The Income Lever and the Allocation of Aid

Lidia Ceriani
Paolo Verme

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Lidia Ceriani
Bocconi University, Milan, Italy

Paolo Verme
The World Bank, Washington DC, USA

Abstract

The paper develops a concept and a measure of the monetary capacity of a country to reduce its own poverty and shows how these tools can be used to guide budget allocations or the distribution of Aid. We call this concept the income lever and define it as the relation between the welfare of the poor and the welfare of the non-poor in a given society. Making use of tax and distributive theory, the paper shows how to different redistributive criteria correspond different normative criteria of income lever. We then construct various income lever indexes based on these criteria and use such indexes to rank countries according to their own monetary poverty reduction capacity. As shown in the empirical application, this methodology can provide an equitable tool to rank countries or regions when it comes to budget or Aid allocations, whether it is the allocation of social funds within the European Union (North-North transfers) or the allocation of Aid from rich to poor countries (North-South transfers).

Keywords: Aid distribution, poverty reduction, redistribution policies.

JEL Classification: H2, H5, I3, O1, O2, F3.

1 Introduction

The motivations behind aid flows across countries have varied over time and space. It could be argued that these motivations ranged (and still range) from pure altruistic motivations to pure selfish and opportunistic ones. This is not surprising. National governments manage tax payers resources and they are accountable to the electorate. As elected governments have a mandate and a duty to pursue citizens' interests - at home or abroad - these interests may span across multiple dimensions. Governments' altruistic behavior normally derives from an internal demand for altruism, now prominent in many societies, while governments' selfish behavior should be mostly understood as an internal demand for such behavior. This is, after all, the golden rule of democracy.

The birth and development of multilateral organizations over the twentieth century contributed to change these simple dynamics. Multilateral organizations now play a supernational role not only in terms of coordinating national policies but also in terms of designing and guiding global policies in both normative and positive terms. The UN declaration of human rights and the UN international tribunal are two examples of how multilateral platforms have been able to shape and disseminate global values.

One example of this phenomenon is the increasing attention devoted to global poverty. With the fall of the Berlin wall in 1989, the publication of the 1990 World Bank World Development Report on poverty and the establishment of the Millennium Development Goals in 2000, multilateral and bilateral organizations have altered their policy priorities turning poverty reduction into the most prominent development objective. Poverty reeduction is not only the main overarching development objective for multilateral organizations such as the World Bank, the Asian Development Bank or the European Commission but also for bilateral aid organizations of rich countries such as France, Japan or the UK (OECD, 2005). This is a change vis-a-vis previous decades where investments, industrialization, agricultural development, fiscal stability and debt reduction dominated at different times the global development agenda.

This shift in emphasis towards poverty reduction has evidently affected the distribution of aid not only for poor countries but also for poor areas in rich countries. More than

ever before, individual countries and multi-lateral organizations distribute aid according to poverty or income criteria. For example, the World Bank classifies countries in different income categories and accords to different categories different benefits and so does the European Union to allocate social funds across members' countries and to allocate aid outside the Union.

Beyond these global objectives, the reality of aid allocation is, of course, much more complex. It is still the result of a mixture of old and new criteria, altruistic and non, and a mixture of development indicators, policy capacity and geopolitical factors. However, poverty reduction can be safely described today as the ultimate development goal. And the motivation for aid largely reside in the idea that it can help low income countries to reduce poverty. What is mostly debated is not whether aid should exist or not but what is the optimal allocation of aid to minimize poverty given a budget constraint. In other words, whether the allocation of aid should be simply driven by criteria such as poverty or GDP per capita or should include other criteria such as the policy capacity of recipients countries or other criteria.

This paper addresses this question introducing an additional criteria for the allocation of aid called the "Income Lever" (IL). Poverty measurement is characterized by the quantification of the number of poor individuals or by the quantification of the poverty gap, the total amount of resources necessary to end poverty. This is what is technically called the "focus axiom" or, in other words, the focus on only a part of the income distribution, the part below the poverty line. By focussing on the poor, no attention is given to the distribution of incomes above the poverty line.

This paper argues that donors should also consider the distribution of incomes above the poverty line and the recipients' monetary capacity to reduce their own poverty via internal redistribution of incomes. This monetary capacity depends, among other factors, on the relation between the welfare of the poor and the welfare of the non-poor in any given country. It is argued, therefore, that it is not enough to know whether a society *is poor*, it is also important to understand whether a society has *the monetary capacity to reduce its own poverty*. This is what we call the "Income Lever (IL)".

The purpose of this paper is to develop different indexes to measure the income lever, and to

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provide different distributional interpretations of such indexes using tax and distributional theory. Two countries with identical poverty rates and identical populations below the poverty line may exhibit very different income distributions above the poverty line with one country being much richer than the other. Understandably, these two countries should not be treated equally from the donors' community. We therefore switch attention from poverty measurement to the measurement of the IL, the relation between the welfare of the poor and the welfare of the non-poor. Neither the poverty rate nor GDP per capita, two of the most popular measures used to rank recipients' countries, can capture this relation. The IL is therefore proposed as a complement to these indicators and in order to rank countries more accurately for the purpose of aid allocation.

In the next section we review briefly the rationale for the allocation of aid discussing guiding principles and empirical practices. Section three outlines the theoreatical framework for the IL indexes proposed while section four describes a selection of indexes treating separately indexes that result in proportional, progressive and regressive redistribution of incomes. Section five provides two empirical illustrations, one applied to the European Union to illustrate the use of the IL indexes in the context of North-North transfers and one on Sub-Saharian Africa (SSA) to illustrate the use of the indexes in the context of North-South transfers.

2 Principles and practices behind the allocation of aid

The literature on the allocation of aid has polarized around two streams of literature, one that focused on the discussion of what principles and criteria should be used to guide the allocation of aid (normative studies) and one that focused on the reality of aid allocation trying to determine the criteria that are used by donors *de facto* to allocate aid and the effectiveness of aid in achieving its objectives (positive studies). We briefly review these two strands of the literature in turn.

Normative studies. Broadly speaking, aid allocation criteria include norms regarding effectiveness, equity and transparency (see for example Guillaumont, 2008). Effectiveness regards the capacity of aid to improve on target indicators such as poverty. Equity regards

the capacity of aid to treat equal countries equally. And transparency regards the capacity to assess the equity and effectiveness of aid. In a recent note, Anderson and Waddington (2006) group contributions to the normative debate into three main allocation principles respectively based on: poverty-efficiency, equal opportunity or structural indicators, roughly reflecting in this way the broader norms described.

The poverty-efficiency literature emphasizes the importance of considering the poverty level in conjunction with the policy capacity of a country so as to maximize the poverty reduction capacity of aid at the global level given a budget constraint. Collier and Dollar (2001) and Collier and Dollar (2002), for example, promote a poverty-efficiency aid allocation criteria. Poverty being equal, aid should increase with the policy capacity of a country, because aid can have larger growth effect in a better policy environment. Vice-versa, the policy capacity being equal, aid should increase with the level of poverty because the growth-promoting effect of aid has more poverty reduction capacity in a very poor country. The poverty-efficiency position is supported by influential institutions such as the World Bank (Wolfensohn, Stern, Goldin, Rogers, and Karlsson, 2002) or the OECD (OECD, 2003; OECD, 2006) although empirical evidence (among others, Nunnenkamp and Thiele, 2006) suggests that the broader donors' community rarely follows this criterion.

This position is also questioned by scholars arguing for transparency, who point out the necessity of predictable, or less volatile, flows of aid to individual countries (among others Eifert and Gelb, 2008, Fielding and Mavrotas, 2008, Bulir and Hamann, 2006, Bulir and Hamann, 2003). As the policy capacity of a country is hard to assess and also volatile, the poverty efficiency criteria would be difficult to implement and also subject to frequent changes. This would speak in favor of using standard statistics such as GDP per capita or poverty rates to rank countries and allocate aid so as to capture basic but well understood indicators. Guillaumont, 2008 argues that the poverty-efficiency position is not backed by evidence and that a structural vulnerability approach whereby countries are considered based on their structural and exogenous constraints would be preferable, which is an argument for allocating more aid to the LDCs.

A different stream of the literature (Llavador and Roemer, 2001; Cogneau and Naudet, 2007) focuses instead on equal opportunities. These authors believe that the distribution

of aid should equalize *opportunities* among recipient countries for achieving growth, controlling for the *effort* undertook to turn aid into economic growth. This is based on the Roemer's inequality of opportunities literature when one should distinguish between circumstances and efforts and try to give a premium to efforts. This approach emphasizes the role of equity although - as it was the case of the poverty-efficiency literature - it is difficult to implement in practice given that the distinction between efforts and circumstances is not simple to make with empirical data.

For the sake of transparency and in order to comply to specific normative criteria, some organizations have tried to translate guiding principles into formulas used to rank countries for the purpose of the allocation of aid. The World Bank uses a Performance Based Allocation (PBA) formula including indicators such as GNI per capita, population size and a measure of the country performance. Unicef uses a formula that includes the size of the child population and the under-five mortality rate. The European commission (EC) uses several different formulae combined with various normative criteria to allocate social funds within the union or aid funds outside the union with criteria being different according to different groups of countries such as the Africa Caribbean and Pacific (ACP) countries, Mediterranean countries or new accession countries. These are examples of tentatives to operationalize normative criteria but, in the overall panorama of Aid, these criteria remain few and organization specific.

Positive studies. The empirical literature on aid allocation has tried instead to answer two main questions: what are the actual determinants and motivations of aid flows and whether aid is effective in boosting growth and reducing poverty in developing countries.

With respect to the determinants of aid flows, Baulch (2003) analyzes the distribution of international development assistance using aid concentration curves. He finds that among the six most generous bilateral donors (United States, Japan, Germany, United Kingdom, France and the Netherlands), only the United Kingdom and the Netherlands devolve the largest part of their aid budget to assistance to the poorest countries, while the other countries give large proportions of their aid budgets to relatively well-off middle income countries. The same bias is found in the analysis of the three main institutions providing multilateral development aid. The World Bank and other UN organizations show different

degree of progressivity in aid allocation while the European Union directs aid to middle-income countries where poor individuals account for the minor share of the world's absolute poor. Alesina and Dollar (2000) also find that donor countries are inspired more by their political-strategic interests rather than by the extent of poverty, or the institutional and political environment of recipients.

Chauvet (2002) investigates how aid allocation by donors is influenced by elite, violent, and social instabilities. The author finds that the three different forms of socio-political instabilities have a different impact according to the type of aid (bilateral or multilateral) and the type of recipient countries (middle-income non-oil-exporting countries, low-income countries and oil-exporting countries). A recent contribution by Dreher, Nunnenkamp, and Thiele (2011) focuses on the difference in bilateral aid allocation patterns between new donors not members of the Development Assistance Committee (DAC) of the OECD and DAC members. Their findings indicate that both types of donors share the same shortfalls by not taking into account bad policy behaviors of recipients countries and by being influenced by commercial interest. According to Koch, Dreher, Nunnenkamp, and Thiele (2009) economic interests do not influence non-governmental organizations (NGOs) although NGOs seem affected by the geographical choices of the donor countries in which the NGOs are based, by the presence of other NGOs in the recipient countries and by sharing the same religion with the recipient country.

With respect to the aid effectiveness literature, the results are mixed. Burnside and Dollar (2000) analyze a sample of 51 countries in the period 1970-1993, and find that aid has a positive impact on growth in countries with a good policy environment (accounting for fiscal, monetary and trade policies), but not in countries with poor policies. These results have been later challenged, among others, by Easterly, Levine, and Roodman (2004) who find less clear-cut results by replicating the estimates. Also Dalgaard and Erickson (2009) find a modest effect of aid on growth by applying a theory-based calibration approach on a sample of Sub-Saharan African countries. Claessens, Cassimon, and Campenhout (2009) find that aid has improved over the years in terms of targeting, by increasingly focusing on poorer countries, and in terms of efficiency, by increasingly favoring countries with better policy environments. For an interesting literature review and meta-analysis on the topic, see Doucouliagos and Paldam (2008).

In essence, the normative debate and its advances are still fairly far from the actual criteria used by donors to allocate aid. Also, while poverty reduction has increased in importance among the overarching development priorities, the actual allocation of aid is not driven mainly by poverty. These outcomes are partly explained by the fact that the measurement of poverty requires instruments that have only recently become widely available. When the World Development Report on poverty was published in 1990 only a handful of countries carried out and made available household consumption surveys. Today, the World Bank has a database of over 1,700 household surveys many of which are for public use. We are now in a position to make much better use of micro data for allocating Aid and targeting the poor whether we believe in efficiency, equity or structural criteria.

The IL methodology proposed makes an optimal use of the micro data available and complies to efficiency, equity and transparency criteria. It improves on the simple measurement of poverty by extending the analysis to the non-poor. The concept can help to improve the policy capacities of countries by highlighting the potential for redistributive policies, it complies to the equal opportunity principle by allocating aid according to the monetary capacity of a country to address its own poverty and it is transparent in that responds to principles well established in the tax and distribution theory literature.

3   Framework

The idea that individuals should contribute *equally* towards the expenses of the government dates back to Mill (1848) theory of *equality of sacrifice*.

> *For what reason ought equality to be the rule in matters of taxation? For the reason that it ought to be so in all affairs of government. As a government ought to make no distinction of persons or classes in the strength of their claims on it, whatever sacrifices it requires from them should be made to bear as nearly as possible with the same pressure upon all, which, it must be observed, is the mode by which least sacrifice is occasioned on the whole. If any one bears less than his fair share of the burthen, some other person must suffer more than his share, and the alleviation to the one is not, ceteris paribus, so great a good to him, as*

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> *the increased pressure upon the other is an evil. Equality of taxation, therefore,*
> *as a maxim of politics, means* equality of sacrifice. *It means apportioning the*
> *contribution of each person towards the expenses of government so that he shall*
> *feel neither more nor less inconvenience from his share of the payment than*
> *every other person experiences from his.* (Mill, 1848, Book V, Chapter II, On
> the General Principles of Taxation).

Equality of sacrifice can be interpreted as equality of absolute, proportional or marginal sacrifice where sacrifice is measured in terms of utility. It is absolute if everyone sacrifices an equal amount of utility irrespective of the starting utility. It is proportional if everyone sacrifice the same amount of utility relatively to the starting utility. It is marginal if everyone sacrifices the same amount of marginal utility. The interpretation of equality of sacrifice is a question for the social planner as well as the assumptions about the shape of the individual utility functions. In this paper paper we will not make any normative judgement on the type of sacrifice or on the shape of the utility function. However, any normative choice that the social planner will make on these two grounds (type of sacrifice and utility) will results in a proportional, progressive or regressive redistribution mechanism. This is what we focus on in this paper where we will construct different IL indexes that imply different redistribution mechanisms.

How this equality of sacrifice is then realized through transfers depends upon two assumptions. The first assumption concerns the form of the utility functions attributed to individuals and - as in orthodox economic theory - we can simply assume these functions to be linear in incomes and identical for all individuals in society. The second assumption regards instead our preferences for different redistributive criteria such as proportional, progressive or regressive. As we will show in the next sections, to different preferences correspond different IL indexes.

Let N be a population made of $i = 1, 2, ..., n$ individuals, $n \in \mathbb{N}$. Each i-th individual is denoted by an income level $y_i \in \mathbb{R}_+$, and let us assume that the poverty line is set at level z_N. Without loss of generality, let us assume that $y_1 \leq y_2 \leq \cdots \leq y_n$. The set of poor individuals in society N, Q_N^P, is defined as the set of individuals whose income falls below the poverty line: $Q_N^P = \{i \in N : y_i < z_N\}$. Symmetrically, the set of non-poor individuals

in society is N and $Q_N^{\sim P}$, is defined as the set of individuals whose income is greater or equal than the poverty line: $Q_N^{\sim P} = \{i \in N : y_i \geq z_N\}$. To eradicate poverty, we should fill the gap between each poor individual's income and the poverty line. The total amount of income to eradicate poverty is therefore given by the sum of poverty gaps:

$$G_N^P = \sum_{i \in Q_N^P} (z_N - y_i) \tag{1}$$

On the other hand, incomes in excess of the poverty line can be quantifiable by the sum of all the wealth gaps, defined as follows:

$$G_N^{\sim P} = \sum_{i \in Q_N^{\sim P}} (y_i - z_N) \tag{2}$$

This quantity can be considered as the upper-bound budget for any redistributive policy aiming at keeping above (or at) the poverty line all non-poor individuals.

Figure 1 shows a simple illustration of the poverty and wealth gaps. On the $y-axis$ we plotted income and on the $x-axis$ we plotted the population share (this is what it is usually defined as Pen's parade from Pen, 1971). The poverty line z divides the poverty gap region from the wealth gap region so that the figure provides a first visual indication of the relative proportions of these two areas. The point q_z denotes the share of poor individuals in the population (poverty headcount index).
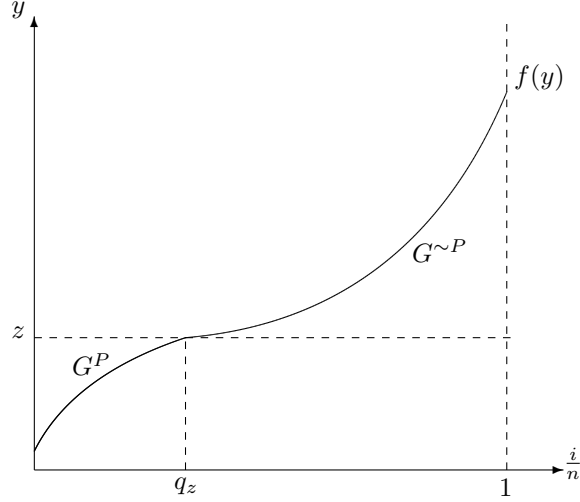
4 Alternative income lever indexes

4.1 Proportional redistribution IL indexes

As a first and simple index, we define the income lever as a measure of the relative proportions between the poverty gap and the wealth gap as follows:

$$IL_N^{prop} = \frac{G_N^P}{G_N^{\sim P}} \tag{3}$$

Figure 1: Poverty and excess-poverty gaps

Note: On the y-axis we measure income levels, on the x-axis shares of the population. Therefore, q_z stands for the share of individuals having an income level smaller than the poverty line z (in other words, q_z is the headcount index). The area above $f(y)$ and below z is the sum of poverty gaps G^P, while the area below $f(y)$ and above z is the sum of wealth gaps $G^{\sim P}$

The index described in equation (3) is increasing in the sum of poverty gaps, decreasing in the sum of wealth gaps, and it is scale invariant, which are all reasonable properties.[1] Moreover, it has a straightforward distributional implication. It can be considered as the proportional tax-rate α that has to be levied on the incomes of each non-poor individual to defeat poverty:

$$\sum_{i \in Q_N^{\sim P}} \alpha(y_i - z_N) = \sum_{i \in Q_N^P} (z_N - y_i) \tag{4}$$

Solving for α:

$$\alpha = \frac{\sum_{i \in Q_N^P}(z_N - y_i)}{\sum_{i \in Q_N^{\sim P}}(y_i - z_N)} = \frac{G_N^P}{G_N^{\sim P}} = IL_N^{prop} \tag{5}$$

If $G_N^P \leq G_N^{\sim P}$, then $\alpha \in [0,1]$, whereas if $G_N^P > G_N^{\sim P}$, then $\alpha > 1$. Note that this interpretation of the index reveals the normative statement embedded in the index IL_N^{prop}: we claim that each non-poor individual should contribute to poverty reduction equally and in a proportional way to her wealth gap. This is evidently a choice and a normative statement.

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[1]See Quiggin and Mahadevan (2010) for a characterization of this index.

As an example, imagine two populations, A and B, where $n = 5$, with the following income distributions sorted in ascending order of income: $A = (2, 5, 6, 15, 17)$, $B = (2, 5, 6, 9, 13)$, and let $z_A = z_B = 6$. It is evident that the two populations are equal in terms of poverty, given that standard poverty measures are subject to the focus axiom. However, from the perspective of the income lever as defined in equation 3, the two populations have a different capacity to reduce poverty. Indeed, $IL_A = \frac{5}{20}$ is smaller than $IL_B = \frac{5}{10}$, which places society A in a better position than society B when it comes to poverty reduction, simply because society A can rely on a larger wealth gap than society B. We can therefore make an ordinal ranking of the two societies based on the income lever.

4.2   Regressive redistribution IL indexes

For each non-poor individual $i \in Q_N^{\sim P}$, let $g_i^{\sim P}$ be the wealth gap, with $g_i^{\sim P} = y_i - z_N$. Let $||.||$ be the cardinality of a generic set so that $||Q_N^{\sim P}||$ is the number of individuals belonging to the population set $Q_N^{\sim P}$ (set of non-poor individuals).

We can now imagine that all people who can afford a transfer without falling into poverty contribute equally, in absolute terms, to poverty eradication. In other words, we want to find the flat transfer f_N that each non-poor individual in society N should provide to contribute to the eradication of poverty. This is equivalent to the average poverty gap to be levied on non-poor individuals who can bear the cost without crossing the poverty line:

$$f_N = \frac{G_N^P}{||Q_N^{\sim P,f}||} \tag{6}$$

where $Q_N^{\sim P,f}$ is the set of non-poor individuals who can bear the cost of the transfer and it is defined as $Q_N^{\sim P,f} = \{i \in Q_N^{\sim P} : (y_i - f) \geq z\}$. Note that the set of non-poor individuals $Q_N^{\sim P,f}$ is endogenously defined as it depends upon the magnitude of the sum of poverty gaps, the number of non-poor individuals, and the distribution of incomes above the poverty line.

The level of f itself is a good measure of income lever because the smaller the flat transfer,

the lighter the income lever. In other words, the weight needed to lift all poor individuals out of poverty is small. Therefore, we define f as our second income lever index:

$$IL_N^{flatA} = f_N = \frac{G_N^P}{||Q_N^{\sim P,f}||} \tag{7}$$

Consider, for instance two societies A and B, where the distributions of incomes are $A = (2, 5, 6, 9, 13)$ and $B = (2, 5, 6, 7, 15)$. Let the poverty line $z = 6$. Using IL_N^{prop}, the two societies have the same income lever: $IL_A^{prop} = IL_B^{prop} = 0.5$. However, by using IL_N^{flat}, we find that $IL_A^{flat} = 2.5$ while $IL_B^{flat} = 5$. We then find that society B's effort to reduce poverty is higher than society A's, and therefore the income lever of society B is higher than the income lever of society A.

Note that this second scheme forces the definition of a *no tax area*, a group of non-poor individuals who are not considered responsible for the eradication of poverty. The dimension of this no-tax area is positively correlated with the dimension of the sum of poverty gaps and the inequality of the distribution of income among non-poor individuals, and negatively correlated with the number of non-poor individuals. Above the no-tax area, instead, each individual should transfer the same fixed amount.

Figure 2 illustrates this new concept using the same coordinates as in Figure 1 All non-poor individuals are - in principle - called to contribute to the poverty eradication effort in equal amounts. However, to make sure that some of the non-poor will not fall into poverty as a consequence of the flat tax, a no tax area is derived based on the underlying distribution of incomes so that all individuals above the no tax areas will be able to afford the flat tax without falling below the poverty line.

Note that a flat tax is a regressive tax. Let us define f_i the average transfer levied on the $i - th$ non-poor individual:

$$\bar{f}_i = \frac{f_n}{y_i} \tag{8}$$

Then, it is straightforward to show that $\bar{f}_i$ is decreasing with incomes:

Figure 2: Flat Transfer
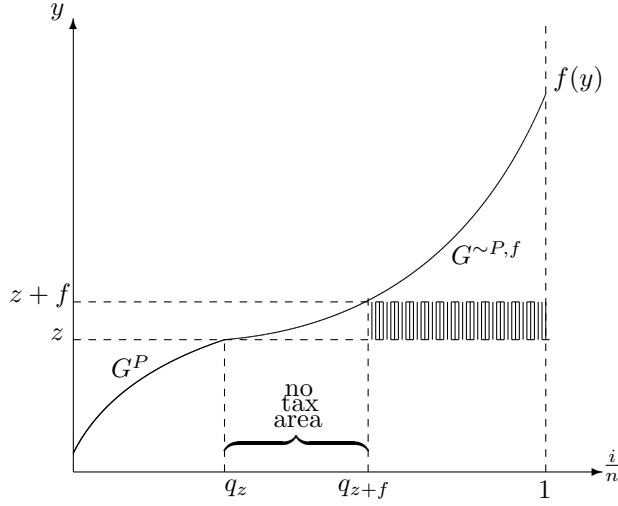
$$\frac{d\bar{f}_i}{dy_i} = \frac{-f_n}{y_i^2} \leq 0 \tag{9}$$

Therefore, any ordering between countries based on (7) relies implicitly on a regressive redistribution hypothesis: the marginal tax rate to be levied on non-poor individuals is decreasing with the wealth gaps. This is again a normative choice that the social planner is called to make.

Note that the proposed IL_N^{flat} is just one of the possible indexes we can think of based on the definition of the flat transfer f. For instance, another reasonable index can be:

$$IL_N^{flatB} = f \frac{G^P}{G^{\sim P,f}} \tag{10}$$

where $G^{\sim P,f} = \sum_{i:y_i \geq z+f}(g_i^{\sim P} - f)$. Index IL_N^{flat*} is the weighted version of IL_N^{flatA}. The weight stands for the additional contributive capacity of the new set of non-poor individuals after taking away the flat transfer. In other words, for a given flat transfer, the society where the sum of excess poverty gap minus the transfer for the new set of non-poor is larger, has the lower income lever.

Consider for instance two societies C and D, where the distributions of incomes are $C =$

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$(2, 5, 6, 7, 8, 13)$ and $D = (2, 5, 6, 7.5, 8.5, 12)$. Let the poverty line $z = 6$. The sum poverty gaps is the same as previous examples: $IL_C^{prop} = IL_D^{prop} = 0.5$, $IL_C^{flatA} = IL_D^{flatA} = 2.5$, but $IL_C^{flatB} = 2.5 * \frac{5}{4} < IL_D^{flatB} = 2.5 * \frac{5}{3.5}$.

4.3 Progressive redistribution IL indexes

The measure defined in (3) may be interpreted as the *average* tax rate to be levied on the sum of wealth gaps, therefore underlying a proportional redistribution scheme. The measure defined in (7), instead, may be interpreted as the flat-tax to be levied on non-poor individuals, therefore underlying a regressive redistribution scheme. A different set of income lever measures can be defined starting from a progressive idea of redistributive scheme.

We can imagine that not all the individuals above the poverty line are to be considered responsible for transferring income to poor individuals, but just the *rich* individuals. We can define as *rich* the subset of non-poor individuals whose income is higher than a threshold r, the *richness line*. Let $Q_N^{\sim P, r}$ be the set of all individuals whose income lies above r:

$$Q_N^{\sim P, r} = \{i : y_i \geq r\}, \tag{11}$$

and let $G^{\sim P, r}$ be the sum of *richness* gaps g_i^r:

$$G^{\sim P, r} = \sum_{i \in Q_N^{\sim P, r}} g_i^r = \sum_{i \in Q_N^{\sim P, r}} (y_i - r). \tag{12}$$

The richness line can be determined in different ways, and the discussion about the topic is broad and largely beyond the scope of this paper. Medeiros (2006) and Eisenhauer (2011), for example, define the richness line as a function of the poverty line. Other scholars define the richness line as a function of the median income (see Peichl, Schaefer, and Scheicher, 2010 or Brzezinski, 2010) while Peichl and Pestel (2011) define the richness threshold as the 80th percentile. Once the richness line is defined, then the income lever becomes:

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$$IL_N^{progA} = \frac{G_N^P}{G^{\sim P,r}} \tag{13}$$

Note that IL_N^{progA} has a twofold interpretation. First, it may be seen as the proportional tax rate δ to be applied on all wealth gaps above a no-tax area defined by the richness line. Second, it may be interpreted as the marginal tax rate on the bracket of wealth gaps larger than r, the first bracket $(0 - r)$ being taxed with a marginal tax rate equal to zero. Differently from IL_N^{reg}, this new measure implies a progressive transfer scheme. For each non-poor individual exceeding the no-tax area, the average transfer $\bar{t}$ is increasing in incomes of non-poor individuals:

$$\frac{d\bar{t}}{dy_i} = \frac{d\left[\frac{\delta(y_i-r)}{y_i}\right]}{dy_i} = \frac{\delta r}{y_i^2} > 0. \tag{14}$$

Consider the two societies A and B with incomes $A = (3, 5, 6, 8, 9, 12, 15)$ and $B = (3, 5, 6, 7, 11, 13, 13)$. Let the poverty line be $z = 6$. The two societies have the same income lever with $IL_A^{prop} = IL_B^{prop} = 0.2$. They also have the same income lever as measured by $IL_A^{reg} = IL_B^{reg} = 0.05$. However, the two societies would appear different with a progressive income lever scheme since $IL_A^{progA} = \frac{4}{12} > IL_B^{progA} = \frac{4}{13}$.

The progressive scheme described can be visualized in Figure 3 using the same axes as in Figure 1 and 2. As in Figure 2, we have a no-tax area but unlike Figure 2 the no-tax area is defined by the choice of the richness line and not by the implicit distribution of incomes. In this case, it is the social planner who defines the richness line and the group of people thought to be liable for poverty reduction.

IL^{progA} is not the only income lever index that can be obtained by setting the richness line r. We may want to take into account, for instance, also the proportion of individuals who are taxed over all non-poor individuals: the same value of IL^{progA}, in fact, can be obtained by taxing all possible non-poor individuals (and in this case $IL^{prop} = IL^{progA}$), or just a small subset of individuals. In this second case, the income lever is smaller as the same tax effort (in the form of a proportional tax) is levied on a smaller percentage of rich individuals.

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Figure 3: Progressive Transfers, setting a richness line
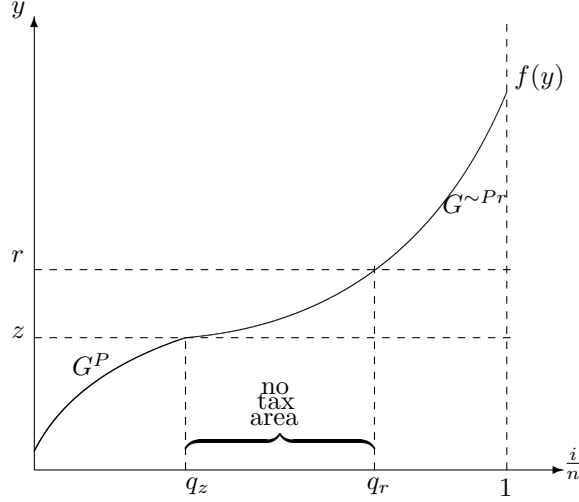
If we believe that the richest individuals in society are responsible for eradicating poverty, we may want to collect revenues by leveling the income distribution from the top of the income scale until the point where enough revenues are collected to fill the poverty gap. In this case, the set of rich individuals to be taxed is found endogenously. We can proceed in a recursive way. In the first step we tax away the difference between the richest income and the second richest income $(y_n - y_{n-1})$. If $y_n - y_{n-1} \geq G_N^P$ the recursive process ends at the first step, where only one individual is responsible for eradicating poverty. Otherwise, we go on by taxing the second richest individual in the original distribution by $(y_{n-1} - y_{n-2})$. If $(y_n + y_{n-1}) - 2(y_{n-2}) \geq G_N^P$ the recursive process ends, and we are taxing two individuals. Otherwise, we include the third richest individual and so on, until we reach the last step m defined as:

$$m = \left\{ \min j : \sum_{j=1}^{n} j \left(y_{n-j+1} - y_{n-j} \right) \geq G_n^P \right\} \tag{15}$$

Note that m corresponds to the minimum number of richest individuals that the government should target for collecting enough revenues to fill the poverty gap. A straightforward index of income lever can therefore be defined as the proportion of taxed individuals on the total number of non-poor individuals: the highest this proportion, the heavier the income

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lever:

$$IL^{progB} = \frac{m}{||Q^{\sim P}||} \qquad (16)$$

Consider the following example. Let us assume that society A has a sum of poverty gaps $G_A^P = 7$ and that the income distribution among rich individuals is (6,7,8,9,10,11). The following matrix shows the stepwise procedure.

steps	individual incomes						G^P-Revenues
	y_1	y_2	y_3	y_4	y_5	y_6	
0	6	7	8	9	10	11	7
1	6	7	8	9	10	10	7-(11-10) =5
2	6	7	8	9	9	9	7- [(11-10) + 2(10-9)] =4
3	6	7	8	8	8	8	7- [(11-10) + 2(10-9) +3(9-8)]
4	6	7	7	7	7	7	7- [(11-10) + 2(10-9) +3(9-8) + 4(8-7)]=-3

The recursive process in the example ends at step 4: the first four richest individuals are taxed out of 5 non-poor individuals: $IL_n^{progB1} = \frac{4}{5}$.

Note that this procedure mimics what it is done in Medeiros (2006) in order to define endogenously an affluence line, which can be considered by itself as an indicator of income lever: the highest the affluence line, the smaller the income lever. In particular, given m as defined in equation (15), the affluence line a_N can be defined as:

$$a_N = y_{n-m} + \max\left\{0, \frac{\sum_{k=1}^m k\,(y_{n-k+1} - y_{n-k}) - G_N^P}{m}\right\} \qquad (17)$$

In the example given above, for instance, the affluence line a_A would be $7 + \frac{3}{4} = 7.75$.

Instead of using the affluence line, we may think of using the ratio between the poverty line and the affluence line, so that the index becomes scale invariant:

$$IL^{progC} = \frac{z_N}{a_N} \qquad (18)$$

As it was the case for Figures 2 and 3, in Figure 4 we also have a threshold that separates non-poor tax-payers from non-poor non tax-payers and we also have a no-tax area. The difference from previous examples is that the process starts from the top, a sort of reversed Rawlsian approach, where the richest individual is taxed first for the income distance with the second richest individual and this is followed by the second richest, the third and the $q_a - th$ richest individual until the full poverty gap is recovered. This mechanism boils down to a progressive transfer, where progressivity is obtained by fixing a tax allowance in the measure of a, and a proportional tax rate of 1.

Figure 4: Progressive Transfers, finding an affluence line
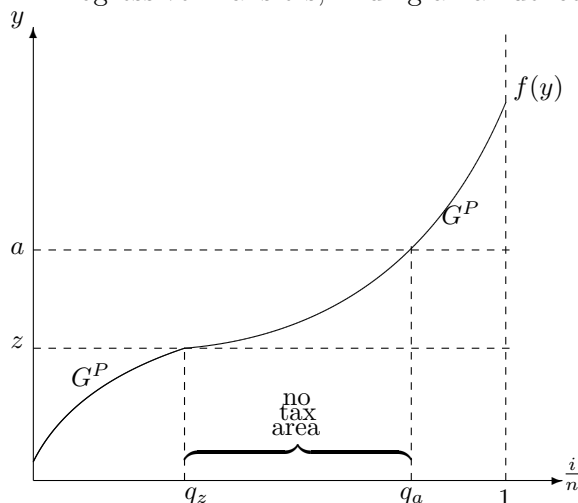
5   Empirical Illustrations

As an illustration of the indexes developed in the previous section, we present here the results of the analysis on a sample of European member states (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia and Slovakia) and a sample of African Countries (Benin, Cote d'Ivoire, Cameroon, Ethiopia, Mali, Mauritania, Uganda, South Africa). We present figures for poverty (headcount and sum of poverty gaps) and income lever indexes developed in the previous sections. The following Table 1 summarizes all indexes.

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Table 1: indexes used the empirical illustration

<table>
<tr><td colspan="3" align="center">Poverty indexes</td></tr>
<tr><td>P^0</td><td>$=$</td><td>$\frac{||Q^p||}{n}$</td></tr>
<tr><td>P^1</td><td>$=$</td><td>$\sum_{i=1}^{n} \frac{z-\tilde{y}_i}{z}$, where $\tilde{y}_i = z$ for each $i \in Q^{\sim P}$</td></tr>
<tr><td colspan="3" align="center">Income Lever indexes</td></tr>
<tr><td>IL^{prop}</td><td>$=$</td><td>$\frac{G^P}{G^{\sim P}}$</td></tr>
<tr><td>IL^{flatA}</td><td>$=$</td><td>$\frac{G^P}{||Q^{\sim P,f}||}$</td></tr>
<tr><td>IL^{progA}</td><td>$=$</td><td>$\frac{G^P}{G^{\sim P,r}}$</td></tr>
<tr><td>IL^{progB}</td><td>$=$</td><td>$\frac{m}{||Q^{\sim P}||}$, where $m = \left\{ \min j : \sum_{j=1}^{n} j\left(y_{n-j+1} - y_{n-j}\right) \geq G_n^P \right\}$</td></tr>
<tr><td>IL^{progC}</td><td>$=$</td><td>$\frac{z}{a_N}$, where $a_N = y_{n-m} + \max\left\{ 0, \frac{\sum_{k=1}^{m} k(y_{n-k+1} - y_{n-k}) - G_N^P}{m} \right\}$</td></tr>
</table>

5.1 Ranking EU nations for North-North transfers

The European Union finances the economic imbalances between different regions using the *European Regional Development Fund - ERDF* (EC, 2006). During the period 2007-2013, a total of 347.410 billions Euros (2007 prices) have been allocated to financing regional policies designed to meet the objectives of Convergence, Regional Competitiveness and Employment and Territorial Cooperation. We focus here on the Convergence objective which aims at helping the least-developed member states and regions by improving conditions for growth and employment. The resources allocated to this objective are equivalent to 81.5% of the total ERDF funds. Eligible regions (at *NUTS2* level) are those with a per-capita GDP level below 75% of the European average[2]. Nearly all regions of the new member states fall under this definition and most of Southern Italy, East Germany, Greece and Portugal, much of Spain, and some parts of the United Kingdom. Among our sample of countries, all regions are included, with the exception of Prague (Czech Republic), Bratislava (Slovakia) and the following Hungarian regions: Észak-Alföld, Dél-Dunántúl,

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[2]These regions receive 70.5% of the resources. The remaining funds are allocated to regions where per capita GDP has risen above 75% of the European average and to member States whose per capita Gross National Income is below 90% of the European average and which are running economic convergence programmes.

Észak-Magyarország, Közp-Dunántúl, Nyugat-Dunántúl.

We use data from the 2008 round of the European Union's Survey on Income and Living Conditions (EU-SILC). As income variable, we use the household equivalent disposable income using the modified OECD scale. We then deflate incomes using the harmonized consumer price indexes provided by Eurostat (2011), in order to have real and comparable incomes. As poverty line z, we use 11 USD *per day* which is the threshold set by the World Bank for these set of countries. Since income data are expressed in Euros, we use the exchange rate euro-dollar (1.43 euro per 1 dollar in 2008). Following Medeiros (2006) and Eisenhauer (2011), we define the richness line as a function of the poverty line. In particular, considering that the absolute poverty line z may be interpreted as 60% of the median income y_m of an hypothetical income distribution, we set the richness line at 200% of y_m (see Peichl, Schaefer, and Scheicher, 2010).

Table 2 summarizes the values of the different indexes (P^0, P^1, IL^{prop}, IL^{flatA}, IL^{prog_A}, IL^{prog_B}, IL^{prog_C}) for the sample of European countries. Recall that P^0 stands for the percentage of poor individuals in the population (Headcount index) and P^1 is the poverty gaps index.

IL^{prop} can be interpreted as the average tax rate to be levied on non-poor individuals to collect enough revenue to rise all poor individuals to the poverty line. For Romania we see that the index is greater than 1 (3.62). It means that, to defeat poverty, the income of non-poor individuals should almost quadruplicate. Estonia and Hungaria have the same proportion of poor individuals and almost the same poverty gap index. Note however that in Estonia it is sufficient a proportional tax rate of 5.5% levied on the non-poor to solve poverty, while in Hungaria the tax rate should be fixed at 8.8%.

IL^{flatA} is the flat tax f to be levied on all non-poor individuals who can bear this cost without crossing the poverty line. For Romania no flat-tax can be collected without having non-poor individuals crossing the poverty line.

IL^{prog_A} can be interpreted as the tax rate to be applied on all wealth gaps above a no-tax area defined by a deduction r, which is the exogenous richness line. In Romania nobody is above the richness line, therefore the sum of richness gaps is zero and the index cannot

be computed.

IL^{progB} is the smallest proportion of rich individuals that alone can defeat poverty by transferring all their incomes above the endogenous affluence line. A value of the index greater than one means that the number of rich individuals should be a multiple of the actual number of individuals above the poverty line, and therefore it is not possible for the country to defeat poverty alone (and this is the case for Romania).

Finally, IL^{progC} is the ratio between the poverty line and the endogenous affluence line: the smaller the ratio, the larger the gaps between the two lines. If the affluence line in a country is much higher than the poverty line, this means that the distribution of income above the poverty line is very unequal.

Table 2: Poverty and Income Lever indexes and ranks (1-higher to 8-lower) for a selection of European countries, 2008

Country	P^0		P^1		IL^{prop}		IL^{flat}		IL^{progA}		IL^{progB}		IL^{progC}	
	index	r	index	r	index	r	index	r	index	r	index	r	index	r
Czech Republic	0.05	8	0.009	8	0.007	8	24.97	8	0.060	8	0.053	8	0.177	8
Estonia	0.20	5	0.053	5	0.057	6	190.88	5	0.535	7	0.063	6	0.251	7
Hungary	0.20	6	0.050	6	0.088	4	180.40	6	1.878	2	0.063	4	0.349	3
Latvia	0.35	3	0.130	2	0.176	3	643.58	2	1.159	4	0.154	3	0.318	4
Lithuania	0.35	2	0.111	3	0.181	2	550.44	3	1.385	3	0.154	2	0.359	2
Poland	0.24	4	0.064	4	0.085	5	244.61	4	0.698	6	0.063	5	0.255	6
Romania	0.80	1	0.376	1	3.620	1	-	1	-	1	3.750	1	2.606	1
Slovakia	0.10	7	0.028	7	0.036	7	89.62	7	0.740	5	0.056	7	0.283	5

Source: our elaboration on EU-SILC 2008 cross-section data. 'r' indicates rank.

Table 2 also shows the ranking r of the the set of countries considered, which can be used for the purpose of aid allocation. In general, a donor may want to select the index that best corresponds to widely accepted normative criteria. While proportional and progressive criteria are usually the norm in tax systems worldwide and therefore justifiable in the context of aid allocation, regressive criteria are much less popular and more difficult to defend. One can also look at the consistency across indexes. The Czech Republic, for example, comes consistently in the last place while Romania comes in first place across all indexes. In these two cases, the ranking is consistent across indexes and easier to use for the purpose of aid allocation.

Is this ranking related to the actual distribution of EU social funds? Table 3 shows the indicative allocation of cohesion funds across the eight countries considered and the rank, which can be compared to the rank in Table 2. In first and last position we find Romania and the Czech Republic and this matches perfectly with all indicators in Table 2. The IL index which better approximates the rank of the actual distribution of funds is IL^{progA}, where all ranks are the same, except for Slovakia and Estionia.

Table 3: Indicative allocation of Cohesion Fund, 200713 (2007 prices, in % GDP)

Country	Cohesion Fund (%GDP)	rank
Czech Republic	6.69	8
Estonia	7.17	5
Hungary	8.69	2
Latvia	7.32	4
Lithuania	8.02	3
Poland	7.13	6
Romania	18.94	1
Slovakia	7.11	7

Source: our elaboration on European Union (2007) and Eurostat for GDP

6 Ranking poor countries for North-South transfers

Table 4 summarizes poverty and income lever indexes together with the countries ranks obtained by computing each index for eight African countries based on the Global Income Distribution Database (GIDD). This is a database constructed by the World Bank that homogenized a number of standard variables including income and consumption across household consumption surveys worldwide.[3] The welfare variable used is household equivalent consumption at Purchasing Power Parity (PPP) in USD where the equivalence scale is the square root of household size. To compute the indexes, we define as poverty line z the World Bank official poverty line of 1.25 USD/day PPP. Similarly to what we have done with the selection of European countries, we set the richness line $r = 2z/0.6 = 4.16$ USD/day PPP.

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[3]For a full description of the data see Ackah, Bussolo, Hoynos, and Medvedev (2008)

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Note that Mali and Uganda have the same headcount index (P^0=0.5). Nevertheless, in Uganda a proportional income tax of 30% should be levied on the non-poor to solve poverty, while in Mali the proportional tax rate would be higher: 38% (see IL^{prop}). We can therefore conclude that poverty is more burdensome in Mali, where the contribution effort of non-poor individuals would be higher.

The income lever index IL^{flat} stands for the average transfer payed by all non-poor individuals who would remain non-poor after the tax. The higher this flat tax, the higher the income lever. Note, for instance, that Benin has a poverty incidence of 0.45, which is slightly higher than Ethiopia (0.40). On the other hand, the flat tax that would eliminate poverty in Benin is almost three times higher than the one in Ethiopia, as the income lever index IL^{prop} indicates: 23.23 dollars in Benin against 8.31 dollars in Ethiopia.

The income lever index IL^{progA} may be interpreted as the proportional tax rate that has to be levied on individuals above the richness line r. A value greater than one, as it is the case for Benin, Ethiopia, Mali and Uganda, means that there is no possibility of a poverty-solving redistribution by targeting individuals above r. On the other hand, even if Cote d'Ivoire and South Africa have the same poverty headcount ($P^0 = 0.25$), South Africa has a higher poverty reduction power than Cote d'Ivoire since it is sufficient to levy a proportional tax rate of less than 5% to eradicate poverty versus a proportional tax rate of 12% needed in Cote d'Ivoire (see IL^{progA} in Table 4).

Recall that IL^{progB} shows the proportion of individuals above the endogenous affluence line over the total number of non-poor individuals (the individuals above the poverty line). The affluence line is defined in such a way that revenues collected by flattering the highest incomes at the affluence line equal the sum of poverty gaps. The smaller the percentage of individuals who bear the transfer, the lighter the burden of poverty reduction (and the smaller IL^{progB}). For instance, Mali and Uganda has the same poverty headcount ($P^0 = 0.5$), but in Mali the percentage of non-poor individuals to be taxed is double than in Uganda (IL^{progB} is 0.4 in Mali and 0.2 in Uganda).

Finally, IL^{progC} is the ratio between the poverty line and the affluence line: in Mali and Ethiopia the endogenous affluence line is roughly two times the poverty line. In South Africa, the affluence line is twenty times the poverty line. This result suggest that in South

Africa the distribution above the poverty line is very unequal. A small minority (the 6.7% of individuals above the poverty line, as indicated by IL^{progB}) could transfer all income above the affluence line to eradicate poverty and they would still have an income level twenty times higher than the poverty line. Note that the same small minority is needed in Cote d'Ivoire (where Il^{progB} is still 0.67), but they would end up with an income level just ten times higher than the poverty line.

Table 4: Poverty and Income Lever indexes and ranks (1-higher to 8-lower) for a selection of African countries

Country (year)	P^0		P^1		IL^{prop}		IL^{flat}		IL^{progA}		IL^{progB}		IL^{progC}	
	index	r	index	r	index	r	index	r	index	r	index	r	index	r
Benin (2003)	0.45	3	0.152	3	0.315	2	23.13	3	2.319	3	0.273	2	0.451	3
Ivory Coast (2002)	0.25	6	0.067	7	0.045	6	3.39	7	0.119	7	0.067	6	0.099	7
Cameroon (2001)	0.35	5	0.095	5	0.089	5	6.00	5	0.267	5	0.077	5	0.131	6
Ethiopia (2000)	0.40	4	0.098	4	0.235	4	8.31	4	4.599	1	0.167	4	0.484	2
Mali (2001)	0.50	1	0.187	1	0.376	1	28.42	2	3.070	2	0.400	1	0.496	1
Mauritania (2000)	0.20	8	0.059	8	0.043	7	2.97	8	0.150	6	0.063	8	0.137	5
Uganda (2002)	0.50	1	0.179	2	0.295	3	34.01	1	1.094	4	0.200	3	0.318	4
South-Africa (2000)	0.25	6	0.090	6	0.030	8	4.88	6	0.046	8	0.067	7	0.047	8

Source: our elaboration on Global Income Distribution Database (GIDD). 'r' indicates rank.

As a final exercise, one may want to ask the question of whether the IL indexes proposed proxie any of the criteria currently used to allocate aid. In Table 5, we show the average net official development assistance (ODA) in percentage of the gross national income received by the same African countries considered before. The net ODA comprises grants or loans to developing countries and territories on the OECD/DAC list of aid recipients that are undertaken by the official sector with promotion of economic development and welfare as the main objective and at concessional financial terms. Among the selected countries, Mauritania received the most generous amount of aid, followed by Ethiopia. Note that Mauritania is the least poor country (see estimates in Table 4) and Ethiopia is the fourth poorer countries out of the eight considered). More generally none of the criteria summarized in Table 4 could justify the distribution of aid listed in Table 5.

Table 5: Net ODA received (% of GNI), average 2000-2003

Country	ODA (% GNI)	rank
Benin	9.77	5
Ivory Coast	4.33	7
Cameroon	5.54	6
Ethiopia	14.67	2
Mali	13.33	4
Mauritania	20.17	1
Uganda	14.09	3
South-Africa	0.40	8

Source: our elaboration on WB opendata

7 Conclusion

In a global scenario where rich countries are facing increasing budget constraints, the debate on the optimal allocation of Aid has become more important than ever. Exploiting at best new opportunities offered by the widespread availability of micro data, the paper has developed a concept and a measure of the monetary capacity of a country to reduce its own poverty defined as the Income Lever (IL). We constructed various income lever indexes based on different distributive criteria and used such indexes to rank countries according to their own monetary poverty reduction capacity. As shown in the empirical application, this methodology can provide an efficient, equitable and transparent tool to rank countries or regions when it comes to budget or Aid allocations, whether it is the allocation of social funds within the European Union (North-North transfers) or the allocation of Aid from rich to poor countries (North-South transfers).

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