.7%	59.1%	56.7%
	Total inequality	0.0455	0.0477	0.0423	0.0426	0.0407
Mean log deviation	Absolute Iop	0.16311 (0.0000381)	0.17727 (0.0000340)	0.09785 (0.0000108)	0.10137 (0.0000242)	0.08217 (0.0000107)
	Relative Iop	41.3%	40.1%	27.8%	28.6%	25.2%
	Total inequality	0.395	0.442	0.352	0.355	0.326

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: Standard errors for the absolute IOp in parentheses. (*) EU aggregate composed of 23 countries as in 2005 for the comparison over time. Full-time workers.

A key circumstance among those included whose effect has visibly reduced between 2005 and 2011 is gender (see Table 4 or TableA4 in the Appendix), as a result of reductions in the gender pay-gap and women-friendly labour policies implemented in many EU countries (European Commission 2022). The premium associated with having highly educated parents seems also to have slightly declined over time, more pronouncedly between 2005 and 2011, while it remained broadly constant thereafter. However, the lower effect of parental education as a circumstance determining EU inequalities has to be considered in conjunction with parental occupation, whose impact seems to have risen between 2005 and 2019, although the rise is specific to the 2005-2011 period, mirroring the findings of the analysis at country level in Figure 2. Finally, the role of health limitations as a circumstance seems to have remained largely constant over time, with potential indications of a lower effect.

5. Conclusions

This study offers an in-depth analysis of the extent, evolution, and sources of inequality of opportunity in earnings in Europe, adopting both a cross-country and pan-EU perspective. The results show a great deal of heterogeneity across EU countries: traditional country rankings based on economic inequality, with low-inequality Nordic and some Eastern countries as compared to Mediterranean countries, are only partially confirmed when the opportunity perspective is used. Parental education and gender are the most relevant circumstances shaping the earnings opportunities granted to full-time workers in the labour market.

The most relevant change in the indicator of inequality of opportunity is observed from 2005 to 2011, hence for the period including the financial crisis episode, albeit heterogeneously across countries. Thus, a focus on inequality of opportunity is particularly timely at the current juncture, as EU economies are currently in a phase of recovery following the COVID-19 crisis. More modest changes emerged in the subsequent 2011-2019 period.

For the first time, to our knowledge, inequality of opportunity has been assessed in the EU as a single entity. In such an integrated area, opportunities are not equally distributed among individuals. National labour markets differently reward external circumstances beyond individual control, as analysed in the country-specific section. Moreover, the country of origin may be thought of as an additional circumstance, outside the control of the individual, that determines earnings level on a pan-EU scale. In this context, the role of the EU is twofold: a direct role of labour earnings convergence across countries and an indirect role configured as a coordinated reduction of the impact of circumstances on earnings across EU countries. In a multilevel framework that can address these considerations, the relative inequality of opportunity index at EU level is estimated higher than the average of EU indices. At the same time, the role of country of origin has declined remarkably between 2005 and 2019 as a circumstance determining earnings inequality at EU level. Gender and parental education have also slightly reduced their inequality-magnifying role in the EU distribution of earnings, especially between 2005 and 2011, while it remained rather constant thereafter.

Elaborating from previous contributions, these findings reveal that the link between total inequality and inequality of opportunity is far from clear. This evidence suggests that, even in the case of countries characterised by lower level of income inequality, distinguishing between circumstance and effort driven inequalities matters, as there can be societies in which total inequality is low but relative IOp may be high. In these contexts, policies targeted to remove the latter are especially welcome as circumstances-driven inequalities are considered the least acceptable. Initiatives like the EU Child Guarantee and the Council Recommendation on adequate minimum income along with policies that reduce the burden of early disadvantage or detach it from future labour market outcomes, are expected to improve equality of opportunity. Moreover, these findings underscore that there are additional aspects, such as the role of gender and parental background in shaping labour market outcomes, that can represent a barrier to equality of opportunity, apart from total inequality, and that need to be investigated. Focusing on opportunity inequality may help policy makers to identify priorities of redistributive policies and put in place more tailored and specific compensatory interventions.

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Appendix

Table A1. Total inequality and IOp in gross labour earnings using the MLD coefficient in 2019, working-age population

Countries	2019			Contribution of circumstances						
	Total inequality	Absolute IOp	Relative IOp	Age	Gender	Birth area	Parental education	Parental occupation	Family composition	Physical limitations
Austria	0.0022	0.0003	13.64%	42.81%	11.65%	19.55%	13.72%	4.41%	5.05%	2.81%
Belgium	0.0023	0.0003	13.04%	55.27%	3.13%	12.16%	12.73%	4.82%	3.55%	8.34%
Bulgaria	0.0045	0.0006	13.33%	4.93%	5.52%	0.01%	67.14%	19.61%	1.65%	1.13%
Cyprus	0.0027	0.0007	25.93%	38.39%	15.21%	27.20%	8.54%	6.17%	3.69%	0.79%
Czechia	0.0017	0.0004	23.53%	1.51%	48.52%	0.04%	21.49%	12.26%	2.34%	13.84%
Germany	0.0014	0.0002	14.29%	47.84%	22.14%	0.35%	15.50%	4.44%	5.75%	3.97%
Denmark	0.0033	0.0002	6.06%	30.31%	22.43%	9.95%	16.83%	7.77%	8.59%	4.12%
Estonia	0.0034	0.0002	0.59%	1.26%	20.54%	7.03%	35.09%	19.16%	5.20%	11.71%
Spain	0.0047	0.0006	12.77%	42.02%	6.45%	28.06%	12.09%	8.71%	2.00%	0.69%
Finland	0.0013	0.0001	7.69%	41.63%	33.22%	1.39%	9.66%	6.76%	5.58%	1.75%
France	0.0017	0.0002	11.76%	33.45%	23.63%	3.79%	19.31%	8.38%	6.19%	5.24%
Greece	0.0014	0.0002	14.29%	46.19%	11.73%	13.96%	19.55%	7.44%	0.88%	0.27%
Croatia	0.0022	0.0003	13.64%	17.62%	33.88%	0.87%	23.38%	15.77%	2.70%	5.77%
Hungary	0.0032	0.0002	6.25%	5.72%	18.31%	0.26%	31.42%	21.92%	4.11%	18.27%
Ireland	0.0015	0.0002	13.33%	42.00%	15.14%	3.14%	17.81%	12.66%	5.99%	3.25%
Italy	0.0025	0.0003	12.00%	31.91%	19.27%	26.53%	11.03%	9.55%	1.52%	0.20%
Lithuania	0.0036	0.0003	8.33%	6.00%	34.41%	0.11%	34.43%	17.80%	4.33%	2.93%
Luxembourg	0.0019	0.0004	21.05%	25.10%	5.42%	11.64%	45.71%	5.65%	3.30%	3.19%
Latvia	0.0041	0.0002	4.88%	3.01%	29.90%	0.19%	40.01%	15.92%	3.14%	7.83%
Malta	0.0016	0.0001	6.25%	7.60%	10.15%	2.32%	52.10%	20.91%	5.96%	0.96%
Netherlands	0.0012	0.0002	16.67%	66.77%	4.66%	4.57%	10.13%	9.59%	1.56%	2.72%
Poland	0.0023	0.0002	8.70%	4.90%	36.34%	1.09%	31.53%	21.60%	0.73%	3.80%
Portugal	0.0021	0.0003	14.29%	21.18%	16.43%	0.20%	25.37%	27.84%	2.76%	6.23%
Romania	0.0012	0.0002	16.67%	0.64%	5.22%	0.07%	40.86%	51.77%	0.87%	0.58%
Sweden	0.0019	0.0002	10.53%	56.45%	6.01%	17.15%	7.28%	5.97%	1.37%	5.77%
Slovenia	0.0022	0.0003	13.64%	32.47%	15.91%	7.77%	10.26%	8.04%	2.23%	23.32%
Slovak Republic	0.0011	0.0002	18.18%	3.47%	50.81%	0.08%	23.39%	15.70%	0.54%	6.01%

Source: Our elaborations based on EU-SILC 2019.

Note: Inequality estimates and decomposition based on the Mean Logarithmic Deviation (MLD).

Table A2. Total inequality and IOp in gross labour earnings in 2011, working-age population

Countries	2011			Contribution of circumstances						
	Total inequality	Absolute IOp	Relative IOp	Age	Gender	Birth area	Parental education	Parental occupation	Family composition	Physical limitations
Austria	0.0028	0.0004	14.29%	35.40%	13.96%	27.15%	10.58%	8.15%	0.21%	4.56%
Belgium	0.0011	0.0002	18.18%	47.39%	13.51%	3.44%	21.43%	7.26%	4.20%	2.76%
Bulgaria	0.0029	0.0004	13.79%	3.09%	27.91%	1.00%	46.86%	17.60%	1.61%	1.94%
Cyprus	0.0027	0.0008	29.63%	21.65%	28.05%	35.96%	7.48%	5.91%	0.71%	0.22%
Czechia	0.002	0.0004	20.00%	0.77%	50.35%	0.16%	22.76%	16.23%	0.19%	9.55%
Germany	0.0015	0.0002	13.33%	38.90%	28.96%	1.80%	10.54%	4.92%	5.53%	9.35%
Denmark	0.0013	0.0001	7.69%	20.02%	20.62%	0.06%	21.16%	24.51%	12.20%	1.43%
Estonia	0.0032	0.0004	12.50%	1.94%	41.23%	10.72%	19.63%	19.12%	0.32%	7.04%
Spain	0.0036	0.0005	13.89%	39.14%	8.38%	28.66%	10.58%	12.05%	0.79%	0.40%
Finland	0.0012	0.0001	8.33%	32.32%	34.95%	3.78%	13.72%	9.12%	3.98%	2.12%
France	0.0023	0.0002	8.70%	38.14%	24.08%	0.67%	17.12%	8.59%	5.42%	5.98%
Greece	0.0015	0.0003	20.00%	54.39%	12.68%	11.77%	12.35%	5.69%	1.98%	1.15%
Croatia	0.0018	0.0003	16.67%	31.13%	11.16%	0.21%	45.28%	11.96%	0.12%	0.14%
Hungary	0.0025	0.0003	12.00%	14.16%	8.13%	0.42%	46.49%	25.78%	0.50%	4.51%
Ireland	0.0015	0.0002	13.33%	32.09%	14.31%	15.53%	9.54%	15.77%	9.79%	2.97%
Italy	0.0019	0.0003	15.79%	38.23%	11.27%	24.35%	12.34%	11.87%	0.72%	1.22%
Lithuania	0.0052	0.0004	7.69%	31.68%	0.09%	0.45%	25.16%	15.80%	11.75%	15.07%
Luxembourg	0.0017	0.0005	29.41%	24.88%	12.35%	15.17%	31.30%	13.58%	2.53%	0.19%
Latvia	0.0054	0.0003	5.56%	1.94%	20.50%	0.50%	30.94%	32.30%	1.45%	12.37%
Malta	0.0015	0.0001	6.67%	12.12%	21.37%	0.13%	39.48%	21.22%	2.02%	3.65%
Netherlands	0.002	0.0002	10.00%	49.24%	0.93%	21.65%	5.84%	6.58%	8.18%	7.58%
Poland	0.0028	0.0002	7.14%	18.79%	20.64%	0.04%	34.54%	24.08%	0.43%	1.48%
Portugal	0.0025	0.0004	16.00%	26.68%	9.26%	0.14%	20.85%	33.67%	1.77%	7.63%
Romania	0.0017	0.0002	11.76%	9.20%	21.94%	1.89%	41.69%	22.68%	0.75%	1.84%
Sweden	0.0035	0.0002	5.71%	41.73%	28.73%	4.86%	2.88%	8.61%	0.58%	12.61%
Slovenia	0.0022	0.0003	13.64%	40.99%	2.58%	9.95%	15.18%	18.99%	1.50%	10.81%
Slovak Republic	0.002	0.0002	10.00%	3.17%	51.66%	1.28%	21.05%	17.70%	0.41%	4.72%

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Table A3. Total inequality and IOp in gross labour earnings in 2005, working-age population

Countries	2005			Contribution of circumstances						
	Total inequality	Absolute IOp	Relative IOp	Age	Gender	Birth area	Parental education	Parental occupation	Family composition	Physical limitations
Austria	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Belgium	0.0014	0.0001	7.14%	42.77%	29.79%	4.94%	12.96%	2.99%	4.29%	2.26%
Bulgaria	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cyprus	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Czechia	0.0023	0.0003	13.04%	1.43%	62.01%	0.13%	19.28%	13.70%	1.58%	1.86%
Germany	0.0022	0.0001	4.55%	37.25%	32.15%	0.75%	16.40%	3.41%	3.43%	6.62%
Denmark	0.0027	0.0001	3.70%	39.84%	34.27%	3.72%	6.24%	8.73%	6.87%	0.33%
Estonia	0.0043	0.0005	11.63%	3.25%	35.67%	5.55%	28.36%	6.72%	1.90%	18.55%
Spain	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Finland	0.0025	0.0001	4.00%	23.02%	44.13%	3.59%	13.90%	9.04%	0.67%	5.64%
France	0.0021	0.0002	9.53%	44.44%	20.49%	1.21%	18.56%	9.63%	2.41%	3.26%
Greece	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Croatia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Hungary	0.0043	0.0004	9.30%	14.95%	6.33%	0.77%	51.79%	13.78%	1.70%	10.70%
Ireland	0.0021	0.0002	9.52%	5.62%	18.95%	6.44%	51.05%	4.92%	2.90%	10.12%
Italy	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Lithuania	0.0044	0.0004	9.09%	7.25%	12.94%	0.05%	50.86%	9.39%	4.78%	14.72%
Luxembourg	0.0021	0.0005	23.81%	36.99%	16.21%	15.21%	21.31%	7.07%	0.44%	2.77%
Latvia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Malta	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	0.0021	0.0002	9.52%	55.56%	14.44%	0.95%	9.16%	6.88%	1.32%	11.69%
Poland	0.0055	0.0004	7.27%	19.65%	6.34%	0.07%	43.94%	26.93%	0.55%	2.52%
Portugal	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Romania	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sweden	0.0038	0.0003	7.89%	35.20%	30.14%	5.13%	3.57%	2.54%	2.05%	21.38%
Slovenia	0.0029	0.0002	6.90%	22.29%	4.35%	8.47%	17.60%	26.25%	1.71%	19.34%
Slovak Republic	0.0031	0.0002	6.45%	6.98%	52.62%	0.67%	27.56%	4.21%	0.11%	7.86%

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Table A4. Impact of circumstances on individual (log)labour earnings in the EU, output of an OLS model with country fixed effects

	2005	2011	2019
Female	-0.2062301 ***	-0.1921095 ***	-0.2024586 ***
Parental education			
One secondary	0.1669357 ***	0.1420633 ***	0.107232 ***
Both secondary	0.2208519 ***	0.1855571 ***	0.1552203 ***
One tertiary	0.2570465 ***	0.2400107 ***	0.2359982 ***
Both tertiary	0.2479209 ***	0.3074361 ***	0.3296936 ***
Parental occupation			
One blue collar	-0.0053007	0.0013127	-0.0242282
Both blue collar	-0.0815404 ***	-0.0641896 ***	-0.0582195 ***
One high	0.0456634 ***	0.0998574 ***	0.0743707 ***
Both high	0.0745913 ***	0.1198783 ***	0.105377 ***
Family composition			
Only one parent	-0.0449326 ***	-0.0638585 ***	-0.0670152 ***
Without parents	-0.0624397 ***	-0.0405335 *	-0.0771187 **
Physical limitation	-0.1258228 ***	-0.1597751 ***	-0.1357071 ***
Age	0.0113824 ***	0.0144839 ***	0.0139753 ***
Migrant	-0.0983649 ***	-0.221781 ***	-0.2051954 ***
Constant	7.576183	8.324779	8.932121
Observations	120,431	119,605	122,786
R-squared	0.389	0.2835	0.2697
Countries	23	23	23

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Baseline for parental occupation: elementary; for parental education: primary. Full-time workers.

Table A5. EU-wide inequality of opportunity indices, (log) labour earnings

Counterfactual distribution: OLS model with country fixed effects						
		2005	2011	2019	*2011	*2019
Gini coefficient	Absolute Iop	0.02914 (0.0004694)	0.03128 (0.0003653)	0.02489 (0.000147)	0.02451 (0.0003541)	0.02300 (0.0001595)
	Relative Iop	64.0%	65.5%	58.8%	57.6%	56.5%
	Total inequality	0.046	0.048	0.042	0.043	0.041
Mean log deviation	Absolute Iop	0.1493 (0.0000342)	0.16852 (0.0000325)	0.09466 (0.0000104)	0.09615 (0.0000228)	0.08112 (0.0000105)
	Relative Iop	37.8%	38.1%	26.9%	27.1%	24.9%
	Total inequality	0.395	0.442	0.352	0.355	0.326

Source: Our elaborations based on EU-SILC 2005-2011-2019.

Note: Standard errors for the absolute IOP in parentheses. (*) EU aggregate composed of 23 countries as in 2005 for the comparison over time. Full-time workers.

Appendix B

Italy's conversion of net wages (PY010N) into gross wages from EU-SILC 2005 has been obtained as follows:

1. computation of the personal income tax rate (*aliquote IRPEF*) associated to the net wage reported
2. computation of the gross income tax
3. subtraction of deductions for dependents and employee's income from the gross income tax
4. imputation of social contributions and net income tax

Below a summary of the net and the gross variable (in EUR) after the conversion.

Table B1. Summary statistics of the net and gross wage distribution, IT 2005

	net wages	gross wages
Percentiles		
5%	2400	3137.618
10%	4800	5715.965
25%	10000	11246.2
50%	14700	17616.22
75%	19104	23816.52
90%	25248	32330
95%	31376	40953.32

Spain's conversion has been kindly transmitted from the Spanish National Statistical Institute, which we warmly thank for its availability.²⁴ It is available here:

https://www.ine.es/en/prodyser/microdatos_en.htm

²⁴ Special thanks to José Maria Mendez Martin.

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