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INEQUALITY OF OPPORTUNITY IN EUROPE

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Using the EU-SILC database, we estimate and compare the Inequality of Opportunity (IO) of 23 European countries in 2005. IO is estimated as the between-type (*ex-ante*) inequality component following the parametric procedure of Ferreira and Gignoux (2011), which allows for the inclusion of the large set of circumstances in the database. We also measure the degree of correlation between IO estimates and a set of past and contemporaneous economic factors related to the degree of development, labor market performance, investment in human capital, and social protection spending.

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1. Introduction

Equality of opportunity has traditionally been understood as the absence of barriers to access positions, education, and jobs. In line with this conception, hiring should be meritocratic and characteristics like economic class, gender, and race should have no bearing on the merit of the individual (Lucas, 1995). Rawls (1971) and Sen (1980, 1985), among others, invoked a more general notion of equality of opportunity. They argued that equality of opportunity would require compensating persons for a variety of *circumstances* (i.e., socioeconomic background, ethnicity, place of birth, etc.) whose distribution is morally arbitrary.[1]

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[1]Dworkin (1981a, 1981b) took the issue a little further. This author argued that people should be held responsible for their preferences but not their resources. However, some philosophers (e.g., Arneson, 1989; Cohen, 1989) have criticized the separating line between those aspects for which a person should be held accountable (preferences) and those for which he should not (resources).

Roemer (1993, 1998) brings that philosophical debate into economics and formalizes a precise definition of equality of opportunity (see also Van de Gaer, 1993). He emphasizes that an individual's outcome (income, welfare, health, etc.) is a function of variables *within* and *beyond* the individual's control, called effort (occupational choice, number of hours worked, or investment in human capital) and circumstances (socioeconomic and cultural background or race), respectively. As a consequence, total inequality can be seen, in reality, as a combination of inequality of effort (IE) and inequality of opportunity (IO). Thus, an equal-opportunity policy must guarantee that those who exert an equal degree of effort, regardless of their circumstances, are able to achieve equal levels of outcome (i.e., the policy should *level the playing field*).

Recent contributions by the World Bank (2006), Bourguignon *et al*. (2007a), and Marrero and Rodríguez (2010) have noted that IO, in addition to being the one type of inequality that is truly important from the standpoint of social justice, could exert a different effect (i.e., negative) on growth than IE, whose impact would be positive.[2] Thus, correcting a country's IO would not only result in a fairer society in terms of social equality, but it would also spur economic efficiency and growth.

Given the importance of IO, the main goal of this paper is to measure and compare IO estimates among European countries using a homogenous database. In particular, we compute total income inequality and IO for 23 European countries in 2005 using the Survey on Income, Social Inclusion and Living Conditions in Europe (EU-SILC) database. Data requirements for comparing IO across countries in a homogenous way are severe (Lefranc *et al*., 2008). In this regard, the EU-SILC is an exception that gives information on individual disposable income and a rich set of circumstances (for its 2005 wave). This paper thus contributes to the existing literature by using a homogenous database that combines a rich set of comparable circumstance variables for a large number of countries. IO is estimated as the between-type (*ex-ante*) inequality component following the parametric procedure of Ferreira and Gignoux (2011). This approach allows for the inclusion of the large set of circumstances in the EU-SILC, even in the presence of small sample sizes.

In general, we find that Nordic (Denmark, Finland, Norway, and Sweden), Western continental (Germany, Netherlands, Austria, Belgium, and France), and some among the richer Eastern EU (Slovakia, Czech Republic, Slovenia, and Hungary) countries are within the low-IO group. The high-IO group basically consists of Mediterranean (Italy, Greece, and Spain), Atlantic (Portugal, Ireland, and the U.K.) and poorer Eastern EU (Estonia, Latvia, Poland, and Lithuania) countries. Moreover, although the IO and total inequality rankings are highly correlated, we note that some countries' ranks change significantly depending on whether IO or overall inequality is considered. For example, Sweden, Slovenia, Belgium, France, Ireland, and Portugal rank worse in terms of IO than total inequality, while the opposite is true for Finland, Germany, Latvia, and Slovakia.

In addition to these IO estimates, we would like to know which specific national characteristics have a causal effect on IO. But addressing these questions

[2]In this respect, it is interesting to note that some macroeconomic factors may affect the IO and IE components of total inequality in a different way (see Marrero and Rodríguez, 2012). In Galor (2009) the reader can find an overview of the modern perspective on the relationship between inequality and economic development.

is quite challenging because, among other things, a sufficiently large and rich panel of data would be required. Unfortunately, our database (the EU-SILC) consists only of a cross-section of 26 countries for just one year (2005). Nevertheless, we conduct a more modest analysis and measure the degree of correlation between income inequality in 2005 (our IO and total inequality estimates) and a set of past and contemporaneous economic variables related to the degree of development, labor market performance, investment in human capital, and social protection spending. Given the increasing importance of the topic, the current state of the art, and the limited availability of data, we believe that a better understanding of cross-country differences in IO deserves this attempt.

The paper is structured as follows. Section 2 reviews the previous literature on IO. Section 3 presents the methodology employed, while Section 4 introduces the database used to measure IO in Europe. Section 5 shows the estimates found for IO in Europe and some correlations between IO and variables related to development, labor market, human capital investment, and social policy. Finally, Section 6 concludes.

2. Review of the Literature

The modern theories of justice recognize that an individual's income is a function of variables *beyond* and *within* the individual's control, called circumstances and effort, respectively.[3] As a consequence, overall inequality is the result of heterogeneous circumstances (IO), which represent individual initial conditions, and efforts (IE), which represent individual decisions.

There exist many procedures to estimate IO and this section reviews the most relevant. A first distinction is made between the pioneering approaches of Roemer (1993) and Van de Gaer (1993). Roemer's procedure states that there is equality of opportunity if all individuals who exert the same degree of effort obtain the same level of outcome. For this task, he proposes to compute, across types, the minimum outcome level of individuals who exert the same degree of effort (i.e., individuals in the same *tranche*) and then maximize the average. Alternatively, Van de Gaer focuses on the set of outcomes available to individuals sharing similar circumstances (the opportunity set). Then, there is equality of opportunity if the opportunity set available to every individual does not depend on one's initial circumstances. As an equality-of-opportunity criterion, he proposes first averaging outcomes across tranches, and then maximizing the minimum of those averages across types.[4]

These two alternative approaches have given rise to the so-called *ex-post* and *ex-ante* procedures, respectively (Fleurbaey, 2008). In sum, for the *ex-post* approach there is equality of opportunity if all individuals who exert the same

[3]Talent could be considered a circumstance; however, this variable is controversial as it might reflect past effort of a person (while being a child) and hence is not obviously something for which a person should not be held accountable. Lefranc *et al.* (2009) also consider luck as an additional source of income.

[4]Note that intergenerational mobility is a closed related concept to equality of opportunity if parental income is considered as the relevant circumstance (O'Neill *et al.*, 2000; Van de Gaer *et al.*, 2001).

effort obtain the same outcome, while for the *ex-ante* approach there is equality of opportunity if all individuals face the same set of opportunities regardless of their circumstances. We focus our attention in this paper only on the *ex-ante* approach.[5]

Roemer and Van de Gaer use the minimum function to comply with the Rawlsian *maximin* principle. However, other authors have followed alternative routes. On the one hand, partial equality-of-opportunity orderings have been proposed. For example, Peragine (2004) proposed the use of the Generalized Lorenz Curve to make ordinal welfare comparisons for income distributions according to equality of opportunity; Rodríguez (2008) proposed an equality-of-opportunity partial ordering based on the TIP's dominance criteria;[6] Lefranc *et al.* (2009) considered a mechanism to contrast equality of opportunity based on the first and second stochastic dominance criteria in a model that considers circumstances, effort, and also luck (see also Peragine and Serlenga, 2008). On the other hand, complete equality-of-opportunity orderings based on inequality indices have also been proposed. For example, Moreno-Ternero (2007) proposed to minimize the average of outcome inequality (across types) at each relative effort level;[7] Lefranc *et al.* (2008) considered an index to measure inequality of opportunity based on the Gini index; Rodríguez (2008) provided a class of inequality-of-opportunity measures based on the Foster–Greer–Thorbecke family of poverty measures (Foster *et al.*, 1984);[8] and Pistolesi (2009) used counterfactual distributions built on duration models to measure equality of opportunity.

In line with the last set of approaches, and given the importance of assessing the magnitude of IO in terms of overall inequality, the procedure of decomposing total inequality into IO and IE components has gained great popularity in recent years. First proposed by Ruiz-Castillo (2003) and subsequently improved by Checchi and Peragine (2010) and Ferreira and Gignoux (2011), overall inequality can be decomposed into two components, one due to IO and the other due to IE (see also Cogneau and Mesplé-Somps, 2009). Using an *ex-ante* criterion, population is partitioned according to individuals' circumstances and IO is evaluated in terms of differences *between* individuals endowed with the same circumstances, so that IO is represented by the between-group component of overall inequality.[9]

Among the alternative estimation procedures, a last distinction is made based on how IO and IE are finally estimated: non-parametrically (Checchi and Peragine, 2010) or parametrically (Bourguignon *et al.*, 2007b; Ferreira and Gignoux, 2011). In contrast to the standard non-parametric approach, the

[5]See Ooghe *et al.* (2007) and Fleurbaey and Peragine (forthcoming) for a theoretical comparison between the *ex-post* and *ex-ante* approaches.

[6]The TIP curve is applied in the poverty literature; see, for example, Jenkins and Lambert (1997).

[7]He also proposed to minimize the maximum inequality throughout the different levels of relative effort and the inequality between the average outcome of each type of individual.

[8]It is worth noting that the first two mechanisms developed by Moreno-Ternero (2007) are particular cases of the class of measures proposed by Rodríguez (2008).

[9]Using an *ex-post* procedure, population is firstly partitioned into types, according to individuals' circumstances, and then each type is further subdivided according to personal effort. Correspondingly, IO is evaluated in terms of outcomes of individuals who have exerted the same effort, so that IO is represented by the *within-group* component of overall inequality.

parametric method is a regression-based approach for computing the share of IO.[10] Nevertheless, the suitability of both estimation methods (parametric and non-parametric) depends mainly on the characteristics, the sample size, and the observed circumstances of the database. When the number of observed circumstances is high and the sample size is not large enough, some group types may present a small number of observations and, as a result, the non-parametric estimates may be inaccurate. Meanwhile, the parametric approach assumes a particular specification, and the possible existence of relevant unobserved circumstances—correlated with the observed ones—may cause the residuals of the parametric regressions not to be orthogonal to the regressors.[11]

In this paper we estimate the IO of 23 European countries in 2005 by using the EU-SILC database. Because this database contains a considerable number of circumstances, we apply the parametric (*ex-ante*) approach proposed in Ferreira and Gignoux (2011). In this manner, we can take advantage of all the circumstances included in the EU-SILC database and avoid the lack of accuracy in the non-parametric estimates, despite the fact that the residuals of the parametric regressions might not be orthogonal to the regressors. In the next section, we explain the method, and in Section 4 we present the data and the set of circumstances that are used in the empirical analysis.

3. A Methodology for Computing IO

Based on Ferreira and Gignoux (2011), this section presents the method used for computing IO. Consider a finite population of discrete individuals indexed by $i \in \{1, \ldots, N\}$, the individual income, y_i, is assumed to be a function of the amount of effort, e_i, and the set of circumstances, C_i, that the individual faces, such that $y_i = f(C_i, e_i)$. Effort is treated as a continuous variable, while, for each individual i, C_i is a vector of J elements, each element corresponding to a particular circumstance. While circumstances are exogenous because they cannot be affected by individual decisions, effort is assumed to be influenced, among other factors, by circumstances. Consequently, individual income can be rewritten as $y_i = f[C_i, e_i(C_i)]$.

Population then is divided into M mutually exclusive and exhaustive groups (or types), $\Gamma = \{H_1, \ldots, H_M\}$, where all the individuals in the same group m have the same circumstances: $H_1 \cup H_2 \cup \ldots \cup H_M = \{1, \ldots, N\}$, $H_r \cap H_s = \emptyset$, $\forall$ r and s, and $C_i = C_k$, $\forall$ i and $k | i \in H_m$ and $k \in H_m$, $\forall m$. Effort distribution for individuals of type m is denoted by F^m, and $e^m(\pi)$ represents the level of effort exerted by an individual in the π^{th} quantile of that effort distribution, with $\pi \in [0, 1]$. Given type m, the income level attained by the individual in the π^{th} quantile is denoted by $v^m(\pi) = y^m(e^m(\pi))$. In this manner, the order of incomes and efforts within each type coincide since, for a particular type, the income will be determined exclusively by

[10]The main difference between the approaches in Ferreira and Gignoux (2011) and Bourguignon *et al.* (2007b) is that the former seeks to estimate a lower-bound of the true IO because all individual circumstances certainly cannot be observed, while the latter seeks to estimate the effect of a specific (observed) set of circumstances by using Monte-Carlo simulations in order to estimate bounds around the possible biases in specific coefficients.

[11]See Marrero and Rodríguez (2011) for an empirical comparison between the parametric and non-parametric approaches for the U.S. (1970–2009).

the effort.[12] Thus, there is equality of opportunity when an individual's income is independent of his social origins (Bourguignon *et al.*, 2007b; Lefranc *et al.*, 2008). Strictly speaking, this would translate into the following condition:

$$F^m(y) = F^k(y), \forall m, k \mid H_m \in \Gamma, H_k \in \Gamma. \tag{1}$$

Given income distributions by types, first and second order stochastic dominance by types could be contrasted. The stochastic dominance criterion, however, is partial and incomplete, since the distribution functions can cross (Atkinson, 1970). When the number of circumstances is large, the number of observations per type will be small, which, in practice, precludes an accuracy estimation of the distribution functions. An alternative is to consider a particular moment of said distributions, such as the average. Thus, given $\pi \in [0, 1]$, let us define

$$\mu = (\mu^1, \ldots, \mu^M) = \left(\int_0^1 v^1(\pi)\, d\pi, \ldots, \int_0^1 v^M(\pi)\, d\pi\right), \tag{2}$$

the *M*-dimensional vector of average incomes for the various types. A necessary (though not sufficient) condition to be equality of opportunity is that the elements of vector μ be equal, that is:

$$\mu^m(y) = \mu^k(y), \forall m, k \mid H_m \in \Gamma, H_k \in \Gamma. \tag{3}$$

As commented in the previous section, while Van de Gaer (1993) proposed maximizing the minimum average income, $Min(\mu) = \min_m \left\{\int_0^1 v^m(\pi)\, d\pi\right\}$, many other authors have proposed using an inequality index, such as the Gini or the Theil 0. In our context, one advantage of the latter proposal is that, by taking into account every element in the average vector μ and not just its minimum element, the calculation would be less subject to extreme values. Accordingly, IO can be defined as $I(\mu)$, where I is a specific inequality index.[13]

Of all the possible inequality indices that fulfill the basic principles found in the literature on inequality (progressive transfers, symmetry, scale invariance, and replication of the population), Ferreira and Gignoux (2011) select the mean logarithmic deviation or Theil 0, T_0, since it belongs to the Generalized Entropy class of inequality indices, and therefore is additively decomposable (Bourguignon, 1979; Cowell, 1980; Shorrocks, 1980), has a path-independent decomposition (Foster and Shneyerov, 2000), and uses weights based on the groups' population shares. The decomposition of this index into between-group and within-group inequality components is

$$T_0(Y) = T_0(\mu) + \sum_{m=1}^{M} \frac{n^m}{N} T_0(y^m), \tag{4}$$

[12]This property is equivalent to the *strictly increasing* axiom in the literature on IO (see O'Neill *et al.*, 2000).

[13]Note that whenever total inequality can be additively decomposed by population groups according to a set of circumstances, the IO term will be the *between-group* inequality component, while the *within-group* inequality component could be interpreted as the IE term.

where n^m represents the population of type m. The between-group inequality index would be the IO index (actually, a *lower bound* of the IO; see below), since the groups would be determined just by the observed individual circumstances. As for the within-group inequality, this could be considered as that due to effort. However, this term may contain other elements arising from non-observed circumstances and/or luck. That is why our analysis focuses on aggregate inequality and on IO estimates.

As discussed in the previous section, the between-group component can be non-parametrically estimated, but this approach presents problems of accuracy when the number of circumstances is high, as in our case. Therefore, parametric techniques should be used to yield reliable estimates. Following Bourguignon *et al.* (2007b) and Ferreira and Gignoux (2011), the parametric specifications rest on the assumption that the income of individual i is $y_i = f(C_i, e_i(C_i, u), v)$, where u and v represent random variables, like luck, as well as possible non-observed factors. If we now consider the reduced form of the above expression, $y = \Phi(C, \varepsilon)$, we can estimate the log-linear equation using ordinary least squares (OLS):

$$\ln y = C\lambda + \varepsilon. \tag{5}$$

Thus, once the within-group dispersion is accounted for, the OLS estimate would yield an approximation $\hat{\mu}_i = \exp\left[C_i\hat{\lambda}\right]$ for the individual incomes. Based on these estimated individual incomes, we can directly obtain the smoothed distribution $(\hat{\mu}_1, \ldots, \hat{\mu}_N)$ and the parametric estimate of IO as $IO = T_0(\hat{\mu}_1, \ldots, \hat{\mu}_N)$.

4. The EU-SILC European Database

The availability of suitable data is crucial to a rigorous study of IO. An empirical analysis of IO requires not only comparable measures of individual disposable income, but also for individual circumstances or social origins to be measured in a comparable and homogenous way. Unfortunately, there are few databases with this information, and even then, the number of circumstances tends to be limited.[14]

The database used in this paper is the EU Survey on Income, Social Inclusion and Living Conditions, or EU-SILC. This survey was recently implemented (in 2004), and only the data for 2005 is of use for our purposes, since this is the only year for which information is available on the parents' occupation and level of education, which are the most widely used variables to measure the individual social background in the related inequality-of-opportunity literature.[15] Annual incomes always include transitory variations and measurement errors and, as a result, income averages for a given number of years could be useful in neutralizing these erratic components (Pistolesi, 2009). Unfortunately, we cannot average

[14]For example, the set of papers in Volume 13 of the *Review of Economic Dynamics* (2010) consider databases with information on individual income; however, they do not contain information on individual circumstances. Likewise, studies on inequality of opportunity (Roemer *et al.*, 2003; Rodríguez, 2008; Cogneau and Mesplé-Somps, 2009; Lefranc *et al.*, 2009; Ferreira and Gignoux, 2011) have based their results on the use of a different database for each country, so a real cross-country analysis of inequality of opportunity has not been conducted yet.

[15]See, for example, Roemer *et al.* (2003), Checchi and Peragine (2010), Bourguignon *et al.* (2007b), Rodríguez (2008), Lefranc *et al.* (2009), and Ferreira and Gignoux (2011).

incomes because the EU-SILC is only available for our purposes in 2005, which is clearly the main disadvantage of this database.[16]

A benefit of this survey is that it offers information for a large number of different countries (26 total): Austria (AT), Belgium (BE), Czech Republic (CZ), Germany (DE), Denmark (DK), Estonia (EE), Greece (EL), Spain (ES), Finland (FI), France (FR), Hungary (HU), Ireland (IE), Italy (IT), Lithuania (LT), Latvia (LV), the Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Sweden (SE), Slovenia (SI), Slovakia (SK), and the United Kingdom (UK).[17] A second advantage is the considerable number of circumstances that this database contains. For our study, we use the educational levels and occupations of both parents, the origin (national, European, or rest of the world) of the individual, and lastly, a qualitative variable that measures the prevalent economic conditions in the individual's home during his/her childhood. To the best of our knowledge, the 2005 EU-SILC database features the highest number of individual circumstances measured homogenously for such a large number of countries.

The variable used to calculate inequality is the disposable equivalent income for those households whose head is between 26 and 50 years of age.[18] This way, we consider the cohorts with the highest proportion of employed persons and avoid the composition effect (individuals with different ages are in different phases of the wage-earning time series) while approaching the concept of permanent income. In terms of the IO calculation, it must be noted that the circumstance vector observed is, by definition, a subset of the vector of all possible circumstances. The estimated IO values, then, will be a lower-bound of the true IO and will increase with the number of circumstances observed (Ferreira and Gignoux, 2011).[19]

Table 1 summarizes the information of the selected set of circumstances.[20] In general, Nordic and Western continental countries present the highest disposable equivalent household income (28,000 Euros of Norway, almost 27,000 of the U.K., and 25,000 of Denmark and Ireland). Italy, Spain, Greece, Slovenia, and Portugal follow the leading group, with an average personal income between 10,000 and 17,000. Finally, the remaining Eastern EU countries (Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, and Slovakia) are in the group of low-income countries, and their average income ranges from 3000 to 5000 Euros.

By circumstances, we find that the greatest heterogeneity is observed for the levels of education attained by parents, especially in terms of their primary and

[16]It is worth noting that removing transitory income variations might lead to a smoothing of the role of effort, which might then overestimate the relative importance of IO. To neutralize for data extremes, we have omitted those observations with negative or zero incomes, and/or incomes 15 times higher than the mean income of their distribution.

[17]We have omitted Luxembourg, Iceland, and Cyprus from the analysis because of their reduced sample sizes.

[18]The equivalence scale used in this paper is the same as that used in the EU-SILC database. Specifically, the equivalence scale is $e = 1 + 0.5(N_{14^+} - 1) + 0.3N_{13^-}$, where N_{14^+} is the number of household members 14 years of age or older and N_{13^-} is the number of household members 13 years of age or younger.

[19]For parametric estimates, every time we include a new circumstance, whichever correlation it has with the set of observed circumstances, the explained variance of income does not decrease, i.e., the coefficient of determination of the regression is at least as high as it was before the inclusion of the new circumstance. In this sense we can always assure that our parametric estimates are a lower bound.

[20]Given the restrictions imposed on the observations, it is remarkable that the sample size is larger than 2,500 units on average (the range goes from Latvia with 1159 observations to Italy with 8638 observations).

TABLE 1

Summary Statistics of the EU-SILC Database

	AT	BE	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT
Selected sample size[a]	2,155	1,838	1,589	4,255	1,241	1,377	2,126	5,389	1,980	3,725	2,590	1,449	8,638
Equivalized personal income[b]													
Average	19,633	19,553	5,075	20,163	24,716	3,753	11,766	13,041	20,930	18,533	3,950	24,359	17,281
Standard deviation	10,283	9,848	3,089	12,609	8,628	2,515	8,230	8,187	12,135	9,858	2,595	15,978	10,711
Father's education													
Less than primary*	–	12.6	–	–	–	0.5	23.7	21.3	0.2	5.3	0.6	1.9	12.3
Primary	0.1	27.0	0.4	2.1	–	11.3	51.6	56.1	1.9	50.9	13.8	62.1	50.8
Secondary	95.3	38.8	88.0	60.3	78.4	63.7	15.8	12.5	75.3	32.9	71.9	22.4	33.2
Tertiary	4.6	21.6	11.6	37.5	21.6	24.5	8.9	10.0	22.7	10.9	13.6	13.6	3.6
Mother's education													
Less than primary*	–	14.2	–	–	–	0.9	28.6	24.3	0.2	6.3	0.9	1.7	16.4
Primary	1.8[c]	31.8	0.4	3.3	0.2	10.6	52.4	60.0	2.1	57.2	16.4	57.9	55.5
Secondary	62.0[c]	39.0	93.3	81.3	83.3	61.9	12.9	11.3	80.8	28.1	72.4	29.3	26.6
Tertiary	3.9c	15.0	6.2	15.4	16.5	26.6	6.1	4.3	16.9	8.4	10.3	11.2	1.5
Father's occupation													
Manager	5.0	11.5	4.3	6.7	9.6	10.5	11.7	6.7	10.2	8.5	5.9	25.1	9.9
Professional	3.4	12.9	6.7	16.6	13.3	8.3	4.5	3.9	8.0	10.7	6.7	9.8	3.7
Technician	12.4	6.8	16.1	12.2	10.8	5.4	2.2	4.8	12.9	8.4	5.4	3.0	7.5
Clerk	6.1	10.3	3.0	7.4	4.4	0.9	5.4	5.8	1.8	5.2	3.2	6.4	5.7
Salesman	10.5	6.1	3.9	3.0	6.2	1.2	4.8	7.8	3.8	3.3	3.3	5.6	4.2
Skill agricultural*	14.6	4.1	4.1	5.3	12.6	3.0	34.8	14.2	22.4	12.0	10.5	1.1	11.9
Craft trade	25.7	25.4	35.6	31.0	23.0	28.7	18.0	24.8	21.5	24.1	35.5	19.8	28.1
Machine operator	7.7	9.5	19.5	11.3	8.3	33.0	7.7	11.7	15.5	17.4	17.6	10.1	14.7
Elementary occup.	14.5	11.0	5.7	5.3	11.0	7.6	9.9	18.7	3.3	7.1	10.0	17.1	12.4
Armed/military	0.1	2.3	1.1	1.1	0.8	1.5	1.0	1.7	0.7	3.4	1.9	1.9	1.9
Economic difficulties during childhood													
Most of time	–	3.1	3.6	–	1.9	2.4	–	7.9	4.2	–	9.3	6.9	12.7
Often	–	5.0	8.7	–	3.8	11.0	–	9.1	7.3	–	16.9	7.3	20.2
Occasionally	–	11.7	26.9	–	14.4	36.5	–	20.2	24.4	–	15.6	21.0	31.1
Rarely	–	11.1	26.1	–	17.1	23.9	–	21.1	24.7	–	33.6	24.2	19.8
Never*	–	69.1	34.7	–	62.8	26.1	–	41.7	39.4	–	24.4	40.6	16.2
Country of birth													
Local*	88.7	88.3	97.4	95.7	97.4	89.5	90.4	93.1	97.8	88.4	97.6	86.2	93.1
Other EU	2.9	5.4	1.7	0.0	0.8	0.0	2.4	6.4	1.2	3.7	0.3	9.8	1.4
Others	8.4	6.4	0.9	4.3	1.8	10.5	7.2	0.5	1.0	7.9	2.0	3.9	5.5

Table 1 continued on next page

TABLE 1 (*continued*)

	LT	LV	NL	NO	PL	PT	SE	SI	SK	UK	Mean	S.D.
Selected sample size[a]	1,702	1,159	1,695	1,423	6,055	1,654	1,342	1,393	2,292	1,874	2,563	1,869
Equivalized personal income[b]												
Average	2,736	3,058	19,807	28,470	3,187	9,693	18,908	10,045	3,212	26,850	14,292	8,629
Standard deviation	1,970	2,856	8,762	13,742	2,527	7,954	7,474	4,246	1,934	18,361	8,021	4,720
Father's education												
Less than primary*	4.8	1.1	–	–	10.6	30.2	1.6	3.2	–	44.6	10.9	12.9
Primary	32.8	11.0	21.7	–	37.6	58.9	41.3	36.5	4.7	–	28.6	21.9
Secondary	37.7	67.6	54.9	56.0	45.0	7.0	35.8	51.3	84.3	19.5	49.9	25.6
Tertiary	24.7	20.4	23.4	44.0	6.9	3.9	21.2	9.0	11.1	35.8	17.6	11.0
Mother's education												
Less than primary*	5.7	1.5	–	–	12.0	41.0	2.6	4.4	–	53.9	13.4	16.0
Primary	34.1	10.9	25.0	–	41.9	51.8	41.1	54.6	5.1	–	30.6	22.7
Secondary	32.8	67.6	65.5	67.8	39.9	3.6	37.0	35.6	89.5	26.6	49.4	27.5
Tertiary	27.4	20.0	9.5	32.2	6.2	3.6	19.3	5.5	5.4	19.5	13.1	8.5
Father's occupation												
Manager	6.6	6.2	23.1	13.2	3.5	7.3	–	4.7	8.3	13.4	9.6	5.5
Professional	8.1	9.2	14.2	10.5	4.8	2.5	–	5.2	7.7	15.4	8.5	4.1
Technician	2.9	5.8	15.2	18.9	6.5	4.3	–	9.9	11.0	8.2	8.7	4.6
Clerk	2.2	1.3	7.3	4.6	3.1	5.1	–	4.8	2.9	3.7	4.6	2.2
Salesman	2.0	2.2	4.5	4.6	2.2	5.7	–	5.7	2.8	3.8	4.4	2.1
Skill agricultural*	5.1	2.8	1.5	9.6	24.4	22.7	–	13.4	2.7	3.0	10.7	8.9
Craft trade	27.3	27.5	19.5	22.7	29.4	28.1	–	26.2	28.8	23.9	26.1	4.6
Machine operator	24.3	31.1	9.4	14.0	16.4	12.0	–	23.3	22.6	16.2	16.1	7.2
Elementary occup.	20.6	11.8	4.0	1.0	8.1	10.9	–	6.0	13.1	12.4	10.1	5.0
Armed/military	0.8	2.1	1.4	0.9	1.6	1.3	–	0.9	0.0	0.0	1.3	0.8
Economic difficulties during childhood												
Most of time	8.0	5.3	2.3	1.8	7.2	–	3.7	11.3	23.9	7.5	6.8	5.4
Often	15.3	12.1	6.5	3.7	13.8	–	5.5	21.2	29.4	9.5	11.5	6.9
Occasionally	29.2	26.2	13.8	12.7	30.5	–	12.8	31.8	32.0	21.8	22.9	8.0
Rarely	19.0	19.4	20.2	27.5	16.2	–	20.9	19.3	12.3	22.4	21.0	5.3
Never*	28.5	37.0	57.2	54.4	32.2	–	57.0	16.4	2.5	38.8	37.7	17.6
Country of birth												
Local*	94.2	87.3	94.8	92.1	99.8	96.3	87.6	91.0	98.6	89.1	92.8	4.2
Other EU	0.4	0.0	1.2	3.4	0.0	1.4	4.5	0.0	1.0	0.5	2.1	2.5
Others	5.5	12.7	4.0	4.4	0.1	2.4	8.0	9.0	0.4	10.5	5.1	3.7

Notes: [a]We restrict the sample to households' head aged 26 to 50. We exclude outliers and observations with missing data or showing negative or zero values of income.

[b]The equivalence scale is: $e = 1 + 0.5(N_{14^+} - 1) + 0.3N_{13^-}$, where N_{14^+} and N_{13^-} are the number of household members 14 years of age or older and 13 years of age or younger, repectively.

[c]Data for mother's education in Austria is incomplete (percentages do not add up to one).

Codes: AT, Austria; BE, Belgium; CZ, Czech Republic; DE, Germany; DK, Denmark; EE, Estonia; EL, Greece; FI, Finland; IE, Ireland; ES, Spain; FR, France; IT, Italy; LV, Latvia; LT, Lithuania; HU, Hungary; NL, The Netherlands; NO, Norway; PL, Poland; PT, Portugal; SI, Slovenia; SK, Slovakia; SE, Sweden; UK, United Kingdom.

*When data are available, these are the omitted categories in the OLS regression (5). If data are non-available, the omitted category is the next superior.

secondary education, while the distribution of the father's occupation (we do not have data for Sweden for this series) is much more homogenous across countries.[21] For example, the percentage of fathers with at least secondary education (most common in most countries) varies between 7 and 25 percent in Portugal, Spain, the U.K., Ireland, and Greece, up to the range of 70–95 percent in Slovakia, Hungary, Finland, Denmark, the Czech Republic, and Austria. Similar profiles are found for the mother's education. Regarding father's occupation, with the exceptions of Ireland, Estonia, Finland, Latvia, Greece, and the Netherlands, the most common profession (with an average of 26 percent and a standard deviation of 4.6 points) is that of "craft and related trades workers," followed by that of "plant and machine operators and assemblers," with an average of 16 percent.

Regarding the economic perception during childhood (we do not have data for Austria, France, Germany, Greece, and Portugal for this series), the most common response (on average) is "never," with 37 percent; the "rarely" and "occasionally" answers reach just over 20 percent. However, there are also important differences among countries. For example, in Belgium, Denmark, the Netherlands, Norway, and Sweden, almost 80 percent say they "never" or "rarely" had economic difficulties, while this percentage drops below 50 percent in Estonia, Italy, Lithuania, Poland, Slovakia, and Slovenia. Finally, regarding the country of birth, over 90 percent of individuals in the sample were born in their country of residence. Only Ireland has a significant percentage (nearly 10 percent) of people born in another EU country, while in the U.K., Sweden, Latvia, Slovenia, Austria, Estonia, and France, the percentage of residents born outside the EU is between 8 and 13 percent.

5. Inequality of Opportunity in Europe

In this section we first provide overall inequality and IO estimates based on the *ex-ante* parametric approach of Ferreira and Gignoux (2011) described in Section 3. In a second part, we measure the degree of correlation of inequality and IO estimates with a set of variables related to the degree of development, labor market performance, investment in human capital, and social protection spending.

5.1. *IO Estimates*

As a first step, we estimate (by OLS) the regression $\ln y = C\lambda + \varepsilon$ for each country, which relates household income (in logarithms) with the set of circumstances considered in the analysis. The reduced-form OLS regression estimates for all 23 European countries are presented in Table 2.[22] In general terms, coefficients have the expected sign.

[21]We have considered the father's occupation as the relevant circumstance for most countries, given the large group of missing observations for the mother's occupation. The exception is the U.K., where we have used the mother's occupation, because of the many missing observations for the father's occupation.

[22]When an explanatory variable's estimated coefficient is not shown, that is because there are no observations with that circumstance in the sample. As emphasized by Ferreira and Gignoux (2011), since this is a reduced-form equation, estimates cannot be interpreted causally, and coefficients would capture not only the direct effects of circumstances on income, but also the indirect effects on income through non-included circumstances or effort.

TABLE 2

Reduced-Form OLS Regression of Household Income on Circumstances

Variables	AT	BE	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE
Primary education (F)		–0.021					0.105**	0.178***		0.072**		
		(0.060)					(0.054)	(0.039)		(0.041)		
Secondary education (F)		0.012		0.175***		–0.034	0.231***	0.234***		0.091**	0.024	0.131***
		(0.059)		(0.061)		(0.068)	(0.073)	(0.053)		(0.043)	(0.039)	(0.043)
Tertiary education (F)	–0.069	0.028	0.077*	0.126**	0.015	0.131*	0.086	0.254***	0.086**	0.152***	0.047	0.061
	(0.100)	(0.067)	(0.051)	(0.063)	(0.047)	(0.083)	(0.104)	(0.064)	(0.038)	(0.052)	(0.057)	(0.059)
Primary education (M)		0.059					0.084**	0.155***		0.078**		
		(0.058)					(0.051)	(0.037)		(0.041)		
Secondary education (M)		0.137***		0.192***		0.195***	0.147**	0.237***	0.114*	0.142***	0.118***	0.179***
		(0.056)		(0.049)		(0.069)	(0.073)	(0.053)	(0.074)	(0.044)	(0.035)	(0.040)
Tertiary education (M)	–0.016	0.138**	0.100**	0.152***	–0.070	0.331***	0.365***	0.302***	0.142	0.205***	0.200***	0.149***
	(0.058)	(0.064)	(0.053)	(0.053)	(0.041)	(0.078)	(0.100)	(0.070)	(0.079)	(0.051)	(0.049)	(0.058)
Manager (F)	0.114**	0.048	0.186**	0.139***	0.068	0.216**	0.169***	0.108**	0.164***	0.202***	0.354***	0.061*
	(0.059)	(0.068)	(0.083)	(0.046)	(0.059)	(0.124)	(0.060)	(0.055)	(0.048)	(0.034)	(0.055)	(0.042)
Professional (F)	0.219**	0.025	0.227***	0.140***	0.030	0.164	0.232**	0.256***	0.067	0.150***	0.389***	0.197***
	(0.118)	(0.070)	(0.083)	(0.042)	(0.067)	(0.131)	(0.105)	(0.080)	(0.054)	(0.037)	(0.061)	(0.064)
Technician (F)	0.129***	–0.028	0.140**	0.052	0.014	0.238**	0.302***	0.329***	0.047	0.191***	0.272***	0.148**
	(0.043)	(0.072)	(0.065)	(0.041)	(0.060)	(0.135)	(0.125)	(0.063)	(0.041)	(0.034)	(0.053)	(0.087)
Clerk (F)	0.111**	0.013	0.246***	0.026	–0.013	0.304*	0.172**	0.210***	0.049	0.114***	0.202***	0.112**
	(0.053)	(0.068)	(0.089)	(0.045)	(0.075)	(0.225)	(0.085)	(0.058)	(0.083)	(0.038)	(0.062)	(0.064)
Salesman (F)	0.029	0.017	0.054	0.108**	0.031	0.344**	0.003	0.107**	0.079*	0.057	0.164***	0.122**
	(0.044)	(0.073)	(0.083)	(0.057)	(0.066)	(0.202)	(0.083)	(0.051)	(0.060)	(0.045)	(0.062)	(0.067)
Craft trade worker (F)	0.015	–0.022	0.068	0.005	–0.058	0.111	0.124***	0.055*	0.025	0.057**	0.143***	
	(0.036)	(0.060)	(0.061)	(0.037)	(0.047)	(0.113)	(0.051)	(0.038)	(0.032)	(0.026)	(0.035)	
Machine operator (F)	–0.025	–0.030	0.066	0.014	–0.050	–0.002	0.064	0.169***	0.040	0.049**	0.096***	–0.009
	(0.049)	(0.067)	(0.064)	(0.041)	(0.060)	(0.113)	(0.069)	(0.045)	(0.036)	(0.027)	(0.039)	(0.054)
Elementary occupation (F)	–0.087**	–0.039	–0.115	0.077*	–0.008	–0.050	0.005	0.043	–0.021	–0.007	–0.057*	–0.053
	(0.041)	(0.065)	(0.076)	(0.048)	(0.055)	(0.126)	(0.062)	(0.040)	(0.063)	(0.034)	(0.042)	(0.046)
Armed occupation (F)	0.528*	0.035	0.107	0.077	0.073	–0.132	0.153	0.228**	0.220**	0.148***	0.172**	–0.031
	(0.361)	(0.093)	(0.130)	(0.083)	(0.157)	(0.190)	(0.181)	(0.092)	(0.132)	(0.046)	(0.081)	(0.105)
Difficulties most of the time		–0.381***	–0.210***		–0.032	–0.158		–0.088**	0.006		–0.104***	–0.271***
		(0.066)	(0.066)		(0.098)	(0.126)		(0.045)	(0.056)		(0.038)	(0.059)
Difficulties often		–0.147***	–0.079**		0.031	–0.123**		–0.098**	–0.031		–0.086***	–0.292***
		(0.053)	(0.045)		(0.071)	(0.067)		(0.042)	(0.043)		(0.031)	(0.058)
Difficulties occasionally		–0.139***	–0.034		0.040	0.032		–0.162***	0.017		–0.015	–0.149***
		(0.036)	(0.031)		(0.040)	(0.048)		(0.031)	(0.028)		(0.031)	(0.039)
Difficulties rarely		–0.082**	0.001		0.022	0.073*		–0.051**	–0.005		–0.020	–0.134***
		(0.037)	(0.031)		(0.037)	(0.052)		(0.030)	(0.028)		(0.026)	(0.037)
EU	0.026	–0.084**	0.053		0.178		0.132	–0.349***	0.016	–0.021	0.034	–0.140
	(0.067)	(0.050)	(0.091)		(0.151)		(0.113)	(0.046)	(0.101)	(0.039)	(0.174)	(0.048)
Other	–0.286***	–0.348***	–0.310***	–0.110***	–0.090	–0.056	–0.495***	–0.673***	–0.218**	–0.238***	–0.068	–0.254***
	(0.040)	(0.049)	(0.126)	(0.040)	(0.102)	(0.061)	(0.067)	(0.159)	(0.109)	(0.031)	(0.068)	(0.073)
Constant	9.765***	9.754***	8.336***	9.402***	10.049***	7.726***	8.934***	8.960***	9.654***	9.470***	7.917***	9.918***
	(0.029)	(0.067)	(0.061)	(0.068)	(0.040)	(0.124)	(0.039)	(0.041)	(0.077)	(0.044)	(0.041)	(0.040)
Observations	2155	1838	1589	4255	1241	1377	2126	5389	1980	3725	2590	1449
R-squared	0.05	0.11	0.06	0.02	0.01	0.09	0.07	0.08	0.03	0.09	0.12	0.15

Variables	IT	LT	LV	NL	NO	PL	PT	SE	SI	SK	UK
Primary education (F)	0.186***	0.371***				0.067	0.219***		0.176**		
	(0.032)	(0.105)				(0.055)	(0.041)		(0.087)		
Secondary education (F)	0.227***	0.377***	0.229**	0.069**		0.087*	0.365***	–0.057	0.246***	0.006	0.140***
	(0.037)	(0.110)	(0.108)	(0.030)		(0.058)	(0.086)	(0.050)	(0.088)	(0.073)	(0.051)
Tertiary education (F)	0.371***	0.511***	0.417***	0.162***	–0.020	0.094	0.728***	0.083*	0.210**	0.076	0.191***
	(0.068)	(0.126)	(0.146)	(0.041)	(0.040)	(0.086)	(0.149)	(0.064)	(0.109)	(0.086)	(0.046)
Primary education (M)	0.127***	–0.023				0.057	0.116***	–0.100	–0.126**		
	(0.028)	(0.096)				(0.052)	(0.038)	(0.140)	(0.074)		
Secondary education (M)	0.191***	0.012	0.113	0.017		0.210***	0.179**	–0.015	–0.062	0.089	0.171***
	(0.034)	(0.101)	(0.105)	(0.028)		(0.054)	(0.101)	(0.145)	(0.077)	(0.070)	(0.044)
Tertiary education (M)	0.275***	0.256**	0.201*	–0.021	0.031	0.344***	0.308***	–0.060	–0.064	0.184**	0.122***
	(0.080)	(0.110)	(0.130)	(0.046)	(0.040)	(0.072)	(0.111)	(0.150)	(0.096)	(0.085)	(0.049)
Manager (F)	0.075**	0.288**	0.242	0.011	0.010	0.257***	0.385***		0.284***	0.151**	0.247***
	(0.038)	(0.126)	(0.210)	(0.033)	(0.072)	(0.064)	(0.068)		(0.077)	(0.075)	(0.103)
Professional (F)	0.087*	0.127	0.271*	–0.013	0.015	0.439***	0.256*		0.127*	0.188***	0.185**
	(0.063)	(0.124)	(0.209)	(0.043)	(0.079)	(0.077)	(0.159)		(0.087)	(0.079)	(0.104)
Technician (F)	0.098***	0.165	0.277*	0.074**	–0.001	0.257***	0.446***		0.173***	0.178***	0.112
	(0.042)	(0.149)	(0.211)	(0.037)	(0.068)	(0.050)	(0.092)		(0.057)	(0.071)	(0.108)
Clerk (F)	0.055	0.396***	–0.290	0.088**	0.152*	0.204***	0.287***		0.088*	0.193**	0.007
	(0.045)	(0.161)	(0.303)	(0.046)	(0.095)	(0.063)	(0.079)		(0.065)	(0.088)	(0.123)
Salesman (F)	–0.023	0.401***	0.240	–0.095**	–0.018	0.085	0.331***		0.115**	0.144*	0.179*
	(0.049)	(0.169)	(0.255)	(0.055)	(0.094)	(0.072)	(0.073)		(0.063)	(0.088)	(0.122)
Craft trade worker (F)	0.001	0.153*	0.104		–0.038	0.132***	0.125***		0.008	0.103*	0.083
	(0.030)	(0.097)	(0.180)		(0.064)	(0.031)	(0.043)		(0.044)	(0.066)	(0.098)
Machine operator (F)	0.102***	0.015	0.181	0.004	0.038	0.140***	0.100**		0.029	0.080	0.085
	(0.034)	(0.099)	(0.179)	(0.042)	(0.070)	(0.034)	(0.055)		(0.043)	(0.067)	(0.100)
Elementary occupation (F)	–0.138***	–0.035	0.113	–0.022	0.003	0.031	0.127**		0.009	0.001	0.043
	(0.034)	(0.099)	(0.191)	(0.058)	(0.177)	(0.041)	(0.056)		(0.058)	(0.069)	(0.102)
Armed occupation (F)	0.182***	0.094	0.156	–0.032	–0.076	0.350***	0.534***		0.243**		
	(0.067)	(0.243)	(0.273)	(0.095)	(0.183)	(0.089)	(0.139)		(0.134)		
Difficulties most of the time	–0.195***	–0.150**	–0.023	–0.154**	–0.045	–0.240***		0.129	0.010	–0.006	–0.105*
	(0.033)	(0.083)	(0.136)	(0.072)	(0.129)	(0.043)		(0.107)	(0.049)	(0.070)	(0.064)
Difficulties often	–0.165***	–0.042	0.006	–0.057*	–0.033	–0.162***		0.037	0.026	–0.017	–0.003
	(0.030)	(0.066)	(0.096)	(0.045)	(0.091)	(0.034)		(0.088)	(0.042)	(0.069)	(0.058)
Difficulties occasionally	–0.081***	–0.028	–0.043	–0.056**	–0.105**	–0.056**		0.030	0.024	–0.054	0.072**
	(0.027)	(0.054)	(0.073)	(0.032)	(0.053)	(0.027)		(0.061)	(0.038)	(0.069)	(0.043)
Difficulties rarely	–0.063**	0.013	0.022	–0.021	–0.056*	–0.046*		0.021	0.067	–0.062	–0.043
	(0.029)	(0.060)	(0.080)	(0.028)	(0.039)	(0.031)		(0.050)	(0.040)	(0.073)	(0.042)
EU	–0.454***	0.006		0.107	0.105		–0.173*	–0.155*		0.165*	–0.005
	(0.073)	(0.340)		(0.099)	(0.092)		(0.129)	(0.096)		(0.105)	(0.228)
Other	–0.270***	0.006	–0.127*	–0.213***	–0.372***	–0.369*	–0.147*	–0.473***	–0.179***	–0.138	–0.225***
	(0.037)	(0.089)	(0.088)	(0.055)	(0.083)	(0.282)	(0.101)	(0.083)	(0.043)	(0.158)	(0.052)
Constant	9.356***	7.139***	7.235***	9.734***	10.178***	7.543***	8.543***	9.828***	8.942***	7.772***	9.751***
	(0.040)	(0.143)	(0.201)	(0.034)	(0.058)	(0.040)	(0.036)	(0.141)	(0.082)	(0.101)	(0.096)
Observations	8638	1702	1159	1695	1423	6055	1654	1342	1393	2293	1874
R-squared	0.07	0.10	0.05	0.04	0.03	0.08	0.20	0.04	0.08	0.04	0.08

Notes: Sandard errors in parenthesis.
*Significant at 10%; **significant at 5%; ***significant at 1%.
Omitted categories are: less than primary education; skill agricultural, forestry and fishery worker; never; local.
Codes: See Table 1.
United Kingdom: occupation variables refer to mother's occupation.
M, Mother; F, Father.

The parents' education is positively correlated with children's income, which increases with the educational level of the father and/or the mother. In general, with respect to the omitted category (parents with less than primary education), results are specially significant and robust when parents attain at least secondary or tertiary education. Both variables, father's education and mother's education, are highly significant in France, Germany, Greece, Italy, Portugal, Spain, and the U.K. However, for some countries (Belgium, Estonia, Hungary, Ireland, Poland, and Slovakia), the education attained by the mother seems to be more significant than the education attained by the father, while the opposite is true in Latvia, Lithuania, the Netherlands, Sweden, and Slovenia.

Regarding the occupation of the father, and taking "workers in the farming, forestry and fishing" sectors as a reference, all of the remaining occupations tend to be positively correlated with the individual's income. The exception is that of the "elementary occupation" concept, whose relative correlation is sometimes negative, although just significant for Austria, Hungary, and Italy. Among the alternative occupations, the most robust results are found for the "managers" category, followed by that of "technicians and professionals," although some exceptions can be found in Belgium, Denmark, the Netherlands, and Norway.

The perception of having "financial difficulties during the childhood years" is negatively correlated with household income. Since the omitted category is that the individual "never had difficulties," most of the estimated coefficients for all other categories are negative, though the number of significant coefficients associated with these categories is smaller than those found for the parents' education variables. Finally, a circumstance that also tends to be negatively correlated with household income is that of having roots outside the country of residence, especially if the country of origin is not European. Given the reference category "be born in the country of residence," being from another EU country is insignificant in most cases (except for Belgium, Italy, Portugal, and Spain, where it is negative, and Slovakia, where it is positive), while being born outside the EU is a significant and negative circumstance.

Now, Table 3 shows the main results for income inequality (Theil 0) and IO for the 23 European countries considered. The first row contains the estimates of overall inequality, the second row the IO estimates, the third provides the relative IO measure, i.e., the IO to total inequality ratio, the fourth and the fifth rows show the position of each country (from lowest to highest) by Theil 0 and IO, respectively, and the last row provides the number of observations used to calculate these indexes. Moreover, we show below each estimate the corresponding standard error estimated by bootstrapping (Davison and Hinkley, 2005).

Since the database is homogenous, the set of circumstances (for most countries) and the sample design are common to all countries, and our inequality measures can be used to compare cross-country differences in terms of (absolute and relative) IO. First, it is worth noting that, despite the specific characteristics of our selected sample (recall from the previous section) and the fact that we use the Theil 0 index, the ranking of our overall inequality estimates is quite similar to that published by Eurostat using the Gini coefficient. In fact, their linear coefficient of correlation is 0.92. According to the Eurostat Gini index in 2005, the lowest inequality is observed in Sweden, Denmark, and Slovenia, with Gini levels of

TABLE 3

Indices of Total Inequality, Absolute IO, and Relative IO in Europe (2005)

Index	AT	BE	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE
Theil 0	0.1181	0.1031	0.1196	0.1305	0.0689	0.1985	0.2127	0.2144	0.1160	0.1096	0.1314	0.1611
	(0.0062)	(0.0075)	(0.0079)	(0.0052)	(0.0083)	(0.0115)	(0.0126)	(0.0087)	(0.0066)	(0.0035)	(0.0074)	(0.0084)
IO	0.0060	0.0123	0.0070	0.0027	0.0013	0.0218	0.0230	0.0286	0.0038	0.0097	0.0152	0.0242
	(0.0012)	(0.0032)	(0.0016)	(0.0006)	(0.0009)	(0.0047)	(0.0034)	(0.0028)	(0.0011)	(0.0011)	(0.0018)	(0.0031)
Ratio (%)	5.08	11.93	5.85	2.07	1.89	10.98	10.81	13.34	3.28	8.85	11.57	15.02
	(0.97)	(2.44)	(1.26)	(0.46)	(0.96)	(1.95)	(1.55)	(1.13)	(0.88)	(1.00)	(1.35)	(1.88)
T0 position	9	4	10	12	1	17	18	19	7	6	13	14
IO position	7	12	8	2	1	16	18	21	3	11	13	19
N	2155	1838	1589	4255	1241	1377	2126	5389	1980	3725	2590	1449

Index	IT	LT	LV	NL	NO	PL	PT	SE	SI	SK	UK
Theil 0	0.1874	0.2482	0.2995	0.0884	0.1169	0.2649	0.2264	0.1095	0.0873	0.1251	0.1952
	(0.0065)	(0.0144)	(0.0242)	(0.0052)	(0.0118)	(0.0078)	(0.0113)	(0.0152)	(0.0059)	(0.0068)	(0.0115)
IO	0.0220	0.0358	0.0213	0.0041	0.0048	0.0272	0.0503	0.0087	0.0084	0.0045	0.0199
	(0.0023)	(0.0065)	(0.0078)	(0.0011)	(0.0033)	(0.0030)	(0.0061)	(0.0054)	(0.0016)	(0.0013)	(0.0034)
Ratio (%)	11.74	14.42	7.11	4.64	4.11	10.27	22.22	7.95	9.62	3.60	10.19
	(1.05)	(2.15)	(2.45)	(1.13)	(2.48)	(0.99)	(2.22)	(3.81)	(1.85)	(0.96)	(1.61)
T0 position	15	21	23	3	8	22	20	5	2	11	16
IO position	17	22	15	4	6	20	23	10	9	5	14
N	8638	1702	1159	1695	1423	6055	1654	1342	1393	2292	1874

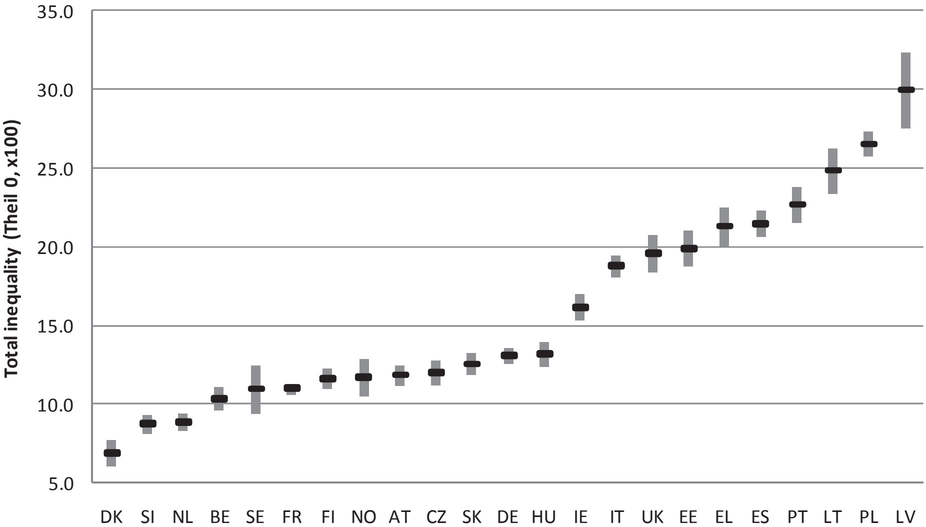

Figure 1. Total Inequality in Europe (2005) (Theil 0 index)

0.23–0.24, closely followed by the Czech Republic, Finland, Germany, Austria, Slovakia, the Netherlands, Hungary, France, Belgium, and Norway, with Gini estimates between 0.26 and 0.28.[23] All other European countries present clearly higher Gini indexes (at least 15 percent higher), between the 0.32 of Ireland and Spain and the highest levels of 0.36–0.38 in Poland, Lithuania, Latvia, and Portugal.

Figure 1 shows our Theil 0 estimates, together with the estimated bootstrapped standard deviations (using one standard deviation around the point estimate). Countries are sorted from lowest to highest Theil 0 estimates. We can see clearly that the two main groups (low- and high-inequality countries) are equivalent to those provided by Eurostat, though there are some minor differences when looking inside each group.[24] Nevertheless, considering the fact that some confidence intervals overlap, these within-group differences are in some cases not relevant.

As noted in Section 2, we could apply a partial ordering to measure IO. The advantage of an ordinal criterion is that comparisons of IO between countries would be more robust. However, an ordinal criterion will be not conclusive in many cases.[25] For this reason, we opted to compute a complete ordering based on

[23]Data from Eurostat 2005, in the "Living Conditions and Welfare Statistics" section (Gini coefficients): http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_di12&lang=en.

[24]The group of low-inequality countries is: Sweden, Slovenia, Denmark, Czech Republic, Finland, Germany, Australia, Slovakia, Netherlands, Hungary, France, Belgium, and Norway. The group of high-inequality countries is: Spain, Ireland, Italy, Greece, Estonia, the U.K., Poland, Latvia, Lithuania, and Portugal.

[25]For example, if there is no first and second stochastic dominance when applying the method proposed in Peragine (2004) and Lefranc *et al.* (2009), or if inequality-of-opportunity curves cross when applying the method proposed in Rodríguez (2008), we would be unable to conclude which country presents a higher IO.

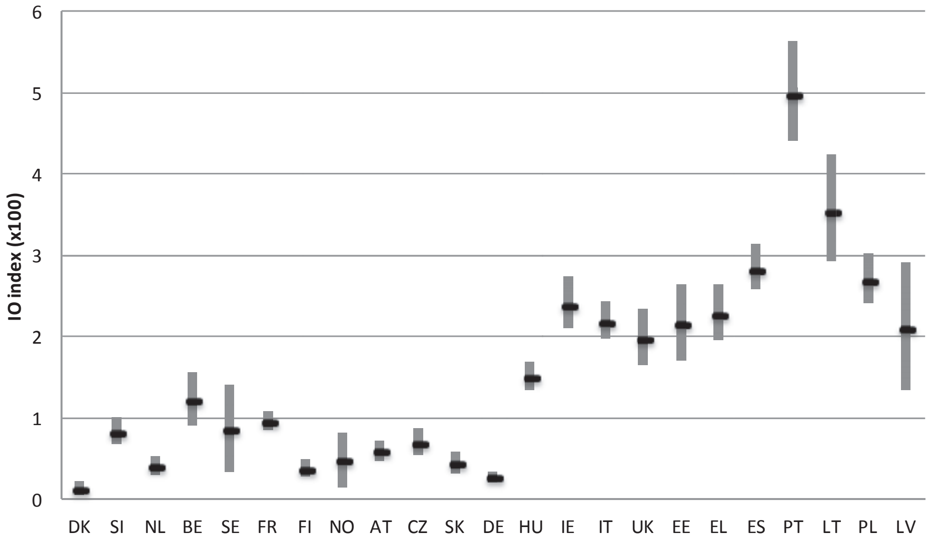

Figure 2. Absolute Inequality of Opportunity in Europe (2005) (Theil 0 index)

the mean logarithmic deviation, thus enabling us to compare the IO for all countries. Nevertheless, we have considered in our comparisons the fact that some intervals overlap.

Figure 2 shows the IO estimates together with their standard deviations. For comparative purposes, we show in the figure the same order of countries as in Figure 1. As was the case when comparing Theil 0 estimates, IO confidence intervals overlap for some countries. As a first result, we find again two main groups of countries, which basically coincide with those groups of overall inequality: low-IO countries (Denmark, Germany, Sweden, Finland, the Netherlands, Belgium, Slovenia, France, Czech Republic, Austria, Slovakia, Hungary, and Norway) and high-IO countries (Latvia, Poland, Lithuania, Portugal, Spain, Greece, the U.K., Estonia, Italy, and Ireland).[26] The first group basically comprises Nordic, Continental, and some Easter countries. In contrast, the second group basically consists of Mediterranean, Atlantic, and some other Eastern countries.

We find numerous similarities when comparing these results with previous studies. Based on a heterogeneous database of 11 countries and different years constructed by Roemer *et al.* (2003), Rodríguez (2008) and Lefranc *et al.* (2009) applied their proposals.[27] In general terms, these authors find that Italy and Spain are the countries with the highest IO, the Netherlands, Belgium, France, and the U.K. present an intermediate IO, while Denmark, Sweden, Norway, and Germany

[26]Note that the small IO measure found for Denmark is consistent with the fact that circumstances are not significant in the regression shown in Table 2.

[27]Roemer *et al.* (2003)'s database contained information on the following countries: 1991 data for Great Britain, Spain, Sweden, and the United States; 1992 data for Belgium; 1993 data for Denmark and Italy; 1994 data for France and West Germany; and 1995 data for the Netherlands and Norway.

are the countries with the lowest IO.[28] As a conclusion, considering the results of previous studies together with our results, we can say that the IO ranking of European countries has changed little in the last 15 years.

Although intervals overlap in some cases, we note that some countries' ranks change significantly depending on whether overall inequality or IO is considered. For example, Sweden, Slovenia, Belgium, France, Hungary, Ireland, and Portugal rank worse in terms of IO than total inequality, while the opposite is true for Finland, Germany, Latvia, and Slovakia.

Lastly, we comment on the results for the relative IO, i.e., the IO to total inequality ratio (see Table 3). We first notice that the percentage of total inequality represented by IO in Europe is on average approximately 9 percent, ranging from 2 percent in Denmark to 22 percent in Portugal.[29] In this respect, it is worth recalling that the addition of more circumstances would increase the relative importance of the IO component. Therefore, the relative IO estimates are dependent on data availability. Comparing absolute with IO ratio estimates, most countries maintain their relative position. Exceptions are Slovenia, Hungary, Ireland, and Belgium which worsen significantly, and Latvia, Greece, and Poland which perform better.

5.2. *Correlation Analysis*

There exists an extensive literature studying the determinants of income inequality. Among those studies, we find relevant for our proposal the analysis in Perugini and Martino (2008). These authors explain aggregate inequality differences in Europe by considering factors related to the degree of development, labor market performance, investment in human capital, and social protection spending. Following this approach, we measure the correlation between certain indicators related to the factors above and our measures of inequality (total and IO). Although we are aware that our limited sample prevents us from carrying out a quantitative analysis of the determinants of IO, we consider it instructive to show these correlations.[30]

We consider a variety of indicators that reflect a country's level of development: the PPP-adjusted per capita GDP, and the percentage of jobs concentrated in the agriculture and in the service sector. With respect to the labor market, we use the employment rate (total and female) and the unemployment rate (total and the

[28]Rodríguez (2008) finds that Denmark dominates all other economies in terms of the inequality-of-opportunity curve, while our results show that Denmark is by far the country with lowest IO in Europe.

[29]In this respect, note that Checchi and Peragine (2010) computed an IO ratio below 10 percent for Italy, while Ferreira and Gignoux (2011) found percentages between 20 and 33 percent for six Latin American countries (Brazil, Colombia, Ecuador, Guatemala, Panama, and Peru) when using the income variable.

[30]Total inequality and IO are highly persistent variables and, for this reason, their past levels might cause past or present levels of education, economic development, or social public expenditures. In addition, omitted variables, such as the quality of institutions or the initial economic efficiency, might affect all variables. It is thus needless to say that reversed causation and omitted bias problems are impossible to address when considering a cross-section regression with just 23 observations. We acknowledge this point to an anonymous referee.

TABLE 4
CORRELATION OF OVERALL INEQUALITY AND IO WITH ALTERNATIVE INDICATORS

	Lag Correlation* (1998 vs. 2005)		Contemporaneous Correlation* (2005 vs. 2005)	
Development indicators	Theil 0	IO	Theil 0	IO
GDP	–0.6240	–0.4679	–0.5772	–0.4421
% empl. Agric.	0.7287	0.5754	0.6761	0.6289
% empl. Serv.	–0.5135	–0.4653	–0.4812	–0.4758
Education indicators	Theil 0	IO	Theil 0	IO
Second.attained (total)	–0.2072	–0.5855	–0.2177	–0.5972
Second.attained (female)	–0.1493	–0.5228	–0.1515	–0.5333
Tertiary-upper attained (total)	–0.0032	0.0772	0.3697	0.2280
Early leaves	0.5333	0.7852	0.3595	0.6620
Labor market indicators	Theil 0	IO	Theil 0	IO
Employment rate	–0.3585	–0.3007	–0.4020	–0.2678
Employment rate (female)	–0.3610	–0.3810	–0.4248	–0.3638
Unemployment rate	0.5234	0.2790	0.3596	0.1311
Long-run unemployment	0.4485	0.4604	0.2748	0.2142
Social public expenditures items	Theil 0	IO	Theil 0	IO
Total	–0.6746	–0.6049	–0.6222	–0.4181
Social protection, total	–0.6689	–0.6403	–0.6245	–0.4346
Unemployment	–0.5649	–0.4365	–0.4531	–0.2750
Old persons	–0.2115	–0.3355	–0.3104	–0.2079
Health	–0.7539	–0.5517	–0.6587	–0.3617
Social exclusion	–0.6111	–0.5422	–0.6271	–0.5624
Disability	–0.4391	–0.4184	–0.5061	–0.4063
Child care	–0.6507	–0.6994	–0.6827	–0.6565

Notes: *Lag correlation: Corr.(Ineq.1998, Indicator2005); Contemporaneous correlation: Corr.(Ineq.2005, Indicator2005).

long-term rate). We also consider standard variables for measuring education: the population with at least a secondary level of education (total and female) and with at least a university degree (both as a percentage of the population older than 15), and the percentage of the population between the ages of 18 and 24 without a secondary education degree (dropouts). Finally, we consider the total spending on social protection, as well as their various outlays including child care, disability, social exclusion, health care, pensions, and unemployment (all measured as a percentage of GDP). The sources used for these variables and their descriptive statistics are shown in the Appendix.

Table 4 shows contemporaneous (i.e., inequality and indicators are both measured in 2005) and lagged (i.e., inequality is measured in 2005 and indicators in 1998) cross-correlations of total inequality and IO with respect to all the indicators commented above. Although the differences between cross-lagged and contemporaneous correlations are generally small because of the persistence of inequality and IO, several cases are worth noting. For example, the lagged correlation is clearly superior in magnitude to the contemporary one for the cases of overall and long-term unemployment rate, education dropouts, expenditures on social protection, unemployment, and health care expenditures. We focus on lagged correlations hereinafter.

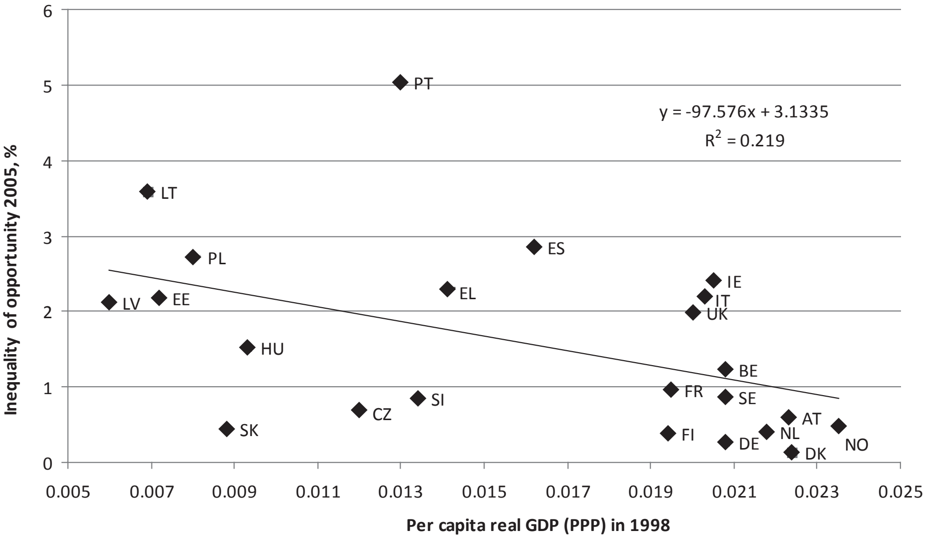

Figure 3. Development and IO in Europe

The correlations between both measures of inequality and development indicators are negative.[31] This negative correlation is explicitly shown in Figure 3, which represents the scatter plot between IO and per capita real GDP. Information in this figure can be used to show differences across countries in IO levels for a given degree of development. First, Eastern European countries with higher per capita GDP (Hungary, Slovakia, the Czech Republic, and Slovenia) are well below the regression curve, meaning that their IO levels are below what would be associated with their levels of development. However, poorer Eastern EU countries (Estonia, Latvia, Poland, and especially Lithuania) do not perform so well. Focusing on the richest Western countries, there are three clearly distinguishable groups: Denmark, Finland, Austria, Germany, Norway, and the Netherlands, whose IO levels are less than expected based on their levels of development; the U.K., Italy, Ireland, Spain, and especially Portugal, whose IO levels are clearly higher than expected; and Sweden, France, Belgium, and Greece, which are very close to the regression line. Despite having highlighted certain geographical patterns among European countries, an explanation of the differences in total inequality and IO between these countries is clearly a challenging and promising extension of this paper.

Regarding labor market indicators, we find negative correlations with total inequality and IO, although they are the weaker among all analyzed. For example, IO is poorly correlated with the overall unemployment rate (0.3), while its correlation with long-term unemployment reaches 0.5.[32] This weakness is consistent

[31]Note that the correlation with the share of employment in the agriculture sector is positive, but this indicator must be taken as one of non-development.

[32]We have also calculated correlations between IO and part-time employment, temporary employment, self-employment, and selected unemployment rate gaps, and they are close to zero. We do not show these results in the table.

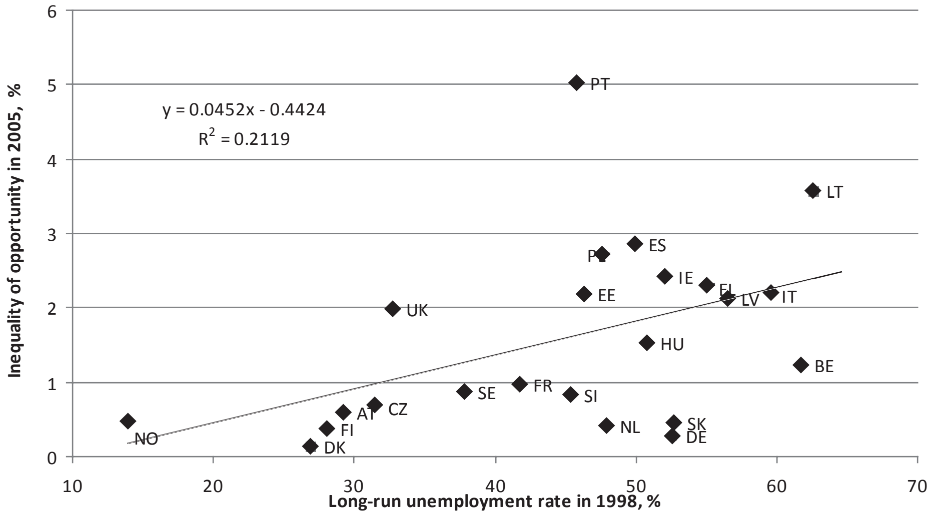

Figure 4. Long-Run Unemployment Rate and IO in Europe

with the theory, which emphasizes the complexity and inconclusiveness of this relationship (Burniaux *et al.*, 2006). For illustrative purposes, Figure 4 shows the scatter plot between IO and the long-term unemployment rate.

With respect to education variables, total inequality and IO are negatively correlated with the attainment of secondary level of education and positively with dropouts, while they are weakly correlated with the attainment of tertiary and upper education levels. For the secondary level of education and dropouts, correlations are clearly higher for IO than for total inequality. Figure 5 shows the scatter plot between dropouts and IO. The fit is clearly positive (the largest among educational variables) and, when compared with other scatter plots, we note the good fit for Portugal.[33]

Finally, with respect to social protection expenditures, all items are negatively correlated with total inequality and IO. It is worth noting that, for all social expenditure concepts, small differences between IO and Theil 0 correlations are observed. For illustrative purposes, Figure 6 shows the scatter plot between total social protection spending (as a percentage of GDP) and IO. The fit is clearly negative and significant. An additional finding is that some items among those included in social protection expenditures are more correlated with inequality and IO than others. In particular, social exclusion, health care, and especially child care expenditures are highly correlated with both inequalities, overall and IO.

[33]We are aware that Portugal is affecting our correlations between educational variables and IO. For example, the correlation between dropouts and IO is 0.7852 when including Portugal (Table 4), while this correlation decreases to 0.6309 when excluding Portugal. However, dropping Portugal from the sample does not change the main findings: correlations are higher (in absolute terms) for IO than for total inequality, the sign of the correlations is maintained, and dropouts is the variable of education most correlated with IO.

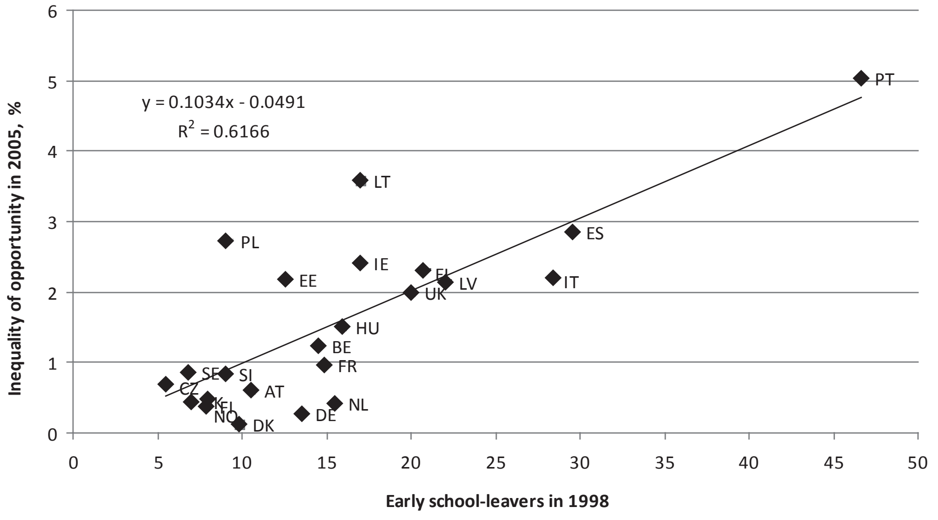

Figure 5. Education Dropouts and IO in Europe

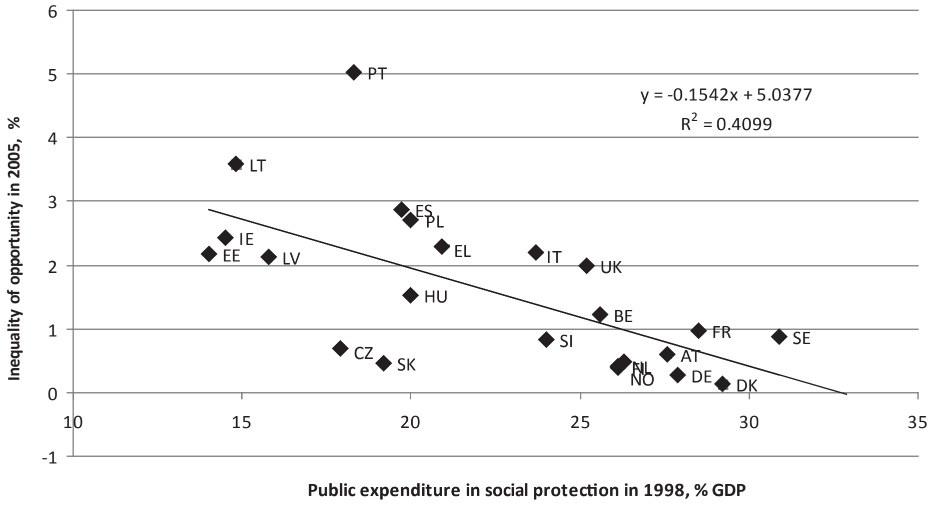

Figure 6. Public Expenditure in Social Protection and IO in Europe

6. Concluding Remarks

The modern theories of justice recognize an individual's income as being a function of the effort made and of the initial circumstances affecting the individual. Moreover, they state that only the reduction of IO would contribute to a fairer society in terms of social equality. For this to happen, a public policy must be implemented that, far from simply redistributing income, provides every individual with the same initial conditions without modifying the economic incentives to maximize effort.

Using the EU-SILC database, we have estimated the Inequality of Opportunity (IO) for 23 European countries in 2005. When comparing our IO results with previous findings (obtained from heterogeneous databases), we observe a high persistence of the IO levels and rankings between countries: Nordic, continental, and some Eastern countries are low-IO countries, while the Mediterranean, Atlantic, and some other Eastern countries are high-IO countries. Understanding the main factors (institutional, political, cultural, etc.) behind the persistence of such country differences constitutes one of the main challenges in the agenda of the inequality-of-opportunity analysis.

As a modest first attempt to understand some reasons behind observed IO differences in Europe, we have calculated the degree of correlation between IO estimates and a set of economic factors related to the degree of development, labor market performance, investment in human capital, and social protection spending. First, we show that development and labor market variables are negatively correlated with inequality and IO, though those correlations with the labor market variables are weak. In more development economies with a less regulated and better functioning labor market, we expect individual wages to be more related to personal effort and merits than to individual circumstances. Second, education dropouts and reaching secondary education levels are highly negatively correlated with inequality and especially with IO, while the correlation with the attainment of tertiary education is close to zero. High levels of education may contribute to reduce the role of parental socio-economic conditions, hence we would expect countries with lower education dropouts and higher secondary education levels to be also characterized by lower IO.

Finally, we have shown that total social protection expenditures are negatively correlated with total inequality and IO. In general, any concept of public welfare would help to reduce income inequality, though not all items of welfare expenditure are equally correlated. For example, spending to reduce social exclusion and on child and health care are greatly correlated with IO. A tentative explanation of the significant negative correlation between overall welfare expenditures and IO is that welfare provision favors low incomes which, in general, present worse circumstances.

It is clear from the above that future research on equality of opportunity should also focus its attention on developing a formal theoretical framework which explicitly specifies the IO factors and its channels of causality.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table A1: Descriptive Statistics for the lndependent Vrariables