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Vincenzo Carrieri
Vito Peragine

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Decomposing inequality 'at work': Cross-country evidence from EU-SILC*

Vincenzo Carrieri†
CELPE and Universitty of Salerno, Italy

Vito Peragine
University of Bari "Aldo Moro", Italy

Abstract

We propose a structural model to estimate inequality of opportunity (IOp) among workers and to distinguish two different sources of inequality: (i) inequality in the labour attachment and (ii) inequality in the remuneration of each working hour. Considering working hours as a measure of effort, our model can also be conceived as an attempt of disentangling the direct from the indirect contribution of circumstances to IOp. We estimate a system of seemingly unrelated regression equations and we use an original identification strategy based on a local market condition variable acting as exclusion restriction. By using data from the 2011 wave of the EU-SILC data base, we find in general a strong positive direct effect and a negative indirect effect of circumstances on overall IOp. Moreover, we are able to identify three cluster of countries: a first cluster includes continental countries (Italy, Spain, France) and Sweden, which show a low degree of IOp. A second cluster shows "moderate" levels of IOp and includes Finland and United Kingdom. A third cluster of countries shows the highest levels of IOp and includes all eastern countries.

Keywords: Inequality of Opportunity, income inequality, labour attachment.

JEL Classification: D60, D63, J62.

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†**Corresponding author:** CELPE, Universitty of Salerno and Health, Econometrics and Data Group, University of York. Department of Economics and Statistics, University of Salerno, Via Giovanni Paolo II, 84084 Fisciano (SA), Italy.

1 Introduction

Income inequality originates from different sources. Disentangling the effect of the different factors on existing income differentials is useful both for positive and normative analyses: on the positive side, the knowledge of the different sources of income inequality can affect the popular support for redistributive public intervention (see, among others, Alesina and Angelotos, 2005). Different survey-based evidences show that, at least in contemporary western liberal societies, inequalities associated to individual effort are generally considered as fair, while inequalities due to inherited factors, such as family bequest or family socio-economic background, are perceived as more objectionable. This reported evidence on the social attitude toward inequalities has a correspondence with a literature recently emerged in the field of normative economics, the equality of opportunity (EOp) literature, based on the idea that a society can accept inequalities due to the individual responsibility while objecting to those due to exogenous circumstances. This literature has proposed different models in which the opportunities open to individuals are deduced from basic assumptions on the functional relations between individual achievements, circumstances, i.e., factors that lie outside the sphere of individual responsibility, and individual effort (see Roemer (1993) and Fleurbaey (1994) for the first influential contributions and see Roemer (1998) and Fleurbaey (2008) for book-length discussions of the opportunity egalitarian theory). EOp theory has generated a large and rapidly growing empirical literature in which different methodologies have been proposed in order to identify the outcome inequalities which can be attributed to exogenous circumstances, and to distinguish them from the residual inequalities, attributable to individual effort. Useful surveys that cover both the theoretical and the empirical literatures are to be found in Ferreira and Peragine (2014), Pignataro (2012), Ramos and Van de Gaer (2012), Roemer and Trannoy (2013).

This literature typically employs a reduced form approach in which the individual income is assumed to be generated by a production function that depends on two classes of factors: circumstances and effort. Hence the full process by which the individual income is generated is not explicitly modeled, and the opportunities open to each individual are deduced from basic information on the full (multidimensional) distribution of income, circumstances and effort.

In this paper we move a step forward in the direction of a more structural model, by trying to distinguish (some of) the different channels that affect the individual income. To this end, we focus on inequality of opportunity (hereafter IOp) among workers and we consider labour income as the advantage variable. Labour income is seen as a product of two different factors: the number of working hours and the remuneration of each hour worked (wage for employee and earning for self-employed). For both channels, we investigate the different role played by circumstances and effort.

This distinction might be interesting both from the normative economics standpoint and for policy implications. In particular, we argue, this distinction is crucial when comparing, in terms of equality of opportunity, economies with different labour market institutions and different social norms. As we will see, this is the case of our empirical

investigation, in which we compare a set of European countries, both western and eastern countries, characterized by very different labour market conditions.

In some recent contributions (see for instance the discussion in Roemer and Trannoy, 2013) the number of working hours are interpreted as an empirical measure of effort, when purged from the effect of circumstances. If one is willing to take this view, the model presented in this paper can also be conceived as an attempt of disentagling the direct from the indirect contribution of circumstances (passing through effort) on IOp. This issue has been addressed in the literature by Bourguignon et al. (2007) with an analysis of Brazilian data and by using schooling, the decision to migrate and labour market status as measures of effort. The authors try to derive a bound of IOp estimates by simulating the potential bias arising from the endogeneity of efforts through a Monte Carlo simulation and some restrictions on the variance-covariance matrix and on key coefficients. As recognized by the authors some years later (Bourguignon et al. 2013), they fail to properly take into account endogeneity of efforts. In this paper, we adopt an original identification strategy using a proxy of local market conditions as exclusion restriction: specifically, we employ the definition of "comparison group" introduced in the happiness economics literature (see McBride, 2001; Ferrer-i-Carbonell, 2005) and use the average number of hours worked by" comparable" individuals as proxy of local market conditions. This allows to properly disentangle the direct from the indirect contribution of circumstances on income.

We estimate the model on data from the 2011 wave of The European Union Statistics on Income and Living Conditions (EU-SILC) which includes a rotating module around intergenerational transmission of disadvantage. This allows to dispose of a large set of variables on familiy background when individual was 14 years old. Analysis is presented for a number of European countries: Czech Republic (CZ), Spain (ES), Finland (FI), France (FR), Italy (IT), Poland (PL), Romania (RO), Sweden (SE), United Kingdom (UK). Notably, this set includes some eastern countries for which little is known about the extent of IOp.

Similarly to Bourguignon et al. (2007) we interpret IOp as the deviation between the observed earnings distribution from the conditions that define equality of opportunity, i.e., a simulated distribution in which circumstances are the same for everyone.

Our analysis shows some new aspects of the IOp in Europe. We find a strong positive direct effect and a general negative indirect effect of circumstances on overall IOp. Moreover, the results show the existence of three cluster of countries. A first cluster includes continental countries (Italy, Spain, France) and Sweden, with a low degree of IOp, ranging from 14.5% to 18% (19%-27% according to Theil index). A second cluster shows "moderate" levels of IOp and includes Finland and United Kingdom. In these countries we estimate an overall IOp close to 25% (32%-37% using Theil). A third cluster of countries shows the highest levels of IOp and includes all eastern countries with an overall IOp higher than 27%. Within eastern countries, the lowest level of IOp is estimated in Romania (27% when using mean log deviation and 35.81% using theil) while the highest level is found in Poland (33.5% using mean log deviation) and Czech Republic (38.43% using Theil).

The rest of the paper is organized as follows. Next section describes the empirical model. In section 3 we discuss the data and the main variables used in the analysis. Section 4 presents the results. Section 5 summarizes and concludes.

2 The Empirical Model

Our aim is to measure the extent of inequality of opportunity within labour market, by distinguishing the share of IOp in labour force attachment from the share of IOp in the remuneration of each hours worked (ie. wage in the case of employee and earnings in the case of self-employed). More formally, we can write labour income (I) as the product: $W_h * H_w$, where W_h is the hourly wage/earnings and H_w are the numbers of hours spent at work. Defining C as a vector of circumstances,labour income may be written as $I = f(C, H_w(C, \epsilon_1), \epsilon_2)$ whereϵ_1 and ϵ_2 are unobserved determinants.

From this formula, circumstances affect income both directly and indirectly. Directly, because they may influence the probability of getting a higher paid job through social connections, better skill endowement and so on. Indirectly, circumstances may affect also the labour attachment influencing the number of working hours. This might be due to different health endowments, residential location (i.e. living in a place with poor or rich job opportunities), etc. In both cases unboserved determinants (ϵ_1, ϵ_2), such as brute luck may play also a role.

An empirical model to disentangle the first from the second channel might be conceived as follows:

$$\begin{cases} I = a_0 + a_1 * C + a_2 * D + a_3 * H_w + a_4 * Controls + \epsilon_1 \\ H_w = b_0 + b_1 * C + b_2 * D + b_3 * Market + b_4 * MD + b_5 * CD + b_6 * Controls + \epsilon_2 \end{cases} \tag{1}$$

Where C is a vector of circumstances, D is a vector of Demographics, $Controls$ is a vector of control variables, $Market$ is a variable indicating local market conditions and CD and MD are vectors of interactions between demographics and circumstances and market conditions, respectively.(Please see section 3 for more details on the variables used).

In the model (1) circumstances affect income both directly and indirectly (through the impact on working hours), while working hours are included as regressor in the top equation and as dependent variable in the second one. In this way, the effect of working hours on income is purged from the effect of circumstances on working hours deriving from the estimates of the second equation. The model is estimated jointly as a system of Seemingly Unrelated Equations (SUR) so that correlation between ϵ_1 and ϵ_2 is controlled for. This rules out any impact of unobservables (circumstances or efforts) affecting jointly income and working hours.

The model might be in principle identified through functional form. However, this strategy relies heavily on the assumed functional form, ie. a normal bivariate distribution of the error terms ϵ_1 and ϵ_2, and we will use some exclusions restrictions in order to further improve identification. Our key exclusion restriction is a variable acting as a

proxy of local market conditions ($Market$). The use of market condition as exclusion restriction has been recently discussed also by Roemer and Trannoy (2013). Our market condition variable measures for each individual i, the average number of hours worked by 'comparable' individuals. We borrow the definition of comparison group from the happiness economics literature (ie. see McBride, 2001; Ferrer-i-Carbonell, 2005). Thus, we consider as "comparable", individuals with similar age (+ or - 5 years), same gender and living in the same geographical area (NUTS-2 or NUTS 1 region) of individual i[1].

In our setting, exclusion restrictions should be variables that (a) are correlated with circumstances (b) are not correlated with income itself, but only through working hours. Our market condition variable fits these two criteria. It is highly correlated with individual working hours but it does not affect directly income in the first equation [2]. The validity of such identification is strength by the fact that all variables used to define the reference group (age, gender and regions fixed effects) are included in the regression in the $Controls$ vector (please see section 3 for more details), so that the choice of the variables identifying the reference group does not affect the parameter estimates. Importantly, the inclusion of regions fixed effects and variables capturing urbanization degree of the area of residence are especially useful to control for the impact of other local conditions on labour income. We also include the interaction between market conditions and demographics (MD) and the interaction between circumstances and demographics (CD) in the second equation. Following Roemer and Trannoy (2013), this is desirable on theoretical ground, because it allows that the reaction of individuals to their environments (market and background conditions) may vary across individuals. Since these 'preference shifters' variables are assumed to influence only the effort variable (see Roemer and Trannoy, 2013 for the normative discussion on this aspect) we include them only in the second equation. This provides also some additional exclusion restrictions which may help to identify the model.

In the same spirit of Bourguignon et al. (2007) we consider inequality of opportunity as the deviation between the observed earnings distribution from the conditions that define equality of opportunity. Namely, we compare the actual distribution of earnings

[1] On average, we build 121 comparison groups in each country and each comparison group consists of 90 workers. These numbers are in line with the ones reported in other papers building "comparison group" (see for instance Carrieri, 2011). To make the comparison easier across countries, we use for Italy a finer comparison group made of workers with the same age, same gender and living in the same region. This because we dispose of much more observations for Italy (please see table 1). Using this slightly different comparison group, the average number of worker in the each group is around 80 workers in Italy which is in line with the average comparison group size observed in the other countries analyzed.

[2] We also did a number of tests supporting the validity of this exclusion restriction. Firstly, we test the strength of the exclusion restriction using the standard first stage F-statistics. In all country estimates, we find a F-statistics largely higher than the common cut-off of 10 (Angrist and Pischke, 2009). Secondly, we also test the significance of the market condition variable in the first equation including all other variables shown in equation (1).We did not find any significant effect of the market condition variable at convential levels. Although the validity of exclusion restriction is never formally testable, both results give us confidence on the use of such variable as exclusion restriction.

to the benchkmark case of equality of circumstances, ie. a counterfactual in which circumstances are the same for everyone: $\check{I} = f(\bar{C}, H_w(\bar{C}, \epsilon_1), \epsilon_2)$. At the same time, we disentangle the IOp share due to *wages / earnings*, (or the direct effect of circumstances) using the counterfactual $\check{I}_h = f(\bar{C}, H_w(C, \epsilon_1), \epsilon_2)$, where the effect of circumstances is neutralized in income equation but not in the working hours equation. The share of IOp due to labour attachment (or alternatively to the impact of circumstances on the effort variable, ie. working hours) is simply obtained by substracting the share of IOp due to wages from the total share of IOp.

Lastly, we use standard metrics of inequality M (the Theil index and the mean log deviation) to compute overall inequality and inequality due to working hours and wages. Overall IOp is thus measured as follows:

$$IOp = \frac{M(I) - M(\check{I})}{M(I)} \tag{2}$$

Where I is the actual income distribution and $\check{I}$ is the counterfactual distribution where all circumstances are equalized. At the same time, Inequalities in wages is computed as follows:

$$IOp^W = \frac{M(I) - M(\check{I}_h)}{M(I)} \tag{3}$$

Where $\check{I}_h$ is the counterfactual distribution in which circumstances are equalized in the first equation but not in the hourly wage equation. The effect passing only through working hours is simply given by: $IOp^{WH} = IOp - IOp^W$.

3 Data and variables

Our analysis is based on data from The European Union Statistics on Income and Living Conditions (EU-SILC) survey. EU-SILC survey collects cross-sectional data on income, poverty, social exclusion and living conditions of all EU-27 countries.We use the 2011 wave because it includes an ad-hoc module related to the "intergenerational trasmission of disadvantage" which collects information on a large number of charateristics of the respondent's parents. To retrieve information on local market conditions ($Market$ variable) we base our analysis only on countries for which NUTS-2 or NUTS-1 regions identification is made available in EU-SILC. These are Czech Republic (CZ), Spain (ES) (NUTS-2), Finland (FI), France (FR) (NUTS-2), Italy (IT), Poland (PL), Romania (RO), Sweden (SE), United Kingdom (UK) (NUTS-2). Given our research purposes, we restrict the analysis to working individuals aged 15 years old or more. We consider both full-time and part-time employee and self-employed. Excluding some missing values, we dispose of around 66 thousands of observations from the 9 countries considered. Sample size per country ranges from around 4800 observations (Sweden) to around 14 thousands of observations (Italy).

Our measure of labour income is the gross personal income. This includes employee income and/or income from self-employment or family work earned in the income reference period (twelve months before the interview). Income from old-age benefits, social contributions, unemployment benefits and any possible source of income recognized by the State is excluded. This is consistent with the idea of measuring inequality of opportunity within the labour market. Self-employment income includes gross operating profit or losses. Working hours is the number of hours usually worked per week in the main job.

We can dispose of a vast array of circumstances variables. These cover 4 dimensions of the family situation of the respondent when she was around 14 years old: Family data, Parents' Education, Parents' occupation and Family's wealth. When a theoretical ordering was possible, we built the circumstances variables in a way that the worst circumstance category is left as a reference (for categorical variables). (i) Family data include information on whether the respondent lived with both parents or only one (Reference:lived without parents and/or in a institute), the Adults working/Children ratio of the family of origin (Continuous variable), the origin of the father and the mother: Native, EU (Reference: Extra-EU). (ii) Parent's education data include information on the father and mother highest qualification attained: Tertiary, Secondary, Primary (Reference: Illiterate). (iii) Parent's occupation data include information on the father and mother occupation according to ISCO-88 classification: manager,professional, worker (Reference: elementary occupations and out of the labour force). (iv) Wealth data include information on the self-reported financial situation of the family of origin: Very good or good (Reference: moderately bad, bad or very bad financial situation), The self-reported ability to make ends meet of the family of origin: No Problem (Reference: with great difficulty, with difficulty or with some difficulty), and information on the home ownership: Owner, Tenant (Reference: free house).

With respect to the control variables, we include in the model five dummies measuring the highest individual ISCED-Education level attained: Primary (ISCED1), lower secondary (ISCED2), upper secondary (ISCED3), post-secondary (ISCED4), Tertiary and post tertiary (ISCED5) (reference category: pre-primary education). Lastly, we control for the region of residence, including regions fixed effects (NUTS-2 or NUTS-1) and for the level of urbanization of the area including two dummy variables for large city (around 500 inabithants for squared kilometer and at least 50,000 inabithants) and medium size city (from 100 to 500 inabithants per squared kilometer). Rural area is left as reference category.

A summary of the main variables included in the regression is shown in table 1 along with the sample mean of the variable by country. In the last row of the table the number of non-missing observations available per country is also reported. As table 1 shows, average yearly labour income ranges from 22,164 euros in Romania to 25,279 in Italy. Demographics of workers are almost similar across countries analyzed: on average slightly more than the 50% of workers are males and the average age of workers is around 49 years. This figure might seem a bit high, but is due to the fact that we exclude from

the sample very young workers (below 15 years old). On aggregate, workers seem to share a similar set of circumstances across countries. Only a significantly higher concentration of workers with low educated parents (53% of workers have a father and 60% of workers have a mother with primary education, respectively) and a lower proportion of individual grow up in family without financial problems (27% of workers) are found in Italy. With respect to other covariates, we observe a similar distribution of workers across educational groups in all countries analyzed. In Italy, we observe a relatively a higher proportion of workers with low-secondary education and a lower concentration of workers with tertiary education. Not surprisingy, Finland, Romania,Sweden and Polonia (to a less extent) display the highest share of individuals living in less densely populated areas compared to other countries.Lastly, average working hours per week are around 39 across all countries analyzed. A slightly lower figure is observed in Finland and Sweden. All in all, we do not detect significant differences in the charateristics of wokers across countries. In the next paragraph, we'll show that the figure is completely different when the attention is shifted towards the analysis of the equality of opportunity across countries.

[Table 1 around here]

4 Results

Estimates of equation (1) for each country are shown in table 2. In the top panel of the table, estimates of the income equation are reported, while results of working hours equation are reported in the bottom panel. Results are based on a joint estimation of equation (1). However, results are equivalent to the estimates of two separate OLS models because correlation between error terms is rarely statistically significant across countries. This indicates that the estimates do not suffer from unobservables common to both equations.

[Table 2 around here]

Given that both models are linear, the interpretation of the coefficents in straightforward. For instance, coefficient of male variable implies a wage premium for males equals to around 9500 euros per year in Czech Republic. In general, gender gap is observed in each country in line with the vast empirical literature on gender differentials (see for instance Blau and Kahn, 1992). Lowest gender penalization is observed in Poland (around 7000 euros) while the highest wage premium for males is found in Finland (around 10000 euros). Also the age coefficient is always positive and significant which implies a positive reward of experience in the labour market. Interestingly, own education is significant only when considering differentials between individuals with tertiary education and individuals without formal education. On the contrary, circumstances variable are very important determinants of labour income in all countries.

Among circumstances, we found a strong positive effect of parents' occupation, family wealth and parents' ethnicity. For instance, having a father with a managerial occupation implies an increase in income (compared to having a father with an elementary occupation) ranging from around 4000 euros in France to 11000 euros in Finland. Similarly, professional-elementary occupation income gap ranges from around 4000 euros (France) to around 8000 euros (Spain). Also parents'wealth has a sizeable impact on labour income.Other than self-assessed measures of family wealth, we found a strong effect of house ownership on children's income. Income differentials between individuals grow up in a house of property and individuals grow up in a house provided by the State range from around 5000 euros in Italy to around 10000 euros in Sweden.With respect to parents' ethnicity a large income differential is found only in some countries. However, differences in income between children with father born in a EU country compared to father born in a non-EU country amount to almost 9000 euros in the UK and around 8000 euros in Finland. On the other side, circumstances related to parents' education are not highly associated with offspring's labour income. Significant differences are observed only when comparing father with tertiary education to father without any formal education and not in all countries analyzed. This is somewhat different from previous literature on IOp but it depends on the fact that we dispose of much more detailed informations on parents' occupation and wealth which are obviously also correlated with parents' education. To some extent, this suggests that parents' occupation and wealth are more important than parents' education in shaping future offspring's income. Finally, as expected, a positive and significant effect of working hours is found in all countries.

As far as the working hours equation is concerned, we detect a bit more heterogenity across countries. This is expecially true for circumstances variables which are positively associated with labour attachment in some countries and negatively correlated in some others. For instance, second generation migrants work less hours on average in Finland, but they usually work more hours in Sweden. Similarly, a better father's occupation is associated with a lower labour attachment in Finland and Spain but not in the majority of the other countries. In all regressions the market condition variable is strongly and positively correlated with working hours. An increase of one hour of work per week across individuals in the comparison group predicts an increase in individual working hours per week which ranges from 0.86 (Poland) to 1.15 (Czech Republic and Romania). This positive and significant correlation gives additional support to the strength of the variable as exclusion restriction.

On the basis of these estimates, we calculate the inequality of opportunity indexes following equations (2)-(4).We use as metrics of inequality both the Theil index and the Mean Log Deviation. Results of this exsercise are shown in table 3. For each country, we report the overall IOp, the IOp in wage/earning and IOp in labour attachment. For illustrative purpose, estimates are reported also in figure 1 both for mean log deviation (Top panel) and Theil index (Bottom panel).

[Table 3 around here]

[Figure1 around here]

Overall, we find that estimates based on mean log deviation tend to be more conservative compared to the ones based on theil index (see column 1 of table 3). The estimates of the share of overall inequality of opportunity range from around 14.53% of Spain to 33.5% of Poland when mean log deviation is used as inequality measure. Estimates based on theil index ranges from 19.44% of Italy to around 38% of Czech Republic.With the exception of the extreme values, country ranking is almost unaffected by the choice of the inequality metrics.

These estimates allow to identify three clusters of countries according to the degree of IOp. A first cluster includes continental countries (Italy, Spain, France) and Sweden. For these countries, the degree of IOp is low, ranging from 14.5% to 18% (19%-27% according to Theil index). A second cluster shows "moderate" levels of IOp and includes Finland and United Kingdom.In these countries we estimate an overall IOp close to 25% (32%-37% using Theil). A third cluster of countries show the highest levels of IOp and includes all eastern countries with an overall IOp higher than 27%.Within eastern countries, lowest level of IOp is estimated in Romania (27% when using mean log deviation and 35.81%using theil) while highest level is found in Poland (33.5% using mean log deviation) and Czech Republic (38.43% using Theil).

These numbers are in line with the ones found in other few empirical papers measuring IOp across countries analyzed in our paper. Bjorklund, Jantti and Romer (2012) using male registers data found that around 30% of inequality in Sweden can be attributable to bad circumstances. Using a different kind of data we found for Sweden a level of IOp close to 27% when using Theil index. Checchi and Peragine (2010) found that inequality of opportunity accounts for about 20% of overall income inequality in Italy. Our numbers for Italy are only slightly lower (16% and 19.44%) but they are largely comparable to Checchi and Peragine (2010). Overall, our estimates of the overall share of IOp are a bit more conservative if compared with the majority of studies measuring inequality of opportunity. This is due to the fact that we focus only on an "advantaged" subsample of individuals, ie. individuals holding a job position. Not surprisingly, these individuals tend to share better background circumstances than the others, such as unemployed or inactive people.

Columns 2 and 3 of table 3 contain an interesting contribution of our exercise, that is the decomposition of inequality of opportunity in the share of IOp in wage/earnings and the share of IOp in labour attachment. We found that the largest part of inequality of opportunity in the labour market is due to the inequality in the former. This is found in all countries analyzed. The share of IOp due to wage/earnings ranges from 20% of Italy to around 35% of Poland (22.9%-37.89% when using Theil). This pattern mimics the one observed with respect to overall inequality of opportunity (shown in column 1) but with some distinctions. For instance, Italy, Spain and Sweden are the countries with the lowest level of overall IOp but they exhibit a "moderate" level of IOp in wage, around 20-22%. Similarly, in the UK and Finland, where "moderate" levels of overall IOp are found, the share of IOp in in wage/earnings is lower than many other countries. These differences are due to an unsimilar contribution of the IOp in labor attachment to the

overall IOp (column 3).

Generally, we find that such contribution is often negative, despite it is not very big in magnitude. It ranges from -1% of Poland to around -8% of Spain. A negative contribution means that individuals in bad circumstances work on average a higher number of hours than their counterpart. If one is willing to consider the number of hours spent at work as a measure of effort, our estimates show that in the majority of countries analyzed, people in bad circumstances exert a higher level of effort. Important exceptions are the UK and Finland, where a positive indirect contribution of circumstances is found. A positive contribution is also found in France and Czech Republic but the magnitude is negligible and also the sign of the contribution is sensitive to the inequality metrics chosen.

5 Conclusions

Inequality of Opportunity literature mostly considers income as measure of individual achievement and tipically employes a reduced form approach in which the individual income is assumed to be generated by a production function, equal for all individuals, that depends on two class of factors: circumstances and effort. In this paper we moved a step forward in the direction of a more structural model by distinguishing (some of) the different channels that affect the individual income. To this end, we focused on inequality of opportunity (IOp) among workers, and we considered labour income as the advantage variable. Labour income is seen as a product of two different factors: the number of hours worked and the remuneration of each hour worked (wage for employee and earnings for self-employed). For both channels, we investigated whether inequality of opportunity exists.

We estimated a system of seemingly unrelated regression equations with exclusion restrictions, and we measured the resulting IOp by comparing the actual income distribution to simulated counterfactuals in which the effect of circumstances is neutralized in both regressions (to derive the overall IOp) and only in income regression (to derive the share of IOp in wage-earnings). The difference between the overall share of IOp and the share of IOp in wage/earnings gives us the share of IOp in labour attachment, i.e., the number of hours worked. The analysis is carried out by using two measures of inequality, the mean log deviation and the Theil Index.

Despite a large set of circumstances variables, our estimates can be interpreted only as lower bound of the true IOp because of the unobservability of the full set of circumstances beyond the sphere of individual responsability. This is a common drawback of all studies dealing with the measurement of IOp (see the discussion in Ferreira and Peragine, 2014).

Keeping this caveat in mind, our analysis makes three important contributions. Firstly, we identified three clusters of countries according to the degree of overall IOp. A first cluster exhibits low levels of IOp, from 14.5% to 18% and it includes continental countries (Spain, Italy, France) and Sweden. A second cluster exhibits moderate levels of IOp (close to 25%) and it includes the UK and Finland. A third cluster includes all eastern countries and exhibits levels of IOp going from 27% of Romania to almost

34% of Poland. These estimates are in line with few empirical papers dealing with the measurement of IOp in EU countries (Checchi and Peragine, 2010 for Italy; Bjorklund, Jantti and Roemer, 2012 for Sweden). In addition, our analysis shows that the IOp is not negligible in the UK and Finland and it is particularly severe in eastern countries, where the levels of IOp (near to 30%) are close to the IOp levels observed in Latin America (see Ferreira and Gignoux, 2011, and Brunori et al. 2013).

Secondly, the decomposition of inequality of opportunity in the share of IOp in wages and the share of IOp in labour attachment reveals that the largest part of inequality of opportunity in the labour market is due to the inequality in wage-earnings. This is found in all countries analyzed. The share of IOp due to wages ranges from 20% of Italy to around 35% of Poland. Regression analysis suggests that parents' occupation, family wealth and parents' ethnicity are the main drivers of such results. They play a significant role in shaping offsrping's income. Such big direct effect of circumstances seems to suggest that social connections may play a role in the sorting of workers in better paid jobs, in influencing career advancements and increasing the success of self-employment actitivies. With a different intensity across countries, our results suggest that this is a common feature of all EU countries analyzed.

As a last result, we found that the contribution of labour attachment to IOp is negative in the majority of countries, despite it is not very big in magnitude. Considering working hours as a measure of effort, this implies that, on average, people in bad circumstances exert an higher level of effort. In other terms, if the number of working hours were the same for all individuals, estimates of IOp would be even higher.

All these results suggest that to enhance equality of opportunity in Europe, the first problem to be addressed is the circumstances-related access to better paid jobs. This seems to be particularly critical for the eastern countries, where unequal opportunities account for more than 30% of inequality in hourly earnings. On the other side, policies aimed at increasing labour market attachment of people in bad circumstances are likely to be less important to reach the target of equality of opportunity among European workers.

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Tables and Figures

Table 1: Descriptive Statistics by Country

Variable	CZ	ES	FI	FR	IT	PL	RO	SE	UK
Income	23871.22	23165.55	24580.39	23434.76	25279.88	22144.65	22164.12	24513.43	23649.57
Demographics									
age	49.63	49.19	49.33	49.22	49.15	49.34	49.78	49.51	49.77
male	0.52	0.51	0.51	0.51	0.53	0.53	0.52	0.52	0.51
Cirmustances									
No parents(Ref.)	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01
parents	0.89	0.89	0.88	0.89	0.90	0.88	0.88	0.88	0.88
onlyone	0.10	0.10	0.11	0.10	0.09	0.10	0.10	0.11	0.11
acratio	1.01	1.03	1.01	1.03	0.99	1.03	1.02	1.00	1.02
Extra-EU F. (Ref.)	0.08	0.07	0.08	0.08	0.08	0.05	0.08	0.08	0.09
domesticf	0.85	0.86	0.84	0.85	0.87	0.87	0.85	0.85	0.85
EUf	0.07	0.07	0.08	0.07	0.05	0.06	0.05	0.07	0.06
Extra-EU M. (Ref.)	0.06	0.05	0.06	0.06	0.07	0.06	0.05	0.02	0.06
domesticm	0.87	0.88	0.86	0.87	0.89	0.89	0.87	0.87	0.87
EUm	0.07	0.07	0.08	0.07	0.05	0.06	0.08	0.07	0.07
No Education F. (Ref.)	0.11	0.10	0.12	0.11	0.11	0.10	0.07	0.11	0.11
tertiaryf	0.13	0.12	0.12	0.12	0.09	0.12	0.12	0.12	0.13
secondaryf	0.30	0.28	0.29	0.29	0.25	0.30	0.30	0.30	0.29
primaryf	0.46	0.50	0.47	0.48	0.53	0.48	0.47	0.47	0.47
No Education M. (Ref.)	0.09	0.08	0.08	0.09	0.08	0.08	0.08	0.09	0.09
tertiarym	0.09	0.08	0.08	0.08	0.06	0.08	0.09	0.08	0.09
secondarym	0.29	0.27	0.30	0.29	0.26	0.29	0.29	0.30	0.29
primarym	0.53	0.57	0.54	0.54	0.60	0.55	0.54	0.53	0.53
Other Occupations F (Ref.).	0.23	0.24	0.23	0.22	0.23	0.23	0.24	0.23	0.23
Manager	0.05	0.05	0.06	0.06	0.06	0.05	0.05	0.06	0.05
Professional	0.17	0.16	0.17	0.16	0.15	0.16	0.15	0.16	0.16
Worker	0.55	0.55	0.54	0.56	0.56	0.56	0.56	0.55	0.55
Other Occupations M (Ref.).	0.51	0.53	0.52	0.51	0.60	0.47	0.53	0.52	0.51
Managerm	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02
Professionalm	0.13	0.11	0.12	0.12	0.10	0.11	0.12	0.12	0.12
Workerm	0.35	0.31	0.34	0.35	0.28	0.34	0.35	0.34	0.35
Good Financial Situation	0.32	0.32	0.32	0.32	0.27	0.32	0.30	0.32	0.32
Ends Met	0.55	0.55	0.54	0.54	0.53	0.54	0.53	0.54	0.55
Free House (Ref.)	0.06	0.06	0.06	0.05	0.05	0.06	0.06	0.05	0.05
owner	0.70	0.69	0.71	0.71	0.70	0.69	0.72	0.71	0.71
tenant	0.24	0.25	0.23	0.24	0.25	0.25	0.22	0.24	0.24
Personal Education									
No Education (Ref.)	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01
ISCED1	0.05	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.05
ISCED2	0.10	0.13	0.11	0.11	0.17	0.12	0.11	0.11	0.10
ISCED3	0.47	0.44	0.47	0.47	0.46	0.46	0.46	0.46	0.46
ISCED4	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.04	0.05
ISCED5	0.33	0.32	0.31	0.32	0.28	0.32	0.32	0.33	0.33
Urbanization									
Rural Area (Ref.)	0.41	0.30	0.63	0.21	0.23	0.48	0.65	0.65	0.14
Large city	0.34	0.50	0.23	0.42	0.38	0.40	0.34	0.19	0.62
Medium City	0.25	0.20	0.14	0.37	0.39	0.12	0.01	0.16	0.24
Effort Variable									
hours	39.20	39.17	38.86	39.15	39.17	39.50	39.37	38.91	39.09
Market Conditions									
mean_hours	38.46	38.65	38.29	38.57	38.86	38.84	38.79	38.16	38.32
Observations	6640	9398	6873	8126	14762	9495	5472	4876	5778

Sample mean of the variables by country. NUTS Regions dummies are omitted. CZ=Czech Republic, ES=Spain, FI=Finland, FR=France, IT=Italy, PL=Poland, RO=Romania, SE=Sweden, UK=United Kingdom. Source: EU-SILC 2011, own calculations.

Table 2: Country Estimates

Variable	Country								
	CZ	ES	FI	FR	IT	PL	RO	SE	UK
Income Equation									
age	68.88***	86.56***	91.45***	122.17***	130.94***	87.92***	117.81***	100.75***	67.64***
male	9524.96***	7498.42***	10187.96***	8559.34***	8637.08***	7053.02***	7266.61***	7207.46***	8927.08***
parents	-692.57	-367.33	373.11	-2553.69	605.56	866.45	3201.26	-5450.65	2618.61
onlyone	219.93	-297.04	2391.32	-2238.67	-434.02	1058.03	2665.37	-3750.71	5861.92*
acratio	-1249.80***	-1069.41***	-1488.32***	-903.04*	-771.21**	-880.87***	-402.15	-1416.73***	-1066.35**
domesticf	-2256.74	-602.57	-2947.11	1347.50	-1990.88	-3350.58***	-3133.00*	-760.08	1607.17
EUf	2014.63	5557.65***	7819.84**	6319.20**	-726.69	19.41	121.10	4986.21*	8610.00***
domesticm	-1122.62	-463.54	-1633.99	-4770.11**	4411.47***	2700.69**	-657.20	-3947.66*	-2014.30
EUm	9676.08***	3403.42*	-354.22	2657.57	7334.14***	9623.30***	4741.82**	1360.42	1505.52
tertiaryf	7773.99***	135.55	5484.91**	4874.44**	2172.80	3405.58***	6752.39***	7132.82***	6080.27***
secondaryf	2371.37	-140.91	5193.05***	1909.17	379.35	1071.87	4496.41***	3531.93**	964.07
primaryf	-1332.63	-2417.98**	-1061.85	-1433.68	-986.12	-2133.02**	-972.52	-1952.37	-2461.86*
tertiarym	-5329.80***	-174.94	-6146.05**	4655.70*	-3601.77**	-3066.16**	-343.60	-4245.13*	-1536.92
secondarym	-1243.30	532.57	-3370.61	864.31	388.14	-1654.24	561.16	-69.73	494.17
primarym	-209.03	-1253.63	-1849.75	1111.40	-111.19	439.03	535.02	-64.47	1103.08
managerf	5935.04***	7787.55***	11290.88***	4897.18***	11095.59***	7125.77***	9970.64***	10795.70***	6651.42***
professionalf	7920.76***	7999.54***	5431.44***	4281.03***	5768.33***	7498.33***	5743.47***	7573.93***	7263.29***
workerf	1259.88	2494.28***	3004.52***	98.43	719.95	2071.12***	2582.24***	2204.75**	2311.22***
managerm	-8947.09***	-6232.02***	3251.68	-7472.99**	-6495.56***	-2829.73	-7230.27***	-5021.13*	-6305.08***
professionalm	-8310.97***	-7066.99***	-6232.98***	-11277.33***	-6024.28***	-6278.39***	-11235.74***	-7327.54***	-7213.25***
workerm	-6737.72***	-5849.41***	-7896.57***	-4414.02***	-6349.13***	-6053.04***	-7266.63***	-5540.86***	-6002.37***
goodmoney	2982.45***	129.15	2371.01**	1226.21	-258.76	1475.57***	3054.71***	2079.75**	2830.83***
abilityends	2780.04***	2971.64***	2415.29**	3381.66***	2931.38***	3332.23***	1658.83**	2820.14***	1441.88*
owner	7480.71***	6150.95***	7930.82***	7281.64***	5042.68***	5412.13***	6903.39***	9959.87***	7826.75***
tenant	10133.49***	9715.09***	11374.29***	9664.74***	8997.08***	9255.85***	10180.70***	13700.10***	10811.14***
isced1	1012.05	-3138.24	10517.66	-5560.27	-3804.33	2636.32	-4228.19	2377.07	-7851.15
isced2	3460.63	1162.62	13313.41	-3268.10	394.88	5704.71	-3184.31	1578.51	-6899.97
isced3	4782.13	2694.76	14690.51	-2352.24	2067.66	6132.05	-1422.66	4453.64	-5436.45
isced4	13258.66*	7165.31	19516.51*	2074.69	5178.28	10500.45	5061.84	11171.42	-4353.17
isced5	18346.20**	14496.60*	29418.58***	10769.16	14923.84**	18227.86***	9933.89	17510.26*	7695.72
urban	-490.24	1120.19*	798.15	-299.18	485.72	19.69	222.49	676.72	-2236.38*
semiurban	-877.41	712.35	477.28	-835.27	-714.36	-126.06	1430.01	1502.37	-2207.20*
hours	307.16***	398.08***	444.59***	362.52***	428.76***	273.77***	335.96***	463.23***	384.37***

Country Estimates- Table 2 Cont

Variable	Country								
	CZ	ES	FI	FR	IT	PL	RO	SE	UK
Working Hours Equation									
mean_hours	1.15***	0.92***	1.12***	0.95***	1.02***	0.86***	1.15***	1.04***	0.76***
age	0.06	-0.02	0.02	-0.11	0.04	0.15	0.03	0.01	-0.09
male	-0.15	1.31	8.31	3.69	4.45	-7.82	0.75	9.20	-2.06
parents	-2.16	-0.64	-6.90*	-0.75	-3.45	5.82**	0.22	-0.75	-1.41
onlyone	-4.03	-3.48	-5.10	-0.99	-2.48	4.77	1.18	-4.41	-1.45
acratio	-0.08	0.41	0.64	0.16	1.11***	-0.55	-0.21	1.27**	-0.76
domesticf	1.43	-1.94	5.00**	1.53	-0.42	-0.66	-0.51	-6.70***	1.58
EUf	0.97	-2.39	6.72**	-0.40	-0.87	-5.54**	0.43	-10.14***	1.61
domesticm	0.60	0.67	-0.97	-1.76	1.09	-1.00	0.88	8.92***	-0.59
EUm	2.29	-1.90	-5.47*	1.90	1.03	0.20	-1.80	11.05***	-1.88
tertiaryf	-2.26	0.43	-0.25	-4.37**	2.96*	0.71	-3.24	-2.17	0.98
secondaryf	-2.18	1.44	0.58	-2.62*	1.72	1.76	-1.96	-1.66	0.88
primaryf	-0.71	0.62	2.05	-1.75	2.15*	1.64	-2.68	-1.81	2.39
tertiarym	0.86	-0.14	6.50***	0.40	0.05	2.98	4.77**	0.72	2.88
secondarym	4.29**	-1.43	3.77**	0.01	-0.30	1.48	4.76**	3.45	-0.18
primarym	2.18	-0.41	2.27	-1.22	-0.96	1.33	5.34***	1.87	-0.99
managerf	1.33	-0.24	-3.90**	2.30	-1.90	2.21	-0.71	2.19	-3.25
professionalf	-0.84	-2.63**	-3.12**	0.81	-1.56	-1.62	-0.22	1.36	-1.23
workerf	1.40	-1.18	-2.25**	0.14	-0.60	-0.27	-0.25	0.55	-0.51
managerm	6.58**	6.81**	3.71	4.69*	2.37	0.29	2.87	3.56	2.96
professionalm	2.61*	4.15***	1.17	1.37	1.71*	1.72	-0.25	0.26	0.81
workerm	2.42***	2.05***	2.76***	1.04	1.54**	2.59***	1.44	1.19	1.45
goodmoney	0.07	0.74	-0.60	-0.81	-0.26	-1.64**	0.06	-1.14	1.65*
abilityends	-0.25	-1.49*	-1.85**	-0.87	0.09	-0.25	-0.36	-0.86	-0.52
owner	-3.88**	1.23	0.89	-0.06	-0.32	-2.13	-1.15	-0.15	0.84
tenant	-4.44***	-0.97	-0.22	-1.18	-1.86	-2.82**	-2.06	-1.74	0.72
isced1	2.64	1.55	-2.89	-2.65	1.67	-2.09	-0.34	-2.51	-0.33
isced2	2.02	1.28	-2.68	-2.71	2.04	-3.44	1.16	-2.94	0.12
isced3	2.00	1.58	-2.41	-2.45	2.04	-2.39	1.39	-2.86	0.24
isced4	2.97	1.79	-2.51	-2.70	2.29	-2.11	1.41	-2.56	0.51
isced5	2.44	1.70	-2.00	-2.03	2.22	-2.15	1.52	-2.48	1.13
urban	-0.07	0.22	-0.44	0.11	0.20	-0.02	0.04	0.14	0.29
semiurban	-0.31	0.41	-0.26	0.22	0.43**	-0.61*	-0.82	-0.33	-0.01
NUTS fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Interaction C*D	YES	YES	YES	YES	YES	YES	YES	YES	YES
Interaction M*D	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	6640	9398	6873	8126	14762	9495	5472	4876	5778

Estimated Coefficients of equation (1). Standard errors not reported. ***, **, * indicate significance at 1%, 5% and 10% level,respectively.CZ=Czech Republic, ES=Spain, FI=Finland, FR=France, IT=Italy, PL=Poland, RO=Romania, SE=Sweden, UK=United Kingdom. Source: EU-SILC 2011, own calculations.

Table 3: Inequality of Opportunity and Decomposition-Mean Log Deviation and Theil index

Country	IOp	IOp^W	IOp^{WH}
CZ			
mld	31.76%	30.91%	0.85%
Theil	38.43%	37.76%	0.67%
ES			
mld	14.53%	22.5%	-7.97%
Theil	23.2%	28.7%	-5.5%
FI			
mld	25.05%	19.13%	5.92%
Theil	37.76%	34.79%	2.97%
FR			
mld	18.84%	17.16%	1.68%
Theil	26.98%	27.32%	-0.34%
IT			
mld	15.99%	20.00%	-4.01%
Theil	19.44%	22.90%	-3.46 %
PL			
mld	33.5%	34.76%	-1.26%
Theil	34.14%	34.3%	-0.16%
RO			
mld	27.25%	29.76%	-2.51%
Theil	35.81%	37.89%	-2.08%
SE			
mld	17.31%	22.24%	-4.93%
Theil	27.76%	35.31%	-7.55%
UK			
mld	25.25%	19.14%	6.11%
Theil	31.99%	29.69%	2.30%

Estimates of inequality of opportunity indexes according to equations (2)-(4). Mean Log Deviation (mld) and Theil index (Theil). CZ=Czech Republic, ES=Spain, FI=Finland, FR=France, IT=Italy, PL=Poland, RO=Romania, SE=Sweden, UK=United Kingdom. Source: EU-SILC 2011, own calculations.

Figure 1: Overall Share of Iop, Share of Iop in wages and Share of Iop in working hours. Mean Log Deviation index **(Top Panel)** Theil Index **(Bottom Panel)** CZ=Czech Republic, ES=Spain, FI=Finland, FR=France, IT=Italy, PL=Poland, RO=Romania, SE=Sweden, UK=United Kingdom. Source: EU-SILC 2011, own calculations.