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Inequality of opportunity in Italy

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Abstract In this paper we provide a methodology to measure opportunity inequality and to decompose overall income inequality in an "ethically offensive" and an "ethically acceptable" part. Moreover, we analyze inequality of opportunity in Italy. According to our results, inequality of opportunity accounts for about 20% of overall income inequality in Italy. Moreover, the regions in the South are characterized by a higher degree of opportunity inequality than the regions in the North, especially when considering population subgroups by gender.

Keywords Inequality of opportunity · Income inequality · Intergenerational mobility

1 Motivation

Equality of opportunity (EOp) seems to be the prevailing conception of social justice in Western liberal societies [30]. Indeed, this idea has been defended and put forward by a number of scholars in recent years, both in the area of political philosophy and normative economics (see [2, 9, 12, 13, 17, 28, 29]). According to the opportunity

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egalitarian view, the principle of justice does not require equality of individuals' final achievements; once the means or opportunities to reach a valuable outcome have been equally distributed, which particular opportunity, from those open to her, the individual chooses, is outside the scope of justice.

The theory of equality of opportunity poses two different economic issues: the first is the problem of measuring the degree of opportunity inequality in a society; the second is the design of a public policy intended to implement the EOp view. The focus of the present paper is on the former issue.

The analysis of opportunity inequality in a society, in addition to being interesting *per se*, has also an instrumental value, for several reasons. First, studying the opportunity inequality in a given country can help to understand the economic and institutional mechanisms that generate existing income inequalities. Second, opportunity inequality, rather than income inequality, can be strongly related to aggregate economic performance: it has been suggested [5, 34] that the existence of strong and persistent inequalities in the initial opportunities open to individuals can generate true inequality traps that, in turn, represent severe constraints to the future perspectives of growth of an economy.[1] Finally, social attitudes towards redistributive policies may be affected by the knowledge, or the perception, of the origin of income inequalities [1]: existing surveys show that most people judge income inequalities arising from different levels of effort as less objectionable than those due to exogenous circumstances as race, family origin, etc.. Hence, showing that a large amount of existing inequalities is due to unequal ex ante opportunities may increase the support for redistributive policies.

Nevertheless, it is a common practice among economist to evaluate social inequities by looking at the degree of income inequality or, alternatively, at the degree of income poverty in a society. One reason for this is that measuring opportunity inequality is not an easy task. In general, income (or consumption) levels are observable, while opportunities are not. In addition to data limitation, the theory of opportunity inequality measurement is still in its infancy and different, often conflicting, approaches have been proposed. See, among others, Bourguignon et al. [4], Checchi et al. [8], Dardanoni et al. [10], Ferreira and Gignoux [14], Goux and Maurin [20], Lefranc et al. [21], Moreno-Ternero [22], Peragine [23–25], Peragine and Serlenga [26], Ruiz-Castillo [31] and Villar [33].

The present paper has two objectives. The first is to propose a theoretically sound methodology to measure opportunity inequality: we propose a non parametric approach in order to measure opportunity inequality and to decompose overall income inequality into an ethically acceptable component and an ethically unacceptable component. The second goal is to provide an empirical application of these new evaluation tools and to show how they compare with standard methods of income inequality measurement. In the empirical section of the paper we study the degree of inequality of opportunity for earnings acquisition in Italy. To the best of our knowledge, this is the first analysis of opportunity inequality in Italy. We believe that our study is able to shed some light on aspects otherwise undetected and undetectable by previous distributional analysis.

[1] Indeed, an empirical analysis of the relation between opportunity inequality and growth is an interesting task for future research.

The paper is structured as follows. Section 2 provides a unified framework for the measurement of opportunity inequality. Section 3 suggests two different approaches, the ex ante and the ex post approaches, and underlines the existence of a possible tension between the two. Section 4 reports the design and the results of the empirical analysis. Section 5 concludes.

2 A unified framework for opportunity inequality

Recent work in the field of axiomatic normative theory[2] has shown that the ideal of EOp can be decomposed into two distinct and sometimes conflicting ethical principles: the first, egalitarian in spirit, states that differences in individual achievements which can be unambiguously attributed to differences in factors beyond the individual responsibility (call them *circumstances*), are inequitable and ought to be compensated by society; this is called the principle of compensation. On the other hand, differences of achievements which can be attributed to factors within the personal responsibility (*effort*, for short) are equitable and should not to be compensated; this is called the principle of natural reward [16].

While these principles have been introduced and studied mainly in the context of fair division models or welfare analysis, they can be reinterpreted in a pure inequality context: in this context they justify a version of opportunity egalitarianism which combines inequality aversion along the dimension of circumstances and no inequality aversion along the dimension of effort.[3]

The model we use is the following. Each individual in our society is completely described by a list of traits, which can be partitioned into two different classes: the first class includes traits beyond the individual responsibility, represented by a person's vector of circumstances $\mathbf{c}$; examples of circumstances are race, gender, family background, etc. The individual sets of circumstances belong to a finite set $\Omega = \{\mathbf{c}_1, ..., \mathbf{c}_n\}$. For example, suppose that the only circumstances are race, which can only take values in the set $\{black, white\}$, and parental education,[4] that only takes values in the set {graduate parents, non graduate parents}; in this case the set Ω would be the following: $\Omega = (\{$black, non graduate parents$\}, \{$black, graduate parents$\}, \{$white, non graduate parents$\}, \{$white, graduate parents$\})$.

The second class includes factors for which the individual is fully responsible and is represented by a scalar variable, *effort*, $e \in \Theta$. Different from circumstances, we assume that effort is one-dimensional. While in principle we agree that people may engage in raising their income using different traits of their endowments (say: creativity, endurance, loyalty, and so on), in practice none of these traits can be directly observed, and we need to replace them with observable proxies. As a

[2]This literature started with Bossert [3] and Fleurbaey [16]. For a recent survey see Fleurbaey [17].

[3]There is an alternative, more libertarian approach to EOp, which focuses on trying to avoid redistribution along the dimension of effort and therefore measures inequalities of treatment rather than outcome along this dimension. This approach requires information about income transfers and we will not study it here. See Fleurbaey [17].

[4]In the empirical application we shall consider only one circumstance, represented by parental education.

consequence we prefer to restrict the dimensionality of effort. It is important to notice that by effort in this paper we mean not only the extent to which a person exerts himself, but all the other background traits of the individual that might affect his success, but that are excluded from the list of circumstances.

Clearly, different partitions of the individual traits into circumstances and effort correspond to different notions of equality of opportunity. Income is generated by a function $g : \Omega \times \Theta \to \mathbb{R}_+$, that assigns individual incomes to combinations of effort and circumstances:

$$x = g(\mathbf{c}, e).$$

Hence, this is a pure deterministic model, where for any given existing circumstances any variation in individual income is attributed to personal effort. We therefore deviate from standard Mincerian models of income generation, where incomes are explained by circumstances, proxies for effort and a random component which is typically assumed to be i.i.d.. In our analysis, the individual is held responsible for any random component that may affect his/her income (included native ability or talent, as long as they are not included in the vector of circumstances).

Circumstances include a vast list of income generating inputs that are out of control of the individual, like gender, age, ethnicity, region of residence or parental background. As far as this last variable, we can identify alternative channels through which parents may affect the income generating capacity of their children (see Dardanoni et al. [10]):

a) provision of social connections which are relevant in the labour market;
b) formation of beliefs, preferences and skills in children, through family culture and investment;
c) genetic transmission of native ability.

Clearly, various notions of equality of opportunity correspond to different choices of which of these channels are to be regarded as circumstances. In the sequel, on the basis of the data available, we will treat only factors a) and b) as circumstances, which will be proxied by the level of parental education. This amounts to saying that any other factors, as native ability, talent, luck, and so on, are implicitly classified as within the sphere of individual responsibility. This assumption may lead us to overestimate the portion of inequality which is ethically acceptable. If, even under this extremely conservative view of what constitutes responsibility, a society exhibits a certain degree of inequality of opportunity for income, then it would be legitimate to conclude that a "minimal" compensatory policy should be predicated on family characteristics of the individuals.[5]

Effort is unobservable. The function g is also unobservable, hence we do not make any assumption about the degree of substitutability or complementarity among the circumstances in order to keep the approach as general as possible. We assume,

[5]Strictly speaking, this is true as long as the ignored circumstance variables are not inversely correlated with family background.

however, that the function g is fixed and identical for all individuals. Moreover, we introduce two basic assumptions:

Assumption 1 *The function g is monotonically increasing in effort e .*
Assumption 2 *The conditional distribution of effort e is independent of the circumstances.*

Assumption 1 is fairly reasonable. Assumption 2 appears to be more problematic, given the non observability of effort. From a theoretical point of view it would be hardly sustainable to hold people accountable for the factor e, were it dependent on external circumstances. However, from the empirical point of view, there are income determinants that are clearly the joint outcomes of effort and circumstances. Typical is the case of acquired education (clearly discussed by Pistolesi [27]), which is the result of parental background (educated parents are typically richer in monetary and cultural resources) but also requires personal effort (in order to afford the psychological costs of studying). Since income is correlated with education, this would violate our Assumption 2. In such a case, we would be forced to extend the requirement of orthogonality between circumstances and effort to all these "intermediate" variables (where we could add labour market participation, fertility choices, migration, and similar). For this reason, we consider Assumption 2 as the simplest version which is compatible with the empirical application we adopt in Section 4, and we will stick to it.

We now propose two different partitions of the total population. For a society of size N the income distribution is represented by a vector $X \in \mathbb{R}_+^N$. First, for $\mathbf{c}_i \in \Omega$, we call *type i* the set of individuals whose vector of circumstances is $\mathbf{c}_i$. We denote by N_i^X the number of people of type i in distribution X, and by $\mathbf{x}_i = \{x_i^1, ..., x_i^{N_i^X}\} \in \mathbb{R}_+^{N_i^X}$ the type i income distribution. Thus the income profile X can be written as

$$X = \{\mathbf{x}_1, ..., \mathbf{x}_n\} \in \mathbb{R}_+^N. \tag{1}$$

The type income distribution $\mathbf{x}_i$ represents the set of outcome levels which can be achieved - by exerting different degrees of effort - starting from the same circumstance $\mathbf{c}_i$. That is to say, the distribution $\mathbf{x}_i$ is a representation of the *opportunity set* - expressed in outcome terms - open to any individual endowed with circumstances $\mathbf{c}_i$.

The second partition is based on the effort variable: for $e \in \Theta$, we call *tranche e* the set of individuals whose effort is e. However, as we are considering the case of non observability of effort, we need to deduce the *degree* of effort from some observable behaviour. More precisely, we need a *proxy* in order to measure it in an ordinal sense and to compare the effort of different individuals. Given the monotonicity of the income function and the independence of effort from circumstances, this will correspond to the quantile in the income distribution of the type. Following Roemer [29, 30] we say that all individuals at the p^{th} quantile of their income distributions, across types, have tried equally hard.

Thus, we define the tranche p in a population as the subset of individuals whose incomes are at the p^{th} rank of their respective type income distributions. Considering a given type i, let us denote the vector of incomes in quantile p of type i by $\chi_{i,p}$. For the entire population, the subset of individuals who have exercised responsibility p is represented by the following *tranche p* vector, $\chi_p = \{\chi_{1,p}, ..., \chi_{n,p}\} \in \mathbb{R}_+^{\frac{N}{m}}$,

where m is the number of quantiles.[6] Accordingly, the income profile X can now also be written as

$$X = \{\chi_1, ..., \chi_m\} \in \mathbb{R}_+^N. \tag{2}$$

Now compare the formulation in Eq. 1 with that given in Eq. 2. They suggest two different approaches to measure opportunity inequality: the ex ante and the ex post approaches.[7]

The ex ante approach focuses on the types distributions and on a comparison of the outcome distributions of different types. Thus, it puts special emphasis on the differences in the ex ante prospects for individuals with identical circumstances. Accordingly, it focuses on inequality between types, and is instead neutral with respect to inequality within types.

In this paper, more specifically, we adopt an utiltarian version[8] of the ex ante approach, by focusing on the mean income per type.

Definition 1 The ex ante (utilitarian) approach. There is EOp if all the types have the same mean income. Inequality of opportunity decreases if inequality between the types incomes decreases.

In contrast, the ex post approach focuses on ex post inequalities in classes of individuals with identical effort. Consequently, it looks at the inequality within tranches distributions.

Definition 2 The ex post approach. There is EOp if all those who exerted the same degree of effort have the same outcome. Inequality of opportunity decreases if outcome inequality decreases among the individuals at the same degree of effort.

Both approaches appear as relevant and plausible, and it is difficult to give priority to one or another. Therefore, we now develop each of them in turn, and for each of them we provide a measure of opportunity inequality.[9] Moreover, we show that the two approaches, which look both consistent with the EOp principle, can be incompatible.

[6] Working in a discrete framework, we need to assume that, for all $i \in \{1, ..., n\}$, N_i^X is divisible by m.

[7] The ex ante approach was first proposed by Van de Gaer [32], while the ex post approach corresponds to the theory of equality of opportunity proposed by Roemer [29, 30]. For a general discussion and a comparison see Fleurbaey [17]. These two approaches are explored within a social welfare framework by Peragine [25].

[8] For a "non utiltarian" ex ante approach to EOp, which bases the comparison between types on dominance conditions rather than on the types mean, see Lefranc et al. [21] and Peragine and Serlenga [26].

[9] For a different approach see Devooght [11] who proposes to construct a reference opportunity egalitarian income distribution to replace the perfectly equal income distribution which is used as norm by all common income inequality measures, and then uses a particular measure of distributional change to determine the degree of opportunity inequality.

3 Measuring and decomposing opportunity inequality

3.1 The ex post (tranches) approach

In this section we focus on the following representation of the income profile: $X = \{\chi_1, ..., \chi_m\}$. Consider that, given a partition in m quantiles, there will be a set of incomes within a given quantile p of a type i, denoted by $\chi_{i,p}$. However, by definition, all individuals with income in $\chi_{i,p}$ are considered as having the same circumstances and having exercised the same degree of effort. That is to say, there will be a certain amount of inequality within $\chi_{i,p}$.

The amount of this residual inequality will depend on the specific tranche partition one decides to adopt: the fewer the quantiles into which the population is partitioned, the bigger the residual inequality. Possibly, the more the quantiles, the finer is our approximation of the responsibility exercised, the less the residual inequality.[10] At the limit this inequality would disappear. Hence, within our model, this inequality is explained by the coarseness of quantiles and can therefore be attributed to effort.[11] Therefore, to obtain a measure of the inequality which can be attributed to circumstances, we propose to apply a smoothing transformation in order to eliminate such residual income inequality: starting from an income profile X we can generate an artificial distribution X^S by substituting, to each income $x \in \chi_{i,p}$, for all types i and for all tranches p, the arithmetic mean of the vector $\chi_{i,p}$, denoted by $\mu^X_{i,p}$. With this transformation, denoting by $1_{i,m}$ the unit vector of length $\frac{N^X_i}{m}$, we obtain the new "smoothed" vector[12] $\chi^S_{i,p} = \{\mu^X_{i,p} 1_{i,m}\} \in \mathbb{R}_+^{\frac{N^X_i}{m}}$. Accordingly, the "smoothed" tranche p vector is now defined as $\chi^S_p = \{\chi^S_{1,p}, ..., \chi^S_{n,p}\} \in \mathbb{R}^{\frac{N}{m}}$ and the smoothed income profile X^S is:

$$X^S = \left(\chi^S_1, ..., \chi^S_m\right) \in \mathbb{R}^N_+$$

In this section we are interested in finding criteria to rank distributions to which the above defined smoothing transformation has been applied.

An empirical question here arises: how important is the transformation $X \to X^S$? In the empirical part of the paper we shall quantify this impact and we will show that it has a fairly acceptable impact over the original distribution.

Now we move to the essential part of our exercise: we want to distinguish, within the overall inequality observed in a distribution, (*i*) the inequality due to exogenous circumstances and (*ii*) the inequality due to individual responsibility.

[10] See Peragine [25] for a discussion of such issue.

[11] It is interesting to notice that in the model of EOp used by Lefranc et al. [21], where the individual outcome is a function of circumstances, effort and luck, the income inequality within each cell $\chi_{i,p}$, that is for given levels of circumstances and effort, is instead attributed to luck: their definitions of equality of opportunity focus on the differences between the income distributions $\chi_{i,p}$, at each effort level p. While they propose to test such differences according to stochastic dominance test, we instead use a cardinal measure of inequality of opportunity.

[12] Smoothing transformations analogous to the one introduced here could be formulated by using any other "representative income", such as the geometric or harmonic mean or the equally distributed equivalent income. Here we use the arithmetic mean because we want to preserve the same total income.

Starting with a generic income vector X, consider the three following reference vectors:

$$(a)\quad X^S = \left(\chi_1^S, ..., \chi_p^S, ..., \chi_m^S\right) \in \mathbb{R}_+^N$$

$$(b)\quad X_B^S = \left(\mu_{\chi_1^S} 1_{\frac{N}{m}}, ..., \mu_{\chi_p^S} 1_{\frac{N}{m}}, ..., \mu_{\chi_m^S} 1_{\frac{N}{m}}\right) \in \mathbb{R}_+^N$$

$$(c)\quad X_W^S = \left(\tilde{\mathbf{x}}_1^S, ..., \tilde{\mathbf{x}}_p^S, ..., \tilde{\mathbf{x}}_m^S\right) \in \mathbb{R}_+^N$$

where $\mu_{\chi_p^S}$ is the mean income of tranche p, $1_{\frac{N}{m}}$ is the unit vector of length $\frac{N}{m}$, and the vector $\tilde{\mathbf{x}}_p, \forall p \in \{1, ..., m\}$ is obtained by rescaling each income $\mu_{i,p}^X$ in the following way (μ_X is the overall mean income):

$$\forall i \in \{1, ..., n\}, \forall p \in \{1, ..., m\}, \mu_{i,p}^X \to \frac{\mu_X}{\mu_{\chi_p^S}} \mu_{i,p}^X.$$

The distribution X^S is the overall income vector; X_B^S is a hypothetical smoothed distribution in which each person's income is replaced with the mean income of the tranche to which she belongs. This smoothing process removes all inequality within the tranches; X_W^S is a standardized distribution obtained by proportionally scaling each tranche distribution until it has the same mean as the overall distribution. Standardization suppresses between-tranche inequality while leaving within tranche inequality unaltered.

The interpretation in the current context is as follows. The artificial vector X_B^S is the distribution obtained by eliminating opportunity inequality. An inequality index applied to this distribution fully captures the inequality only due to individual responsibility. On the other hand, by rescaling all tranche distributions until all tranches have the same mean income, we are left with an income vector X_W^S where the only inequality present is the within-tranches inequality: an inequality index applied to this distribution fully captures the income inequality only due to circumstances, i.e., the inequality of opportunity.

Hence, in the tranches approach, for any income distributions $X \in \mathbb{R}_+^N$, and a given measure of inequality $I : \mathbb{R}_+^N \to \mathbb{R}_+$, the part of inequality due to initial circumstances will be given by $I\left(X_W^S\right)$ or, in relative terms, by:

$$OI_W^e = \frac{I\left(X_W^S\right)}{I\left(X^S\right)}$$

OI_W^e gives the portion of overall inequality that can be attributed to unequal opportunities according to the tranches approach.

Alternatively, we can express the opportunity inequality as a residual, hence obtaining

$$OI_B^e = 1 - \frac{I\left(X_B^S\right)}{I\left(X^S\right)}$$

OI_B^e gives the portion of overall inequality that cannot be attributed to individual effort. Hence, in a deterministic model as the one we are using, it is an indirect measure of opportunity inequality.

Notice that, given this model of measurement, the smoothing transformation introduced above in order to eliminate the "unexplained" inequality within each "cell" χ_p^S, has the effect of reducing the degree of inequality in the distribution X_W^S and in the distribution X^S, while it does not affect the degree of inequality in the distribution X_B^S. That is to say, by eliminating all unexplained inequalities we are underestimating the degree of opportunity inequality and, by converse, overestimating the degree of effort inequality in a society.

OI_W^e and OI_B^e could give different figures of opportunity inequality; this happens for instance if one uses the Gini index as inequality measure.[13] To avoid this effect, and to obtain an ethical decomposition of the overall inequality into opportunity and effort inequality, we can use a decomposable measure of inequality, which is a measure such that the within and between terms sum to total inequality. Now, to obtain a decomposition such that the terms OI_W^e and OI_B^e have the same value, one needs to use a "path independent" inequality measure as characterized by Foster and Shneyrov [19]. In particular, we need to use the *mean logarithmic deviation (MLD),* which is the only index which has a path-independent decomposition using the arithmetic mean as the representative income. For a distribution $X = (x_1, ..., x_N)$ with mean μ_X the MLD is defined as:

$$MLD(X) = \frac{1}{N}\sum_{i=1}^{N} \ln \frac{\mu_X}{x_i}$$

By using the MLD as inequality index, one obtains that, for any income distributions $X \in \mathbb{R}_+^N$:

$$I\left(X^S\right) = I\left(X_B^S\right) + I\left(X_W^S\right)$$

which is to be interpreted as: Total income inequality = Effort inequality + Opportunity inequality. Thus, in this case we have:

$$OI_W^e = OI_B^e$$

Hence we have a measure of opportunity inequality and a decomposition of overall inequality into an ethically acceptable and an ethically offensive part.

3.2 The utilitarian ex ante (types) approach

In this section we present an analysis similar to the one presented in the previous section, but focusing now on the types approach.

Consider the following reference vectors:

$$\left(a'\right) \quad X = (\mathbf{x}_1, ..., \mathbf{x}_i, ..., \mathbf{x}_n) \in \mathbb{R}_+^N$$

$$\left(b'\right) \quad X_B = \left(\mu_{\mathbf{x_1}} 1_{N_1}, ..., \mu_{\mathbf{x}_i} 1_{N_i}, ..., \mu_{\mathbf{x}_n} 1_{N_n}\right) \in \mathbb{R}_+^N$$

$$\left(c'\right) \quad X_W = \left(\tilde{\mathbf{x}}_1, ..., \tilde{\mathbf{x}}_i, ..., \tilde{\mathbf{x}}_n\right) \in \mathbb{R}_+^N$$

[13] In this paper we adopt a relative, *i.e.* scale invariant, concept of inequality.

where we recall that $\mu_{\mathbf{x}_i}$ is the mean of the type i income vector, and $\tilde{\mathbf{x}}_i$, $\forall i \in \{1, ..., n\}$ is obtained by rescaling each type i income in the following way:

$$\forall i \in \{1, ..., n\}, \forall h \in \{1, ..., N_i\}, x_i^h \to \frac{\mu_X}{\mu_{\mathbf{x}_i}} x_i^h$$

In this case, (a') is the overall income vector, (b') eliminates within-types inequality, and (c') eliminates between-types inequality.

The interpretation is as follows. By measuring the inequality in the artificial vector X_B, obtained by replacing each income with its type mean income $\mu_{\mathbf{x}_i}$, we capture only and fully the between-types inequality, which, in turn, reflects the opportunity inequality. On the other hand, by rescaling all type distributions until all types have the same mean income, we are left with an income vector (X_W) in which the only inequality present is the within-types inequality, to be interpreted as inequality due to individual responsibility.[14]

Hence, in the types approach, for any income distributions $X \in \mathbb{R}_+^N$, and a given measure of inequality $I : \mathbb{R}_+^N \to \mathbb{R}_+$, the part of inequality due to initial circumstances will be given by $I(X_B)$ or, in relative terms, by:

$$OI_B^c = \frac{I(X_B)}{I(X)}$$

OI_B^c gives the portion of overall inequality that can be attributed to unequal opportunities according to the types approach.

Alternatively, we can express the opportunity inequality as a residual, hence obtaining

$$OI_W^c = 1 - \frac{I(X_W)}{I(X)}$$

OI_W^c gives the portion of overall inequality that cannot be attributed to individual effort. Hence, in our deterministic model, it is an indirect measure of opportunity inequality.

Just as discussed in the previous section, OI_W^c and OI_B^c can give different figures of opportunity inequality. Also in this case, we can use the *mean logarithmic deviation (MLD),* and obtaining that, for any income distributions $X \in \mathbb{R}_+^N$:

$$I(X) = I(X_W) + I(X_B)$$

which is to be interpreted as: Total income inequality = Effort inequality + Opportunity inequality. We have also in this case:

$$OI_W^c = OI_B^c$$

[14]The interpretation of the inequality in the vector X_W as opportunity inequality could however be criticized. In fact, the inequality in X_W reflects also the possibly different slopes of the income distributions in different types, which are a characteristic of the types, not of the individual effort. Hence, part of the inequality in X_W is due to difference between types. This observation simply says that with the types approach we are not able to track ex post inequalities as well as with the tranche approach. This could be interpreted as a weakness of the ex ante approach as compared with the ex post approach. We are indebted to Marc Fleurbaey for this observation.

Hence, again, we have a measure of opportunity inequality and a decomposition of overall inequality into an ethically acceptable and an ethically offensive part.[15]

3.3 A tension between the types and the tranches approaches

We said in the previous sections that the types approach is linked to the principle of reward, while the tranches approach is inspired by the principle of compensation. Now, it has been proved that these two principles, in some important domains, are incompatible. This ethical tension has been explored in depth by Fleurbaey [16] and Fleurbaey and Maniquet [18] in the context of fair division models and by Fleurbaey [17] in the context of welfare criteria, as Roemer [30], Van de gaer [32] and Peragine [25] criteria. The aim of this section is to show that an analogous clash between compensation and reward seems to exist also when one is interested in inequality *per se*.

To see this, consider the following example.

Example

Consider an example with six individuals, three types (1, 2 and 3), and two effort levels (low, high). We have two societies, with the following income distributions:

Society 1

types /effort level	low	high
type 1	10	20
type 2	20	30
type 3	30	40

Society 2

types /effort level	low	high
type 1	10	20
type 2	10	40
type 3	10	60

The two societies share a basic feature: *ceteris paribus*, it is better to be in a richer type, and to exert a higher level of effort. Hence, in both cases there is dominance[16] between types: type 3 dominates type 2 which, in turn, dominates type 1.

Notice that society 1 is obtained from society 2 by means of two different progressive Pigou-Dalton transfers: the first takes place in type 2, the second takes place in types 3.

Let us compare the two societies.

According to the types approach, society 1 and society 2 exhibit the same level of opportunity inequality, as they have the same type's means. As expected, the types

[15]For analogous decompositions, which have the same conceptual inspiration but however use a parametric approach, see Bourguignon et al. [5] and Ferreira and Gignoux [14]. Actually, Ferreira and Gignoux [14] compare the parametric and non parametric methods in the types approach for different Latin America countries, by using different definitions of individual objectives and different inequality measures. See Checchi et al. [8] for a comparison of the parametric and non parametric methodology in both the ex ante and ex post approaches.

[16]Strictly speaking, it is a case of first order stochastic dominance.

approach is perfectly neutral with respect to inequalities due to effort. Hence any redistribution within types leaves the degree of opportunity inequality unchanged.

On the other hand, according to the tranches approach society 1 shows more opportunity inequality than society 2.

To see this, notice the following: (*i*) the income vector corresponding to column Low in society 1 shows the same level of inequality as the column High in society 2 for any Lorenz-consistent measure of inequality; (*ii*) the column High in society 1 shows more inequality than the column Low in society 2—which in fact does not show any inequality at all. According to our proposed measure of opportunity inequality, (which is a Lorenz-consistent additively decomposable inequality measure with a pure—i.e., income independent—weighting scheme), society 2 will be declared more opportunity equal than society 1 according to the tranches approach.

Thus, we have proved that the types and the tranches approach may generate different rankings of distributions. In general, any redistribution within types will have no effect on opportunity inequality as measured by the types approach, while it could affect the results in the case of the tranches approach.

While, as explained by Fleurbaey [17], in the context of welfare criteria this clash disappears if one assumes rank ordering between types (i.e., if one assumes types distributions that can be ranked according to first order dominance), in the context of pure inequality analysis we have shown that the tension is so robust as to survive in the case of rank ordered type distributions.[17]

4 The empirical analysis

Any empirical application of the theory described in the previous sections requires the identification of the individual *objective* and of the relevant list of *circumstances.* In this paper, we present an application of the proposed decomposition of inequality, using actual earnings as individual objective.[18] As for the circumstances, we are concerned with the role played by the family background, which is in turn measured by the level of parents' education. We first compute the degree of opportunity inequality for the entire country distribution. However, as we are aware that the degree of EOp varies in a country population, we identify different sub-populations and we compare them in terms of equality of opportunity. In particular, we partition the total population on the basis of two characteristics: gender and geographic location. Consider first gender differences. Different countries (or regions) exhibit different degrees of female labour market participation, depending on historical traditions, religion, availability of child-care services, and so on. Since measuring EOp with respect to income acquisition requires a positive income for each individual, any EOp measure would obviously be affected by the extent of female participation to the labour market. Similarly, income distribution is conditioned by the actual

[17] Indeed, it would be interesting to study the exact domain of the incompatibility between the ex post and and the ex ante approach in opportunity inequality measurement; see on this Fleurbaey and Peragine [15].

[18] In the working paper version of this paper (Checchi and Peragine [7]) we have also studied the distribution of competences in the PISA 2003 survey of competences of 15-year old students, obtaining surprisingly similar results.

working of the local labour market (level of unemployment, unions compressing wages, presence of minimum wage, etc.). It would make little sense to compare EOp computed in a region close to full employment, experiencing growing wages, with the same measure obtained in another region where employment is stagnant, informal employment is widespread and wages are declining. For these reasons we have followed the following strategy: we have considered the country population as composed by four sub-populations, which we consider as rather homogenous in terms of labour market prospects and participation (men in the North; women in the North; men in the Centre, South or islands; women in the Centre, South or islands). In the sample period (1993–2000) their employment rates in the relevant age populations (20–60) were respectively 85.7%, 55.6%, 73.3% and 31.5%. We then compute EOp for the entire population and for each population subgroup, being able to assess which group is enjoying (suffering) the higher (in)equality of opportunity. A reasonable expectation, that will be confirmed by the data, is that the larger is the access to the labour market, the higher is the EOp.[19]

We draw data on individual annual earnings and family background from the Survey on Income and Wealth of Italian Households (SHIW), waves 1993, 1995, 1998 and 2000. Conducted any two years by the Bank of Italy, the survey collects data on representative samples of approximately ten thousand Italian households each wave. Respondents provide information on parents' education and occupation, their own educational achievement and other demographic variables.[20] We have restricted the sample to observations with positive earnings from dependent employment (given the low reliability of self-declared incomes from self-employed).[21] The survey asks for net earnings; based on existing fiscal laws and information about family composition, we have reconstructed gross earnings. Wages are then corrected for inflation by regressing them on survey dummies, and converting them in Euros. Overall we consider 16392 observations[22] (see Table 1).

Family background is measured by the highest educational attainment in the couple of parents. Local labour markets are taken into account by splitting the sample into Northern regions and Central-Southern regions; further on, we also split the regional samples by gender. Thus we assume that *there is only one circumstance that is out of responsibility of individuals, and it is measured by parents' education in each subpopulation (defined by gender and location)*. One could question that the

[19]While ideally it would have been interesting to define "types" according to family origin, gender and region of residence (all three characteristics being out of individual control), we could not proceed in this direction, due to lack of a sufficient number of observations (since each cell has to be divided into deciles in order to analyse the distribution of effort).

[20]We could not use surveys collected before 1993, because information about parental background was absent. The English version of the questionnaire, data and survey documentation can be downloaded from the Bank of Italy web site: http://www.bancaditalia.it/statistiche/ibf.

[21]By so doing we underestimate the extent of earnings inequality, because the higher variability of earnings from self-employment. This may be relevant in geographical comparisons, whenever the extent of self-employment varies across regions. However, given the possibility of negative incomes which may also vary across regions, we have preferred to leave them out of our analysis.

[22]The Bank of Italy survey contains a panel component of approximately one-third of the interviewed. We have retained this component in order to save observations. This implies that the same individual may appear more than once in our sample, though with different incomes according to different survey years. We adopt sample weights in order to get a representative sample of the Italian population for each wave.

Table 1 Descriptive statistics—Gross earnings—Italy (SHIW) 1993–2000—sample weights First row: mean—second row: standard deviation—third row: observations

Highest educational attainment among parents	North		Centre-South		
	Man	Woman	Man	Woman	Total
No formal education	19289.15	14189.12	14608.21	11156.24	14786.31
	6560.825	6340.921	6618.895	6544.096	7037.354
	329	185	1313	514	2341
Primary school	19971.32	15037.77	17973.02	13821.12	17180.71
	8481.819	5689.796	9655.072	6161.756	8349.661
	2138	1664	3140	1702	8644
Lower secondary	21941.13	16457.4	19810.72	14915.97	18731.25
	9998.227	6244.776	9475.573	6019.18	8808.679
	808	703	829	577	2917
Upper secondary	23726.1	16703.06	21620.28	17624.39	20038.3
	13013.27	7562.451	12074.22	6931.528	10753.46
	497	441	478	472	1888
Bachelor	29017.76	22046.51	29536.29	16786.29	24080.08
	17783.94	9202.045	19780.29	6346.453	15268.1
	123	145	162	172	602
Total	20980.63	15780.95	18050.22	14274.43	17660.41
	9814.521	6455.006	10084.42	6583.299	9087.96
	3895	3138	5922	3437	16392

Note: North includes Piemonte, Val d'Aosta, Liguria, Lombardia, Veneto, Friuli Venezia Giulia, Trentino Alto Adige and Emilia Romagna

region of residence is not fully exogenous, since one could choose to migrate from the poorest (Southern) regions to the richer (Northern) ones. In order to reduce the potential bias due to migration, we exclude 1633 observations of individuals born in Southern regions who are currently living in Northern ones. As it can be seen from Table 1, gross wages are increasing in parental education. They are also higher for male subsamples when compared to female ones; finally Northern earnings are higher and less dispersed than Southern ones.

Under the maintained assumption that individuals at the same percentile of earning distribution have exerted the same degree of effort, we have partitioned the earnings distribution (conditional on parental background) into 10 deciles. Mean wages and sample sizes for each cell are reported in Table 2.

We are now in the condition of analyzing the earning distribution, according to two characteristics, parental education and individual effort, for each of the four population subgroups. Then we introduce a smoothing transformation, as described in Section 3.1: we replace actual individual earnings with the average earnings of each cell, as reported in Table 2 (10 deciles $\times$ 5 types of family background, in each macro-region and for each gender separately). Table 3 reports, for the entire country and for each population sub-group, a comparison of the degree of overall inequality, computed according to a set of inequality measures in addition to the mean log deviation, in the original and in the smoothed distribution. These differences express the impact of our smoothing transformation and the extent of the unexplained inequality. From the same table we can also notice that earnings inequality is higher in Southern regions and among men.

The main results of our analysis are summarized in Table 4 and in Figs. 1 and 2. According to the tranches approach (see Table 4), when inequality of income

Table 2 Mean earnings by "types" and "effort" and macro-regions—sample weights–first row: mean—second row: observations

Region→	North										Centre-South									
Gender→	Men					Women					Men					Women				
Types→ Quantiles↓	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	10166	10900	10042	8967	7892	5281	5591	6291	5170	6634	5024	6796	7790	7571	7259	3267	4169	4914	5020	6135
	33	214	82	50	14	19	167	72	45	15	134	317	85	49	17	54	172	58	48	18
2	14280	14065	14715	14647	15506	7797	9331	10353	9655	13138	8583	11871	12855	13204	15293	5044	6867	7686	10759	10191
	33	218	84	53	11	18	168	69	44	18	130	316	81	47	16	50	170	58	48	17
3	15289	15481	16205	16841	17384	10403	11751	12769	12825	15609	11241	13924	14746	15701	18549	6430	9926	10364	13765	14078
	34	210	77	47	12	19	175	72	46	12	131	311	83	48	16	58	169	58	46	17
4	16647	16661	17821	18832	18841	13117	13418	14473	14777	17791	13098	15169	16111	17421	21153	8189	12599	12713	15594	15918
	32	214	82	54	13	19	156	69	44	13	132	313	83	48	18	44	180	59	50	20
5	17712	17917	19103	20714	21106	14328	14583	15766	15997	19209	14475	16475	17564	18870	22989	10300	14260	14805	16773	16936
	35	215	79	49	12	20	172	70	42	15	130	319	83	50	14	51	173	56	44	16
6	19127	19180	20461	22345	26236	15316	15759	17022	17483	20342	15701	17755	19083	20773	26543	12523	15648	16163	18252	17945
	33	212	81	46	12	16	169	71	51	14	131	317	83	45	17	52	170	58	48	18
7	20292	20711	22476	24583	33093	16019	16812	18205	18443	22346	17164	19060	20702	23010	30507	13960	16948	17586	19654	19360
	31	214	81	49	13	21	160	74	39	17	134	305	84	49	16	51	167	57	55	15
8	21810	23116	25183	27805	42629	17213	18409	19633	20132	24280	18687	20777	22603	26412	38223	15508	18253	19250	21023	20539
	33	214	82	50	12	16	183	68	42	12	130	314	83	47	16	53	161	62	40	19
9	24356	27369	31343	34551	49441	18923	20007	21639	22844	30211	20889	23377	25845	31894	49251	17381	19780	20809	23017	22604
	33	214	83	50	12	19	148	68	44	16	130	315	82	48	16	50	171	54	46	16
10	33203	41053	44805	56949	68335	25358	25520	28583	32787	40792	27156	35277	40950	48004	85113	23541	24700	25143	29894	28072
	32	213	77	49	12	18	166	70	44	13	131	313	82	47	16	51	169	57	47	16

Note: Types correspond to 1 "no formal education", 2 "primary school", 3 "lower secondary", 4 "upper secondary" and 5 "bachelor"

Table 3 Descriptive statistics: inequality measures

Inequality measures	Entire sample		North—men		North—women		Centre-South—men		Centre-South—women	
	Actual gross earnings	Mean gross earnings (by region, sex, types and quantiles)	Actual gross earnings	Mean gross earnings (by region, sex, types and quantiles)	Actual gross earnings	Mean gross earnings (by region, sex, types and quantiles)	Actual gross earnings	Mean gross earnings (by region, sex, types and quantiles)	Actual gross earnings	Mean gross earnings (by region, sex, types and quantiles)
Relative mean deviation	0.16382	0.16352	0.16278	0.16262	0.14637	0.14575	0.16139	0.16124	0.17368	0.17319
Coefficient of variation	0.52627	0.47360	0.50048	0.45786	0.42942	0.38817	0.54361	0.46652	0.44803	0.42913
Standard deviation of logs	0.50935	0.47588	0.43735	0.39918	0.46404	0.42687	0.48366	0.45157	0.55746	0.52539
Gini coefficient	0.24517	0.24214	0.23292	0.22915	0.21602	0.21287	0.24002	0.23645	0.24544	0.24275
Theil index (GE(α), $\alpha = 1$)	0.11276	0.10207	0.10097	0.09065	0.08455	0.07568	0.11048	0.09709	0.10446	0.09872
Mean log deviation (GE(α), $\alpha = 0$)	0.11742	0.10662	0.09584	0.08516	0.09335	0.08299	0.10991	0.09879	0.12685	0.11748
Entropy index (GE(α), $\alpha = -1$)	0.1678	0.12930	0.12824	0.08669	0.13196	0.10026	0.15299	0.11439	0.19339	0.15859
Half(Coeff. Var.squared) (GE(α), $\alpha = 2$)	0.13847	0.11213	0.12521	0.10479	0.09217	0.07532	0.14773	0.1088	0.10033	0.09205

Table 4 Inequality decomposition, by macro-regions—mean log deviation—"tranche" approach

	Opportunity inequality	Incidence % opportunity inequality	Effort inequality	Total inequality mean gross earnings (by region, sex, types and quantiles)	Total inequality (actual gross earnings)
Entire population					
North	0.01729	18.0%	0.078869	0.096159	0.10669
Center-South	0.01852	16.6%	0.093169	0.111687	0.12218
Italy	0.01744	19.5%	0.089355	0.10662	0.11742
Men					
North	0.004301	5.1%	0.080862	0.085163	0.09584
Center-South	0.009868	10.0%	0.088921	0.098789	0.10991
Italy	0.0086593	9.9%	0.086828	0.095487	0.10795
Women					
North	0.003213	3.9%	0.079776	0.082989	0.09335
Center-South	0.01087	9.3%	0.106614	0.117484	0.12685
Italy	0.007333	7.7%	0.095106	0.10243	0.11188

attributable to inequality of opportunity is calculated by percentile, and the types are defined in terms of parental education, we obtain that inequality of opportunity (OI^e) for the entire Italian population is equal to 0.01744, which account for approximately one fifth (19.5%) of the overall inequality. But the aggregate analysis may be misleading, when the population is heterogeneous. If we turn to analyze regional differences within the country, we obtain that inequality of opportunity is equal to 0.01852 in Centre-South and 0.01729 in North. Thus even if the inequality

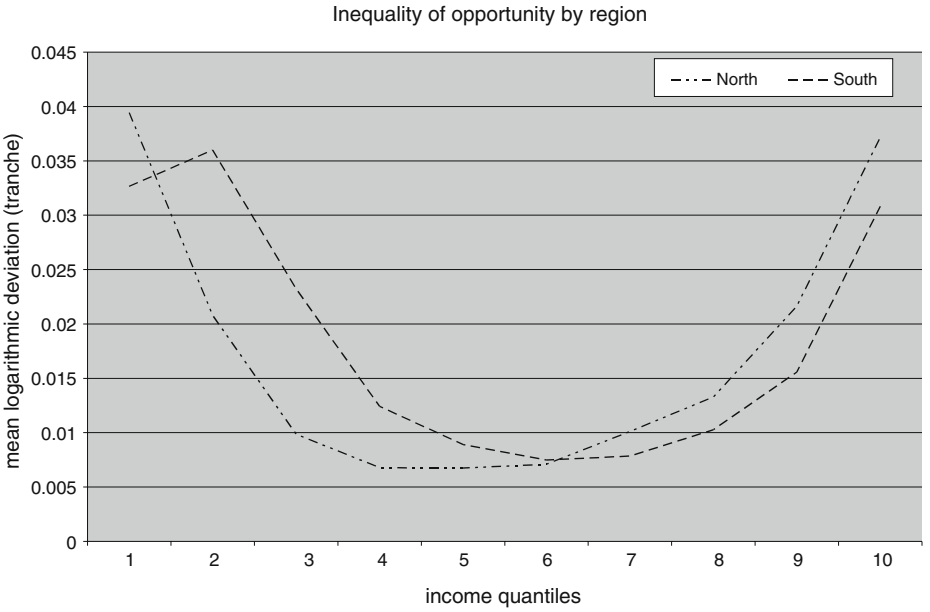

Fig. 1 Inequality of opportunity by macro-regions—Italy (SHIW) 1993–2000

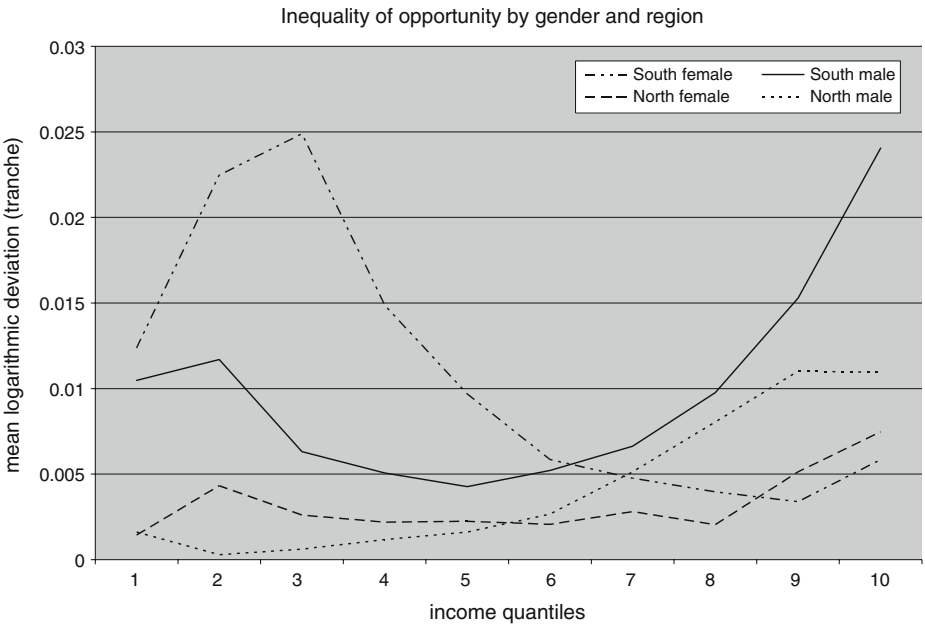

Fig. 2 Inequality of opportunity by gender and regions—Italy (SHIW) 1993–2000

of opportunities is greater in absolute terms in the Southern regions, still in relative terms the situation is reversed. Given the lower overall inequality in the North, the fraction of it which is attributable to inequality of opportunities is approximately one fifth (18.0%), which is greater than the incidence in the South (16.6%). It is interesting to notice that inequality of opportunities is higher at the extremes of the earnings distribution, where the advantages/disadvantages of the family background affects the destinies of the children in a more significant way (see Fig. 1). This is consistent with the finding of more intergenerational immobility at the extremes of income distribution (see [6]).

So far one could get the impression that inequality had similar patterns in both regions. But this is due to compositional effects. When we repeat our procedure splitting further on the sample by gender, we find that inequality of opportunities is much higher in the South, especially for women (see Table 4 and Fig. 2). Effectively, if we look at the entire income distribution we observe that men and women from Southern regions tend to be overrepresented in the bottom part of the entire distribution, while the opposite occur to the other tail for Northern workers (see Table 2). We also notice that women in the South tend to be more penalized (in terms of opportunities) the lower is their economic position, while men in the same region experience similar disadvantage at the top of their relative earnings distribution. Analogous trends do not materialize in Northern regions, especially in the case of women where no specific trend can be observed (see again Fig. 2).

Thus in Italy the inequality of opportunities generated by family origins takes different faces according to gender and location. A woman born and working in the South is the most discriminated in terms of opportunities, especially when ending up in the bottom of the earning distribution. Similarly a man born and working in

Table 5 Inequality decomposition, by macro-regions—mean log deviation—"types" approach

	Effort inequality	Opportunity inequality	Incidence % opportunity inequality	Total inequality mean gross earnings (by region, sex, types and quantiles)
Entire population				
North	0.091139	0.015549	14.57%	0.106688
Center-South	0.107079	0.015101	12.36%	0.12218
Italy	0.1022974	0.015121	14.78%	0.117418
Men				
North	0.091847	0.003993	4.17%	0.09584
Center-South	0.099836	0.010078	9.17%	0.109914
Italy	0.099303	0.009033	9.10%	0.108336
Women				
North	0.09026	0.003091	3.31%	0.093351
Center-South	0.119559	0.007286	5.74%	0.126845
Italy	0.106766	0.005109	4.79%	0.111875

the South experiences increasing inequality of opportunity when going to the top of the distribution. The picture that would emerge for Southern regions is compatible with parental resources being gender biased.[23] Whenever parents invest more in boys than in girls, in a context where the labour market is segmented according to family networks, then boys would experience an increasing discrimination from social origin the more they rise the social ladder, while on the contrary girls would be left behind, more intensively the lower is the family background.[24]

We have also computed the inequality of opportunity indexes following the "types" approach (see Table 5). According to the types approach the opportunity inequality in the entire country amounts to the 14.78% of the overall inequality. Also in this case we find that inequality of opportunities appears covering a larger fraction of a lower inequality in Northern regions, but this is just the reflection of

[23]Further supporting evidence comes from least square analysis of the determinants of earnings from dependent employment. Parental education dummies yield coefficients that are almost double in the South subsample than in the North one (when we exclude from the regressors the individual educational attainment), while their magnitude goes up to four times when the individual educational attainment is included. This regression suggests potential reasons why the opportunity inequality is higher in the South: while most of the parental background exerts its effect through favouring the educational attainment of the children in the North, it keeps on playing a role independently from edu cation in the South. This could represent the impact that family networking play in finding good jobs.

[24]Results are obviously biased by the participation to the labour market. If the participation decision is inversely correlated to the extent of inequality of opportunity (a woman does not enter a labour market when she knows in advance that she will be discriminated against according to social origins), then this measure represents a lower bound estimate of the true inequality of opportunities. However there are no methods of analysis that dominate in an uncontroversial way. If we include not working women with zero incomes, one could reasonably argue that mating could be considered as an effort-using strategy, and therefore we should use the income of the spouse. On the contrary, by computing a (counterfactual) theoretical income using least square methods we would actually neglecting the effort-intense activity of job searching. Given the different intensity of labour force participation by gender and region, we have preferred the alternative route of decomposing the inequality analysis along these characteristics.

a compositional effect. When we disaggregate by gender, we find that opportunity inequality is higher in Southern regions for both men and women. However, as shown by a comparison of Table 5 with Table 4, the types approach, when compared to the tranches approach, consistently leads to an underestimation of opportunity inequality.

5 Concluding remarks

The philosophy of equality of opportunity suggests that social and economic inequalities due to factors beyond the individual responsibility are inequitable and should be compensated by the society, whereas inequalities due to personal responsibility are equitable and should not to be compensated. Therefore, according to the opportunity egalitarian conception, in order to assess the equitability of a state of affairs one has to distinguish, in a given distribution of outcomes, the inequalities due to personal responsibility as opposed to the inequalities due to non responsible factors or opportunities. In this paper we have provided a methodology to make such a decomposition. Moreover, we have provided an empirical application of these new evaluation tools, and shown how they compare with standard methods of income inequality measurement.

While analyzing the degree of equality of opportunities existing in Italy, using a representative sample of the working population, we have taken the relative income position as a proxy for the extent of effort, and we have shown how parental education, taken as a circumstance out of individual control, significantly affect the equality of opportunities especially when considering population subgroups (by gender and by region of residence). We have also shown how compositional effects in heterogeneous populations may significantly distort the aggregate view of EOp. While inequality of opportunity in the entire Italian population accounts for one third of overall income inequality, the less developed regions in the South, that are characterized by greater disparities at the global level, suffer greater incidence of opportunity inequality when disaggregated by gender.

Common to many other less developed regions, Southern Italian regions experience the worst of possible worlds: lower per-capita income accompanied by greater overall income inequality, a larger fraction of which is ethically inequitable. Gifted individuals are at greater disadvantage in the South than in the North when coming from lower social origins. This could represent the impact of family networking in finding good jobs, as well as a reduced availability of good jobs in less technologically advanced areas. These greater obstacles and/or lack of adequate incentives in local labour markets can be linked to existing evidence of internal migration flows, which recently speak of a sort of "brain drain", that is strong migration of highly skilled workers from the South towards the Northern regions. While part of this migration is certainly explained by different unemployment rates, it is plausible that the choice to migrate is especially concentrated among individuals with poor family background.[25]

[25] Among the individuals that we exclude from our analysis because of their presumed status of migrant (reconstructed from the difference between region of birth and region of residence), the fraction of those with a college graduate parent is in accordance with the claim in the text. In the North this fraction is 3.81% among the locals and 2.86% among those born in the South; on the contrary, in the South the same fraction is 3.57% among the locals and 4.57% among those born in the North.

If greater inequality of opportunities in the labour market originates from the opaque working of the labour market, there are no easy solutions. Favouring external migration reduces the inequality of opportunities as measured ex post, but not ex ante. In addition, it depresses the incentives to emerge, given the higher obstacles attributable to factors beyond individual control. Fairer competition in accessing rationed jobs would constitute the most appropriate policy, and this can be achieved at some extent in the allocation of public jobs. In the private sector, more transparent intermediation could help in compensating the disadvantage created by differential backgrounds. But these are rather ephemeral suggestions, for a country where more than 50% of the working population declares to have obtained the current job through recommendations of relatives or friends. The final objective of a more fluid society is still a long way off.

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