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The Evolution of Inequality of Opportunity in Europe

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Keyword: inequality, equality of opportunity, earnings, labour market, Europe

JEL Cassification: D31, D63, J31, O15

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*Stefano Filauro is affiliated with Bocconi University. Flaviana Palmisano is affiliated with Sapienza University of Rome. Vito Peragine is affiliated with University of Bari "Aldo Moro". Corresponding author: Stefano Filauro, Bocconi University, Via Roentgen 1, 20136 Milano, Italy. Email: stefano.filauro2@unibocconi.it. Stefano Filauro wishes to thank Ralitsa Donkova for preliminary discussions and for initial help on the programming tasks as well as Stephen Jenkins and the participants of the Ninth Meeting of the Society for the Study of Economic Inequality for useful suggestions. Further thanks go to the analysts of the Analysis and Statistics Unit of DG EMPL (EU Commission) for valuable guidance and support around this research idea. All remaining errors are our own responsibility. This paper builds on *Employment and Social Developments in Europe* 2022, Chapter 4, © European Union, 2022, CC-BY 4.0, available here [Publications catalogue - Employment, Social Affairs & Inclusion - European Commission (europa.eu)] and The *Evolution of Inequality of Opportunity in Europe*, © European Union, forthcoming".

1. Introduction

Economic inequality constitutes a key barrier to sustainable and inclusive economic growth. Policies focusing on growth alone that do not account of their distributional impact or do not remove obstacles to participation in the growth opportunities are not likely to deliver the expected results.

Europe is one of the most equal regions in the world, yet both long-term and new forms of inequalities do characterize the area, and some specific features of these inequalities may create social tensions and generate fissures in the existing social contracts[1]. Understanding the different kinds and sources of inequality is a necessary step toward the implementation of policies that may foster a sustained and inclusive growth in European Countries.

The perspective of inequality of opportunities may help to shed some light on persistent and rising distributional tensions in Europe. 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 the inequality caused by differences at birth (such as gender, ethnicity, or parental background) or, more in general, by factors beyond the individual control may be particularly correlated to low growth, more than other effort-based inequalities. The existence of inequality traps, which systematically exclude some groups of the population from participation in the economic activity, is harmful to growth because they discourage effort and investment by individuals, provoke a loss of productive potential, and contribute to social and institutional instability. Moreover, the inequalities due to initial conditions (the so-called inequalities of opportunities) may be more detestable from an ethical point of view than inequalities generated by individual choices and efforts.

Therefore, given a form of individual outcome (such as incomes, earnings, education), it is useful to distinguish between inequalities of opportunity, that are inequalities of outcomes due to exogenous circumstances, and inequalities 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 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).

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

Following the most recent literature, this study aims at examining the magnitude and evolution of inequality of opportunity in labour incomes in the European Union, by adopting two different approaches: a standard country specific approach, in which inequality of opportunity is measured for each country separately, and a "global" approach, which, following the path explored by Milanovic (2011, 2015, 2016), treats the EU population as a whole and considers the nationality as a circumstance. The paper also aims at identifying the drivers of inequality of opportunity by analysing the role played by different circumstances, and their cumulative effect, in explaining the existing income inequalities in Europe.

Previous analyses of inequality of opportunity in 25 European 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 standard country ranking based on income inequality, where Nordic countries are lowest and Mediterranean and Anglo-Saxons are highest, is only partially confirmed when considering opportunity inequality. When 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: thus total inequality exhibits larger cyclical fluctuations when compared to inequality of opportunity, with a general trend to declining values (due to income compressions generated by the crisis). It is also interesting to notice that in few countries inequality of opportunity remains 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 in short intervals of time. This previous evidence emphasizes 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. In fact, the financial crisis, by reducing the jobs available, may have affected disproportionately more 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, first of all, by parental background. The release of the 2019 wave of the EU-SILC survey, containing ad-hoc modules on intergenerational transmission of disadvantages (as for the 2005 and 2011

waves), gives the opportunity to analyze inequality of opportunity in the EU countries for a period of 15 years.

Therefore, this paper makes the following contributions to the existing literature. First, it provides new comparable estimates of inequality of opportunity in earnings for all EU countries (covered by the EU-SILC database) for all the years for which data are available, covering a period of 15 years. It quantifies, in addition to the overall effect of circumstances, the specific contribution of each circumstance to inequality of opportunity for each country and each wave. Second, it analyses, for the first time, inequality of opportunity in the EU as a single entity, taking into account the country-varying role of circumstances and the role of country of origin. The global approach, as a complement to the standard cross-country approach, allows to uncover the role of individual responsibility as opposed to external circumstances to shape unequal outcomes in a pan-European perspective. The analysis of inequality of opportunity from a supranational perspective, by putting a special emphasis on the different endowments of opportunities deriving from the specific country of individuals, may help to understand the individual rationales to migrate within Europe.

There are additional reasons to analyse inequality of opportunity at the EU level: first, a pan-European perspective on poverty and inequality would represent 'a significant move towards viewing the European Union as a social entity' (Atkinson 1998, p. 29). Secondly, because the perception of fair economic outcomes may depend also on the European dimension, in addition to the national dimension, in an increasingly interconnected economic space where traditional and social media cross national borders. Third, both market and redistributive policy levers that determine individual economic outcomes and their distribution increasingly depend on EU policies in many areas.

The rest of the paper is structured as follows. Section 2 presents the formal model of equality 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 our analysis and the data selection criteria. Section 4 provides and discusses the results. Section 5 concludes.

2. The measurement model

Consider a distribution of income **Y** in a given population. Suppose that all determinants of the individual income Y, including the 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 $g: \Omega \times \Theta \to \mathbb{R}$ such that:

$$Y = g(C, E) \quad (1)$$

In this model income is exclusively determined by circumstances and effort, such that all individuals having 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 outcome inequality. In the literature this is usually done by constructing suitable counterfactual distributions, $\mathbf{Y^C}$, such that by construction $\mathbf{Y^C}$ is able to capture the variability in the outcome uniquely arising from the differences in the circumstance variables, C, while ignoring the differences resulting from different E. The measure of absolute IOp in the society is then measured by the inequality in the counterfactual distribution $\mathbf{Y^C}$. It is also a common practice in prior research to provide the estimates of relative IOp as the share of unfair inequality in the total outcome 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 equality of opportunity and in fact the rankings they generate may be different. In addition to normative considerations, the choice of the methodology to adopt should also reflect the 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 to implement the model above.

In this project we adopt an ex-ante parametric set up[2], which usually assumes a linear relationship between the outcome and the circumstance/effort variables. So, the income generating process can be written as:

$$Y_i = bC_i + cE_i + u_i \quad (1)$$

with u_i being a white noise. As recognized by the literature (see for example Roemer 1998), effort can itself be partially determined by the existing social circumstances, as below:

$$E_i = dC_i + v_i \quad (2)$$

[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.

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

$$Y_i = bC_i + c(dC_i + v_i) + u_i = (b + cd)C_i + (cv_i + u_i) = \beta C_i + \epsilon_i \qquad (3)$$

From the OLS estimates of equation (3) then one obtains the counterfactual distribution. Inequality of opportunity is then measured as the value of a given inequality index $I(\cdot)$ applied to the distribution of the predicted values $\hat{Y}_i$, where $\hat{Y}_i = \hat{\beta} C_i$. Hence, for a given inequality measure I, the value of absolute inequality of opportunity is given by $I(\hat{Y})$ while the value of relative inequality of opportunity is given by the ratio between inequality as estimated in the counterfactual distribution and inequality as observed: $I(\hat{Y})/I(Y)$. In this paper, we use two different inequality measures, 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 requires different additional methodological choices, which include the selection of the sample, the selection of the variables to be used, both as outcome and as circumstances, and the modelling of the variables. The choices above need to be driven by the aim 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 distribution, the position of the various EU countries along the EU-wide distribution is an additional circumstance. Thus, circumstances that affect one's position in the EU-wide distribution are individual circumstances that have a different impact in the national context and the position of the country of origin along the EU distribution. Put differently, the country of origin should be thought of as a circumstance *per se* in the pan-EU context.

To address these considerations, we fit a multilevel model to estimate the counterfactual income distribution determined by circumstances. The key advantage of this approach is the ability to model data with a complex structure, e.g., individuals nested within countries to model dependent data (Snijders and Bosker 1999).[3] Indeed, in a multilevel framework it is possible to

[3] 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.

make individual labour income depend on the set of individual circumstances and country of origin, with a country-varying impact, *i.e.*, varying-intercept and varying-slope models. Hence, multilevel models can partition the overall variance in EU labour incomes into the individual level (within) and the cluster level (between). As 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.

This multilevel framework comes handy to assess the role of the country of origin. A parameter specific to the multilevel models is the intra-class correlation coefficient (ICC). ICC explains how much of the overall variance in EU incomes is due to variation at the cluster (country) rather than at the individual level:

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

where $ICC \in [0, 1]$ denotes the degree of homogeneity of units belonging to the same cluster (EU countries) as it is the ratio between the cluster variance and the total variance. 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 – both as a first step to justify the need for a multilevel model and to obtain an approximation of the country-of-origin effect.[4] For example, whether the effect of country of origin decreased over time, the ICC would display a reduction as an indication of a reduced premium/penalty of the country of origin in determining individual income levels across the EU, i.e. an approximation of convergence between EU countries. Subsequently, we fit a multilevel regression model with random intercepts and random slopes for the circumstance variables to estimate EU incomes as if they depended only on external circumstances $\hat{y}_{i,j}$ with $j = 1, \dots, 27$. The circumstance variables we use in the fixed part of the model are the same as those in the country-specific specifications and are discussed in the next section. The significance of these variables has been tested against the baseline 'null' model with likelihood ratio tests.[5]

For sensitivity purposes we estimate the counterfactual distribution of income with an OLS equation as in (4) with country dummies to control for the different country-of-origin effect on individual incomes. Please note that this strategy appears less accurate in taking into account

[4] A value of ICC significantly differently from 0 implies that clustering at country level affects the intercept (mean) of EU incomes. ICCs have been computed for three kinds of multilevel models: the null, the random-intercept and the random-intercept, random-slope model. In the latter two cases the covariates used in the model are those described in Section 3 and ICC is to be interpreted as conditional on random-effects covariates being equal to 0, which makes it less useful for our purposes.

[5] LR 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.

the country-varying effect of the different circumstances and, as a result, is expected to yield lower estimates of inequality of opportunity at the EU level.[6]

3. Data

We use data from the 2005, 2011, and 2019 waves of the EU-SILC, which is annually run by National Statistics Institutes across the EU and collects information on the income and living conditions of households in the EU. The survey contains 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 contain an *ad-hoc* module on the intergenerational transmission of disadvantages, which includes information on individuals' circumstances.[7] We focus our analysis 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, and the Slovak Republic. The main advantage of EU-SILC is the relatively large number of countries covered, thus, allowing for cross-country analysis of inequalities. Notice, however, that Cyprus, Croatia, Malta, and Romania did not participate yet in the survey in 2005.

Respondents between the ages of 25-60 were asked to provide additional information about their parents' social and economic situation during their teenage years (in particular, when they were around 14). These additional modules report information on educational attainment, occupation of respondent's mother and father and family composition.

Our analysis has a double focus. First, it will explore country-specific changes in the distribution of the final opportunities that are available to individuals as a pure result of the labour market. Second, it will explore changes in the distribution of the final opportunities endorsing an EU-wide case. In both cases the analysis will be performed by using gross labour income (expressed in log) of full-time employees and self-employed as main outcome variable, excluding students, retired and the economically inactive. The choice of gross, rather than net, labour income is motivated by our focus on the functioning of the labour markets in Europe.[8]

[6] 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.

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

[8] In fact, in a companion paper (Filauro, Palmisano, Peragine 2023), 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.

From a policy monitoring viewpoint, the role for the EU to reduce inequality of opportunity in labour income terms[9] is twofold: the more direct role is to reduce labour income disparities between countries so that being born in a country should less and less affect the individual position in the EU labour income distribution. Secondly, an indirect role consists of harmoniously reducing the impact that external circumstances have on earnings inequality across EU countries.[10] Moreover, individual labour incomes are the main income source in all EU countries (Filauro and Fulvimari 2021).

Thus, for both the cross-country and pan-EU analysis, the Mincerian equation of labour income has for dependent variable the ppp-corrected (log of) gross earnings and self-employment income.[11] Labour income is considered gross of social contributions and before the redistributive intervention of personal income taxes.[12] Moreover, gross wages and self-employed income happen to be the concept more largely available for EU countries in all EU-SILC waves. For the sake of comparison over time, we transform net wages into gross wages for Italy and Spain, which reported only the net concept in 2005.[13]

As for the variables capturing circumstances, we use gender, birthplace, health status, parental education, parental occupation, family composition when the individual was a teenager and age.[14]

Gender and birthplace are coded into two categories. Gender is coded as: 1) male; 2) female. Birthplace is coded as: 1) native; 2) non-native. Health status is coded as: 1) limited or strongly limited by health conditions; 2) not limited.

[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 strategies to create an integrated labour market.

[10] Despite these competences being mostly in the remit of nation 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 automatically labour incomes lower than 1, that is, especially the unemployed in the sample.

[12] Although wages net of social contributions and personal income taxes might be the key dimension in the mind of EU mobile workers when they decide to move abroad in the EU, net wages are not available for all countries in EU-SILC.

[13] 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 corrected net into gross wages. The procedure of adjustments is explained in Appendix B. We could not transform net wages for Greece, Latvia and Portugal due to problems in interpreting the national fiscal regimes. For those countries, we adopt net wages in 2005. This is likely to lead to an overestimation of labour income inequality in 2005 as those countries tend to be lower-income countries in the EU distribution and the use of net rather than gross earnings is very likely to stretch further downward the EU labour income distribution.

[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.

As for the remaining three circumstances, we have coded them into the same number of categories to limit the bias in our estimates due to the different categorization of circumstances. 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.

To ensure cross-country comparability, we use the same model specification for all countries.

Two final considerations for the EU-wide case. First, individuals born in a country different from the their country of residence are excluded since, by migrating, they have already bypassed the circumstance of being born in a different country.[15] Second, we report results for 2011 and 2019 for the EU-27 as a whole as well as for a smaller EU aggregate, marked with an asterisk (*), to highlight that that EU aggregate does not include the countries missing in the 2005 SILC, i.e. Romania, Bulgaria, Malta, Croatia, to make it comparable over the entire period.

4. Results

4.1 Inequality of opportunity in labour income: a cross-country perspective

In Tables 1 and 2 we report our estimates of total inequality and inequality of opportunity in labour earnings for the whole population aged between 25 and 60 working full time, for 27 European countries, by 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, despite not being perfectly decomposable, is characterized by a generally smaller sampling variance and limited sensitivity to extreme income values.[16] This last 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 area is about 40 per cent; while the average MLD relative inequality of opportunity is around 13 per cent. As most of the

[15] EU citizens who decided to migrate to another EU country benefitting of the freedom of movement granted within the EU (Article 45 TFEU) are overcoming the circumstance of being born in a specific EU country.

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

empirical research to date has used the mean log deviation, to increase comparability in the sequel of the paper we use the MLD.

While the use of the two indices has a dramatic impact on the magnitude of inequality of opportunity, the ranking of countries does not change much.

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.
Czeck Republic	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.

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.
Czeck Republic	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	4.00%	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.

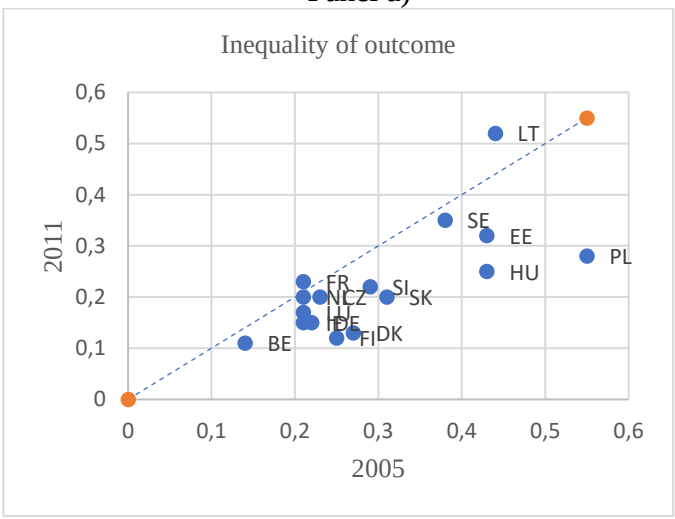
The estimates of total inequality and Iop in labour earnings for 2019 show large variation across EU countries. Concerning total inequality, Spain appears as the most unequal country with a value of the MLD equal to 0.0047, followed by Bulgaria (0.0045). At the other extreme we find Slovakia with a value of the MLD equal to 0.0011 followed by Romania and the Netherlands (0.0012). Moving from outcome to opportunity inequality, Cyprus ranks as the most unequal country with a value of IOp equal to 0.0007, whereas Finland and Malta show the lowest level of IOp - equal to 0.0001 - in the EU-27 context. Cyprus is also the country where unequal opportunity in the labour market matters most in the determination of total outcome inequality (about 26%) as compared to the other countries. In Eastern European countries, particularly

Latvia and Estonia, inequalities attributable to by exogenous factors explain a smallest part of total inequality (about 5%).

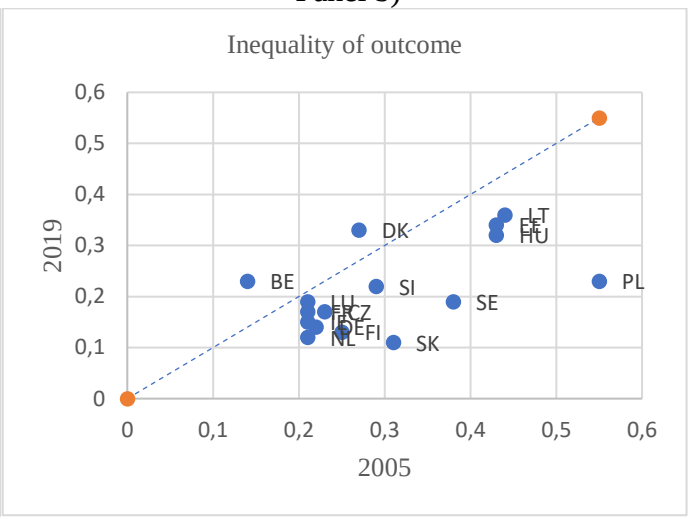
The trend in total inequality (Figure 1) and inequality of opportunity (Figure 2) between 2005, 2011, and 2019 also varies across countries and is characterized by peculiar features.

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

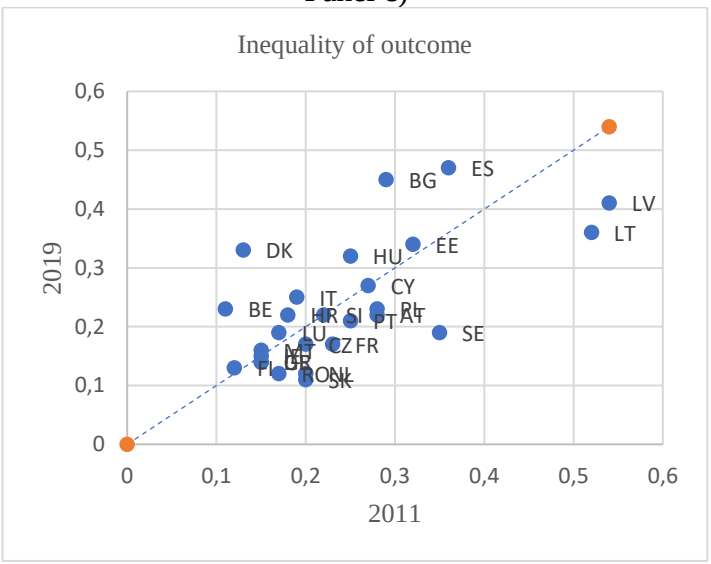
Panel a)



Panel b)



Panel c)



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

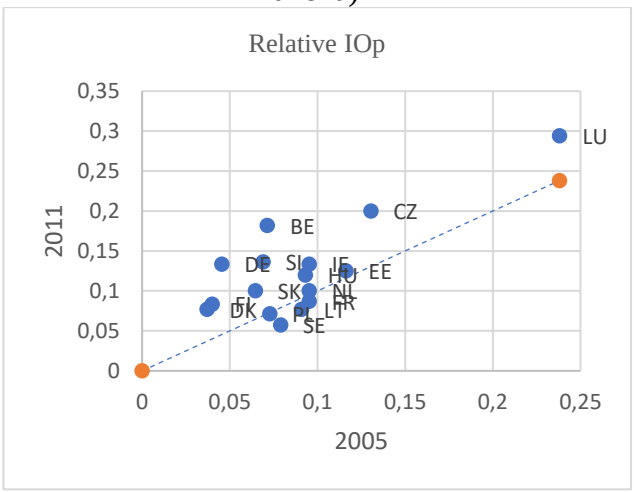
From 2005 to 2011, inequality decreased in many countries, especially for eastern European countries, except for Lithuania which, instead, experienced an increase in inequality (see Figure 1, Panel a). Poland, followed by Hungary, had the the highest reduction in inequality. More variation in our estimates arises when we compare 2011 to 2019. It is worth noticing the sizable increase in inequality that occurred in Denmark and Bulgaria (see Figure 1, Panel c) from one side; from the other side, worth noticing is the reduction taken place in Sweden, Lithuania and Latvia. Thus, the trend that emerges when considering the 2005-2019 horizon 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.

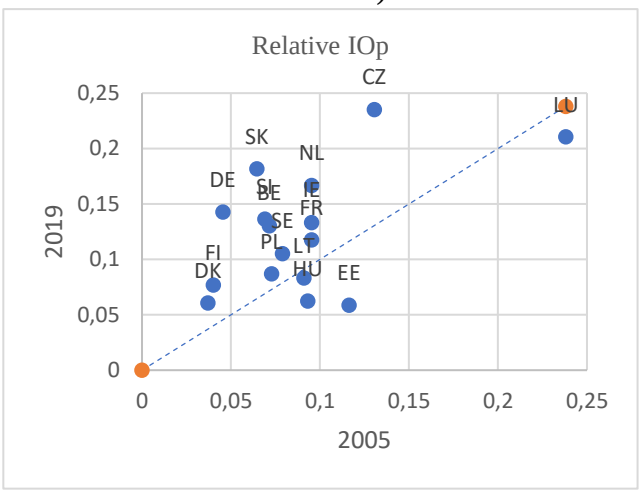
We now focus on opportunities as the appropriate space for measuring inequality (Figure 2).

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

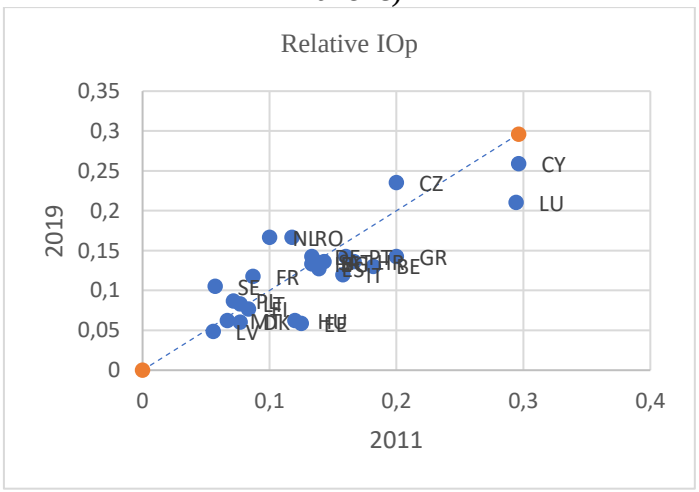
Panel a)



Panel b)



Panel c)



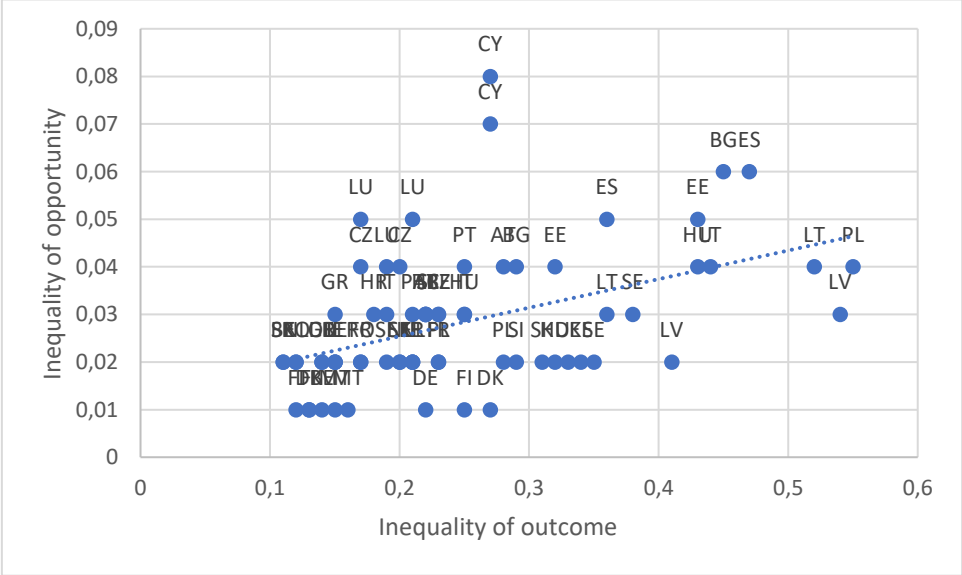
Source: Our elaborations based on EU-SILC 2005-2011-2019.

In this case the dynamics of inequality follows a different trend than total outcome inequality. First, there is less stability over time. From 2005 to 2019, most countries experienced an increase in the share of total inequality due to unequal opportunities. There are only four exceptions to this increasing trend, represented by Luxembourg, Estonia, Lithuania, and Hungary. Second, most of the change occurred between 2005 and 2011. This trend is explained by the different evolution of the numerator and the denominator explaining relative inequality of opportunity: i.e., while absolute IOp remained mostly stable, total inequality decreased in many countries. Slovakia, the Czech Republic, Germany, and the Netherlands are the countries that experienced the highest increase. 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 place in the first part of the period under analysis. In fact, most countries experienced a reduction in relative IOp from 2011 to 2019, offsetting the initial increase. Thus, the economic and financial crisis of 2008 generated the most visible impact on IOp in the short run, while this effect seems to vanish out over a longer period.

Figure 3 relates inequality of opportunity to total inequality and, in a sense, mimics the Great Gatsby Curve introduced by Corak (2013), who focused on the relationship between income inequality and intergenerational income mobility. A firmly positive relationship stands out between the two distributional phenomena so that it is more common to find higher inequality of opportunity in countries characterized by higher total inequality.

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



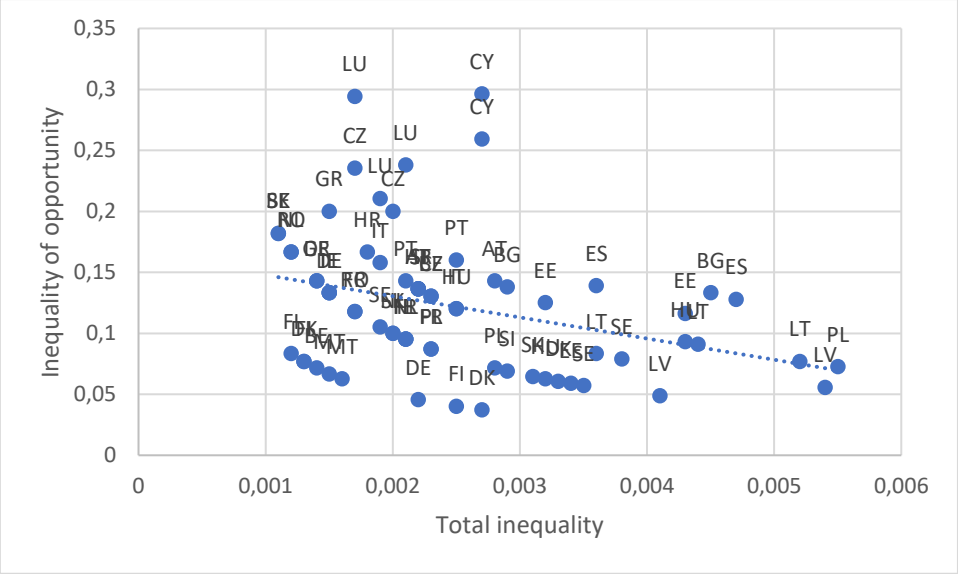
Source: Our elaborations based on EU-SILC 2005-2011-2019.

A number of possible mechanisms might drive this correlation. One possibility is the idea that today's outcomes shape tomorrow's opportunities: large gaps between circumstances at birth are likely to imply bigger gaps in the quality of education, or access to labour market opportunities, among tomorrow's children. Naturally, the reverse mechanism is equally plausible: if opportunity sets differ among people at birth, then individual outcomes later in life are also likely to be unequal. Clearly, inequalities in income and opportunities are both endogenously determined and at this aggregate level of analysis we are not making any claim of causality, even if the correlation detected reflects real underlying economic processes. Figure 3 also shows 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 the remaining countries for which the positive relationship is found.

Interestingly, when we associate total inequality with relative IOp (Figure 4), the above-mentioned relationship is reversed, implying that the value of total inequality cannot be used to predict the portion that can be explained by exogenous factors. This is new evidence suggesting that the impact of circumstances in determining overall inequality can be high or low, no matter the level of total income inequality. This evidence also gives additional support to the need of distinguishing between the two faces of inequality, effort- vs circumstance-driven.

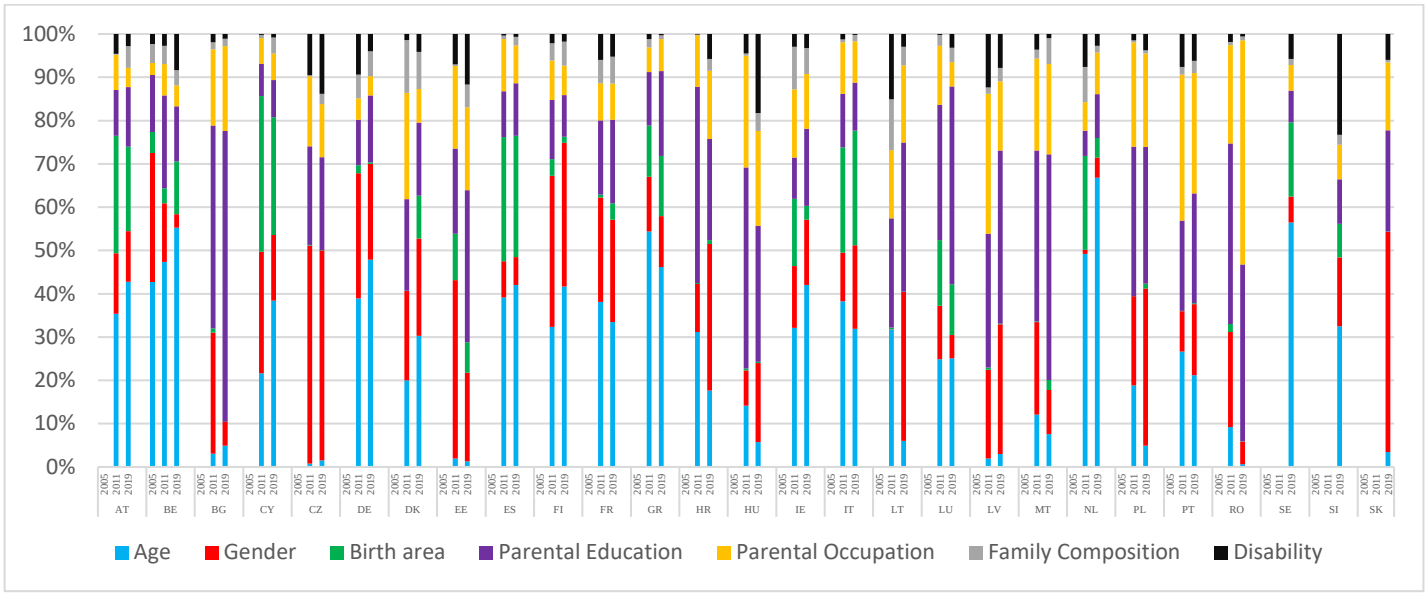
Figure 4. Total inequality and relative IOp in labor earnings, 2005-2011-2019, working age population, MLD



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

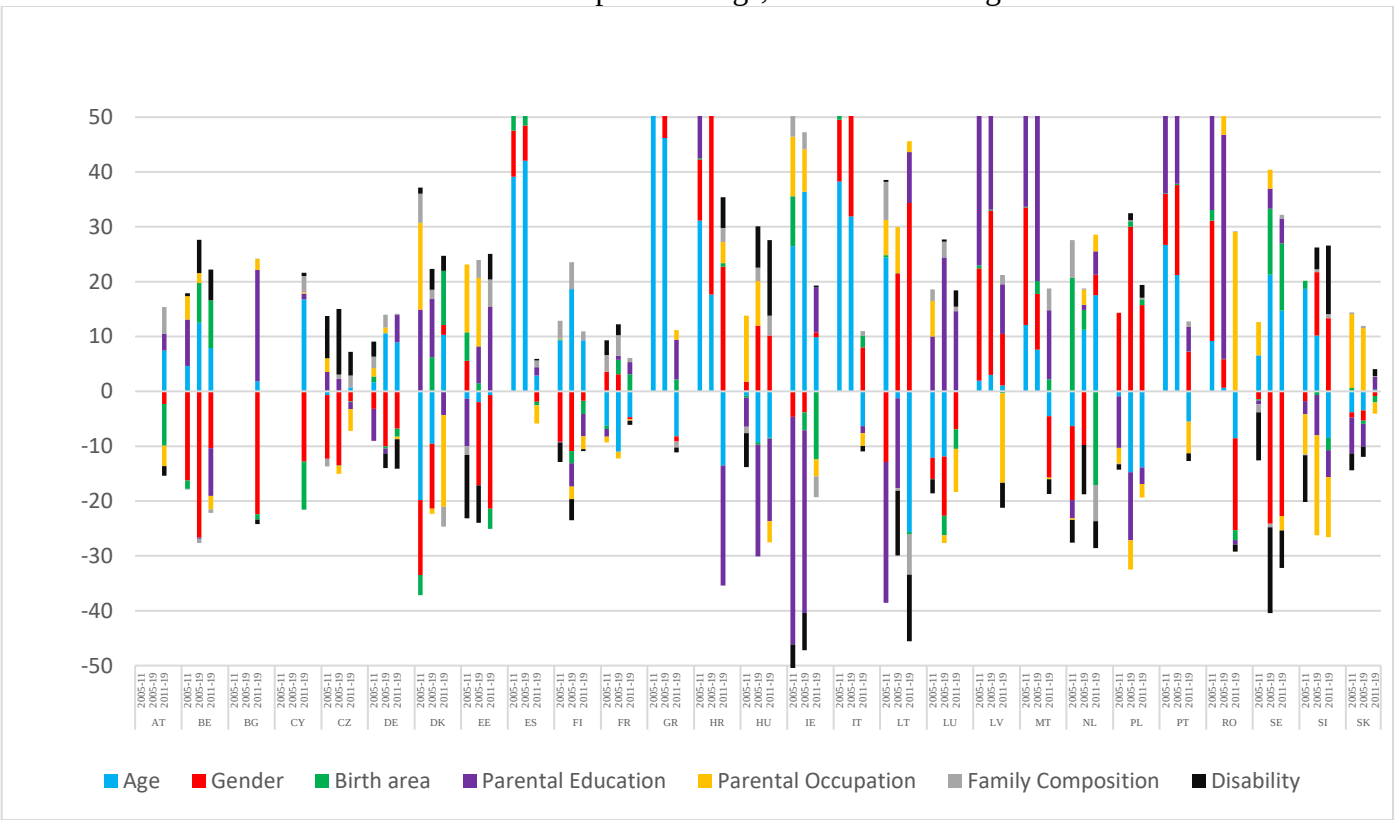
Figure 5 reports the information about the sources of inequality of opportunity for each country. The results of the decomposition by the source of inequality of opportunity are very robust to the survey year (see Table A1, Table A2 and Table A3 in the Appendix). In almost all countries gender contributes the most to IOp. On average, apart from age that, as explained in footnote 14, is used more as a control than as a circumstance, parental education and gender are the other most relevant drivers of IOp, whereas physical limitations and family composition appear to be the least harmful circumstances.

Figure 5. Contribution of circumstances in absolute IOp in gross labor 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 variation of the contribution of circumstances is similar across the periods considered (see Figure 6). The contribution of parental occupation and education are those that changed the most and, indeed, moved in opposite directions. The contribution of parental occupation increased

whereas the contribution of parental education decreased. Since these are the most important circumstances, this compensating effect might explain why IOp remained constant in the majority of countries. The contribution of birth area and family composition also varies but to a lesser extent, whereas the contribution of gender is 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 long-lasting policies of education expansion, 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 labour income: a pan-European perspective

The fraction of inequality in EU labour incomes that takes place at the country level is summarised by the intraclass correlation coefficient (ICC) of the 'null' multilevel model. In a sense, this parameter of the model summarises the power of country of origin in determining labour income inequality at the EU level in 2005 and in 2011 as illustrated in Table 3.

Table 3. Intraclass correlation coefficient. (Log) labour income. EU-wide distribution

Year	ICC	S.e	Confidence interval		Sample	Countries
2005	53.3%	0.073	0.391	0.671	120,480	23
2011	39.7%	0.065	0.279	0.529	135,775	27
2019	27.7%	0.055	0.183	0.395	141,962	27
*2011	33.6%	0.066	0.221	0.474	119,669	23
*2019	26.2%	0.057	0.166	0.388	122,811	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 around 27.5% of the observed variation in labour income in the EU took place at the country level.[17] This means that over one fourth of the share of variance in EU labour incomes is accounted for by country of origin. To put this figure in a time perspective, it is worth noticing that the effect of country of origin on EU labour incomes in 2019 has declined compared to 2005 by over 50% (from 53.3% to 26.2%).[18] This result validates previous research that pointed

[17] This intraclass correlation coefficient (ICC) is computed on a sample where missing observations were dropped. Results computed in the full sample of the EU labour force are available upon request.

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

towards convergence in EU labour incomes across EU countries (Brandolini and Rosolia 2019). Therefore, the country-of-origin penalty (or premium) in the EU declines markedly, especially between 2005 and 2011, before the 2009-2010 economic crisis fully deployed its effects. Also, 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 labour incomes 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 both years indicates that a multilevel model is recommended to model EU labour incomes.

Table 4 shows the impact of circumstances on EU labour incomes in the multilevel model. The impact of circumstances on EU labour incomes, as approximated by the sign and magnitude of the coefficients of the multilevel model, follows general expectations and previous research.[19] This is also in line with recent evidence that shows different effects of these covariates on labour income across countries (Checchi et al. 2016).

In the next step, we approximate the circumstance-determined labour income distribution in the EU with the estimates of the fitted random-intercept, random-slope model, and we compute the associated inequality indices $I(\hat{Y}_{EU})$, corresponding to the index of absolute inequality of opportunity. This is the absolute IOp as presented in Table 1 at country level. Then, we compute inequality indices for the EU-wide labour income distribution ($I(Y_{EU})$ and derive the relative indices of inequality of opportunity in the EU as $I(\hat{Y}_{EU})/\, I(Y_{EU})$. [20]

Results reported in Table 5 reveal that in 2019 the inequality of opportunity index in the EU amounts to around 27%. The interpretation of the index suggests that circumstances in the EU distribution of labour income determine 28% of inequality among European Union's workers, once the different country-specific role of different circumstances is accounted for.[21] This result confirms our expectations that the inequality of opportunity index is remarkably higher in the EU than on average between EU countries, which was around 13% in 2019.[22] This is a key result in the development of the inequality of opportunity research agenda as it quantifies the role of circumstances in the pan-EU perspective. Inequality of opportunity appeared much

[19] 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 of the impact of circumstances on the model with country dummies are shown for robustness in the Appendix. However, no change in the direction of the coefficient is detectable, only slight variations in the intensity of the magnitude.

[20] We do this for both the generalised entropy class of indices such as the Theil or the Mean Logarithmic deviation as well as for the Gini coefficient. Results for the Theil index are not shown but available upon request.

[21] 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.

[22] Unweighted average between EU countries, estimate derived from Table 1.

higher in the 2005 EU, i.e. excluding Romania, Bulgaria, Croatia and Malta for data unavailability.

Table 4. Impact of circumstances on individual (log)labour income in the EU. Output of a multilevel model.

	2005	2011	2019
Gender			
Female	-0.233***	-0.209***	-0.202***
Parental education			
One secondary	0.161***	0.129***	0.115***
Both secondary	0.224***	0.188***	0.170***
One tertiary	0.304***	0.257***	0.245***
Both tertiary	0.363***	0.326***	0.328***
Parental occupation			
One blue collar	-0.007***	0.003***	-0.032***
Both blue collar	-0.063***	-0.044***	-0.075***
One high	0.048***	0.111***	0.059***
Both high	0.059***	0.144***	0.087***
Family composition			
Only one parent	-0.035***	-0.051***	-0.068***
Without parents	-0.054***	-0.067***	-0.104***
Physical limitation	-0.166***	-0.156***	-0.148***
Age	0.010***	0.013***	0.013***
Constant	9.257***	9.234***	9.477***
Observation	120480	119669	122811
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

The relative IOp amounted to about 40.5% in 2005 while the same index in 2019 amounted to 24% in a 2005-composition EU. Thus, in a time perspective, the role of circumstances in the EU distribution of labour income has considerably declined, and this reduction has most notably taken place between 2005 and 2011. Considering the reduction in the absolute IOp, it accounts for over 50% between 2005 and 2019. This reduction is the result of both a decline in the country-of-origin effect in determining EU labour income inequality, due to labour income convergence across countries as captured by the reduction in ICC, and in the overall reduction in the role of circumstances on labour income, albeit not necessarily homogeneously across EU countries. A key circumstance among those included whose effect has visibly reduced between 2005 and 2011 is gender (see Table 3), as a result of gender pay-gap reduction and women-friendly labour policies implemented in many EU countries (European Commission 2022). The premium of 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 the 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.

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

Counterfactual distribution: Multilevel model						
	MLD*100			Gini coefficient		
Year	Absolute IOp	Relative IOp	Total inequality	Absolute IOp	Relative IOp	Total inequality
2005	0.1594 (0.00083)	40.4%	0.394	0.031	67.3%	0.046
2011	0.1749 (0.00137)	39.6%	0.442	0.032	66.5%	0.048
2019	0.0946 (0.00053)	26.9%	0.352	0.025	58.7%	0.042
*2011	0.0981 (0.00049)	27.6%	0.355	0.025	58.2%	0.043
*2019	0.0782 (0.00044)	24.0%	0.326	0.023	55.5%	0.041

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

5. Conclusions

We have analysed the extent, evolution, and sources of inequality of opportunity in labour income in Europe by adopting both a cross-country and pan-EU perspective. The results show a great deal of heterogeneity across European countries: the usual picture of lower inequality in Northern European and in some Eastern European countries as compared to Mediterranean countries is confirmed when the opportunity perspective is used. Parental education and gender are the most relevant circumstances in shaping the opportunities granted to workers in the labour market.

The most relevant change in inequality of opportunity is observed from 2005 and 2011, hence for the period including the financial crisis episode; more modest changes emerge in the subsequent 2011-2019 interval.

For the first time, to our knowledge, we have also assessed inequality of opportunity in the EU as a single entity. In such an integrated area, opportunities though are not equally distributed

among individuals. National labour markets remunerate external circumstances beyond individual control differently 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 EU scale. In this context, the role of the EU is then twofold: a direct role of labour income convergence across countries and an indirect role configured as a harmonic reduction of the impact of circumstances on labour income across EU countries. In a multilevel framework that can address these considerations, we estimate that the relative inequality of opportunity index at EU level is higher than the average of the EU indices. At the same time, the role of the country of origin has declined remarkably between 2005 and 2019 as a circumstance determining labour income inequality at the 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 they have remained rather constant thereafter.

Differently from previous contributions, our 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 characterized by lower level of income inequality, distinguishing between circumstance and effort driven inequalities does matter, as there can be societies in which total inequality is low but IOp may be high. In these contexts, policies targeted to remove the latter are especially welcome as circumstances-driven inequalities are the least acceptable ones, even if they do not have any impact on the former. Moreover, this evidence suggests that there are additional aspects that can represent a barrier to equality of opportunity, apart from total inequality, and that needs to be investigated. The focus on opportunity inequality may help policy makers to identify priorities of redistributive policies and to put more tailored and specific compensatory interventions in place.

References

Atkinson A.B. (1998). *Poverty in Europe*. Blackwell Publishers, Oxford

Bussolo, M., Davalos M. E., Peragine V. and Sundaram R. (2018). *Toward a New Social Contract*, World Bank Publications, The World Bank.

Brandolini, A., Rosolia, A. and Torrini, R. (2011). The distribution of employees' labour earnings in the European Union: Data, concepts and first results. *ECINEQ WP* 198.

Brandolini, A. and Rosolia, A. (2019). The distribution of well-being among Europeans. *Bank of Italy Occasional Paper*, (496).

Brunori P. Peragine, V. and Serlenga L. (2019). Upward and downward bias when measuring inequality of opportunity, *Social Choice and Welfare*, Vol. 52(4), pp. 635-661.

Checchi, D. and Peragine, V. (2010). Inequality of Opportunity in Italy. *The Journal of Economic Inequality*, 8(4), pp. 429-450.

Checchi, D., Peragine, V. and Serlenga L. (2016). Inequality of Opportunity in Europe: is there a role for institutions? *Research in Labour Economics*, Volume 43, 1-44.

Corak, M. (2013). Income Inequality, Equality of Opportunity, and Intergenerational Mobility. *Journal of Economic Perspectives*, 27: 79–102.

European Commission (2022). *Employment and Social Developments in Europe Annual Review 2022*, Chapter 5. Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL), Brussels.

Ferreira, F.H.G. and Gignoux, J. (2011). The measurement of inequality of opportunity: theory and an application to Latin America. *Review of Income and Wealth*, 57(4), pp. 622-657.

Ferreira, F. H., Lakner, C., Lugo, M. A. and Özler, B. (2018). Inequality of opportunity and economic growth: how much can cross-country regressions really tell us? *Review of Income and Wealth*, 64(4), 800-827.

Ferreira, F. H. G. and Peragine, V. (2016). Equality of opportunity: theory and evidence in M. Adler and M. Fleurbaey (eds), *Handbook of Well Being and Public Policy*, Oxford University Press.

Filauro, S. and *Parolin*, Z. (2019). Unequal unions? A comparative decomposition of income inequality in the European *Union and* United States. *Journal of European Social Policy*, *29*(4), pp. 545-563.

Filauro, S. and Fulvimari, A. (2021). Exploring inequality decomposition by income source at EU level. In Guio, A.-C., Marlier, E., Nolan, B. (eds) (2021), *Improving the understanding of poverty and social exclusion in Europe*, Chapter 3, Publications Office of the European Union: Luxembourg.

Fleurbaey, M. (1994). On fair compensation. *Theory and decision*, 36(3), 277-307.

Fleurbaey, M. (2008). *Fairness, Responsibility and Welfare*, 1st Edition, Oxford University Press, Oxford.

Fleurbaey, M. and Peragine, V. (2013). Ex ante versus ex post equality of opportunity. *Economica*, 80(317), pp. 118-130.

Marrero, G.A. and Rodriguez, J.G. (2013). Inequality of opportunity and growth. *Journal of Development Economics*, 104(1), pp. 107-122.

Milanovic, B. (2016). *Global inequality: A new approach for the age of globalization*. Harvard University Press.

Milanovic, B. (2015). Global inequality of opportunity: How much of our income is determined by where we live?. *Review of Economics and Statistics*, *97*(2), 452-460.

Milanovic, B. (2011). A short history of global inequality: The past two centuries. *Explorations in Economic History*, *48*(4), 494-506.

Palmisano, F. and Peragine, V. (2022). Inequality of opportunity: theoretical considerations and recent empirical evidence (with Vito Peragine). In D. Chotikapanich, A. Rambaldi, N. Rohde (eds.) *Advances in Economic Measurement*, Palgrave Macmillan, Singapore, Chapter 8, ISBN 978-981-19-2022-6.

Peragine, V. (2002). Opportunity egalitarianism and income inequality: the rank dependent approach. *Mathematical Social Sciences*, 44(1), pp. 45-64.

Peragine V. (2004). Ranking Income Distributions According to Equality of Opportunity, *The Journal of Economic Inequality*, Springer; Society for the Study of Economic Inequality, vol. 2(1), pages 11-30, April.

Ramos, X., Van de Gaer, D. (2020). Is inequality of opportunity robust to the measurement approach? *Review of Income and Wealth*, https://doi.org/10.1111/roiw.12448.

Ramos, X., and Van de Gaer, D. (2016). Empirical Approaches to Inequality of Opportunity: Principles, Measures, and Evidence. *Journal of Economic Surveys*.

Roemer, J. E. (1993). A pragmatic theory of responsibility for the egalitarian planner. *Philosophy & Public Affairs,* 146-166.

Roemer, J. E. (1998). *Equality of opportunity*, Cambridge, MA: Harvard University Press.

Snijders, T. and Bosker, R. (1999). *Multilevel analysis: An introduction to basic and applied multilevel analysis.*

World Bank (2006). *World Development Report: Equity and Development*, World Bank, Washington, DC.

Appendix A

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	Phisical 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%
Czeck Republic	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	Phisical 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%
Czeck Republic	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	Phisical 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.
Czeck Republic	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 income in the EU. Output of an OLS model with country fixed effects.

	2005	2011	2019
Gender			
Female	-0.206***	-0.192***	-0.203***
Parental education			
One secondary	0.169***	0.146***	0.115***
Both secondary	0.224***	0.190***	0.161***
One tertiary	0.258***	0.240***	0.240***
Both tertiary	0.247***	0.302***	0.323***
Parental occupation			
One blue collar	-0.002	0.011	-0.019*
Both blue collar	-0.078***	-0.055***	-0.051***
One high	0.049***	0.111***	0.086***
Both high	0.078***	0.132***	0.119***
Family composition			
Only one parent	-0.045***	-0.067***	-0.075***
Without parents	-0.066***	-0.058***	-0.113***
Physical limitation	-0.126***	-0.158***	-0.135***
Age	0.011***	0.015***	0.014***
Constant	7.556***	8.295***	8.898***
Observations	120480	119669	122811
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 income.

Counterfactual distribution: OLS model with country fixed effects						
	MLD*100			Gini coefficient		
Year	Absolute IOp	Relative IOp	Total inequality	Absolute IOp	Relative IOp	Total inequality
2005	0.14589 (0.0007743)	37.0%	0.394	0.029	63.9%	0.046
2011	0.16691 (0.00128)	37.8%	0.442	0.031	65.3%	0.048
2019	0.09303 (0.000522)	26.4%	0.352	0.025	58.3%	0.042
*2011	0.09434 (0.000476)	26.6%	0.355	0.024	57.3%	0.043
*2019	0.07926 (0.00046)	24.3%	0.326	0.023	55.9%	0.041

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. [23] It is available here: https://www.ine.es/en/prodyser/microdatos_en.htm

[23] Special thanks to José Maria Mendez Martin.