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Inequality of Opportunity, Income Inequality and Economic Mobility: Some International Comparisons*

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Abstract

Despite a recent surge in the number of studies attempting to measure inequality of opportunity in various countries, methodological differences have so far prevented meaningful international comparisons. This paper presents a comparison of ex-ante measures of inequality of economic opportunity (IEO) across 41 countries, and of the Human Opportunity Index (HOI) for 39 countries. It also examines international correlations between these indices and output per capita, income inequality, and intergenerational mobility. The analysis finds evidence of a "Kuznets curve" for inequality of opportunity, and finds that the IEO index is positively correlated with overall income inequality, and negatively with measures of intergenerational mobility, both in incomes and in years of schooling. The HOI is highly correlated with the Human Development Index, and its internal measure of inequality of opportunity yields very different country rankings from the IEO measure

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1. Introduction

The relationship between inequality and the development process has long been of interest, and both directions of causality have been extensively investigated. The idea that the structural transformation that takes place as an economy develops may lead first to rising and then to falling inequality – known as the Kuznets (1955) hypothesis – was once hugely influential. The view that inequality may, conversely, affect the rate and nature of economic growth has an equally distinguished pedigree, dating back at least to Kaldor (1956). In the 1990s, a burgeoning theoretical literature suggested a number of mechanisms through which wealth inequality might be detrimental to economic growth: when combined with credit constraints and increasing returns; through political channels; fertility effects; etc. See Voitchovsky (2009) for a recent survey of that literature.

But popular concern about inequality in developing (and developed) countries does not originate exclusively – or even primarily – from its possible instrumental effects - on growth, on the growth elasticity of poverty, on health status, on crime, or on any number of other factors that are possibly influenced by the distribution of economic well-being. Many of those who worry about inequality do so because they consider it – or at least some of it – "unjust". Most development economists, however, share the broader profession's discomfort with normative concepts such as justice and, until recently and with some distinguished exceptions, have had little to say about it.

That is a pity. Behavioral economics has taught us that notions of fairness and justice affect individual behavior – in the precise and well-documented sense that they induce sizable deviations from the behaviors predicted by models based on the assumption of purely self-regarding preferences (e.g. Fehr and Schmidt, 1999; Fehr and Gachter, 2000; Fehr and Fischbacher, 2003). Some recent experimental evidence suggests that, when assessing outcome distributions, people do distinguish between factors for which players can be held responsible, and those which are beyond their control (Cappelen et al., 2010). If fairness matters to economic agents and alters their behavior, then understanding fairness ought to matter even to the purest positive economist. If people assess distributional outcomes differently depending on how much of the inequality they observe is thought to be "fair" or "unfair", then it may be useful to measure the extent to which inequality is unfair.

Efforts in this direction have already taken place. Drawing primarily on the welfare economics literature on "inequality of opportunity" (I. Op.), researchers have started to measure unfair inequality in both poor and rich countries. In that literature, there is now widespread agreement on the basic principle of what equality of opportunity refers to: inequalities due to circumstances beyond individual control are unfair, and should be compensated for, while inequalities due to factors for which people can be held responsible (sometimes called "efforts"), may be considered acceptable. But this broad concept can be interpreted in a number of different ways, some of which have been shown to be mutually inconsistent. And there is an array of actual indices that have been proposed to implement these concepts, and used to measure inequality of opportunity in different countries or at different times. The relatively high ratio of different (and incomparable) approaches to actual empirical applications means that it has so far been difficult to make a reasonably broad comparison of inequality of opportunity levels across countries.

This paper takes a first step towards making such a comparison, by drawing on two specific approaches that have been relatively widely used. The first is the measurement of ex ante inequality of economic opportunity. The second is the measurement of (children's) access to basic services adjusted for differences associated with circumstances – commonly known as the Human Opportunity Index (HOI). The latter is not a measure of inequality of opportunity per se; it is better seen as a development index that is designed to be sensitive to inequality of opportunity. Our objective is a modest one: we collect and summarize the results of empirical applications of these two measures to as many countries as possible, and describe the correlations between these measures and a number of other indicators of interest, including GDP per capita, overall income inequality, and two measures of intergenerational mobility.

We hope that the collected evidence on the degree of inequality of opportunity in different countries, and its pattern of association with other variables, might help to shed light on the nature of the (often increasing) inequalities observed today in many areas of the world. The paper is organized as follows. Section 2 contains a brief overview of the concepts and approaches to the measurement of inequality of opportunity. This provides essential background not only for an understanding of where the inequality of opportunity measures come from and what they do, but also of what they do *not* do, and the concepts they do *not* capture. Section 3 contains our review of inequality of opportunity measures for 41 countries, and examines how they correlate with other indicators. Section 4 presents a comparison of HOI applications across 39 developing countries, and how it correlates with other relevant indices, including the United Nations' Human Development Index (HDI). Section 5 contains a discussion of the results and some concluding remarks.

2. Concepts and measurement

The economics literature on inequality of opportunity builds explicitly on a few key contributions from philosophy, including Dworkin (1981a, b), Arneson (1989) and Cohen (1989). The basic idea, as noted above, is that outcomes that are valued by all or most members of society (such as income, wealth, health status, etc.), and which are often termed "advantages", are determined by two types of factors: those for which the individual can be held responsible, and those for which she cannot.[2] Inequalities due to the former - which we will call "efforts" - are normatively acceptable, whereas those due to the latter - which we call "circumstances" - are unfair, and should in principle be eliminated.[3]

However, as economists sought to formalize this idea so as to make it more precise, they quickly faced some fundamental choices, both conceptual and methodological. Some of these are actually choices between mutually inconsistent principles or approaches. Following Fleurbaey (1998, 2008) and Fleurbaey and Peragine (2012) we focus on two such fundamental dichotomies: the distinction between

[2] Which factors belong to which category is a subject of considerable debate in the philosophical literature.

[3] The terminology of advantages, circumstances and efforts follows Roemer (1998). Other authors prefer the term "responsibility factors" to efforts, for example.

the *compensation* and *reward* principles, and the distinction between the *ex-ante* and *ex-post* approaches.[4]

In order to understand these distinctions, it is helpful to introduce the concepts of *types* and *tranches*, using some simple notation. For simplicity, consider the basic set up in which there is a single advantage *y* and a vector of discrete circumstance variables, *C*. Let effort be measured by a continuous scalar variable *e.* Then suppose that all determinants of *y*, including various different forms of luck, can be classified into either the vector *C* or the scalar index *e*. The theory of inequality of opportunity is built upon the idea that these circumstances and efforts determine advantage, as follows:

$$\mathrm{y} = \mathrm{g}(\mathrm{C}, \mathrm{e}) \tag{1}$$

Because *C* is a vector with a finite number of elements, each of which is discrete, we can partition the population into a set of groups that are fully homogeneous in terms of circumstances. Formally, this is the partition $\Pi = \{T_1, T_2, ..., T_K\}$ such that $C_i = C_j, \forall i, j \mid i \in T_k, j \in T_k, \forall k$. Each of these subgroups, indexed by *k*, is called a type T_k, and clearly individuals within each type can differ only in their effort level e_{ik}. Let $\mathrm{F}_\mathrm{k}(\mathrm{y})$ denote the advantage distribution in type *k* and q_k denote its population share. The overall distribution for the population as a whole is $F(y) = \sum_{k=1}^{K} q_k F_k\,(y)$.

Effort variables have been treated in a number of different ways in the literature. In this exposition, we follow the influential approach due to Roemer (1993, 1998), in which effort is treated as unobserved. Roemer argues that the absolute level of effort e_{ik} is not actually an appropriate basis for comparison across individuals, because the average level of effort expended in each type may vary. The children of well-educated parents may *on average* dedicate greater effort to their studies than those of less educated parents, for example. Roemer argues that such average differences in effort levels should be treated as characteristics of the types, rather than of the individuals – effectively as unobserved circumstances. He proposes that effort comparisons be based instead on relative effort, which he equates with the percentile of the distribution of advantage within each type: $p_k = F_k(y)$. This is known in the literature as the Roemer Identification Assumption. It naturally gives rise to an alternative partition of the population, by grouping in separate *tranches* all those who are at identical percentiles of the advantage distribution, across types: $\Theta = \{R_1, R_2, ..., R_P\}$.

So we have a population of individuals, each of whom is fully characterized by the triple (*y, C, e*). This population can be partitioned in two ways: into *types* (within which everyone shares the same circumstances), and into *tranches* (within which everyone shares the same degree of effort). Figure 1 provides a simple illustration, in which there are three types, T_1, T_2 and T_3. The (inverse) cumulative advantage distribution of each type is given by $\mathrm{F}_\mathrm{k}^{-1}$, and their means are indicated on the vertical axis, where advantages (or incomes) are mapped. Tranches are not shown in the figure but, under the Roemer Identification Assumption, they would correspond to 'vertical' sections across the three type distributions, at each percentile p_k on the horizontal axis. With this very basic toolkit, we are ready to

[4] This section is intended as a brief non-technical overview. It cannot – and is not intended to – do justice to the recent literature. Two excellent full-length reviews of the literature on the measurement of I. Op. are Pignataro (2011) and Ramos and van de Gaer (2012).

understand the distinction between the compensation and reward principles, and between ex-ante and ex-post approaches.

The *compensation* principle states the first basic idea of inequality of opportunity as follows: "inequalities due to circumstances should be eliminated". There are two main versions of this principle in the literature. The *ex-ante approach to compensation* (associated with van de Gaer, 1993) seeks to evaluate – i.e. attribute a numerical value v_i to – the opportunity set faced by individual *i*. Inequality of opportunity would then be *eliminated* when all types faced opportunity sets with the same value: $\mathrm{v_i = v, \forall i}$. If that did not hold, inequality of opportunity could be *measured* by computing an appropriate inequality measure *I(.)* over the counterfactual distribution where each person's advantage is replaced by the value of his or her opportunity set, v_i:

$$I(\tilde{y}), \text{ where } \tilde{y}_i = v_i \tag{2}$$

Under this ex-ante compensation approach, then, there are two questions left before a precise measure can be proposed. First, how should opportunity sets be valued, i.e. how should v_i be chosen? And second, what inequality index *I(.)* should be applied to the counterfactual distribution? Most attempts to evaluate the opportunity set faced by individuals in a given type *k* are based on information on the type's advantage distribution $\mathrm{F_k}$. The advantage prospect of individuals in the same type is interpreted as the set of opportunities open to each individual in that type. A specific version of this model, extensively used in empirical analyses, further assumes that the value of the opportunity set F_k can be summarized by a single statistic such as its mean, μ_k.[5] In that case, $v_i = \mu_k, \forall i \in T_k$.

Hence, starting from a multivariate distribution of income and circumstances, a smoothed distribution is obtained, which is interpreted as the distribution of the values of the individual opportunity sets. In this model, measuring opportunity inequality with Equation (2) simply amounts to measuring inequality in the smoothed distribution[6]. Clearly, focusing on the mean imposes full neutrality with respect to inequality within types.

There are also alternatives with respect to the inequality index: van de Gaer (1993) argues for a measure with infinite inequality aversion, effectively $\min \mathrm{v_k}$. Other authors have suggested alternative inequality measures, such as a transformation of the Gini coefficient (Lefranc et al., 2008), a rank dependent mean (Aaberge et al., 2011), or the mean logarithmic deviation (Checchi and Peragine, 2010; Ferreira and Gignoux, 2011).

The *ex-post approach to compensation*, on the other hand, argues that inequalities should be eliminated among any individuals *who exert the same degree of effort*. Under this approach there is no need to evaluate opportunity sets, but one must observe (or agree on a measure of) effort. Under Roemer's identification assumption, eliminating ex-post inequality of opportunity would require eliminating all income differences among individuals at a given percentile of their type's advantage

[5] Alternative approaches propose to use the equally distributed equivalent income (EDEI), see Atkinson (1970), or other welfare indicators (see Lefranc et al. 2008)

[6] The concept of smoothed (and standardized) distributions is introduced by Foster and Shneyerov (2000). In the present context, a smoothed distribution is one where individual incomes are replaced by their subgroups means.

distribution, across types: $y^k(p) = y(p), \forall k, \forall p$. Inequality of opportunity can be measured by applying an inequality measure *I(.)* to the distribution of advantages *within each tranche,* and then aggregating across tranches.

In terms of our illustration in Figure 1, eliminating ex-ante inequality of opportunity (when $v_i = \mu_k$) would be achieved by shifting those inverse distribution curves up or down (i.e. transferring incomes between individuals of different types) until they had the same mean. Eliminating ex-post inequality of opportunity, on the other hand, would require making those distributions identical to one another. The latter requirement clearly demands a more complex set of transfers, so that inequality is eliminated within each and every tranche. Indeed, ex-post equality of opportunity implies ex-ante equality of opportunity, but not the reverse. In this example:

$$\mathrm{F_k(y) = F_l(y), \forall k, l \Rightarrow \mu_k(y) = \mu_l(y)} \qquad (3)$$

Let us now briefly turn to the *reward* principle, which maintains that "inequalities due to unequal effort should be considered acceptable". This is, in some sense, the other side of the coin (from the compensation principle) of the basic idea of inequality of opportunity expressed in the first paragraph of this section. This principle too can be formalized in various ways, the two most prominent ones being the *liberal reward* principle that "inequalities due to unequal effort should be left untouched" --- prohibiting redistribution between individuals with identical circumstances --- and the *utilitarian reward* principle that "inequalities due to unequal effort do not matter" --- advocating a sum-maximizing policy among subgroups with identical circumstances[7].

An interesting recent result from the theoretical literature (see Fleurbaey, 2008, and Fleurbaey and Peragine (2012), is that both of these reward principles are incompatible with the ex-post compensation principle: full respect for the differences in reward to effort within each type is not consistent with full equality within tranches. Although the result is proved for a more general set up, its essence is easily understood from Figure 1 again, focusing on types 1 and 2. The liberal reward principle requires that policy makers do nothing about the differential rewards between high and low percentiles within each of those types. The ex-post compensation principle requires that the two distributions become identical – with the functions lying on top of each other. Those two things cannot both be achieved.

Figure 1 is also suggestive of another result in Fleurbaey and Peragine (2012): there is no such clash between the *ex-ante* compensation principle and the reward principles. One *could* “re-scale” the advantage distributions across types so that they would all have the same mean (or some other value), without changing the absolute advantage differences (the rewards to effort) across percentiles within each type. The ex-post approach to the compensation principle is more demanding, but a conceptual

[7] These various distinctions are discussed in detail in Fleurbaey (2008).

price must be paid for its stringency, namely consistency with the reward principles that also underpin the theory of equality of opportunity.[8]

Most measures of inequality of opportunity computed in practice have followed an ex-ante approach. A notable exception is Checchi and Peragine's (2010) work on inequality of opportunity in Italy, which reports both ex-ante and ex-post measures. There is also a related literature that acknowledges the incompatibility between ex-post compensation and reward, and proposes fair allocation rules that satisfy somewhat weakened versions of those principles. If one treats these fair allocation rules as income norms (that individuals would have received under that particular definition of fairness) then unfair inequality can be defined as some aggregate of the differences between actual and norm incomes across the population. See Ramos and van de Gaer (2012) for an excellent discussion of these measures, and Almas et al. (2011) and Devooght (2008) for examples of the approach.[9] But neither ex-post compensation nor norm-based measures have been computed in similar ways across many countries.

In contrast, the particular version of the ex-ante approach where equation (2) is computed with $v_i = \mu_k$, has been applied to at least some forty countries, by a number of authors. The measure *I(.)* used does vary across some of the papers but most use the mean logarithmic deviation, following Checchi and Peragine (2010) and Ferreira and Gignoux (2011). In a few cases, as detailed below, the Theil (T) index and even the variance are employed. Despite these differences, as well as a variety of caveats on data comparability across – or even within – studies, the eight papers reviewed in Section 3 comprise the most closely comparable sources on actual I. Op. measures across countries that we are aware of.

In closing this section, we turn to another approach that has been applied to a number of countries in recent years, namely the Human Opportunity Index of Barros et al. (2009, 2011). This index is defined over a different set of advantages (which, confusingly, are sometimes referred to as 'basic opportunities'), namely access to certain basic services, such as piped water, electricity or sanitation. In a discrete population of size *n*, let π_i^j denote the probability that person *i* has access to service *j*. $\overline{\pi}^j = \frac{1}{n}\sum_i \pi_i^j$ then denotes the expected coverage of service *j* in the population. In practice, probabilities are often estimated econometrically from binary data on access, and $\overline{\pi}^j$ can be interpreted as the average coverage of service *j*. Let this population also be partitioned into *K* types, by $\Pi = \{T_1, T_2, \ldots, T_K\}$ as before. Denote the population share of type *k* by w_k, and the average coverage of service *j* in type *k* as $\overline{\pi}^{jk} = \frac{1}{n_k}\sum_{i \in k} \pi_i^j$. Then the human opportunity index for service *j* is defined as:

$$H^j = \bar{\pi}^j\left(1 - D^j\right) \quad \text{where} \quad D^j = \frac{1}{2\bar{\pi}^j}\sum_{k=1}^{K} w_k\left|\bar{\pi}^{jk} - \bar{\pi}^j\right| \qquad (4)$$

[8] There is also a potential practical price to be paid in empirical exercises of measuring inequality of opportunity. Because the ex-post approach requires a partition into types *and* tranches, it is more demanding on the data. When many circumstance variables are observed, precision is harder to achieve for ex-post measures. See Ferreira, Gignoux and Aran (2011) for a discussion.

[9] Brunori and Peragine (2011) compare the norm-based measures with the ex-ante and ex-post measures.

In equation (4), D^j is a version of the dissimilarity index commonly used in sociology. In this application, it simply computes an appropriately normalized (and population-weighted) average deviation in service coverage from the mean, across types. The HOI (for service *j)* itself, denoted by H^j, is simply the average access rate in the population, penalized by the degree of dissimilarity in that coverage across types. It is clearly analogous to the Sen welfare function, where mean outcomes are adjusted by one minus a measure of inequality. Sometimes an aggregate index is calculated as an average of H^j across a number of different services, $j \in \{1, \dots, J\}$.[10] Various versions of the HOI have now been computed for at least 39 countries, and basic results are compared in Section 4 below.

3. Ex-ante inequality of opportunity in 41 countries

As noted above, the ex-ante approach to the measurement of inequality of opportunity essentially consists of computing an inequality measure over a counterfactual distribution, where individual advantages are replaced with some valuation of the opportunity set of the type to which the individual belongs. In this section, we review eight papers that have adopted this approach and applied it, in total, to 41 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). The eight papers are Checchi et al. (2010); Ferreira and Gignoux (2011); Ferreira et al. (2011); Pistolesi (2009); Singh (2011); Belhaj-Hassine (2012), Cogneau and Mesple-Somps (2008) and Piraino (2012).

All of these papers use a measure of economic well-being as the advantage indicator: household per capita income, household per capita consumption, or individual labor earnings. All use the mean value of this indicator for each type as the value of the type's opportunity set. We refer to the measure generated by this specific version of the ex-ante approach as an index of inequality of economic opportunity (IEO). There are, in fact, two closely related versions of the index: the absolute or *level* estimate of inequality of opportunity (IEO-L) is given simply by the inequality measure computed over the smoothed distribution, where each person is given the mean income of their types: $I(\tilde{y})$. The ratio of IEO-L to overall inequality in the relevant advantage variable (e.g. household per capita income) yields the relative measure, IEO-R[11]:

$$\mathrm{IEOR} = \frac{\mathrm{I}(\tilde{\mathrm{y}})}{\mathrm{I}(\mathrm{y})} \tag{5}$$

The partition of types varies across studies, ranging from six types to 7,680 (although in four of the eight studies, the range is a more comfortable 72-108 types). Because in some cases the data sets are not large enough to yield precise estimates of μ_k for all types, some authors compute IEO-L using a parametric shortcut. After estimating the reduced-form regression of income on circumstances:

$$\mathrm{y} = \mathrm{C}\beta + \epsilon \tag{6}$$

[10] However, see Ravallion (2011) on the potential pitfalls of such arbitrary aggregate indices or, as he calls them, "mashup indices" of development.

[11] Ferreira and Gignoux (2011) refer to the corresponding measures that are obtained when the mean log deviation is used as the inequality measure *I(.)* as IOL and IOR. They also note that IEO-R is an application of a standard between-group inequality decomposition, which has long been familiar. See e.g. Bourguignon (1979).

and obtaining coefficient estimates $\widehat{\beta}$, these authors use predicted incomes as a parametric approximation to the smoothed distribution:

$$I(\hat{y}), \text{ where } \widehat{y_i} = C_i\hat{\beta} \quad (7)$$

Parametric estimates are also presented either as levels (IEO-L) or ratios (IEO-R), analogously. 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 great: proportional differences between the two average 6.6% in Ferreira and Gignoux (2011).

The fact that the parametric estimates are conservative – i.e. generally lower than the non-parametric ones – is consistent with another important property of these estimates of IEO-R and IEO-L. They are, in each and every case, *lower-bound* estimates of inequality of opportunity. A formal proof of the lower-bound result is contained in Ferreira and Gignoux (2011), but the intuition is straight forward. The set of circumstances which is observed empirically - and used for partitioning the population into types - is a strict subset of the theoretical vector of all circumstance variables. The existence of unobserved circumstances – virtually a certainty in all practical applications – guarantees that these estimates of I.Op. – whether parametric or non-parametric – could only be higher if more circumstance variables were observed.

As discussed in Ferreira and Gignoux (2011), the existence of effort variables, observed or unobserved, is entirely immaterial to this result, since (6) is written as a reduced-form equation, where any effect of circumstances on incomes *through* their effects on effort (such as years of schooling or hours worked) is captured by the regression coefficients, and hence influence the smoothed distribution. In a setting where some variables are treated as observed efforts (as in Bourguignon et al. 2007), Equations (6) and (7) capture the *reduced-form* influence of circumstances on advantages, both directly and indirectly through efforts. By construction, therefore, the only omitted variables that matter for IEO are omitted circumstances.[12]

Table 1 presents the estimates of IEO-L and IEO-R for each of the forty-one countries studied by the eight aforementioned papers. The table also lists their gross national income (GNI) per capita; overall inequality and, when available, a measure of intergenerational earnings elasticity (IGE) reported in the literature; a measure of the intergenerational correlation of education from Hertz at al. (2007); and the Human Opportunity Index. Overall inequality is 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-L index, and a member of the generalized entropy class of inequality measures. Whereas overall inequality, IEO-L and IEO-R come from the eight studies mentioned above, the other variables come from other sources. GNI per capita comes from the World Bank's World Development Indicators database. Our measure of intergenerational correlation of

[12] Of course, this does not hold for the estimates of the individual coefficients $\widehat{\beta}$. First, these coefficients are reduced-form, rather than structural, estimates. In addition, they are likely to be biased (upwards or downwards) even as reduced-form estimates, by the omission of unobserved circumstances. The lower-bound result applies only to the overall measures of inequality of opportunity, IEO-L and IEO-R.

education is simply the correlation coefficient between the parents' education and the child's education, where both are measured by years of completed schooling, as reported by Hertz et al. (2007). Parental education is the average of mother's and father's attainment "wherever possible" (Hertz et al, 2007, p.11). The correlation we report is what the authors call a measure of "standardized persistence".

The measures of intergenerational earnings elasticity reported in Table 1 come from eleven different studies published over the last ten years, namely Azevedo and Bouillon (2010); Cervini Pla (2009); Christofides et al. (2009); Corak (2006); D'Addio (2007); Dunn (2007); Ferreira and Veloso (2006); Grawe (2004); Hnatkovskay et al. (2012); Hugalde (2004); Nuñez and Miranda (2006); and Piraino (2007). Denoting parental earnings (or income) by y_f, and the adult child's earnings by y_s, these elasticity estimates generally come from an equation of the form:

$$\log y_s = \beta \log y_f + \varepsilon \tag{8}$$

An elasticity (β) of 0.4, for example, would mean that income differences of 100% between two fathers (say), would lead to a 40% gap between their sons (on average). As in the case of the IEO measures, the datasets and econometric methods used for estimating this elasticity are not homogeneous across studies. This comparative exercise is very much in the same spirit as Corak (2012), and the same caveats he discusses are applicable here. The values for the Human Opportunity Index reported in Table 1 come from Molinas et al. (2011) for Latin America, and World Bank (2012a, b) for Africa.

Table 1 should be read in close conjunction with Table 2, which provides some basic information on each of the eight studies used to construct the inequality of opportunity estimates in Table 1. Table 2 describes which countries are studied in each paper; the specific data sets (including survey year); the precise income and circumstance variables used; whether the estimation was parametric or otherwise, and the number of types included in each calculation. The table highlights a number of problems for comparability across these studies. First is the nature of the advantage variable (*y*) itself: whereas Checchi et al. (2010), Pistolesi (2009), Singh (2011) and Belhaj-Hassine use labor earnings, Ferreira and Gignoux (2011) and Piraino (2012) use incomes, Cogneau and Mesple-Somps (2008) use consumption, and Ferreira et al. (2011) use imputed consumption. And the definitions of earnings and incomes are not exactly the same across each of these papers either.

These distinctions are not immaterial: in a comparison of six Latin American countries, Ferreira and Gignoux (2011) found substantially higher estimates of IEO-R for consumption expenditure than for income distributions, in the same countries.[13] They attributed this finding to the fact that income inequality measures are thought to contain greater amounts of measurement error, as well as transitory income components, which are less closely correlated with circumstances than permanent income or consumption might be. Bourguignon et al. (2007) also noted differences between estimates for individual earnings and for household per capita incomes, which they attributed to the fact that unequal opportunities affect the latter not only through earnings, but also through assortative mating, fertility decisions, and non-labor income sources.

[13] Similarly, Singh (2010) finds a higher IEO-L for consumption than for earnings in India.

Second, the studies differ in the number of types used for the decomposition and, naturally, in the exact set of circumstances used in each case. On one extreme, the Cogneau and Mesple-Somps study has a mere three types for Uganda, based on father's occupation and education levels, while on the other Pistolesi has 7,680 types, constructed on the basis of information on age (20 levels), parental education (4 levels for the mother and 4 for the father), occupational group of the father (6 categories), individual ethnic group (2 categories), individual region of birth (2 categories). There is, fortunately, a middle range of studies which account for most countries in the sample, with 72 to 108 types each. Nevertheless, results for Africa and the US should certainly be interpreted with caution, in light of the number of types used in each case. Finally, a third comparability caveat, on which we have already dwelled, is the fact that some studies use non-parametric estimates while others use parametric ones.

Bearing these caveats in mind, Table 1 nevertheless illustrates the substantial variation in inequality levels across countries – both in advantages and in opportunities. The mean log deviation for incomes (or the corresponding advantage 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 (IEO-L) 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 level of inequality in the distribution of *values of opportunity sets across types* (the smoothed distribution described in Section 2) in Brazil is almost three times as large as the inequality (measured by the same index) in the distribution of *actual incomes* in Denmark. One can also observe substantial differences in IEO-L 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 those 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 (IEO-R), also varies substantially, from 0.02 in Norway to 0.34 in Guatemala. Slovenia also has a remarkably low inequality of opportunity ratio, at 0.05, while Brazil closely follows Guatemala in the upper tail, at around 0.32. Figure 2 shows the range of relative measures of inequality of opportunity graphically, for the entire sample, highlighting those countries where consumption (actual or predicted) was used instead of earnings or incomes.

It may be of interest to look at how these measures of inequality of opportunity correlate with some other important variables. Output per capita, overall income inequality, and measures of intergenerational mobility – a concept closely related to I.Op. – are natural candidates. Figures 3, 4, 5 and 6 depict the associations between the relative measure of inequality of opportunity (IEO-R) and four other variables – log per capita GNI, total inequality, the intergenerational elasticity of income, and the intergenerational correlation of education. Figure 3 reveals a non-linear relationship between inequality of opportunity and the level of development, as measured by log per capita income levels. In fact, the 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 IOR on a quadratic of log GNI is shown in the figure; the coefficient on the linear term is 0.32 (p-value: 0.05), and that on the quadratic term is -0.017 (p-value: 0.05).

A very similar relationship (not shown) is found between IEO-L and log per capita GNI (with a coefficient of 0.37 on the linear term, and on the square term of -0.02, both significant at the one percent level). While the poorest countries in this figure 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 I. Op. egalitarian, there is still a considerable spread among them.

It is, of course, impossible to interpret this inverted-U pattern solely on the basis of the information available in our data. One can weave hypotheses: the non-linearity might reflect two opposite effects at play, the relative strengths of which change as incomes grow. Perhaps at very low levels of development, new income opportunities are initially captured by a narrow privileged group – a few well-educated families, or a small ruling ethnic group. During that phase, disparities across types may grow even faster than overall income inequality. At some point, however, the grip of the elite on economic opportunities must weaken if growth is to continue. Such mechanisms have been modeled formally: the transition can occur when, at a certain point, the elite decides that the costs of expanding education to "the masses" (in terms of their own share of political power) is outweighed by the likely economic gains from a more skilled labor force (Bourguignon and Verdier, 2000) Alternatively, the threat of revolution may impose the franchise and a broader sharing of political influence, even upon a less enlightened elite (Acemoglu and Robinson, 2000). There is also some evidence that lower inequality of opportunity may be associated with faster growth, at least in richer countries (see, e.g., Marrero and Rodriguez, 2010, for a sample of US states).

But these are only hypotheses consistent with the pattern in Figure 3. It is equally possible, of course, that the pattern is spurious: other variables may cause inequality of opportunity first to rise, and then decline with GNI. As we have learned from work on the (income) Kuznets hypothesis, it would also be foolhardy to infer much about the time-series pattern in any given country from a simple cross-sectional association. At some level, in fact, it is probably fruitless to look for evidence of causal relationships between two variables at such a high order of aggregation. Both overall output levels (GNI) and inequality of opportunity are summary statistics, jointly determined by the full general equilibrium of the economy, including all of the key political economy processes that determine policy variables such as tax rates and spending allocations. It is likely that one can more easily find causality at the microeconomic level. From that vantage point, disentangling causality in the relationship depicted in Figure 3 may well be pointless, even if the correlation between the two aggregate variables reflects genuine economic processes, which are both real and important.

Another question that naturally arises is whether there is any observable empirical relationship between inequality of opportunity and income inequality. Since the former is measured as a component of the latter there is a mechanical aspect to the relationship in levels, but it is not obvious that there is any mechanical reason to expect a correlation between income inequality levels and the *relative* extent of inequality of opportunity. Figure 4 shows the association between overall inequality (in economic advantage) and the *share* of that inequality associated with inequality of opportunity (IEO-R). The correlation coefficient is 0.523 (p-value: 0.0004). A number of possible mechanisms might drive this correlation as well. One that appears eminently plausible is the notion 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 (Ferreira, 2001). Naturally, the reverse causality probably holds too: if opportunity sets differ a great deal among people, then individual outcomes are also likely to be unequal. Inequalities in income and opportunities are both endogenously determined: once again, the quest for causality at the aggregate level may be futile, even if the correlation reflects real underlying political and economic processes.[14]

The use of the links between parents' and children's incomes to describe an important manifestation of inequality of opportunity suggests that the concept should be closely related to intergenerational mobility. Indeed, if we wrote $\mathrm{y} = \log \mathrm{y}_\mathrm{s}$ and $C = \log y_f$, equations (6) and (8) would be identical suggesting that, if the set of observed circumstances becomes restricted to parental income, then our lower-bound measure of inequality of opportunity is very closely related to the commonest measure of intergenerational mobility, namely the IGE. It can easily be checked that the R^2 of (8) is identical to the IEO-R measure defined by (5) and (7) when the variance of logarithms is used as the inequality index.

Figure 5 documents the association between IEO-R and (inverse) economic mobility, as measured by the intergenerational elasticity of earnings (or incomes). The correlation across the 23 countries for which we have both variables in Table 1 is 0.5853 (p-value: 0.0172). Of course, the two measures are not exactly the same, in part because the vector of circumstances *C* used to partition types and generate IEO-R is not the same as a measure of parental income or earnings. In fact, *C* does not contain that variable for any of the 41 countries in Table 1. It does, however, usually contain parental education (and in some cases parental occupation), which are themselves determinants of log parental incomes. And it often contains additional information, such as race or the region of the person's birth.

For these reasons, we expected the correlation in Figure 5 to be strong, but not perfect. Given the likely correlation between most circumstances and parental economic status, it would be surprising if this association turned out to be weak. Given the isomorphism between the ex-ante measurement of inequality of opportunity and the measurement of intergenerational mobility, we find it intriguing that these comparisons do not appear to have been made before.

It should also be noted that Figure 5 is close in spirit to Figure 2 in Corak (2012), which plots the intergenerational earnings elasticity against income inequality (measured by the Gini coefficient) across countries.[15] Instead of plotting the estimates of IGE against overall inequality, we plot the intergenerational elasticity of income against a broader measure of inequality of opportunity.

[14] If an inverted U-shaped relationship is observed between income inequality and per capita GNI levels across countries – i.e. if a cross-sectional "Kuznets curve" holds empirically - then the positive association between income inequality and IEO-R shown in Figure 4 actually implies the inverted U shape in Figure 3. We are grateful to Branko Milanovic for pointing this out.

[15] Corak's figure has rapidly become well-known, in part because Alan Krueger, Chairman of President Obama's Council of Economic Advisers, referred to it in a speech as "the Great Gatsby curve", relating the distance between the rungs of the economic ladder, and the ease with which it is climbed.

Reassuringly, a very similar correlation is found between the same measure of inequality of opportunity (IEO-R) and a different gauge for intergenerational (im)mobility, namely the correlation between parental and child schooling attainment. As noted earlier, the intergenerational correlations of education reported in Table 1 come from Hertz et al. (2007), and use the average years of schooling completed by a person's mother and father as the measure of parental education. Figure 6 shows the scatter-plot for the 23 countries for which data on both variables is available. The correlation coefficient is 0.5965 (p-value: 0.0021). So, inequality of economic opportunity, as measured by IEO-R, is clearly negatively associated with two independent measures of intergenerational mobility (as opposed to persistence), one based on incomes and the other on educational attainment.

4. Measuring development with a penalty for unequal opportunities

The country composition of Table 1 was determined by the availability of information on ex-ante measures of inequality of opportunity, IEO-L and IEO-R, and drew on the eight papers listed in Table 2. The last column of Table 1 contains estimates of the aggregate Human Opportunity Index, defined as a weighted average of the dimension-specific HOI.[16] This information was only available for ten of the 41 countries in Table 1, largely because the index has not been calculated in rich countries.

In Table 3, however, we list the component (or dimension-specific) human opportunity indices for a larger set of countries, and for the following advantages (or "basic opportunities", or "services"): school attendance (10-14 year olds); access to water; access to electricity; access to sanitation; and whether or not the child finished primary school on time (i.e. with zero grade-age delay). The indices are multiplied by 100, so the possible range is 0-100. The 39 countries included - all of them in either Africa or Latin America - is the full set available at the time of writing. As noted earlier, they come from Molinas Vega et al. (2011) for Latin America, and World Bank (2012a, b) for Africa. Following the authors, the table also reports the simple average of the school attendance and primary school completion indices, as the HOI for education, and the simple average of the other three indices as the HOI for housing conditions. The simple average of these two numbers in turn yields the overall HOI reported in the last column of the table.

The motivation behind the HOI, as initially proposed by Barros et al. (2009), was to measure the extent to which children in various developing countries have access to basic opportunities. Although the authors do not motivate it this way, one could view the index as an example of the ex-ante approach applied to a multidimensional advantage space, with each dimension corresponding to access to a particular service – such as water or schooling – and the valuation of the opportunity set of each type being given by the coverage of the service in that type. The particular inequality index applied to that smoothed distribution of probabilities is the dissimilarity index (see equation 4).

[16] The averaging procedure is the same suggested by Barros et al. (2011) for the HOI summary index: first calculate a HOI for education obtained as the mean of the two education components and a HOI for housing conditions (the mean of the other three components). Then obtain a summary HOI as a simple average of the two.

Although the dissimilarity index might therefore be seen as a measure of inequality of opportunity, the HOI itself clearly cannot.[17] It is intended – and defined – as a measure of average access, adjusted (or penalized) by inequality of opportunity. Unsurprisingly, therefore, it is closely correlated with other indicators of "level of development". This association is already clear in Figure 7, which ranks the average HOI for all countries in Table 3, ranging from 9.6 in Niger, to 91.6 in Chile. There is almost no overlap in HOI between the African and the Latin American sub-samples, and the correlation between the HOI and GNI per capita for these countries is 0.89 (p-value: 0.0005).

Perhaps more striking is the correlation with the UNDP's Human Development Index which is even higher (at 0.94) and highly statistically significant. Figure 8 presents the scatter plot. This is remarkable because the two indices are constructed on the basis of completely different data. Until 2010 (the year used in Figure 8), the Human Development Index was calculated as a simple average of three normalized indices in the dimensions of health, income and education. [18] The income index used GNP per capita, and the health index was based on life expectancy at birth, while the education index combined information on literacy and the gross school enrolment ratio. Of these four basic components, only one is close to the indicators used to construct the HOI, namely gross enrolment ratio, which is related to the "school attendance" data used in the first column of Table 3. The other four components of the HOI, listed above, do not enter directly into the computation of the HDI, and neither does the latter explicitly adjust for dissimilarity across types in any way. Conversely, life expectancy at birth, GDP per capita and literacy do not enter the HOI explicitly.

A correlation of 0.94 between these two indices, albeit calculated only over a non-representative sample of 39 countries in two of the world's regions, suggests two things. First, it suggests that the average coverage rates of services like access to water, electricity, etc. are highly correlated with the constituent elements of the HDI. Second, it suggests that the HOI is determined, to a very large extent, by the first term in the product $\overline{\pi}^{j}\left(1-\mathrm{D}^{j}\right)$. In fact, the correlations between average coverage and the component-specific HOI in this sample are extremely high: they are greater than 0.99 for school attendance; access to water; access to electricity; and having finished primary school on time. It is 0.987 for access to sanitation. This implies, of course, that the penalty for inequality of opportunity, $\left(1-\mathrm{D}^{j}\right)$, accounts for a much smaller share of the variance in the HOI than mean coverage.

A final international comparison issue our data can shed light on is the association between the dissimilarity index (the measure of inequality of opportunity contained within the HOI) and the index of inequality of economic opportunity (IEO-R). The dissimilarity index can be interpreted as the proportion

[17] A possible caveat with viewing the dissimilarity index within the HOI as a measure of inequality of opportunity is that the index is typically calculated "for children". This justifies the use of certain variables - like geographic location or education of the adults in the household - as circumstances, which are clearly in the realm of choices for the adults. The argument is that the index applies to children, and these are circumstances from their perspective. But this then raises the issue of age of responsibility, and whether or not all inequalities in access to services for children below a certain age should not be considered inequality of opportunity. Under that view, unequal access to water or sanitation among five-year olds within the same type (i.e. sharing identical observed circumstances) should also be counted as inequality of opportunity.

[18] The correlation with the inequality-adjusted Human Development Index introduced for the first time in 2011 is almost the same: 0.95.

of "basic opportunities" that is improperly allocated, relative to equal access across all types (Barros et al. 2011). In other words, it is a measure of how much re-distribution in access to a particular service would be required to move from the observed allocation to one in which average access was the same across types. Subject to the caveat in footnote 17, this is a perfectly plausible measure of between-type inequality in a particular dimension (that of service *j*). IEO-R, on the other hand, measures inequality of opportunity as the between-type share of income (or consumption) inequality. How do these two measures correlate? Do they yield essentially the same country ranking, even though their information bases are quite different, as appears to be the case with the HDI and the HOI?

It is probably too early to answer this question in cross-country terms. The overlap between the country samples in Table 1 (for which we have estimates of IEO-R) and in Table 3 (for which we have estimates of the dissimilarity index) is only ten countries, six in Latin America and four in Africa. Very little can be said, even about descriptive correlations, on the basis of such a small and unrepresentative sample. Nevertheless, for what it is worth, Figure 9 plots the IEO-R index against the dissimilarity index, averaged across its five dimensions. The correlation is -0.6989 (p-value: 0.0245), suggesting that the two alternative approaches to measuring inequality of opportunity can yield very different country rankings. It is true, of course, that in this sample the negative correlation is driven primarily by a dichotomy between Africa and Latin America, where the latter has lower dissimilarity in access to services, but a higher share of income inequality driven by unequal opportunities. Given that the IEO-R data for Africa in our sample is based on coarser partitions than in most other cases, one really should not read too much into this correlation. Nevertheless, it equally cannot be taken for granted that the IEO-R and the part of the HOI which seeks to capture inequality of opportunity are measuring the same things.

5. Concluding remarks

Inequality of opportunity is a complex concept that can be measured in a number of different ways. A number of measures have recently been proposed, both under the ex-ante and the ex-post approaches, or indeed seeking a compromise between them. But most of these approaches have been applied to a single country or a very small group of countries, making cross-country comparisons impossible. Two exceptions are ex-ante measures of inequality of economic opportunity (IEO), and the Human Opportunity Index (HOI). Our review of this empirical literature yielded (roughly) comparable measures of the IEO for forty-one countries, and of the HOI for thirty-nine. Most countries in the first set are in Europe and Latin America, but there are examples from North America, Asia, Africa and the Middle-East. The second set covers countries in Africa and Latin America exclusively, and the overlap between the two samples is ten countries.

The evidence reviewed suggests that an important portion of income inequality observed in the world today cannot be attributed to differences in individual efforts or responsibility. On the contrary, it can be directly ascribed to exogenous factors such as family background, gender, race, place of birth, etc. There was considerable cross-country variation in the (lower-bound) relative measure of inequality of economic opportunity: Brazil's share (0.32) is sixteen times as large as Norway's. Although there certainly is noise in these measures, and various comparability caveats, there appears to be some signal as well.

In addition, the data reveal a positive correlation between inequality of opportunities and income inequality. Countries with a higher degree of income inequality are also characterized by greater inequality of opportunity. This result is consistent with the empirical literature on social mobility, which considers only one exogenous circumstance (family background measured on the basis of income or social status of the parents) and finds a negative correlation between inequality and mobility (see the "Great Gatsby Curve" of Corak, 2012): less unequal countries are also those that have a higher degree intergenerational mobility.

In fact, the IEO-R measure is strongly positively correlated with two different measures of intergenerational persistence (the converse of mobility): the intergenerational elasticity of income, and the correlation coefficient of parental and child schooling attainment. It bears emphasis that these measures of intergenerational transmission refer to different variables, collected in different data sets, and reported by different studies. This suggests that the cross-country association between inequality of economic opportunity and intergenerational mobility is rather robust.

In a sense, this is not surprising: inequality of opportunity is the missing link between the concepts of income inequality and social mobility: if higher inequality makes intergenerational mobility more difficult, it is likely because opportunities for economic advancement are more unequally distributed among children. Conversely, the way lower mobility may contribute to the persistence of income inequality is through making opportunity sets very different among the children of the rich and the children of the poor.

We also found an inverted-U relationship between per capita GNI and inequality of economic opportunity, reminiscent of the old Kuznets curve for income inequality. We argued that it is impossible to treat that relationship as causal (in either direction), but that this is due primarily to the order of aggregation of the two variables. It is quite possible that the relationship is underpinned by real economic processes, although it is likely that disentangling them requires looking for specific relationships among well-defined microeconomic variables.

Our international comparison exercise also revealed some interesting differences between the IEO-R index and the Human Opportunity Index, even though both can be thought of as belonging to the ex-ante family of I.Op. measures. These differences fall into at least three categories. First, the advantage space for the IEO index is unidimensional, and usually refers to a measure of economic well-being, such as income or consumption, while the HOI focuses on binary indicators of access to services. If it is constructed as an average of the measure for different services, it can be thought of as having a multidimensional advantage space (although aggregation across them is fairly ad-hoc).

Second, the HOI is deliberately constructed as a development index, with a functional form analogous to Sen's welfare index: a mean penalized by an inequality measure. The HOI is not a measure of inequality of opportunity; it *contains* a measure of inequality of opportunities (in the space of access to services), which is the dissimilarity index. As we have seen, however, most of the cross-country variation in the HOI is driven by the mean coverage term, with correlations above 0.98 for each of the five main dimensions usually included. Partly as a result, the HOI is very highly correlated with the HDI, another famous aggregate development index, at least over the currently available sample of countries.

It is not obvious that the extent of this correlation is well-understood by the analysts working on either approach.

Third, over the (small and unrepresentative) sample of countries for which both measures are available, the dissimilarity index and the IEO-R – each an ex-ante measure of inequality of opportunity, albeit with respect to different advantage spaces – are actually negatively correlated. While sample size and comparability issues preclude taking this correlation too seriously, it may nevertheless serve as a cautionary tale that different ways of measuring inequality of opportunity can measure (very) different things, and yield widely disparate country rankings.

We argued in the introduction that fairness matters to people, and affects individual behavior. There is also (anecdotal) evidence that measures of fair or unfair inequality matter to governments, and international institutions like the World Bank increasingly use measures of inequality of opportunity in country dialogue. We hope that this simple description of how the two most commonly-used measures vary across countries, and co-vary with related indicators, may both contribute to greater clarity in those discussions and help spur further analytical work.

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Table 1: Inequality of opportunity, income inequality and economic mobility in 41 countries

Country	GNI per capita PPP	Total inequality	IEO-L	IEO-R	Method	Intergenerational income elasticity	Intergenerational correlation of education	HOI
Austria *(1)*	39,410	0.1800	0.0390	0.2167	parametric			
Belgium *(1)*	37,840	0.1450	0.0250	0.1724	parametric		0.400	
Brazil *(3)*	10,920	0.6920	0.2230	0.3223	parametric	0.5733	0.590	75.90
Colombia *(3)*	9,000	0.5720	0.1330	0.2325	parametric		0.590	79.25
Cyprous *(1)*	30,160	0.1700	0.0510	0.3000	parametric	0.3430		
Czec Rep. *(1)*	23,620	0.1760	0.0190	0.1080	parametric		0.370	
Denmark *(1)*	40,140	0.0830	0.0120	0.1446	parametric	0.0710	0.300	
Ecuador *(3)*	9,270	0.5800	0.1500	0.2586	parametric		0.610	76.25
Egypt *(5)*	5,910	0.4230	0.0491	0.1160	non parametric		0.500	
Estonia *(1)*	19,500	0.2430	0.0260	0.1070	parametric		0.400	
Finland *(1)*	37,180	0.1360	0.0130	0.0956	parametric	0.1353	0.330	
France *(1)*	34,440	0.1630	0.0210	0.1288	parametric	0.4100		
Germany *(1)*	38,170	0.1910	0.0350	0.1832	parametric	0.2130		
Ghana *(2)*	1,600	0.4000	0.0450	0.1125	non parametric		0.390	39.30
Greece *(1)*	27,360	0.2000	0.0340	0.1700	parametric			
Guatemala *(3)*	4,610	0.5930	0.1990	0.3356	parametric			51.73
Guinea *(2)*	980	0.4200	0.0560	0.1333	non parametric			
Hungary *(1)*	19,280	0.2080	0.0210	0.1010	parametric		0.490	
India *(8)*	3,560	0.4218	0.0822	0.1949	parametric	0.5500		
Ireland *(1)*	32,740	0.1880	0.0420	0.2234	parametric		0.460	
Italy *(1)*	31,090	0.1960	0.0280	0.1429	parametric	0.4095	0.540	
Ivory Coast *(2)*	1,650	0.3700	0.0500	0.1351	non parametric			
Latvia *(1)*	16,360	0.2290	0.0280	0.1223	parametric			
Lithuania *(1)*	17,880	0.2280	0.0350	0.1535	parametric			
Luxemburg *(1)*	63,850	0.1480	0.0350	0.2365	parametric			
Madagascar *(2)*	980	0.4400	0.0920	0.2091	non parametric			22.62
Netherlands *(1)*	42,580	0.1920	0.0360	0.1875	parametric	0.2200	0.360	
Norway *(1)*	57,130	0.1300	0.0030	0.0231	parametric	0.2050	0.350	
Panama *(3)*	12,980	0.6300	0.1900	0.3016	parametric		0.610	63.98
Peru *(3)*	8,940	0.5570	0.1560	0.2801	parametric	0.6000	0.660	69.18
Poland *(1)*	19,020	0.2710	0.0250	0.0923	parametric		0.430	
Portugal *(1)*	24,710	0.2470	0.0300	0.1215	parametric			
Slovakia *(1)*	23,140	0.1320	0.0180	0.1364	parametric		0.370	
Slovenia *(1)*	26,970	0.1040	0.0050	0.0481	parametric		0.520	
South Africa *(6)*	10,280	0.6750	0.1690	0.2504	parametric	0.7055	0.440	58.09
Spain *(1)*	31,550	0.2160	0.0420	0.1944	parametric	0.4533		
Sweden *(1)*	39,600	0.1060	0.0120	0.1132	parametric	0.2125	0.400	
Turkey *(4)*	14,580	0.3620	0.0948	0.2620	parametric			
Uganda *(2)*	1,230	0.4300	0.0400	0.0930	non parametric			27.00
UK *(1)*	36,580	0.2040	0.0420	0.2059	parametric	0.4760	0.310	
US *(7)*	47,020	0.2200	0.0409	0.1860	semiparametric	0.4800	0.460	

Notes: The source for inequality and IEO measures for each country is given in parentheses after the country's name, and refers to the studies below. GNI per capita is 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. Sources for the numbers in the last three columns are given in the text.

(1) Checchi et al. (2010)
(2) Cogneau and and Mesple-Somps (2008)
(3) Ferreira and Gignoux (2011)
(4) Ferreira et al. (2011)
(5) Belhaj-Hassine (2012)
(6) Piraino (2012)
(7) Pistolesi (2009)
(8) Singh (2011)

Table 2: 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. (2010)	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 earnings	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	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, Gignoux, Aran (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 eraning	non parametric	gender, father's education, mother's education, father's occupation, region of birth.	72
6	Piraino (2012)	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 (2011)	India	IHDS 2004–2005	household per capita earnings	parametric	father's education, father's occupation, caste, religion, geographical area of residence.	108

Table 3: The Human Opportunity Index for five service indicators and 39 countries

Country	Period	HOI School Attendance (10-14 yrs)	HOI Access to Water	HOI Access to Electricity	HOI Access to Sanitation	HOI Finished primary on time	HOI Education	HOI Housing conditions	HOI
Argentina	2008	96.80	97.30	100.00	64.40	82.60	89.70	87.23	88.47
Brazil	2008	97.30	82.50	96.40	78.20	34.90	66.10	85.70	75.90
Cameroon	2004	79.11	4.91	24.38	1.89	24.50	51.80	10.40	31.10
Chile	2006	98.40	93.90	99.20	86.10	82.00	90.20	93.07	91.63
Colombia	2008	93.00	54.00	100.00	77.00	70.00	81.50	77.00	79.25
Costa Rica	2009	95.50	95.40	98.80	92.80	66.40	80.95	95.67	88.31
Dem. Rep. Congo	2007	72.92	2.73	5.33	1.65	18.64	45.78	3.24	24.51
Dominican Republic	2008	96.50	70.10	95.40	48.80	53.40	74.95	71.43	73.19
Ecuador	2006	85.90	67.60	90.90	50.90	79.50	82.70	69.80	76.25
El Salvador	2007	89.40	18.30	83.00	18.60	42.50	65.95	39.97	52.96
Ethiopia	2011	69.09	0.93	5.61	0.14	15.75	42.42	2.23	22.32
Ghana	2008	84.59	4.90	36.70	3.91	42.26	63.42	15.17	39.30
Guatemala	2006	80.40	63.90	68.20	21.10	24.40	52.40	51.07	51.73
Honduras	2006	82.00	19.70	53.20	25.60	45.10	63.55	32.83	48.19
Jamaica	2002	95.00	23.40	85.40	35.70	93.00	94.00	48.17	71.08
Kenya	2008-09	93.34	8.36	4.92	1.53	47.31	70.32	4.93	37.63
Liberia	2007	59.10	1.03	1.04	4.70	8.45	33.78	2.26	18.02
Madagascar	2008-09	72.49	0.83	3.84	0.44	14.59	43.54	1.70	22.62
Malawi	2010	90.24	1.67	2.51	0.26	24.10	57.17	1.48	29.32
Mali	2006	39.32	3.17	6.14	1.08	10.85	25.09	3.47	14.28
Mexico	2008	92.50	80.30	98.30	72.00	86.70	89.60	83.53	86.57
Mozambique	2003	69.91	1.45	3.00	0.47	5.81	37.86	1.64	19.75
Namibia	2006-07	92.66	25.70	15.48	11.58	53.46	73.06	17.59	45.32
Nicaragua	2005	84.60	14.80	52.50	36.50	33.50	59.05	34.60	46.83
Niger	2006	29.98	1.03	2.54	0.17	5.88	17.93	1.25	9.59
Nigeria	2008	63.00	1.80	29.31	4.20	42.35	52.68	11.77	32.22
Panama	2003	90.80	50.20	60.20	31.40	70.60	80.70	47.27	63.98
Paraguay	2008	92.00	67.20	94.70	48.40	56.30	74.15	70.10	72.13
Peru	2008	95.00	42.60	64.40	54.40	74.10	84.55	53.80	69.18
Rwanda	2010	93.33	0.95	2.90	0.06	8.73	51.03	1.30	26.17
Senegal	2010-11	55.33	36.52	32.28	13.89	24.68	40.00	27.57	33.78
Sierra Leone	2008	65.73	2.37	3.24	0.61	24.41	45.07	2.07	23.57
South Africa	2010	98.72	20.57	78.82	24.95	50.74	74.73	41.44	58.09
Tanzania	2010	81.52	2.84	2.89	0.33	45.72	63.62	2.02	32.82
Uganda	2006	90.64	0.56	1.62	0.10	15.95	53.30	0.76	27.03
Uruguay	2008	94.80	89.30	98.20	96.60	78.40	86.60	94.70	90.65
Venezuela, R. B. de	2005	94.60	88.10	98.50	83.70	73.40	84.00	90.10	87.05
Zambia	2007	87.97	4.69	6.44	3.56	29.81	58.89	4.90	31.89
Zimbabwe	2010-11	92.05	8.48	12.63	7.58	78.00	85.03	9.56	47.30

Note: HOI Education is the simple average of HOI for school attendance and HOI for finishing primary school on time. HOI Housing Conditions is the simple average of the other three individual HOIs. The last column is the simple average of the two preceding sub-aggregates. This follows the authors in the sources below.

Source: Molinas Vega et al. (2011) and World Bank (2012a)

Figure 1: An illustration: inverse advantage distribution for three types

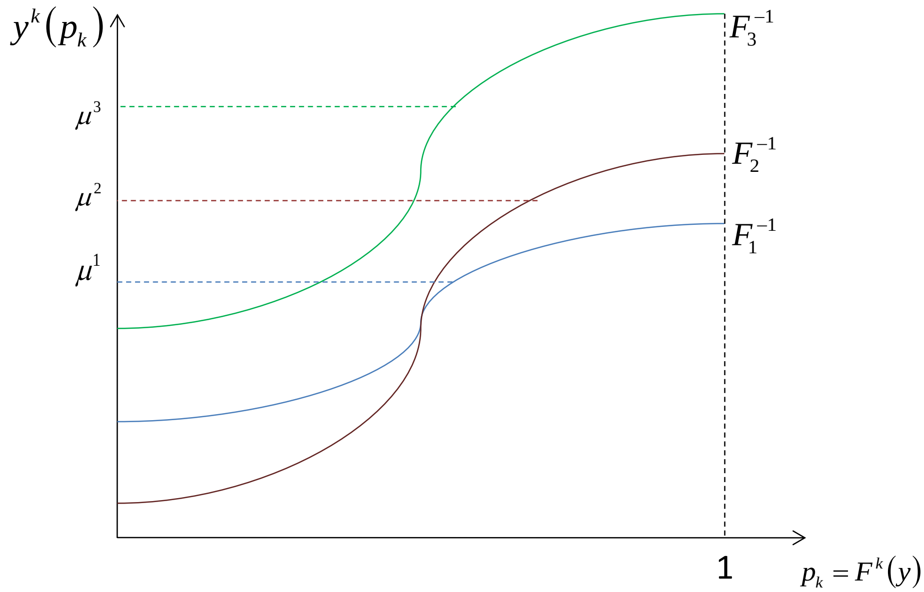


Figure 2: inequality of economic opportunity: lower-bound estimates

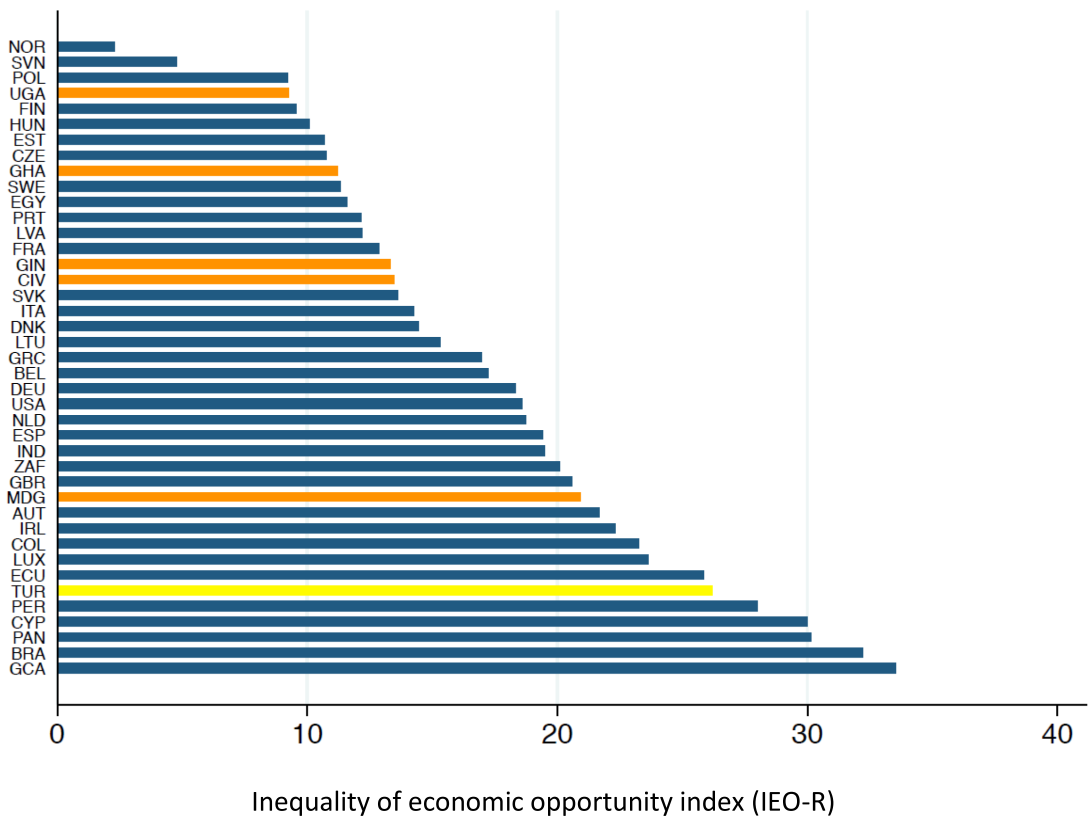


Figure 3: Inequality of economic opportunity and the level of development

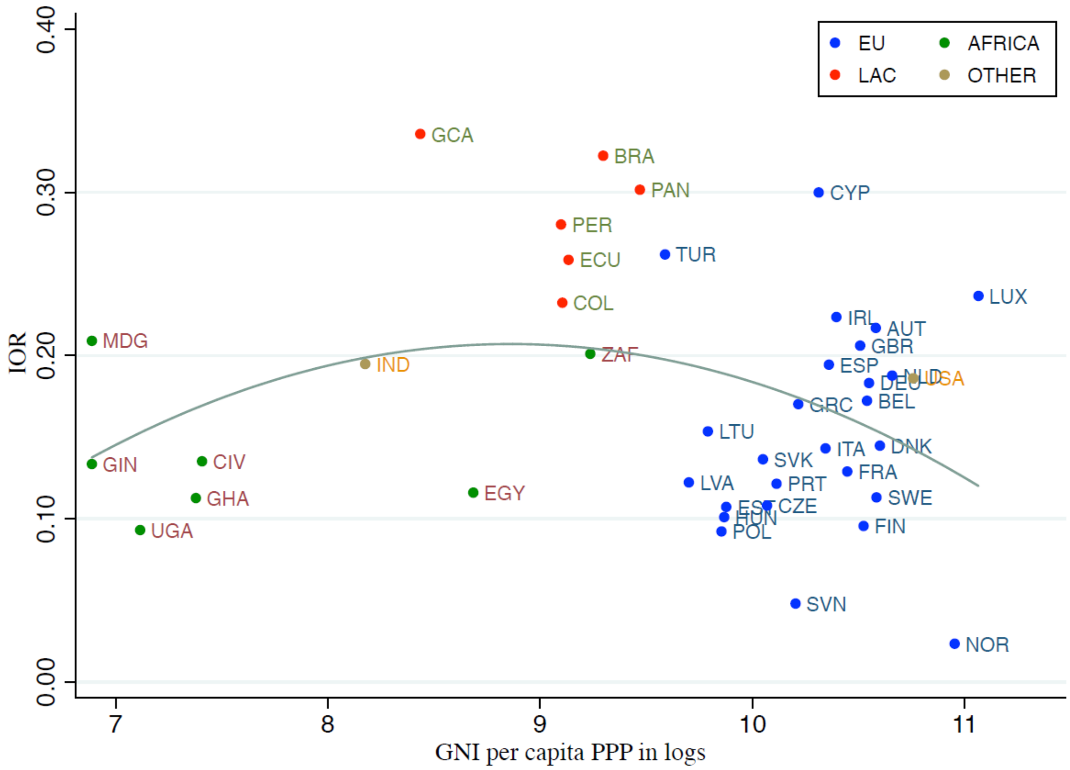
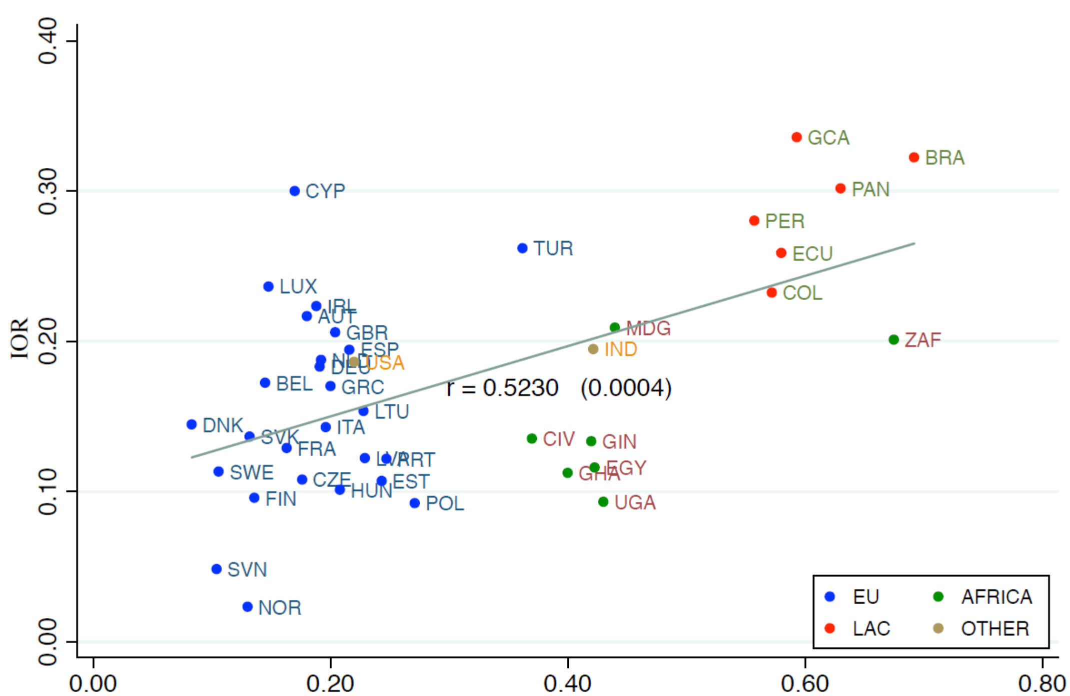


Figure 4: Inequality of opportunity and income inequality



Income Inequality (mean logarithmic deviation)

Figure 5: Inequality of opportunity and intergenerational mobility

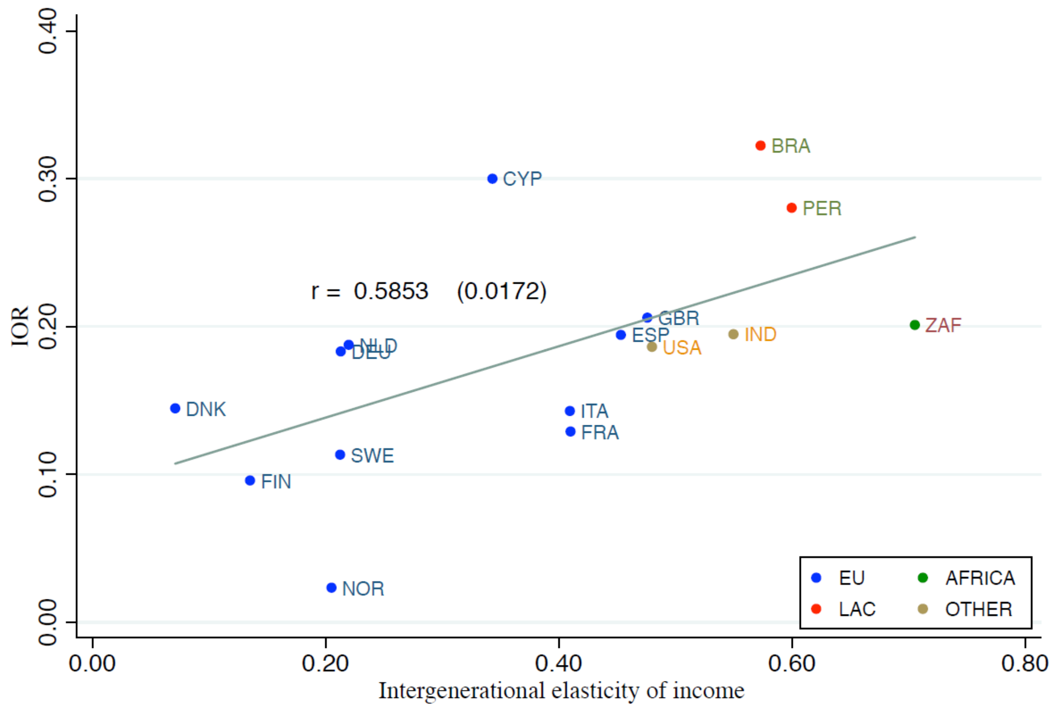


Figure 6: Inequality of opportunity and the intergenerational correlation of education

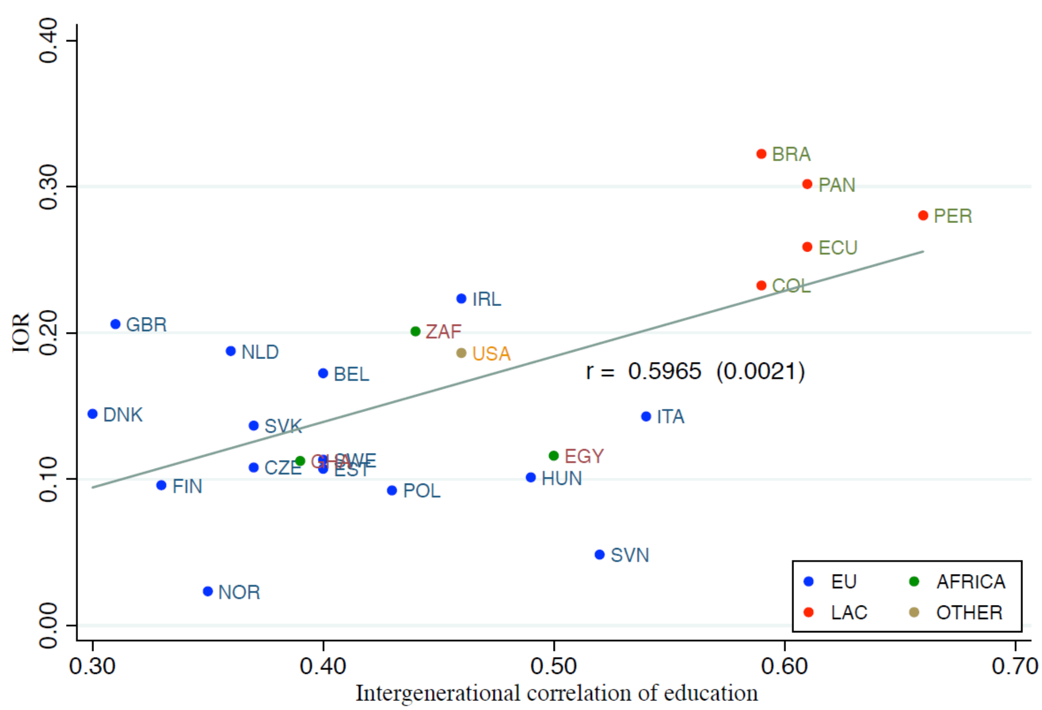


Figure 7: The Human Opportunity Index in Africa and Latin America

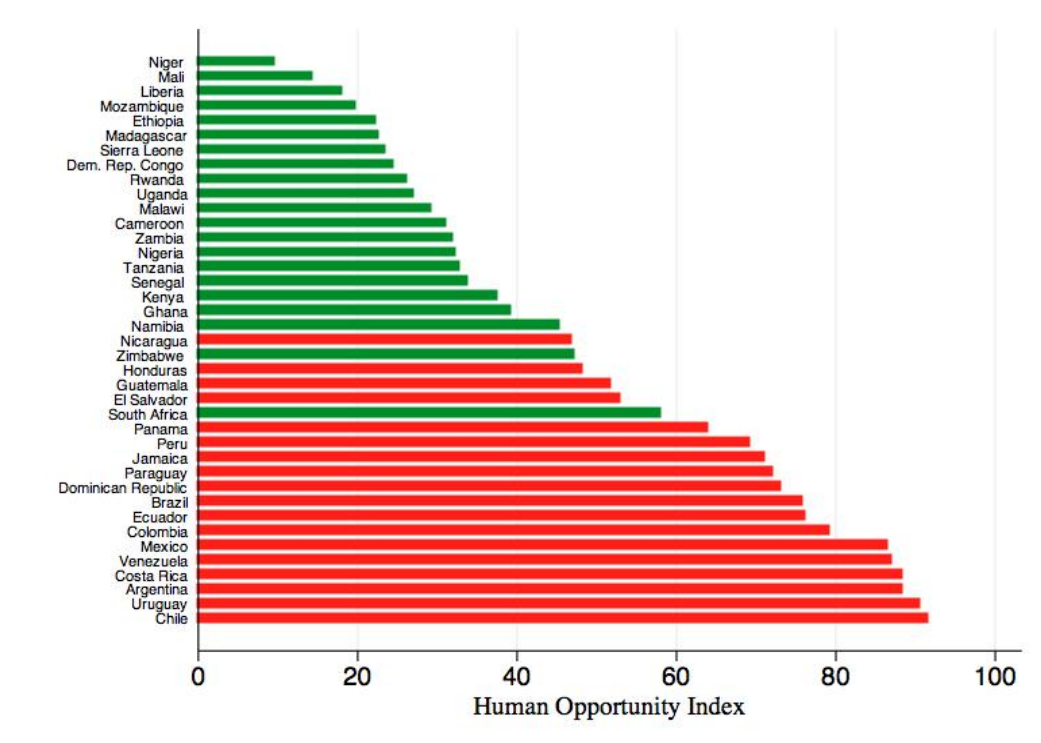


Figure 8: The Human Opportunity and Development Indices

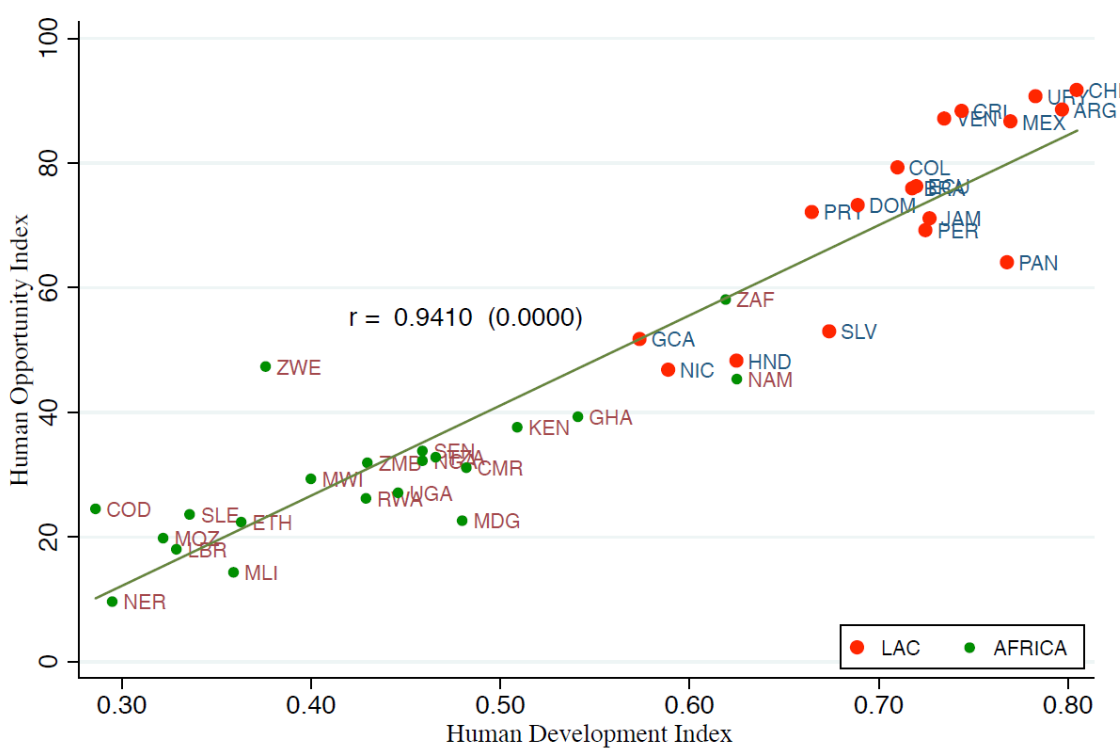


Figure 9: IEO-R and the Dissimilarity Index in the common subsample