Equality of opportunity: theory, measurement and policy implications

Peragine, V.

Biagi, F.

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Abstract

In this report we present the Equality of opportunity approach, clarifying its theoretical foundations and empirical implications, and develop policy implications especially in the area of human capital investment. According to the equality of opportunity (EOp) approach, a primary goal of public policies is to insure that individuals develop their lives in a context where the playfield is levelled. The main idea behind EOp is that inequality in outcomes (e.g., income, wealth, human capital/education and health) is acceptable to the extent that it reflects the result of individual choices taken by individuals that share the same opportunities. According to the "equality of opportunities principle", inequalities that are due to variables beyond individual's control, called *circumstances*, (e.g. family socioeconomic and cultural background, ethnic origin, gender, age etc.), should be eliminated or compensated for by public intervention. Only those variables within the sphere of individual's autonomy, called *effort*, (e.g., number of hours devoted to study or work, quality of the work supplied, occupational choices etc.) can justify a difference in the relevant outcome variable. This implies that the equality of opportunity approach is consistent with the notion of fair inequality, as long as it originates from *effort*.

1 Introduction

The European Pillar of Social Rights is at the basis of the European Social model, one in which equity and efficiency are jointly pursued by investing in human capital, through education, training, and lifelong learning. This model stresses the importance of social policies, including the provision of adequate health care, child and long-term care, active labour market policies and appropriate unemployment insurance schemes.

Equality of opportunities irrespective of gender, racial or ethnic origin, religion or belief, age or sexual orientation is stated in Title 3 of Chapter 1 of the European Pillar of Social Rights. The same Pillar, at Title 1 in Chapter 1, clearly indicates that everyone in the EU has a right to quality and inclusive education, training and life-long learning, so as to fully participate in modern societies. The commitment to make education and training systems more equitable and inclusive, including for migrants and refugees, has been explicitly made at the UNESCO "Global Education Meeting" held in Brussels in December 2018, in the context of a political discussion on the UN 2030 Sustainable Development Goals.

Attention to equity and social inclusion in education is also permeating the 2016 New Skills agenda, the 2016 Communication Investing in Europe's Youth, the Communication on Improving and Modernizing Education (COM (2016) 941), the Communication on an EU renewed agenda for Higher Education (COM (2017) 247), and the Communication on School Development and Excellent Teaching for a Great Start in Life (COM (2017) 248). It is also present in the political guidelines of the Von der Leyen Commission.

In this report we present the Equality of opportunity approach, clarifying its theoretical foundations and empirical implications, and develop policy implications especially in the area of human capital investment.

According to the equality of opportunity (EOp) approach, a primary goal of public policies is to insure that individuals develop their lives in a context where the playfield is levelled. The main idea behind EOp is that inequality in outcomes (e.g., income, wealth, human capital/education and health) is acceptable to the extent that it reflects the result of individual choices taken by individuals that share the same opportunities ("the opportunity set"). According to the "equality of opportunities principle", inequalities that are due to variables beyond individual's control, called *circumstances*, (e.g. family socioeconomic and cultural background, ethnic origin, gender, age etc.), should be eliminated or compensated for by public intervention. Only those variables within the sphere of individual's autonomy, called *effort*, (e.g., number of hours devoted to study or work, quality of the work supplied, occupational choices etc.) can justify a difference in the relevant outcome variable. This implies that the equality of opportunity approach is consistent with the notion of fair inequality, as long as it originates from *effort*. Notice that the equality of opportunity approach looks at all the factors that are outside individual control, not just parental background. Hence, it is different from (relative) social mobility, where the focus is on the comparison of income/occupational classes of offsprings to that of their parents.

The equality of opportunity approach is very appealing as it satisfies two main principles that are broadly accepted across the political spectrum: 1) *compensation*, i.e. a disadvantage/advantage due to characteristics for which individuals have no responsibility should be compensated for by public authorities; 2) *responsibility*, i.e. individuals are free to take their own decisions, of which they should bear the consequences. In fact, even economists who strongly question the ability of the governments to undertake welfare-enhancing income distribution policies, accept that one of the main roles of the government is to supply fair rules and promote equality of opportunities. One could argue that the equality of opportunity approach is the prevailing concept of social justice in Western countries. The actual interpretation of "levelling the playing field", however, remains subject to political and ethical judgement.

This report proceeds as follows: Section 2 discusses the concept of equality of opportunity, its origins and its interpretation by modern philosophers and social scientists. It also discusses its policy implications and the relationship with similar concepts and perspectives that are sometimes grouped under the same "umbrella". Section 3 presents various approaches to the measurement of inequality of opportunity, while Section 4 summarizes results from various studies estimating inequality of opportunity in different countries and with different approaches. Section 5 concludes.

2 The EOp Theory

A preliminary clarification is needed: the concepts of equality, equity, justice and fairness are closely related, but they are not all synonymous. While equity, fairness, and justice implicitly require a definition of what is equitable, just and fair, and hence rely upon normative criteria defined elsewhere, the concept of equality refers to the quality of being identical in status, value or quantity, which does not strictly require any normative criteria. As a consequence, equity/fairness/justice does not necessarily imply equality. In fact, vertical equity requires individuals that differ in some relevant characteristic to be treated differently.

The origin of the concepts of equity, equality, justice and fairness can be found in Ethics and Law, but with the development of Social Sciences they became very important in this area as well, and a whole branch of Economics (i.e. Welfare Economics) was developed as a response to the limits of the concept of efficiency, with the intent to make explicit the prevalent distributional justice criteria. The welfarist approach poses that social decisions should be based on some form of aggregation of individual welfare: different forms of aggregation (i.e. Social Welfare Functions) have been proposed, with the utilitiarian being one of the most often adopted in public decision making. The welfarist approach has had the great merit of bringing attention to potential equity-efficiency trade-offs, which are often at the heart of socio-economic policies (e.g., a given tax reform might increase equity but reduce efficiency: given a well-defined social welfare criteria it is possible to solve the trade-off).

The traditional welfarist approach is fundamentally based on three pillars: 1) individual outcomes should be observed and measured; 2) these outcomes need to be "translated" into individual welfare measures; 3) a social criteria (Social Welfare Function) need to be defined over the space of individual welfare measures. However, it is scarcely informative on the fairness of the process by which individuals generate income or achieve a given economic and social status. This led some economists, philosophers and social scientists (e.g., Dworkin, Rawls, Roemer, Sen) to develop the concept of equality of opportunity. What these contribution have in common is the attempt to go beyond the analysis of (in)equality of outcomes (income, health, education etc.) and move towards the definition of "opportunities" as the relevant space for social policies. The fairness of a given distribution cannot be evaluated by simply observing the inequality in the distribution of the relevant outcomes: it becomes necessary to observe how the observed outcomes are derived from choice sets available to individuals. A given distribution of economic and social status can be considered fair if, besides respecting some procedural rules, it is also the result of efforts exerted by individuals that "play on a levelled field".

In the last decades, many political philosophers have argued that a society is to be considered equitable if "opportunities", rather than outcome, are equally distributed (Rawls, 1971; Sen, 1985; Dworkin, 1981a, 1981b; Cohen, 1989; Arneson, 1989, 1999). Recognizing the role of the individual responsibility in the evaluation of social arrangements, supporters of this approach assert that not all the differences arising from the outcome distribution in a society are equally unfair. In particular, outcome disparities due to personal choices are less ethically objectionable than disparities caused by exogenous attributes over which individuals cannot exert any form of control. Hence, an equitable society, according to the principle of equality of opportunity, would be one in which only disparities due to individual choices arise.

The sources of inequality also play an important role with respect to various socio-economic dimensions.

First, attitude surveys and field experiments show that individuals are in general more prone to accept inequality stemming from their own choices, while perceiving inequalities due to pre-determined factors as highly unfair. On the other hand, economists argue that some sources of inequality are necessary, acting as an incentive to exert more effort. Second, the source of economic inequality also affects individual preferences for redistribution and for political orientation (Alesina and La Ferrara, 2005; Fong, 2001; Gaviria, 2006): when individuals believe that economic success depends on the effort exerted rather than on exogenous circumstances, there appears to be low support for redistributive policies; on the other hand, support for redistribution appears to increase when respondents believe that a large amount of existing inequalities is due to unequal opportunities. Finally, inequality of opportunity among different groups of the society may give useful insights to explain the economic and institutional mechanisms that generate outcome inequalities. Moreover, the degree of opportunity inequality in a society is related to the potentials for future growth (see World Bank, 2006, among others). Suboptimal allocation of resources and a lower potential for growth may, in fact, be generated by the influence of exogenous factors on the individual income and occupation prospects. Further, the persistence of inequality in the initial opportunities may provoke the formation of inequality traps that, preventing the (full) participation of some groups of the population to economic activity, become detrimental for growth.

The relevance of the role played by the individual responsibility and by the source of inequality in the assessment of social states has motivated a variety of declinations of the "equality of opportunity" concept.

Starting from Roemer (1993,1998), Van de gaer (1993) and Fleurbaey (1995), a specific part of the economic literature – the equality of opportunity literature – has been increasingly devoted to develop formal models aimed at capturing each single specification of the equality of opportunity concept. These equal-opportunity frameworks encompass a libertarian view, since they dictate that public policies should be respectful of the individual freedom to pursue her/his own goals. However, by promoting equality in conditions that are beyond the individual control, they also reflect an egalitarian orientation.

In what follows a review of the background literature on the theory of equality of opportunity is provided[1] . In particular, we discuss the different EOp concepts proposed by the literature, how they relate and their policy implications. Following this, the main approaches adopted to measure inequality of opportunity, from both a theoretical and empirical viewpoint, are presented and discussed.

2.1   Philosophical foundations

The choice between opportunity and outcome as the proper "currency of egalitarian justice" (Cohen, 1989) has been animatedly debated in political philosophy for the last four decades. The increasing favor met by the former is due to the appealing feature of the EOp view that recognizes the role of the individual responsibility in the evaluation of social arrangements. However, in shifting the assessment of "equality" from the space of final achievements to the space of opportunities, the contemporary theories of justice differ in the way they frame the border between external opportunities and individual responsible choices factors.

Rawls (1971), who initiated this debate, proposes "primary good", in the form of rights and resources, as the correct space for equality judgements. He argues that, once individuals are equally endowed with primary goods, they will be deemed responsible for the differences arising in the final level of well-being. These differences, in fact, depend on the process followed by each individual to translate those rights and resources into final outcomes. Dworkin (1981a, 1981b) shares the same idea, but proposes to extend the notion of resources to encompass, in addition to transferable goods and wealth, personal talents and handicap, that deserve compensatory schemes. A society is, thus, equitable if the distribution of transferable goods is such that it compensates individuals for their poorer endowment and non-transferable resources.

In later contributions, Arneson (1989) and Cohen (1989) question the concept of equality of resources and embrace the concept of equality of opportunity for welfare. Their conviction is that the sphere of the individual responsibility should be limited to characteristics and choices that are fully under the individual control; this sphere can include the way individuals make use of their rights and resources or can exclude it. The relevant distinction is not between resources and preferences, but between factors within and outside the individual control. This implies that individual preferences can fall outside the sphere of the individual responsibility, depending on the processes generating those preferences. For example, if the preferences are determined by the external environment, they can be considered as outside the domain of individual responsibility.

Although formally different, these philosophical frameworks possess a common feature. They endorse a view of egalitarian justice that attempts to incorporate the role of individual responsibility in the evaluation of social states[2]. They all share the belief that an opportunity egalitarian perspective to social justice requires "levelling the playing field"[3]. Thus, social justice should only be concerned with the equalization of everyone's initial opportunities, letting the individual, through her choices, be the only determinant of her final achievements.

2.2   The basic economic framework

According to this philosophical stream, a society can be defined "fair" only if it satisfies the norm of equality of opportunity: unchosen inequalities should be eliminated, while inequalities arising from individuals' own choices should not. Later works attempt to formalize these philosophical insights within economic frameworks (Roemer, 1993, 1998; Van de gaer, 1993; Fleurbaey, 1995). They are aimed at operationalizing the concept of equality of opportunity by addressing: (i) the measurement of the degree of inequality of opportunity; (ii) the design of redistribution mechanisms able to enhance the degree of

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[1]   This Section is meant to provide an overlook of the EOp theory. For detailed and comprehensive surveys the reader can refer to Ferreira and Peragine (2016), Roemer and Trannoy (2016), Ramos and Van de gaer (2016), Pignataro (2012).
[2]   Sen (1985) also proposes a similar approach.
[3]   See Roemer (1998).

equality of opportunity.

The basic economic model builds on the assumption that the individual outcome, x (income, health or education, for instance), is jointly determined by two sets of characteristics: circumstances and responsibility, or effort for brevity. Circumstances, denoted by C, are pre-determined factors – such as race, gender and socio-economic background – acting independently form the individual's own free will. The individual cannot be deemed accountable for circumstances, since they are externally imposed (i.e. she does not choose them). Effort, denoted by e, instead, is a factor the individual can be deemed accountable for, since it stems from her own choice. Effort includes the extent to which a person exerts herself and all the other characteristics that affect her outcome but are not encompassed in the set of circumstances. These assumptions can be summarized in the following equation[4]:

$$x = g(C, e) \qquad (1)$$

That is, circumstances and effort are transformed into final outcome through a monotonic function, $g(\cdot)$, which is the same for all the individuals in the population. Given eq. (1), it is possible to partition the population into "types" and "tranches".

A type is a group of individuals sharing the same set of circumstances and having access to the same opportunity set. An opportunity set is represented by all possible final outcomes individuals may enjoy, after exerting the effort they choose to put in. Individuals within each type can differ in the level of effort exerted.

A tranche is a group of individuals exerting the same effort. Individuals within the same effort group may belong to different types.

Box 1. The identification of effort

> The partition in tranches is demanding in terms of data, because it requires information on effort. If effort is observed directly (through labour hours, for example) the partition is straightforward. It effort is unobservable, the most frequent solution is the RIA (Roemer's Identification Assumption). It states that individuals that are ranked the same in the distribution of income of each type have exercised the same degree of effort. This is possible since, from eq. (1), individuals belonging to the same type may only differ in the effort exerted. As the function $g(\cdot)$ is assumed to be increasing in the level of effort, it follows that the higher is the level of effort exerted the higher is the outcome an individual gets. It can be then inferred that ranking individuals according to their level of outcome in each type implies ranking them on the base of their effort.
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> RIA also solves the problem of correlation between circumstances and effort. What is often used to identify effort ("how hard you try"), tends to be correlated with circumstances. As a consequence, circumstances, besides affecting directly the final outcome, also affect the ability/incentive of an individual to exert a certain level of effort. For example, it is reasonable to believe that a professor's son has higher incentives to study than a farmer's son, because the culture at home is likely academically orientated. Hence, the level of effort of the professor's son is not strictly comparable to that exerted by the farmer's son. In order to make meaningful comparisons, it is necessary to obtain a normatively relevant evaluation of effort, by depuring the level of effort exerted from the impact of circumstances[5]. This procedure can be accomplished through the RIA. RIA, taking into account the differences arising in each type specific distribution of effort, permits inter-type comparable measures of effort: the "degree" of effort[6].

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[4]   This is a pure deterministic model: for any given set of circumstances, any variation in individual income is attributed to personal effort. In this model circumstances and effort are assumed to be uncorrelated. Extensions of this basic framework include also luck, unobservable variables, and an error term, as additional components of the individual outcome (see Fleurbaey, 2008; Lefranc *et al.*, 2009; Ramos and Van de gaer, 2016).

[5]   The literature proposes alternative solutions to this problem. For example, Bourguignon *et al.* (2007) use econometric techniques, like regression analysis, to obtain cleaned normatively relevant effort variables. It is the disturbance term in a regression of effort on circumstances.

[6]   Note the difference between the level of effort and degree of effort. The level of effort is the pure expenditure of effort. It does not account for the fact that the distribution of effort for a type is a characteristic of the type and a circumstance for the individual. The "degree" of effort, instead, neutralizes the effect of the distribution of effort within a given type. For instance, let's imagine that effort is proxied by educational achievement. The level of effort would simply coincide with the individual educational achievement. However, we know that educational achievement is heavily influenced by parental socio-economic background (which is a circumstance). Hence, as suggested by RIA, to make comparisons of effort across types meaningful, we would have to look at the distribution of educational

From the definition of individual outcome, given in eq. (1), it can be inferred that the overall inequality in the distribution of final outcomes derives from two different sources. The first source is associated to circumstances, C. When circumstances act on the final outcome, provoking disparities among the opportunity sets faced by individuals belonging to different types, there will be inequality of opportunity. This would be the case when circumstances such as gender, race, and health status affect outcomes irrespectively of the amount of effort expressed by individuals. The second source is associated to the effect of effort, e. Individuals exerting different effort may obtain different outcomes, even if they share the same set of circumstances. While the first source of inequality is intrinsically unfair, the second source is considered as morally acceptable, because it is the result of the individuals' own choices.[7]

Then, the question arising is: when is a distribution of outcomes, defined as above, coherent with the norm of equality of opportunity?

The answer depends on the alternative ways of accounting for circumstance and effort factors within the EOp framework. Two factors mainly determine the result: the first is the particular list of characteristics comprised in the set of circumstances[8]; the second depends on the way in which equality of opportunity is declined (according to two different principles - compensation and reward) and evaluated (according to two different perspectives – ex-ante and ex-post).

2.2.1 EOp principles

The first principle, the principle of compensation, endorses an egalitarian view. It states that differences in individual outcomes, unambiguously determined by differences in circumstances, are unfair and need to be compensated by society. According to this principle, equality of opportunity would prevail in a situation where inequalities due to circumstances are eliminated.

The second principle, the principle of reward, focuses on how to be fair to individuals with identical circumstances and unequal effort, and how to allot outcome to effort. It states that differences in individual achievements, unambiguously attributed to differences in effort, are equitable and should not be compensated. According to this principle, equality of opportunity would prevail in a situation where only inequalities in final outcomes due to effort are preserved[9].

Although the compensation and the reward principle can be interpreted as two independent sub-goals of the opportunity egalitarian theory, they can be incompatible[10]. This happens because compensation focuses on the inequality between individuals characterized by different circumstances, whereas, reward focuses on the inequality due to effort among individuals with equal circumstances. Hence, embracing one principle instead of the other does make a difference in the evaluation of the equality of opportunity of a society.

2.2.2 EOp perspectives

The differences stemming from the compensation and the reward principle are reflected in the two different perspectives adopted to evaluate the extent of (in)equality of opportunity. The ex-ante and the ex-post perspectives, in fact, are not always coherent with both principles at the same time. This duality may generate alternative interpretations of the EOp concept, causing different rankings of social states (Fleurbaey and Peragine, 2013; Peragine, 2004a, 2004b; Ramos and Van de gaer, 2016).

According to the ex-ante approach, there is equality of opportunity if everyone can access the same set of opportunities regardless of her circumstances (Van de gaer, 1993; Kranich, 1997). Therefore such approach relies on the evaluation of individuals' opportunity sets, namely outcome prospects (e.g. educational achievement, health status, working status), in comparison with those of individuals with different circumstances. The lower is the difference between the sets of opportunities enjoyed by individuals belonging

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achievement within each type (assuming that the latter would be determined by socio-economic background only). Then, for each type, we would rank individuals with respect to their educational achievement for this specific type. These rankings – which capture the degree of effort- are comparable across types, because a normalization has been imposed.

[7] This leaves open the indirect role of circumstances, since they also affect effort. This issue is addressed in the empirical literature by adopting different econometric specifications.

[8] For instance, age, ethnicity, parental background, social connections, formation of beliefs, genetic transmission of native ability, or any other relevant exogenous characteristic.

[9] The reward principle can be further decomposed into two sub-principles: the natural or liberal reward and the utilitarian reward. See Fleurbaey (2008) for details.

[10] These principles originate from the literature on fair division models (see Fleurbaey, 2008; Fleurbaey and Maniquet, 2006, 2008). Their introduction in the EOp context motivates, instead, the development of different approaches to measure inequality of opportunity.

to different types, the higher is equality of opportunity. Therefore, "compensation" should be applied between opportunity sets, in order to make them as equal as possible.

According to the ex-post approach there is equality of opportunity if individuals exerting the same degree of effort obtain the same outcome (Roemer, 1993; Fleurbaey, 1995). The lower is the difference in the outcome enjoyed by individuals who exert the same degree of effort, the higher is equality of opportunity. For instance, we would have high equality of opportunity when pupils with the same academic achievement (which can be interpreted as a proxy for effort) have the same chances of obtaining successful social positions. When equality of opportunity does not exist, "compensation" should be applied between the outcomes of individuals exerting the same degree of effort, in order to make them as (outcome) equal a possible.

The benchmark for both perspectives is a society in which circumstances are no longer the source of inequalities. However, important differences between the ex-ante and the ex-post approaches arise.

A first difference stands out from the terminology ex-ante/ex-post. The ex-ante perspective advocates equality of opportunity in a situation where circumstances are known but effort is not, hence before individuals make their choice. The ex-post perspective advocates equality of opportunity in a situation where all variables are known, hence once individuals have made their choice. Second, the informational base necessary to evaluate EOp is different. While the ex-ante perspective only requires information on circumstances, the ex-post approach requires information on circumstances and individual effort. The ex-ante approach focuses on the inequality between social groups, emphasizing the differences between the sets of choices available to them. It is instead neutral with respect to the inequality arising within each group (which is interpreted as the result of effort). Hence, the ex-ante perspective only accounts for the direct effect of circumstances on the set of opportunities available to different social groups. The ex-post approach focuses on the inequality within groups of individuals exerting the same degree of effort. Hence, this approach is also able to account for the indirect effect of circumstances on effort.

The difference in the informational base has also implications from an empirical point of view. Thanks to its data parsimony, the ex-ante is, up to now, the most used approach. On the other hand, the ex-post approach, being more data demanding, makes possible a finer evaluation of inequality of opportunity.

Moreover, although the two perspectives are both coherent with the EOp idea, they can be mutually inconsistent, as it is shown in the following example.

Example 1: *Assume that we want to compare two societies, A and B according to EOp. Assume that we can partition both populations in four types (rows: they correspond to circumstances) and two tranches (columns: they correspond to effort), such that we have the following matrices:*

$$A = \begin{pmatrix} 25 & 20 \\ 20 & 15 \\ 35 & 11 \\ 30 & 6 \end{pmatrix} \qquad B = \begin{pmatrix} 26 & 20 \\ 20 & 14 \\ 35 & 12 \\ 29 & 6 \end{pmatrix}$$

In society A, the first row has better opportunities than the second one and the third row has better than the forth (no matter what the level of effort is, type 1 has higher outcome than type 2 and type 3 has a higher outcome than type 4). Increasing A_{11} and decreasing A_{22} makes the inequalities between the first and second row increase. Increasing A_{32} and decreasing A_{41} makes the inequalities between the third and the fourth row increase. The combination of the two can generate society B. Hence, according to the ex-ante perspective of EOp A dominates B. Now suppose that we are in society B. Increasing B_{41} and decreasing B_{11}, makes the inequality in the first column increase. Increasing B_{22} and decreasing B_{32} makes the inequality in the second column increase. The combination of the two manipulations may result in society A. According to the ex-post perspective to EOp, B dominates A, contradicting the previous dominance.

The tension between the ex-ante and ex-post approach allows perceiving the tension between compensation and reward. The ex-ante perspective is consistent with both the compensation and the reward principles[11]. The ex-post perspective, instead, is only consistent with compensation.

2.3 Policy implications

The choice between an ex-ante vs. ex-post perspective, while relevant from both a theoretical and empirical perspective, does not have relevant consequences in terms of policy implications. Two broad types of policies directed at reducing inequality of opportunity can be identified. On the one hand, there are policies that try to reduce the relevance of the various *circumstances*, as drivers of inequality: at an extreme, if all the circumstances would become irrelevant we would obtain complete equality of opportunity. On the other hand, and assuming that some inequality due to circumstances remains, policies should try to compensate for this persistent inequality.

Let's imagine that the focus is on equality of opportunity in labour income and it appears that gender is an important determinant, since i) women tend to be more represented in low-wage professions, ii) within the same occupation, women tend to perform the lowest paid tasks or have limited prospects for professional development; iii) everything else equal (including education, occupations and tasks), women are paid less per hour; iv) everything else equal (including education, occupations, tasks and wages) women tend to work less hours. Point i) – which is consistent with vertical segregation- calls for policies directed at increasing the educational attainment of women, their level of skills and their education/professional aspirations. Policies could be financial, such as monetary support to females attending tertiary education (e.g. reduced fees, scholarships etc.), or non-financial, such as policies directed at breaking gender stereotypes (e.g. policies for increasing the number of females pursuing STEM education). This second type of policies could also work to reduce the effect of point ii) –horizontal segregation- on the gender gap. Vertical and horizontal segregation could also be reduced by setting gender quotas. The inequality discussed at point iii) could be eliminated by policies directed at insuring equal pay for man and women with same individual characteristics and employed in identical occupations and performing identical tasks. Point iv) type of inequality is more subtle, as it appears to stem from "choices", typically in connection with household related tasks (e.g. taking care of the children and the elderly). The problem is that, in this area, the border between "free" and "constrained" choices is very fuzzy and policies should make sure that women' choices in relation to labour market participation are not imposed on them. Policies favouring parental leave for males work to reduce gender stereotypes and hence to reduce the relevance of this type of inequality.

Region of birth is often found to be an important *circumstance* affecting labour income. Policies should first try to reduce regional disparities in all the dimensions that are relevant for the variable of interest. In this case this would imply making sure that there are no significant differences across regions in terms of quality and quantity of infrastructures, education, health care and job opportunities. However, governmental control over job opportunities is limited. These depend upon local and global conditions, which in many cases require interventions that can produce effects only in the medium to long term (e.g. policies directed at addressing changes in industrial structure or at fighting the presence of organized crime). Since policies directed at equalizing opportunity sets across regions would take years to be effective, it is important to put in place compensatory policies that reduce the effect of the *regional circumstance* even in the short run, such as policies directed at supporting access to and completion of education (including tertiary education) for individuals residing in the poorer regions, or reduced taxation for those who reside or invest in these areas.

Considering now the area of education, it is well known that parental socio-economic background plays the largest role in accounting for inequalities in educational attainment (measured in terms of test scores- e.g. PISA scores – or in terms of highest level of education attended). Different aspects can explain why parental background is so important. First, we know that financial resources play an important role in human capital investment decisions, and more so in countries characterized by a large presence of private education. In order to equalize opportunity sets, public policies should focus on redistributing income towards poorer households, especially those with children of school age. Such redistribution could be unconditional (i.e. income support to poor households) or could be targeted to the purchase of education services (for instance using education vouchers, grants or reduced fees for disadvantaged students). However, financial constraints are just one of the drivers of educational inequalities. Other important factors are i) the quantity and quality of resources (including infrastructures and teachers) invested at the school level, ii) the strength of peer-effects, iii) personal attitudes and expectations towards education. In order to guarantee EOp in education, the public sector should

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[11] The ex-ante perspective is coherent with the reward principle since it aims at equalizing the treatment of individuals with equal ex-ante endowments.

make sure that sufficient resources to insure decent standards of education exist in all schools, and that additional resources are spent where they are mostly needed (for instance in schools characterized by a large presence of students from under-privileged background). Peer-effects tend to generate inequality to the extent that students are clustered by socio-economic background. For this reason, it is important to insure that students from different backgrounds are mixed as early as possible. The cultural climate at home is also an important source of inequality, since it affects students' attitudes and expectations. Policies directed at informing students –and their families– of the benefits from attending tertiary education, together with quotas, have proven quite successful in increasing participation to tertiary education by under-privileged students.

2.4 Related concepts

So far, we have discussed the different interpretations underlying the idea of equality of opportunity contemplated in the EOp theory. However, the sociological and economic literatures have developed alternative concepts. They are, in principle, meant to measure the same phenomenon, however they may differ under relevant aspects.

2.4.1 Meritocracy

The first related concept is meritocracy. According to the meritocratic view, equality of opportunity would prevail in a situation in which people with identical levels of effort and choices enjoy identical outcomes. A meritocratic approach to equality of opportunities would put in place policies that insure that to the same level of effort correspond equal outcomes. While it does not directly addresses the role of circumstances, by focussing on effort, this concept is close to the ex-post perspective: inequality arising from different efforts is ethically justifiable. At the same time, meritocracy diverges from ex-post EOp because it neglects the indirect effect of circumstances on the final outcome. In fact, while meritocracy considers only the "level" of effort, ex-post equality of opportunity is concerned with guaranteeing equal outcome to those that exert the same "degree" of effort [12].

In essence, meritocratic policies tend to provide a reward to effort independently from the direct or indirect role that circumstances (in the meaning of EOp) might play. Policies aiming at improving EOp, on the other hand, explicitly recognize that circumstances play an important role in determining the relationship between effort and outcomes and that disadvantaged circumstances should be either eliminated or compensated for.

Meritocracy and ex post EOp coincide only when effort is stochastically independent of circumstances. In general, this is not the case. Assume that outcome is represented by earnings, which depend on the educational effort (educational attainment, number of hours dedicated to study), but which could also be affected by other factors (age, gender, race, social background, etc.). At the same time, educational effort, in general, depends on circumstances, such as the parental education. In this case it can be safely stated that effort (as a measure of merit) is partly due to circumstances. A meritocratic policy maker would focus on insuring that factors different from education do not play a role in wage determination (i.e. avoid any type of wage discrimination based on race, gender, social background, conditional on a given educational level). On the other hand, a policy maker concerned with EOp would recognize that circumstances play an important role in the determination of educational achievement, and would hence try to minimize their role, making sure that returns to effort are equalized across different types.

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[12] See the discussion in BOX 1.

In general, a policymaker endorsing an EOp perspective would level the playing field before the competition for social resources takes place, while a meritocratic policymaker would do it at the competition stage. Hence, a meritocratic policy would allocate social resources by directing them only to those exerting the highest level of effort. It is likely that individuals in the most disadvantaged types will be excluded by the target of this policy because their level of effort is lower, even though they have tried equally hard (they started from a disadvantaged set of circumstances). On the other hand, an EOp policy would sacrifice efficiency by allocating some additional resources to compensate individuals for their disadvantage. For example, according to the meritocratic view, only the students that do well in secondary school or in admission tests would be admitted to university; whereas, according to the EOp view, admission should go beyond pure merit and evaluate relative merit on the basis of students external characteristics (i.e. types)[13].

Meritocracy weakens the issue of being fair with respect to individuals characterized by different circumstances, strengthening, instead, the issue of preserving the incentive to exert more effort. This observation poses the issue of defining the amount of compensation when resources must be assigned according to merit. A trade-off between meritocracy and equality of opportunity might arise if specific social positions were assigned to individuals who may not be equally efficient in producing outputs for that society. A solution could be to adopt a combination of the two principles. For instance, one could adopt an EOp policy in the preliminary stage of education and formation, and a meritocratic policy in the following stage on the selection of candidates for jobs[14]. Beside the different treatment of circumstances in the context of meritocracy and EOp, there are other situations in which, even if one adopted an EOp perspective, the policy implications would tend to be analogous to those of meritocracy. In fact, we can argue that by expanding or restricting the set of circumstances one can get further away or closer to from meritocracy. The example of talent is illuminating. Talent is the product of nature and upbringing, and hence should be considered as a circumstance, at least up to a person's adolescence. In this case, and taking an EOp perspective, it should be concluded that differences in talent should be compensated for. On the other hand, if talent is not considered as a circumstance, a meritocratic interpretation of EOp would arise, since it would not be necessary to compensate persons for their low talent. A similar logic would apply to health status (but in this case most would indeed include it among the circumstances). This is a standard issue when the outcome is represented by education. Should an educational system reinforce differences in talent, by rewarding talent, or instead compensate for them, considering it as a circumstance? In the former case, education resources should be distributed to those who can make the most use of them, and therefore redistribution should reward the joint effect of talent and effort (see Brunori *et al.*, 2013).

Opposed to the concept of meritocracy and talent is the concept of discrimination, which can be considered an additional source of inequality of opportunity. Discrimination arises when individuals equally endowed in terms of talent and productivity face legal barriers to an equal treatment. An example is represented by the wage gap, or the different access to the best jobs, between social groups with equivalent educational background and qualifications (e.g. white vs black wage gap; male vs female wage gap). According to this view, EOp would arise in a situation where equally deserving individuals are treated equally[15].

2.4.2 Intergenerational mobility

Intergenerational mobility is a concept often employed by the economic literature to investigate the issue of equality of opportunity. It is undeniable that more mobile societies might be able to grant more equality of opportunity, however the two concepts should be kept separate.

Relative intergenerational mobility can be interpreted as the extent to which individuals move up or down the social ladder relative to their parents' position. It is close to the ex-ante perspective of EOp because it does not account for the effect of effort on the final outcome. However, the two concepts differ inasmuch as the standard EOp approach is based on a definition of a list of circumstances that goes beyond parental income. Intergenerational mobility would be equivalent to ex-ante EOp if and only if the set of circumstances affecting the outcome of individuals were restricted to parents' income (or social status). When the set of circumstances is broadened to account for other exogenous factors, it is reasonable to believe that a measure of mobility would be able to capture only part of the inequality of opportunity arising in the society.

The policy implications of such divergence are clear-cut. A policymaker aiming at maximizing intergenerational mobility would not be concerned with the issue of fairly rewarding individuals for their effort (similarly to the ex-ante perspective). At the same time, the compensation scheme would be based only on individuals' parental status, while being neutral with respect to differences arising from race or region of birth, for example. A further point of discontinuity is that it would allocate resources to more immobile individuals, even though the state of immobility is the result of low effort.

Recent contributions however propose new concepts and measures of mobility, more consistent with the EOp idea[16]. These frameworks enable to control for a broader set of circumstances and to disentangle the part of mobility that is effectively acting as an equalizer of opportunities from that part due to change in the individual effort.

2.4.3 Intergenerational equity

The theory of equality of opportunity has been moved forward by the 2006 World Development Report (World Bank, 2006), advancing a new definition of equity, as a state in which two conditions should be verified. The first is the equalization of the opportunities for individuals to realize the life of their choosing; the second is the avoidance of extreme poverty (even though this state might be the result of low effort). According to this principle, equality of opportunity would arise in a situation where opportunities for all types are maximized.

The idea underlying this concept is that inequalities have two main dramatic effects: the violation of people's concern for fairness and the costs for the development process, in terms of inefficiencies and wasted economic potential. Greater equity is morally desirable because it incorporate fairness concern; but it is also instrumentally complementary to long-run growth and prosperity because it contrasts the formation of poverty and inequality traps, with the immediate result that the benefits for the poorer and excluded groups are doubled: overall resources grow and the poor can have access to a larger share of them.

From this perspective, an equity policy should be aimed at breaking inequality traps and supporting aggregate growth, by paying attention to specific inequalities and their interactions with markets, social structure and power.

In this vein, an equity policy should be targeted to protect people's human capacities from the start of people's lives and through adulthood. These interventions encompass: early childhood development programs, to enhance a child's life chances and mitigate the intergenerational transmission of poverty and inequality; interventions in education, such as higher public spending on the supply of schools, by ensuring to children from different backgrounds affordable access and the same opportunity of benefiting from quality education. A second target is ensuring equitable access to justice and complementary assets and introducing fairness policies in the markets, such as financial, labour and product markets. These interventions are crucial for constraining the power of the political and economic elite and avoiding discrimination.

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[13] See Betts and Roemer (1999).

[14] Think at the selection criteria to cover a particular job position, surgeon, for example. Given the impact of this job on social welfare, society would sacrify equality of opportunity and endorse pure meritocracy. But it would support equality of opportunity for the access to medicine at university.

[15] Discrimination is the focus of a quite different branch of the literature. For additional details the reader can refer to Borjas (2009).

[16] See Van de gaer *et al.* (2001), Ruiz-Castillo (2003) and Palmisano (2011).

2.4.4 Human Opportunity Index

The most recent interpretation of equality of opportunity can be inferred from the Human Opportunity Index (de Barros *et al.*, 2009). This framework focuses on the unfair allocation of basic opportunities. Here, basic opportunities refer to those goods and services that are critical in determining opportunities for economic advancement in life and are exogenous from the point of view of the individual (i.e. access to them is controlled by the family or by society). This form of inequality may take place early in life, (e.g. access to education, health, nutrition, and basic services), or later (e.g. tertiary education, life-long learning and health).

Children who cannot access basic opportunities might be not allowed to fully utilize their talents with the consequence of a suboptimal accumulation of human and physical capital, which eventually has an impact on outcomes.

The HOI captures two aspects: (i) the extent to which the basic functionings[17] necessary for children's development are available in a given time/place, and (ii) the extent to which access to those functionings depends upon exogenous circumstances.

The HOI stands out as a tool able to express, within the same framework, the extent of the aggregate opportunities in a given country and the extent of fairness in the distribution of these opportunities. According to this approach, there is equality of opportunity if the distribution of basic goods and services is not correlated with circumstances and the access to these basic needs is expanded as much as possible. A society will instead be characterized by inequality of opportunity if some children do not have access to goods and services instrumental to satisfy basic needs and if the extent of access is determined by factors for which a child cannot be held responsible. Hence, EOp would prevail in a situation where all children are given equal access to the basic goods and services that are necessary for their development, which is instrumental to the attainment of any final level of outcome desired when they are adult.

This approach differs in several aspects from the standard EOp theory. The first difference is represented by the space of evaluation: the basic functionings for the HOI and the outcome(s) for the EOp theory. Second, the HOI captures the nature of inequality in access to *basic* opportunities, as opposed to the overall inequality of opportunity defined in the standard approach. This is justified by the idea that by expanding access to basic goods and services (independently from circumstances) will reduce the overall effect of circumstances on the income received by that person in adult age. However, this implies that the HOI captures inequality in access to basic opportunities between groups of individuals with different circumstances, rather than the overall inequality in the access to basic goods. It expresses neutrality with respect to inequality in the access to basic needs among individuals with the same circumstances. Therefore, it can be considered as a lower bound estimate of the total inequality in access to basic needs.

A policy coherent with this approach should ensure equal conditions for access to goods and services directed at satisfying basic needs. For instance, specific sets of social services should be provided to all. These policies should be implemented to increase access to basic opportunities and to ensure that their provision is not systematically biased against any specific group or type of individuals.

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[17] In Sens' language a functioning is what an individual does or is. In other words, functionings are the states and activities that constitute the essence of a person.

3 Measuring IOp

The measurement of (in)equality of opportunity (IOp) represents a crucial issue for the realistic implementation of an opportunity egalitarian policy. Measurement of IOp is necessary to identify the part of the population most in need, to allow comparisons across countries and time, to discover the best practices that can be replicated in different contexts.

Different methods are available to measure the degree of inequality of opportunity in a distribution. They can be classified in two main categories[18]: index-based and stochastic dominance approaches[19]. Before we discuss them in detail, it is important to notice that, in empirical analysis, researchers have to deal with the impossibility of observing opportunity sets (a problem that does not affect theoretical contributions). Hence, empirical analyses try to derive conclusions about opportunity sets from the observation of actual outcomes. This can be done because a relationship between circumstances and effort, on the one hand, and outcome, on the other one, is assumed. By observing outcome and making appropriate assumptions on the distribution of effort, it is possible to derive a (counterfactual) distribution of (unobservable) equality of opportunities. In particular, researchers adopting an ex-ante approach typically start from the selection of the *circumstances*, and then investigate how much of the observed inequality in the outcome variable (e.g., income, wealth, educational attainment, health status) can be accounted for by *circumstances*: the higher is the share of observed inequality that can be traced back to *circumstances* and the higher is the part of observed inequality that is due to lack of equality of opportunity. The move from equality to inequality of opportunity permits the use of the statistical techniques developed to measure inequality. Since the circumstances used in the empirical analysis are just a subset of the factors that in practice influence people's opportunities, the estimates for IOp represent a lower bound of actual Inequality of opportunity

3.1 Indices of IOp

The prevailing index-based approach aims at evaluating the extent of inequality of opportunity in a society by applying an index of inequality, denoted by I, to a counterfactual distribution of an outcome variable (e.g. income) denoted by $\tilde{x}$, which is obtained transforming the individual outcome such that the inequality due to effort is eliminated and the only inequality left is the inequality due to circumstances:

$$\text{Inequality of opportunity} = I(\tilde{x}) \qquad (2)$$

It is useful to recall that the ex-ante perspective focuses on inequality between types, that is, on the inequality among the set of opportunities open to individuals with different circumstances. Ex-post inequality of opportunity focuses on inequality within tranches, that is on the inequality of the outcome enjoyed by individuals exerting the same degree of effort but belonging to different types. Consequently, the construction of the counterfactual distributions depends on the perspective adopted. In addition, the literature proposes different – non-parametric and parametric – solutions to derive them.

For simplicity, treat effort e, as well as each element of the vector of circumstances, C, as discrete variables. Then a given population can be partitioned in two ways: into types T_i , within which all individuals share the same circumstances, and into tranches T_j, within which everyone shares the same degree of effort. Denote by x_{ij} the income generated by circumstances C_i and effort e_j. Suppose, in addition, that there are n types, indexed by $i = 1, \dots, n$, and m tranches, indexed by $j = 1, \dots, m$. In this discrete setting[20], the population can be represented by a matrix $[X_{ij}]$ with n rows, corresponding to types, and m columns, corresponding to tranches: see Table 1.

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[18]   See Ferreira and Peragine (2016) and Ramos and Van de gaer (2016) for a detailed and comprehensive survey on this topic.

[19]   Others approaches borrowed from the fairness allocation theory are based on the comparisons between the actual distribution and the norm distribution. See Devooght (2008) and Almas *et al.* (2011).

[20]   In an alternative formulation, that would treat effort as a continuous variable, $F_i(x)$ would denote the advantage distribution in type i and q_i denote its population share. The overall distribution for the population as a whole would be $F(x) = \sum_{i=1}^{n} q_i F_i(x)$.

Table 1. Distribution of outcomes according to circumstances and effort.

	e_1	e_2	e_3	...	e_m
C_1	x_{11}	x_{12}	x_{13}	...	x_{1m}
C_2	x_{21}	x_{22}	x_{23}	...	x_{2m}
C_3	x_{31}	x_{32}	x_{33}	...	x_{3m}
...	...	...	...	...	...
C_n	x_{n1}	x_{n2}	x_{n3}	...	x_{nm}

The measurement of inequality of opportunity can be thought of as a two-step procedure[21]: first, the actual distribution $[X_{ij}]$ is transformed into a counterfactual distribution $[\tilde{X}_{ij}]$ that reflects only and fully the unfair inequality in $[X_{ij}]$, while all the fair inequality is removed. In the second step, a measure of inequality[22] is applied to $[\tilde{X}_{ij}]$, to obtain $I(\tilde{x})$. In principle, the construction of the counterfactual distribution $[\tilde{X}_{ij}]$ should reflect both the compensation and the reward principles – the two subcomponents of opportunity egalitarianism.

Below we review two of the most influential measurement approaches proposed in the literature: the first subscribes to an ex-ante view of compensation - "between-types inequality"– while the second pursues the ex-post compensation principle – "within-tranches inequality".

Versions of the between-types inequality approach were variously proposed by Peragine (2002, 2004a, 2004b), Bourguignon, *et al.* (2007), Checchi and Peragine (2010) and Ferreira and Gignoux (2011). The approach is inspired by the "min of means" criterion proposed by Van de gaer (1993). The counterfactual distribution is obtained by replacing each individual income x_{ij} by the average income of the type she belongs to. This smoothing transformation is intended to remove all inequality within types. Formally:

Between types $\left(\tilde{X}_{BT}\right)$: For all $j \in \{1, … …, m\}$ and for all $i \in \{1, … …, m\}$, $\tilde{x}_{ij} = \mu_i$.

Table 2. Between-types inequality ($n = m = 3$).

	e_1	e_2	e_3
C_1	μ_1	μ_1	μ_1
C_2	μ_2	μ_2	μ_2
C_3	μ_3	μ_3	μ_3

By making use of standard inequality decomposition techniques (Theil, 1979a, 1979b; Bourguignon, 1979), some authors (notably Checchi and Peragine, 2010 and Ferreira and Gignoux, 2011) have used this approach to propose a useful decomposition of overall inequality into two terms: between types inequality, to be interpreted as inequality of opportunity, and within types inequality, interpreted as inequality due to effort.

Let us turn now to the ex-post measurement approach. Inspired by Roemer's (1993) "mean of mins" criterion, Checchi and Peragine (2010) and Aaberge *et al.* (2011) propose the within-tranches counterfactual distribution

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$(\tilde{X}_{WTR})$, which is obtained by replacing each individual outcome x_{ij} in a given tranche with the ratio between such outcome and the average income of that tranche: $v_j = \sum_{i=1}^{n} p_{ij} x_{ij}$. This normalization procedure is intended to remove all inequalities between tranches and to leave unchanged the inequality within tranches. Formally,

Within tranches $(\tilde{X}_{WTR})$: For all $j \in \{1, \ldots\ldots, m\}$ and for all $i \in \{1, \ldots\ldots, m\}$, $\widetilde{x_{ij}} = g(c_i, e_j)/v_j$.

Table 3. Within tranches inequality ($n = m = 3$)

	e_1	e_2	e_3
C_1	x_{11}/v_1	x_{12}/v_2	x_{13}/v_3
C_2	x_{21}/v_1	x_{22}/v_2	x_{23}/v_3
C_3	x_{31}/v_1	x_{32}/v_2	x_{33}/v_3

It is easy to see that the within-tranches measure is consistent with ex-post compensation: each tranche is obtained simply by rescaling original incomes by a constant $(1/v_j)$. Therefore $\tilde{X}_{WTR}$ accounts for all of the original (relative) inequality within tranches. On the other hand, it does not capture inequality between tranches. Also in this case Checchi and Peragine (2010) propose a useful decomposition of overall inequality into two terms: within tranches inequality, to be interpreted as inequality of opportunity, and between tranches inequality, interpreted as inequality due to effort.

Some studies have tried to compare estimates of ex-post and ex-ante IOp (Aaberge *et al.*, 2011; Cogneau and Mesplé-Somps, 2008), showing how the results from the two approaches differ.

The parametric solution put forward to evaluate ex-ante inequality of opportunity consists, instead, in evaluating the opportunity set as the result of estimation, through regression analysis, of a particular specification of the function $g(\cdot)$ in eq. (1)[23]. Assuming that $g(\cdot)$ is linear, one would estimate

$$x = c\beta + \epsilon \qquad (3)$$

which would produce an estimate $\hat{\beta}$ for the parameter governing the "impact" of circumstances on outcomes. Then, by applying $\hat{\beta}$ to the individual-specific values of observable circumstances one would obtain the predicted outcome for each individual. This would be depured of the effect of effort (and other individual idiosyncratic elements) and could then be used to construct a counterfactual distribution, to be used to generate a measure of IOp. This procedure eliminates within-type inequality and is, thus, consistent with an ex-ante evaluation of inequality of opportunity (see Ferreira and Gignoux, 2011, who propose this methodology to evaluate inequality of opportunity for six Latin American countries[24]).

As for the ex-post evaluation, a counterfactual can be obtained by estimating, through regression analysis, the level of outcome that each individual would enjoy by exerting a reference level of effort, given her circumstances[25]. Usually the mean value for effort in the sample is taken as reference (see Pistolesi, 2009, who implements this approach to analyse the evolution of opportunity inequality in the U.S. between 1968 and 2001, using PSID data[26] and using averaged earnings as outcome variable).

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[23]　Assuming that circumstances and effort are correlated, the function estimated to evaluate the opportunity set of individual k is $g_k(c_k, u_k)$, where u_k is the random component and is assumed equal to 0, so that the effect of effort is taken over by circumstances.

[24]　They use household income per capita as a measure of outcome and the mean log deviation as a measure of inequality. Circumstances are represented by parental education, father's occupation, ethnicity and region of birth. According to their results, Brazil is the most opportunity unequal, followed by Guatemala, Panama, Peru, Ecuador and Columbia.

[25]　The function estimated is $g_k(c_k, e_k^r, u_k)$, where e^r is the reference level of effort and u_k is the random component.

[26]　Circumstances are represented by age, parents' year of education, father's occupation, ethnicity and region of birth. He finds that inequality of opportunity represents between 20% and 43% of earnings inequality, but decreases all over the period reaching around 18% in 2001

3.2 Stochastic dominance approach

A further approach to measure inequality of opportunity uses stochastic dominance tools. This approach is based on the observation that the value of an individual's opportunity set increases as the outcome of the individuals belonging to his type increases. This suggests that ex-ante inequality of opportunity can be established when some type's cumulative distribution function of income first-order stochastically dominates another type's cumulative distribution function. Hence, the absence of first-order stochastic dominance between type's cumulative distribution functions can be used as a test for ex-ante equal opportunities[27]. This approach is proposed and used by Lefranc *et al.* (2008) to evaluate inequality of opportunity in nine Western countries, using pre-tax disposable income as the outcome variable and social background as circumstances[28].

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[27] If inequality averse reward principle is satisfied, absence of first order stochastic dominance can be strengthened to the requirement of absence of second order stochastic dominance between types.

[28] Sweden is the country performing better, followed by West Germany, Great Britain, Belgium and Norway, while Italy, France, Netherland and U.S. are the countries performing worse.

4 Empirical applications

Although rapidly flourishing, some aspects are still limiting the expansion of the literature in the empirical field. The most (but not the only) relevant issues relate to the difficulties involved in finding variables that describe circumstances satisfactorily and to the identification of effort.

As for the first issue, in principle, there can be agreements to define exactly what are the pre-determined characteristics that, while being outside individuals' control, directly affect individual outcome(s). However, in practice, their complete identification is prevented by the availability of data and the impossibility of observing the whole set of exogenous characteristics. In general, the set of circumstances observed in any particular dataset is likely to be a sub-set of all the possible circumstances that determine a person's outcome. The larger is the set of circumstances, the higher is inequality of opportunity. The direct implication is that, due to partial observability, one might end up underestimating the level of inequality of opportunity. Hence, empirical estimates based on data that present this drawback, should be interpreted as lower-bound estimates of the effective inequality of opportunity.

The second issue concerns the possible correlation between effort and circumstances. According to the EOp view, if effort is determined by circumstances, the inequality arising from different effort levels should also be questioned. Therefore, in order to have a reliable estimation of the part of inequality due to exogenous characteristics, the researcher needs to depurate effort from the effect of circumstances. One solution is represented by the methodology proposed in BOX 1.

4.1 Absolute vs relative measures

As discussed in section 3.1, the between-types measure of inequality of opportunity $I(\tilde{x}_{BT})$ is a version of the ex-ante approach that computes inequality over the counterfactual distribution where each individual's outcome is replaced by the mean of the values of the outcome variable for each type k, $\mu(k)$. The between-types measure $I(\tilde{x}_{BT})$ has been applied by a number of authors. Most of them, following Checchi and Peragine (2010) and Ferreira and Gignoux (2011), use the mean logarithmic deviation, but in a few cases the Gini index, the Theil (T) index and even the variance have been adopted.

Brunori et al. (2013) consider eight studies – Checchi *et al.* (2016); Ferreira and Gignoux (2011); Ferreira *et al.* (2011); Pistolesi (2009); Singh (2012); Belhaj-Hassine (2012), Cogneau and Mesple-Somps (2008) and Piraino (2015) – and compare actual IOp measures across forty-one countries, ranging from Guinea and Madagascar, with annual per capita GNIs of PPP$980, to Luxembourg, with a per capita GNI of almost PPP$ 64,000. We now briefly review their results.

Since in all of these studies the advantage indicator is proxied by a measure of economic well-being – household per capita income, household per capita consumption, or individual labor earnings – Brunori *et al.* (2013) refer to the between-types measure of IOp in these studies as an index of Inequality of Economic Opportunity (IEO). In practice, this index is presented in two alternative versions: i) the absolute or level estimate of inequality of opportunity (IEOL), expressed by the between-types inequality measure introduced above, that is $I(\tilde{x}_{BT})$; ii) the ratio of IEOL to overall inequality in the relevant outcome variable, which yields the relative measure, IEOR:

$$IEOR = \frac{I(\tilde{x}_{BT})}{I(x)} \qquad (4)$$

IEOR informs directly on the percentage of observed inequality in the outcome variables that is accounted for by inequality of opportunity.

The partition of types varies across studies, ranging from 6 to 7,680 types (although in four of the eight studies, the range is a more comfortable 72-108 types). Since in some cases the datasets are not large enough to yield precise estimates of the mean μ_k for all types, some authors compute IEOL using the parametric approximation discussed in Section 3.1. Parametric estimates are also presented either as levels (IEOL) or ratios (IEOR). This approach follows Ferreira and Gignoux (2011), which in turn draws on Bourguignon *et al.* (2007). Empirically, parametric estimates of inequality of opportunity tend to be a little lower than their non-parametric counterparts but, at least in the case of Latin America, the differences are not large: proportional differences between the two average 6.6% in Ferreira and Gignoux (2011).

These empirical estimates of "between-types" IOp – whether estimated parametrically or non-parametrically – represents lower-bound estimates of inequality of opportunity and this can be easily understood by considering that the set of circumstances empirically observed is a strict subset of the set of all circumstance variables that

matter in reality[29].

Recently, an upper-bound estimator of between-types inequality of opportunity has also been proposed, requiring panel data sets where the same individuals – or households – are observed at different points in time. Niehues and Peichl (2014) show that if all circumstances are time-invariant (e.g., because they are determined at birth), the share of inequality associated with individual fixed effects in such data can provide an upper-bound estimate for between-types IOp. Intuitively, if all circumstances are time-invariant, their contribution to inequality is fully captured by the fixed effects. If, in addition, some component of individual responsibility (or effort) is also time-invariant, then that estimate is upwardly-biased – hence an upper bound. One limitation of this approach is that it rules out the existence of time-varying circumstances, such as later brute luck.

Table 4 (reported from Brunori et al., 2013) presents the estimates of IEOL and IEOR for the forty-one countries analyzed in the eight aforementioned papers. The table also lists their gross national income (GNI) per capita and overall income inequality, the last one being measured by whatever index was used in the construction of the IEO indices for each country. Except where indicated, this measure was the mean logarithmic deviation, also known as the Theil-I index, a member of the generalized entropy class of inequality measures. While overall inequality, IEOL and IEOR come from the eight studies mentioned above, GNI per capita comes from the World Bank's World Development Indicators database.

Table 4. Inequality of opportunity and income inequality in 41 countries.

Country	GNI per capita PPP	Total inequality	IEO-L	IEO-R
Austria *(1)*	39,410	0.1800	0.0390	0.2167
Belgium *(1)*	37,840	0.1450	0.0250	0.1724
Brazil *(3)*	10,920	0.6920	0.2230	0.3223
Colombia *(3)*	9,000	0.5720	0.1330	0.2325
Cyprus *(1)*	30,160	0.1700	0.0510	0.3000
Czec Rep. *(1)*	23,620	0.1760	0.0190	0.1080
Denmark *(1)*	40,140	0.0830	0.0120	0.1446
Ecuador *(3)*	9,270	0.5800	0.1500	0.2586
Egypt *(5)*	5,910	0.4230	0.0491	0.1160
Estonia *(1)*	19,500	0.2430	0.0260	0.1070
Finland *(1)*	37,180	0.1360	0.0130	0.0956
France *(1)*	34,440	0.1630	0.0210	0.1288
Germany *(1)*	38,170	0.1910	0.0350	0.1832
Ghana *(2)*	1,600	0.4000	0.0450	0.1125
Greece *(1)*	27,360	0.2000	0.0340	0.1700
Guatemala *(3)*	4,610	0.5930	0.1990	0.3356
Guinea *(2)*	980	0.4200	0.0560	0.1333
Hungary *(1)*	19,280	0.2080	0.0210	0.1010

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[29]   For a formal proof of the lower-bound result, see Ferreira and Gignoux (2011).

India (8)	3,560	0.4218	0.0822	0.1949
Ireland (1)	32,740	0.1880	0.0420	0.2234
Italy (1)	31,090	0.1960	0.0280	0.1429
Ivory Coast (2)	1,650	0.3700	0.0500	0.1351
Latvia (1)	16,360	0.2290	0.0280	0.1223
Lithuania (1)	17,880	0.2280	0.0350	0.1535
Luxemburg (1)	63,850	0.1480	0.0350	0.2365
Madagascar (2)	980	0.4400	0.0920	0.2091
Netherlands (1)	42,580	0.1920	0.0360	0.1875
Norway (1)	57,130	0.1300	0.0030	0.0231
Panama (3)	12,980	0.6300	0.1900	0.3016
Peru (3)	8,940	0.5570	0.1560	0.2801
Poland (1)	19,020	0.2710	0.0250	0.0923
Portugal (1)	24,710	0.2470	0.0300	0.1215
Slovakia (1)	23,140	0.1320	0.0180	0.1364
Slovenia (1)	26,970	0.1040	0.0050	0.0481
South Africa (6)	10,280	0.6750	0.1690	0.2504
Spain (1)	31,550	0.2160	0.0420	0.1944
Sweden (1)	39,600	0.1060	0.0120	0.1132
Turkey (4)	14,580	0.3620	0.0948	0.2620
Uganda (2)	1,230	0.4300	0.0400	0.0930
UK (1)	36,580	0.2040	0.0420	0.2059
US (7)	47,020	0.2200	0.0409	0.1860

Source: Brunori et al. (2013)

(1) Checchi *et al.* (2016)

(2) Cogneau and and Mesple-Somps (2008)

(3) Ferreira and Gignoux (2011)

(4) Ferreira *et al.* (2011)

(5) Belhaj-Hassine (2012)

(6) Piraino (2015)

(7) Pistolesi (2009)

(8) Singh (2012)

Note: The source for inequality and IEO measures for each country is given in parentheses after the country's name. GNI per capita is taken from the World Bank's World Development Indicators, for the year 2010, using PPP exchange rates for 2005. Total inequality is measured by the mean logarithmic deviation in all cases except those from source (2), which use the Theil-T index. IEO indices are always based on the same inequality measure used for total inequality in that country.

Table 4 should be read together with Table 5, which describes the countries studied in each paper, the specific data sets, the income and circumstance variables used, whether the estimation was parametric or otherwise, and the number of types included. The table highlights a number of problems for comparability across these studies.

First, as discussed above, the nature of the outcome variable adopted is different: Pistolesi (2009), Singh (2012) and Belhaj-Hassine (2012) use labor earnings, Checchi *et al.* (2016), Ferreira and Gignoux (2011) and Piraino (2015) use incomes, Cogneau and Mesple-Somps (2008) use consumption, and Ferreira *et al.* (2011) use imputed consumption. These distinctions are not immaterial: in a comparison of six Latin American countries, Ferreira and Gignoux (2011) found substantially higher estimates of IEOR for consumption expenditure than for income distributions, in the same countries. In the same vein, Bourguignon *et al.* (2007) found differences between estimates for individual earnings and for household per capita incomes.

Second, the studies differ in the number of types used for the decomposition and in the exact set of circumstances used in each case. At one extreme, the Cogneau and Mesple-Somps study for Uganda has 3 types based on father's occupation and education levels; on the other Pistolesi has 7,680 types, constructed on the basis of information on age, parental education, occupational group of the father, individual ethnic group, and individual region of birth. Fortunately, there is a core set of studies – which account for most countries in the sample – with 72 to 108 types each.

Finally, a third comparability caveat depends on the fact that some studies use non-parametric estimates while others use parametric ones.

Table 5. Comparing eight studies of ex-ante inequality of opportunity across 41 countries.

	References	Countries	Data sources	Outcome	Method	Circumstances	Number of types
1	Checchi *et al.* (2016)	Austria, Belgium, Czech Republic, Germany, Denmark, Estonia, Greece, Spain, Finland, France, Hungary, Ireland, Italy, Lithuania, Latvia, Netherlands, Norway, Poland, Portugal, Sweden, Slovenia, Slovakia, United Kingdom	EU-Silc 2005	post-tax individual incomes	parametric	parental education, parental occupation, gender, nationality, geographical location	72
2	Cogneau and Mesple-Somps (2008)	Ivory Coast, Ghana, Guinea, Madagascar, Uganda	Ivory Coast, EPAMCI, 1985-88 Ghana, 1998, GLSS Guinea, 1994, EICVM Madagascar, 1993, EPAM Uganda, 1992, NIHS	per capita household consumption	non parametric	3 groups based on father's occupation and education, region of birth	6 (3 Uganda)

3	Ferreira and Gignoux (2011)	Brazil, Colombia, Ecuador, Guatemala, Panama, Peru	Brazil, PNAD 1996; Colombia, ECV 2003; Ecuador ECV 2006; Guatemala, ENCOVI 2000; Panama, ENV 2003; Peru, ENAHO 2001	household per capita income	parametric	gender, ethnicity, parental education, father's occupation, region of birth.	108 (54 Peru)
4	Ferreira *et al.* (2011)	Turkey	TDHS 2003-2004 and HBS 2003	imputed per capita consumption	parametric	urban/rural, region of birth, parental education, mother tongue, number of sibling	768
5	Belhaj-Hassine (2012)	Egypt	ELMPS 2006	total monthly earning	non parametric	gender, father's education, mother's education, father's occupation, region of birth.	72
6	Piraino (2015)	South Africa	NIDS 2008-2010	Individual gross income	parametric	race, father's education	24
7	Pistolesi (2009)	US	PSID 2001	individual annual earnings	semiparametric	age, parental education, father's occupation, ethnicity, region of birth	7,680
8	Singh (2012)	India	IHDS 2004–2005	household per capita earnings	parametric	father's education, father's occupation, caste, religion, geographical area of residence.	108

Source: Brunori et al. (2013)

Bearing these caveats in mind, Table 4 nevertheless illustrates the substantial variation in inequality levels – both in outcomes and in opportunities – across countries. The mean log deviation for the outcome indicator ranges from 0.083 in Denmark to 0.675 in South Africa. Norway, Slovenia and Sweden also have comparatively low levels of overall inequality, while Brazil and Guatemala stand out at the upper end. Inequality of opportunity levels (IEOL) range from 0.003 in Norway and 0.005 in Slovenia to 0.199 in Guatemala and 0.223 in Brazil. In other words, the (lower-bound) level of inequality in the distribution of values of opportunity sets across types in Brazil is almost three times as high as the total inequality (measured by the same index) in the distribution of actual incomes in Denmark. One can also observe substantial differences in IEOL among countries at closer levels of development, and more methodologically comparable: Madagascar's level of inequality of opportunity is twice that of Ghana; those of the US and the UK are ten times that of Norway and almost four times higher than Denmark's.

The ratio of these two inequality measures, i.e. the (lower-bound) share of the overall inequality due to inequality of opportunity (IEOR), also varies substantially, from 0.02 in Norway to 0.34 in Guatemala. Slovenia also has a low inequality of opportunity ratio, at 0.05, while Brazil closely follows Guatemala in the upper tail, at around 0.32.

Brunori *et al.* (2013) also investigate how these IOp measures correlate with some other important variables, such as output per capita, overall income inequality, and measures of intergenerational mobility. They report a

non-linear relationship between inequality of opportunity and the level of development, measured by the logarithm of per capita income levels. The resulting association appears to have an inverted-U shape, much as the "Kuznets curve" that used to be hypothesized for the relation between income inequality and the "level of development". The regression of IEOR on a quadratic of log GNI per capita produces a coefficient on the linear term of 0.32 (p-value: 0.05), and that on the quadratic term is -0.017 (p-value: 0.05). While the poorest countries in the sample are all located in Africa, the middle income countries near the turning point of the inverted-U include a number of Latin American countries, as well as Egypt, South Africa and Turkey. The richer part of the sample is dominated by European countries and the United States. Although these tend to be more EOp egalitarian, there is still a considerable spread among them.

Another question that naturally arises is whether there is any empirical association between inequality of opportunity and income inequality. Brunori *et al.* (2013) find a significant positive association between overall inequality (in economic advantage) and the share of that inequality associated with inequality of opportunity (IEOR). The correlation coefficient is 0.523 (p-value: 0.0004).

Such positive correlation might be driven by a number of possible mechanisms, the most plausible amongst them being the fact that today's outcomes shape tomorrow's opportunities: large income gaps between today's parents are likely to imply bigger gaps in the quality of education, or access to labor market opportunities, among tomorrow's children. Obviously, if opportunity sets differ substantially among people, then individual outcomes are also likely to be more unequal, thus suggesting the possible existence of the reverse direction of causation.

4.2   IOp in transition economies

The 2016-2017 Transition Report by the European Bank for Reconstruction and Development (European Bank for Reconstruction and Development, 2016), focuses on inequality and inclusion and devotes a whole chapter to the theme of inequality of opportunity. This section presents the main results emerging from such chapter and in particular those concerning inequality of opportunity with respect to individuals' incomes.
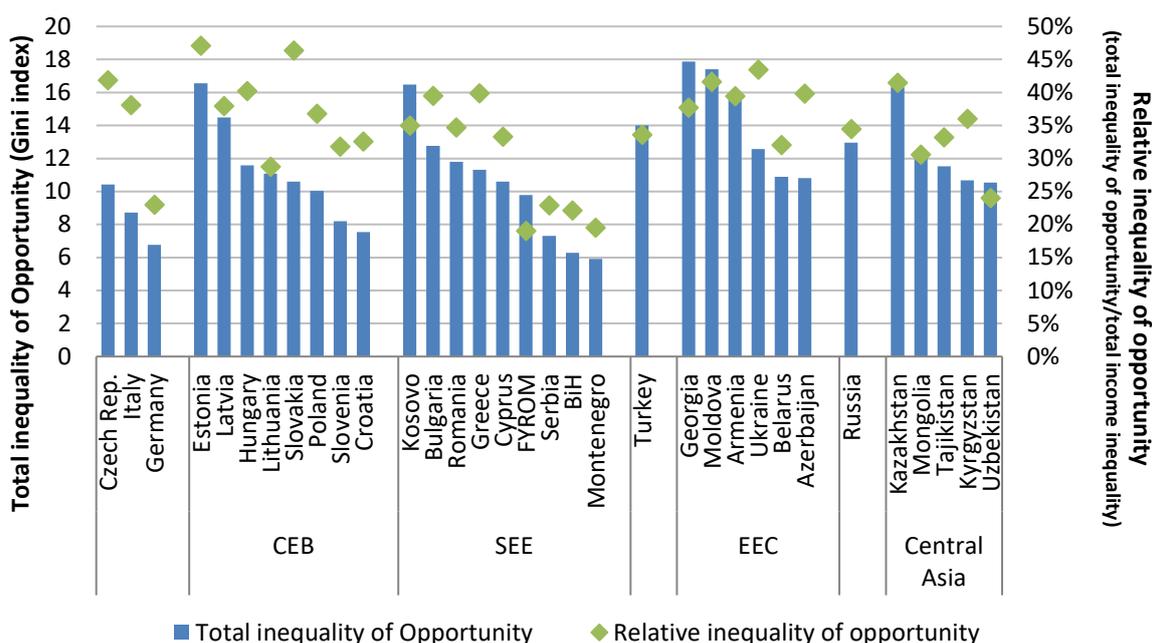
The analysis is based on the last wave of the Life in Transition Survey (LiTS), which has been carried out by the World Bank and the European Bank for Reconstruction and Development (EBRD) between 2015 and 2016. The variable used for income is the self-reported wage coming from employment over the last 12 months, while the measure for inequality of opportunity is based on the Gini index.

First, the Transition Report compares inequality of opportunity (both in absolute and relative terms) between the EBRD region and other countries and across the EBRD region. Total inequality of opportunity in the EBRD region is on average higher than in Western Europe (Figure 1, left axis), but much more modest than other emerging economies or the US. In India inequality of opportunity for income is over three times larger than the average in the EBRD region. In the US, it is nearly twice as large and in Brazil it is almost ten times bigger.

As regards total inequality of opportunity across the EBRD region, the variation is largest within south-eastern Europe (SEE) where Bosnia and Herzegovina, Serbia, and Montenegro display some of the lowest estimates, comparable to that for Germany. Meanwhile inequality of opportunity in Kosovo, Romania and Bulgaria is estimated to be above the median for the EBRD region as a whole. Eastern Europe and the Caucasus (EEC) and Central Asia display more uniform regional trends with relatively high inequality of opportunity.

Relative inequality of opportunity is notably lower in Germany than in the transition region (Figure 1, right axis), whereas it is substantially high in Italy and Czech Republic.
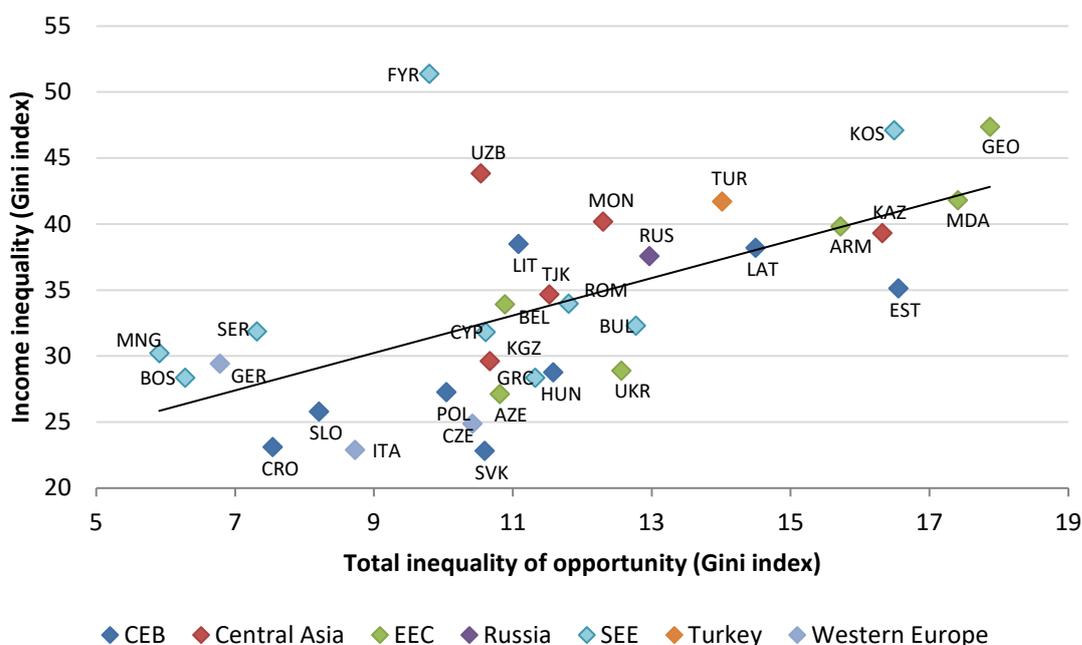
Figure 1. Total inequality of opportunity (left axis) and relative inequality of opportunity (right axes) for income acquisition

Secondly, the Report highlights the relationship existing between inequality of opportunity and income inequality (Figure 2). Such relationship tends to be stronger for countries with higher inequality and weaker for countries with lower inequality. In particular, in Germany and several SEE countries the estimated inequality of opportunity is low with respect to the Gini measure of income inequality.

Figure 2. Inequality of opportunity and income inequality

Finally, the Report addresses the issue concerning the contribution of different circumstances to overall inequality of opportunity. Figure 3 shows the absolute inequality of opportunity on its bars, while the various colours correspond to the contributions of each circumstance. Different countries display different drivers, however the major part of the inequality of opportunity can be traced back to parental background. This accounts for more than 50 per cent of overall inequality of opportunity in a third of the countries where the EBRD invests and is important in almost all other countries. Gender represents the second most important factor: it explains between one-quarter and one-half of the overall inequality of opportunity in most countries. Birthplace accounts for an average of 16 per cent of the inequality of opportunity and its impact is not always consistent. Lastly, being part of an ethnic minority on average accounts for only 7 per cent of the total inequality of opportunity.

Figure 3. Parental background and gender matter most for explaining inequality of opportunity for income acquisition
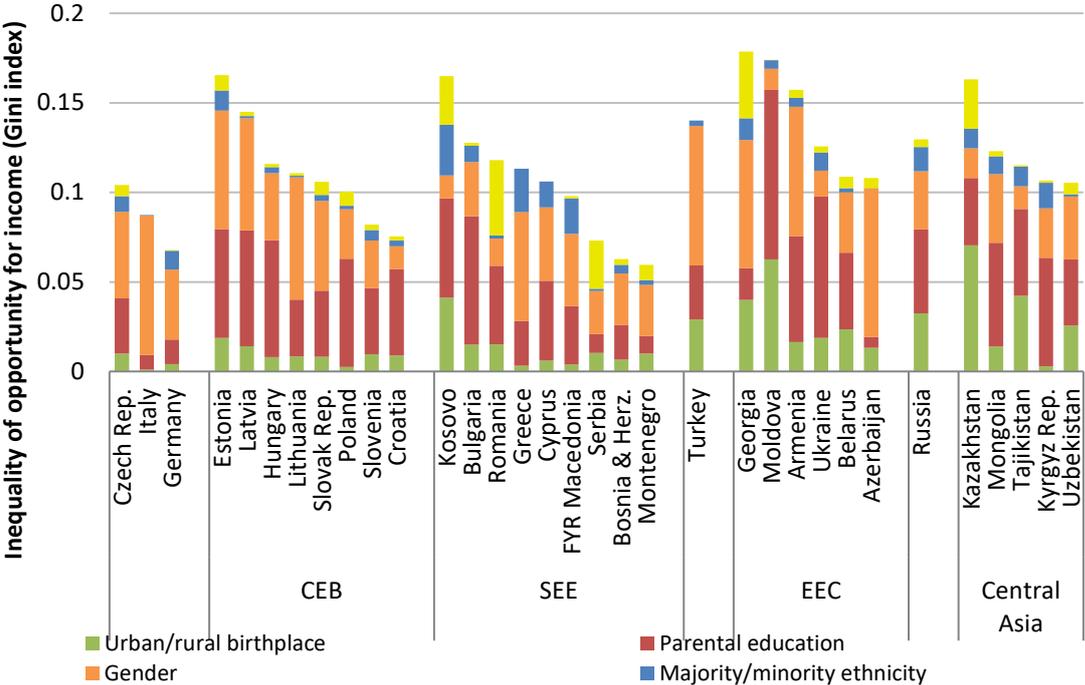
Source: EBRD Transition Report 2016-17.

5 Conclusions

According to the EOp theory, the realization of each individual desired achievement should not be hindered by unequal circumstances. Policies are needed to level the playing filed. For example, a policymaker might compensate individuals for the effect of bad circumstances on their outcome, through the definition of specific forms of investment in education.

According to the EOp theory an optimal policy should take consistently into account two goals: the minimization of the unfair inequality of outcome and the efficient allocation of social resources. However, translating the ideal of equality of opportunity into a public intervention is not a straightforward exercise. In particular, different policy implications emerge. Due to its simpler structure and lower information requirements, the ex-ante approach is probably more appealing for policy makers, and is adopted in the discussion that follows.

Some conclusions are possible.

The implementation of the principle of Equality of opportunity goes beyond the application of the principle of non-discrimination, according to which individuals with different characteristics should be treated equally whenever the individual attributes are irrelevant with respect the a given outcome (e.g., race and gender should not matter when it comes to outcomes such as access to school, health or labour markets). In fact, levelling the playing field might require positive discrimination, in the sense that public policies are called to reduce as much as possible the gaps arising from social or inherited (including genetic) conditions that are outside individual's control. In the field of education this is the case, e.g., of i) policies directed at supporting access to education (and its completion) by students from low socio-economic or migrant background; ii) policies supporting the learning of students with some type of learning disability and impairment. On the other hand, an educational policy supporting equal spending per pupil would not be consistent with Equality of opportunity, exactly because it does not compensates for the existence of circumstances inhibiting access to education or learning.

The value of the principle of Equality of opportunity is particularly high when we consider aspects of life where "personal history" matters. This is clearly the case for education and health: in both cases the current status (i.e. current health or current skills and labour market status) very much depends upon what has happened in the past. Early interventions are preferable because they permit to close the gap earlier in life, more successfully and with lower costs. The focus on education and health care is justified also on the ground that human capital is the essential factor determining labour market status, labour income, wealth and, ultimately, individual welfare. Examples of policies improving Equality of opportunity in the area of human capital are: child-care facilities available for everyone free of charge, universal and free of charge decent primary education, universal and free of charge access to health treatment, financial support to tertiary education attendance for students from low socio-economic background. In all these cases, policies are directed at breaking the linkage between participation/provision of services and socio-economic origin (and, more generally, *circumstances*).

However, policies directed at improving Equality of opportunity do not come for free. They need to be financed, typically through redistributive taxation. This might give rise to a trade-off between guaranteeing EOp and insuring efficiency. Finding the optimal trade-off between the two is complex, and the preferred solution depends upon personal, political and ethical values. Left-wing governments tend to favour EOp while right-wing governments are more concerned with the loss of efficiency. However, the trade-off between the two principles might not arise: if we start from a situation in which EOp is not guaranteed and market failures exist, it is possible (in fact, likely) that rising EOp also improves efficiency (in spite of the negative effects of redistributive taxation). This is the case for public spending on education and health care (which tend to rise human capital), but also for active labour market policies and for efficient unemployment schemes (which improve labour market functioning). In fact, there is evidence that EOp and growth are positively related, and this calls for supporting social expenditures that have an investment character, as they ultimately improve overall productivity.

The potential trade-offs between EOp and efficiency are particularly interesting in the case of education, which spans over a large period (potentially the entire life-cycle), it is dynamic (yesterdays' choices affect todays opportunities), it cannot abstract from individual preferences and abilities, and where trade-offs go beyond the issue of redistributive taxation. For instance, it is debated the extent to which EOp in education should promote quotas for access to higher education by disadvantaged groups, for instance by lowering the entry requirements to tertiary education for selected groups (with potential negative effects on the "quality" of graduates). Alternatively, it is discussed whether EOp policies supporting low-ability students in compulsory schools imply

a disadvantage for high ability students, who could lose motivation and ambition and who could face reduced available resources (if the educational budget is fixed).

We think that it is important to distinguish between the acquisition of attributes (e.g., *in primis* through education) that are relevant in the competition for social positions and the actual competition. EOp should be applied to the first, so that everyone has the same chances to later compete in life. However, at the moment in which competition happens, EOp could be abandoned in favour of the non-discrimination (or meritocratic) principle. An example might clarify: when it comes to selecting medical doctors, it is important to make sure that everyone has the same chances to attend and complete medical school, irrespective of their background; however, it would be unwise to lower professional requirement to promote graduates from a disadvantaged background at the moment of choosing who is going to perform surgery. Hence, distinguishing between compulsory and non-compulsory education is important. In the former (and especially up to primary education), preferences matter less, programs are quite homogeneous and pupils have limited options to choose from, while abilities play an important role in determining student's' success. Since in most countries compulsory education is provided for free by the State, in this phase of life EOp policies should focus on guaranteeing to everyone proper instructional resources and on overcoming difficulties and learning gaps of disadvantaged students, limiting the negative effects on high performing students. The focus here is on insuring that everyone has access to decent education, irrespective of the socio-economic and geographical background, and this implies that in-kind policies (such as support to low ability students, additional hours of math or foreign language etc.) are more effective than cash transfers. However, as they grow, students develop abilities, skills and preferences and education policies should be able to guarantee that everyone, irrespective of the socio-economic background of origin, can access and complete upper secondary or tertiary education, in the field that closely resembles his or her preferences. In this case, cash transfers are very useful as they reduce the extent to which limited economic resources impact on students' participation to higher education. Information policies on the benefits and costs of tertiary education are important as well, as they affect students' aspirations and expectations.

Does EOp imply that there is no space for ex-post distributive policies? We think that the appropriate answer is no. While the public sector can do a lot to try to make access to education and health independent from income and wealth conditions, it is unlikely that complete equalization of opportunities is realized. Which means that an "unfair" portion of inequality resists even when a distributionally-sensitive policy maker tries to equalize opportunities. In fact, scholars argue that simply creating a levelled playing field would not be sufficient for (a) if outcomes cause hardship they cannot be ignored if we want to ensure dignity to all citizens[30], and (b) inequality of outcomes directly affects equality of opportunity for the next generation, since today's ex-post outcomes shape tomorrow's ex-ante playing field. We can then conclude that the equality of opportunity approach is consistent with public intervention directed both at eliminating sources of ex-ante inequality affecting future and current opportunities and at correcting, ex-post, for the unfairness in the redistribution of actual opportunities, for the current and future generations.

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[30]   Dignity is the first of the six value pillars enshrined in the European Union Charter of rights, the other being equality, freedom, solidarity, citizenship, and justice.

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