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Inequality of opportunity during the great recession in Uganda

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Abstract: The paper proposes an analysis of the recent distributional dynamics in Uganda. This analysis is performed by endorsing an opportunity egalitarian perspective, in order to evaluate the outcome dynamics of specific groups of the population and infer the role of growth in the evolution of inequality of opportunity over time. We show that despite a reduction in the real value of the household consumption and a surge in outcome inequality between 2009/10 and 2010/11, the consumption dynamic appears to alleviate inequality of opportunity in Uganda.

Keywords: inequality, inequality of opportunity, Uganda, great recession
JEL classification: D63, F43, F61, F63

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1 Introduction

In 2013 the Ugandan Government announced that Uganda had achieved the first target of the Millennium Development Goals: the poverty headcount ratio declined from above 56 percent in 1992 to 24.5 percent in 2010 (The Republic of Uganda, 2013). This impressive reduction in the incidence of poverty was mainly due to the high rate of growth, which resulted in a growth of per capita consumption of about three percent per annum in the same period. Uganda's economic performance has been linked to a prolonged period of peace and security after the end of the civil war and a series of structural reforms introduced since the late 1980s including trade and financial liberalization. Moreover, improved access to markets and a progressive diversification of household activities away from subsistence farming triggered a process of development, which has led Uganda to be one of the World's fastest growing economies in the last decade[1] (World Bank, 2012).

As shown by Ssewanyan et al. (2004), changes in poverty were almost entirely due to growth rather than redistribution. The poorer regions lagged behind the richer and the inequality between regions tripled from 1992/3 to 2009/10 (World Bank, 2012). Inequality increased also within regions. Appleton (2001) estimated that, with zero economic growth in the 1990s, poverty in Uganda would have increased by a three percentage points.

Thus, although poverty headcounts have decreased significantly since the early 1990s, regional disparities remain, with rural poverty being more than three times higher than that in urban areas (Benin et al., 2008). Moreover, children poverty headcount continues to be greater than that of adults and poverty reduction has been smaller for children. The rate of inequality increase accelerated in more recent years. According to the Uganda Bureau of Statistics the Gini index rose from 0.372 in 2009/10 to 0.411 in 2010/11 (Uganda Bureau of Statistics, 2013). The World Bank reports a less dramatic but similar trend with an increase of 0.02 between 2006 and 2009. However, because of data limitation, these studies have been conducted using the standard practice of comparing aggregate indicators of the the pre-growth and post-growth distribution of outcomes, such as income or consumption.

We argue that a better understanding of the recent distributional dynamics that took place in Uganda can be obtained by complementing the standard micro-approach, based on income and consumption, with an analysis of the distributive effect of growth in terms of opportunities.

The relevance of opportunities for the analysis of distributional phenomena has been defended by a recent but well-established branch of the literature, the equality of opportunity literature: see Ferreira and Peragine (2015), Fleurbaey (2008), Ramos and Van de gaer (2012), Roemer and Trannoy (2013) for recent surveys of the opportunity egalitarian approach. For a specific discussion of the opportunity perspective for the analysis of developing countries see World Bank (2006). This literature revolves around the idea that it is useful to distinguish between the outcome inequalities

[1]Since 2003 Ugandan GDP has grown by 7.4 percent per year.

which can be attributed to exogenous circumstances, i.e., factors that lie outside the sphere of individual responsibility, and the residual inequalities attributable to individual effort. Different models are proposed in which the opportunities open to individuals are deduced from basic assumptions on the functional relations between individual achievements, circumstances, and individual effort.

We endorse this view and, in this paper, we adopt the theoretical framework introduced by Peragine et al. (2014) to investigate the distributional impact of growth. Hence, we evaluate the opportunity redistributive impact of growth by estimating the Individual Opportunity Growth Incidence Curve (type OGIC) and the Type Growth Incidence Curve (individual OGIC). The individual OGIC enables to assess the pure distributional effect of growth in terms of increasing or reducing aggregate inequality of opportunity (IOp). Whereas, the type OGIC allows to track the evolution of specific groups of the population in the growth process to detect the existence of possible inequality traps.[2]

As it is the case for any analytical tool aimed at evaluating inequality of opportunity, the construction of the OGIC requires the explicit endorsement of an exact definition of EOp, among all possible declinations offered by the literature. The *ex ante* approach is at the base of the OGIC framework. It postulates that there is EOp if the value of the opportunity set of all types is the same, hence inequality of opportunity can be measured as inequality between individual opportunity sets. In practice, every individual's actual outcome is replaced by some evaluation of her opportunity set and inequality between these values is identified as inequality of opportunity. However, the ex post principle of EOp is also widely used in the literature. It postulates that there is equality of opportunity if individuals exerting the same degree of effort are given the same outcome (Roemer, 1998), hence inequality of opportunity can be measured as inequality within the group of individuals with same endogenous characteristics (the tranches). Although apparently similar in spirit ex ante and ex post EOp principles have shown to be incompatible (Fleurbaey and Peragine, 2013). In particular, an ex ante measure of IOp has shown to be inconsistent with the compensation principle at the base of the ex post approach. This has, of course, implications when the evaluation of growth under the light of EOp becomes the focus of the analysis: the OGIC framework introduced by Peragine et al. (2014), based on the ex ante approach, results to be not fully consistent with the ex post approach.

In order to deal with this issue, we will proceed with the evaluation of the Ugandan income dynamics by implementing the framework proposed by Brunori et al. (2015), which is coherent with the ex post principle of equality of opportunity. This framework consists of two curves: the *ex post Opportunity Growth Incidence Curve* (ex post OGIC) and the *class Opportunity Growth Incidence Curve* (class OGIC). The former plots the rate of growth of the individuals in the same position in two outcome distributions neutralized for the effect of effort on inequality. The latter

[2]These curves are extensions of the Growth Incidence Curve (GIC), originally proposed by Ravallion and Chen (2003). The GIC plots the mean income growth of each percentile in the distribution and allows to compare the incidence of growth (or contraction) in poorer segments of the population with respect to that of richer segments.

plots the rate of income growth for each sub-group of the population, where the sub-groups are defined in terms of individuals that share the poorest outcome for each given level of effort. These curves integrate the set of existing tools for the evaluation of growth according to an EOp perspective and can be computed in order to complement standard analyses of growth in terms of outcome.

In order to apply these theoretical frameworks to analyze the distributional impact of recent growth episodes in Uganda - the one that took place between the 2009/10 and the 2010/11. This period was characterized by a growth in both GDP and nominal consumption, however, given a rise of CPI of 17 percent, the real value of consumption contracted in the same period by 3.2 percent (Uganda Bureau of Statistics, 2013). To evaluate the effect of this consumption dynamic we use two waves of the Uganda National Panel Survey (UNPS). This survey was realized as part of the Living Standards Measurement Study - the Integrated Surveys on Agriculture project established by the Bill and Melinda Gates Foundation and implemented by the Development Research Group at the World Bank and the Uganda Bureau of Statistics. The dataset is representative at the national and at the main regional levels. Both waves contain information on individual circumstances beyond individual control - namely ethnicity and rural/urban area of birth.

It deserves to be noted that, to the best of our knowledge, this is the first attempt to evaluate a growth episode in Uganda using micro-data and according to both the inequality of outcome and the inequality of opportunity perspective.[3] We show that the recent Ugandan income dynamics have conflicting effects on inequality of outcome and inequality of opportunity. In fact, while growth has been clearly regressive in terms of outcome, the same striking conclusion cannot be drawn when the focus are the opportunities: while type OGIC and the ex post individual OGIC do not show a clear progressive/regressive impact of growth, the class OGIC and the ex ante individual OGIC do show a progressive impact of growth on the distribution of opportunities.

The rest of the paper is organized as follows. Section 2 describes the methodological framework that is used to evaluate inequality and growth consistently with the EOp model. Section 3 presents the results of the analysis on the recent income dynamics in Uganda. Section 4 concludes.

2 The methodological framework: ex ante and ex post equality of opportunity

Consider a population in which each individual $p \in \{1, ..., N\}$ obtains an outcome at a given time $t \in \{1, ..., T\}$, y_t, as function of their circumstances $\mathbf{c} \in \Omega$, fixed over time, and effort $e_t \in \Theta$, $g : \Omega \times \Theta \to \mathbb{R}_+$:

$$y_t = g(c, e_t) \tag{1}$$

[3]The analysis of inequality of opportunity in Uganda is also very limited. The only contribution we are aware of is the one by Cogneau and Mesplé -Somps (2008).

The population can be partitioned into n *types*, where a type $i = 1, ..., n$ includes all individuals with circumstances i, and into m *tranches*, where a tranche $j = 1, ...m$ includes all individuals exerting effort j.

On the basis of the model reported in eq.(1) the literature has explored two main approaches to measuring (in)equality of opportunity (see in particular Ferreira and Peragine 2014 and Ramos and Van de gaer 2012 for recent surveys): these are the so called *ex ante* and *ex post* approaches.

The ex ante EOp principle states that there is EOp if the value of the opportunity set is the same for all individuals. To make this principle operational, we need therefore a measure of the value of individual opportunity set. Given the partition above, the literature suggests to interpret the type outcome distribution as the set of opportunities open to each individual belonging to that type. Hence, individuals in the same type have different outcomes but the same opportunity set. Thus, from the ex ante perspective, inequality of opportunity is outcome inequality between types. Moreover, most of the literature evaluates the type outcome distribution by using a single statistics, its mean (of course other solutions are possible).

In particular, following Checchi and Peragine (2010), ex ante IOp can be evaluated by using the following procedure: starting with an outcome distribution Y^t partitioned into types, first the types are ordered on the basis of the value of their opportunity set, summarized by their mean outcome, $\mu_i(y_t)$, that is: $\mu_1(y_t) \leq \mu_2(y_t) \leq, ..., \leq \mu_n(y_t)$. Then, a smoothing transformation is applied, by replacing each individual outcome with the mean outcome of the type she belongs to, obtaining the smoothed distribution $Y_S^t = (\mu_1^t, ..., \mu_k^t, ..., \mu_N^t)$. Given an outcome distributions $Y^t \in \mathbb{R}_+^N$ and an inequality measure $I : \mathbb{R}_+^N \to \mathbb{R}_+$, ex ante IOp is given by $I(Y_S^t)$. An inequality measure generally used in this context is the mean logarithmic deviation, well known for its property of path independence (Foster and Shneyerov, 2000). Hence:

$$ex\ ante\ IOp = MLD\left(Y_S^t\right) = \frac{1}{N}\sum_{p=1}^{N} \ln \frac{\mu^t}{\mu_k^t} \tag{2}$$

where μ^t is the population grand mean.

Ex ante IOp is often estimated relatively to total inequality due to opportunity, that is dividing eq.(2) by the mean logarithmic deviation of the original outcome distribution Y^t.

The ex ante principle is by far the most adopted approach to evaluate IOp;[4] however, a second approach has been widely used in theoretical and empirical analyses aimed at evaluating IOp: the ex post approach.

The ex post approach to compensation (associated with Roemer 1998) proposes that inequalities should be eliminated among individuals who exert the same degree of effort. Under this approach

[4]In a meta analysis Brunori et al. (2013) reported ex ante IOp estimates for 42 countries.

there is no need to evaluate opportunity sets but, on the other hand, one must observe (or agree on a measure of) effort.

Roemer's specific proposal for the identification of effort, which has been widely used in empirical applications, measures the degree of individual effort by the rank of the individual in the relevant type outcome distributions. Hence, two individuals belonging to different types who sit at the same rank of their relevant distributions are declared to have exerted the same effort, despite having different outcomes.

Hence, the ex post approach focuses on inequality within tranches. This requires to construct a standardized distribution, by proportionally scaling each tranche distribution until it has the same mean as the overall distribution. This distribution removes all the between tranches inequality while does not alter inequality within tranches.

Following again Checchi and Peragine (2010), for any outcome distributions $Y^t \in \mathbb{R}_+^N$, the outcome of a generic individual of type i and exerting effort j is rescaled as follows: $y_{i,j}^t \to \hat{y}_{i,j}^t = \frac{y_{i,j}^t}{\hat{\mu}_j^t}\mu^t$, where $\hat{\mu}_j^t$ is the mean income of tranche j. This standardizing process eliminates all the inequality between tranches, interpreted as inequality due to effort. Given an inequality measure $I : \mathbb{R}_+^N \to \mathbb{R}_+$, ex post IOp is obtained by applying I to the standardized distribution $Y_B^t = (\hat{y}_1^t, ..., \hat{y}_k^t, ..., \hat{y}_N^t)$. Using the mean logarithmic deviation, ex post inequality opportunity is given by:

$$ex\ post\ IOp = MLD\left(Y_B^t\right) = \frac{1}{N}\sum_{k=1}^{N} \ln \frac{\mu^t}{\hat{y}_k^t} \tag{3}$$

Although similar in spirit and empirically strongly correlated, ex ante and ex post IOp have been shown to be incompatible in general (Fleurbaey and Peragine, 2013).

2.1 Ex ante opportunity growth incidence curve

There are two natural ways to look at the distributive effect of growth in terms of *ex ante* opportunities. The first is to ask how growth affects the distribution of opportunities: is growth opportunity-progressive (IOp is lower at time $t+1$ than at time t) or opportunity-regressive (IOp is lower at time t than at time $t+1$)? The second possible way is to investigate whether different circumstances beyond individual control are associated with different levels of growth, therefore investigating whether or not opportunity sets growth disproportionately between types.

Although inspired by the same ethical concern, the two questions are not at all equivalent. This explains why Peragine et al. (2014) introduce two versions of the OGIC: *ex ante individual OGIC* and *type OGIC*, which respectively furnish an answer to the first and the second question above. They, in fact, show that the two curves can lead to different judgments in very general cases.

The ex ante individual OGIC plots the rate of growth of the (value of the) opportunity set given to individuals in the same position in the distribution of opportunities.

Given an initial distribution of outcome Y^t and the corresponding smoothed distribution Y_S^t introduced in the previous section, the ex ante OGIC can simply be obtained applying the GIC proposed by Ravallion and Chen (2003) to Y_S^t and Y_S^{t+1}. Hence the ex ante OGIC can be defined as:

$$g^o_{Y_S}\left(\frac{k}{N}\right) = \frac{\mu_k^{t+1}}{\mu_k^t} - 1, \forall k \in \{1, ..., N\} \tag{4}$$

Where $g^o_{Y^S}\left(\frac{k}{N}\right)$ measures the proportionate change in the value of opportunities of the individuals ranked $\frac{k}{N}$ in the smoothed distributions. Obviously, $g^o_{Y_S}\left(\frac{k}{N}\right) \geq 0$ ($g^o_{Y_S}\left(\frac{k}{N}\right) < 0$) means that there has been a positive (negative) growth in the value of the opportunity set given to the individuals ranked $\frac{k}{N}$ respectively in Y_S^t and in Y_S^{t+1}. Note that, given the assumption of anonymity implicit in this framework, the individuals ranked $\frac{k}{N}$ in t can be different from those ranked $\frac{k}{N}$ in $t+1$. A flat individual OGIC signals that growth does not have any impact on the level of IOp. On the contrary, when growth is progressive (regressive) in terms of opportunity, growth acts by reducing (worsening) IOp and the individual OGIC will be a decreasing (increasing) curve.

The ex ante OGIC does not track the evolution of the opportunity set of each type during a growth episode: in the smoothed distribution, types are ranked according to the value of their opportunity set at each point in time. Thus, the shape of the curve depends on the change of both type specific mean outcome and type specific population share, but it is neutral with respect to a possible re-ranking of types that may occur during a growth process. Now, while these features are desirable when one is interested in studying the evolution of IOp over time, the same characteristics make the individual OGIC unable to detect if there are groups of the population which are systematically excluded from growth.

To address this specific issue and to investigate the relationship between overall economic growth and type specific growth, Peragine et al. (2014) introduce the type OGIC. It plots, against each type, the rate of growth of that specific type, independently from its position in the final distribution of opportunity sets.

Letting $Y_\mu^t = (\mu_1(y_t), ..., \mu_n(y_t))$ be the distribution of type mean outcome at time t, where types are ordered increasingly according to their mean, and $Y_{\tilde{\mu}}^{t+1} = (\tilde{\mu}_1(y_{t+1}), ..., \tilde{\mu}_n(y_{t+1}))$ the distribution of type mean outcome at time $t+1$, where types are ordered according to their position at time t, we define the *type OGIC* as:[5]

$$g^o_{Y_\mu}\left(\frac{i}{n}\right) = \frac{\tilde{\mu}_i(y_{t+1})}{\tilde{\mu}_i(y_t)} - 1, \ \forall i \in \{1, ..., n\} \tag{5}$$

[5]Note that the type OGIC tracks the same types but not the same individuals.

The type OGIC plots, against each type, the variation of the opportunity set of that type. It can be interpreted as the rate of economic development of each social group in the population, where these groups are defined on the base of initial circumstances. $g^{o}_{Y_\mu}\left(\frac{i}{n}\right)$ is horizontal if each type benefits (looses) in the same measure from growth. It is negatively (positively) sloped if the initially disadvantaged types get higher (lower) benefit from growth than those initially advantaged.

To understand the need of employing both curves to evaluate the same growth process, consider the pre- and post-distribution of individual outcome, reported in the tables below. Individuals can exert three possible degrees of effort (low, medium, high) and belong to two groups based on their socioeconomic background (blue collar parents, white collar parents).

Time t

	l	m	h
blue	4	3	6
white	2	8	9

Time $t+1$

	l	m	h
blue	3	6	11
white	2	3	7

It can be easily checked that ex ante IOp is 0.0178 at time t and 0.0319 at time $t+1$. Therefore we expect an upward slopping ex ante OGIC, meaning that growth has been regressive in terms of opportunity:

$$ex\ ante\ OGIC : (-0.0769, -0.0769, -0.0769, 0.0526, 0.0526, 0.0526)$$

However, if types are tracked, growth appears to have been progressive: individuals with low socioeconomic background increased their outcomes, while outcome is decreasing for all the others:

$$type\ OGIC : (0.5385, 0.5385, 0.5385, -0.3684, -0.3684, -0.3684)$$

Because the individual OGIC approach considers anonymous types, and the type OGIC instead traces types' outcome across time, the re-ranking taking place from time t to time $t+1$ causes the two curves to have an opposite slope.[6] This conflict is not a contradiction: a downward sloping

[6]In the example, at time $t+1$ individuals with a low socioeconomic background become richer than individuals

type OGIC does not imply a reduction of IOp over time.

Another intriguing feature of the example proposed above is that, contrarily to the ex ante IOp trend, ex post IOp is reducing over time: from 0.0629 to 0.0343.[7] The use of the OGIC described before would then lead to misleading conclusions on the impact of growth on inequality of opportunity in an ex post perspective. For this reason, in a recent paper, Brunori et al. (2015) introduce a dual version of the OGIC consistent with the ex post principle of IOp. These are: *ex post individual OGIC* and *class OGIC*.

2.2 Ex post opportunity growth incidence curve

Given an initial distribution of outcome Y^t and the corresponding standardized distribution Y_B^t, assuming that individual standardized outcomes are sorted non-decreasingly, that is $Y_B^t = (\hat{y}_1^t \leq ... \leq \hat{y}_k^t \leq ... \leq \hat{y}_N^t)$, the individual OGIC can simply be defined as the GIC applied to the ex post standardized distributions Y_B^t and Y_B^{t+1}. Hence, the *ex post individual OGIC* is expressed as follows:

$$g^o_{Y_B}\left(\frac{k}{N}\right) = \frac{\hat{y}_k^{t+1}}{\hat{y}_k^t} - 1, \forall k = 1, ..., N \tag{6}$$

The ex post individual OGIC plots the percentage outcome change of individuals ranked $\frac{k}{N}$ in the standardized distributions Y_B^t and Y_B^{t+1}. As in the ex ante version, $g^o_{Y_B}\left(\frac{k}{N}\right) \geq 0$ ($g^o_{Y_B}\left(\frac{k}{N}\right) < 0$) means that there has been a positive (negative) growth for those individuals ranked $\frac{k}{N}$ in Y_B^t. Furthermore, a decreasing curve implies that growth has been opportunity equalizing, whereas an increasing curve implies that growth has been regressive in terms of IOp. This interpretation is straightforward if we recall that at the bottom of the distribution we find individuals suffering most the negative effect of bad circumstances. When growth does not alter inequality of opportunity, the curve will just be an horizontal line. Hence, the ex post individual OGIC captures the impact of growth on the distribution of opportunities, according to the ex post approach.

This way of looking at growth and IOp is similar to the ex ante OGIC: it is consistent with the measurement of ex post IOp, but does not track individuals or types. However, in the ex ante individual OGIC, the sign of the *ith* coordinate can be directly interpreted as an improvement/worsening of the value of the opportunity set of those people sitting at the *ith* quantile of the distribution of opportunities. Whereas, in the ex post individual OGIC, the sign of the *ith* coordinate can be interpreted as an improvement/worsening of the unfair advantage/penalty, in terms of outcome due to circumstances beyond individual control.

with a high socioeconomic background.

[7] As shown by Fleurbaey (2008) and Fleurbaey and Peragine (2013), the conflict stems from the partial incompatibility between the two principles at the base of the idea of equal opportunity: the principle of compensation and the principle of reward.

As expected the ex post version of the individual OGIC, applied to the example above, is downward slopping, signaling a progressive redistribution in terms of opportunity between time t and $t+1$:

$$\textit{ex post individual OGIC} : (0.2768, 0.5669, 0.3849, 0.1079, 0.0446, 0.1970)$$

The individual OGIC reported in eq.(6) is clearly related to the variation of ex post IOp over time, as the individual OGIC in eq.(4) is related to the variation of ex ante IOp over time. A natural question here is whether it is also possible to construct an ex post version of the type OGIC. Recall that the type OGIC is a tool aimed at evaluating inequality between types in terms of average growth of each type's opportunity set. The ex post approach is more demanding as it focuses on the outcome dynamic, not only considering the type of origin but also the effort exerted. This makes a difference in all the cases in which the advantage of belonging to a type is not the same across effort tranches. In this case, focusing on types is unsatisfactory because belonging to a type produces different outcomes, depending on the effort exerted. Take the distribution at time $t+1$ in the *ad hoc* example above: being the daughter of a blu collar implies being worse off if the effort exerted is low; by contrast it implies being better off if the effort exerted is high. Therefore, in an ex post perspective, tracking the outcome of different groups means tracing the group of individuals sitting in the same position of the within tranche distribution. This is done in Brunori et al. (2015) by building on the theoretical framework recently introduced by Fleurbaey, et al. (2015).

To illustrate, consider the following matrix

$$Y^t = \begin{array}{c|cccc} & \mathbf{e}_1 & \mathbf{e}_j & \mathbf{e}_m \\ \mathbf{c}_1 & y_{11} & y_{1j} & y_{1m} \\ ... & ... & ... & ... \\ \mathbf{c}_i & y_{i1} & y_{ij} & y_{im} \\ ... & ... & ... & ... \\ \mathbf{c}_n & y_{n1} & y_{nj} & y_{nm} \end{array}$$

Starting with Y^t, it is possible to construct a new distribution, call it Y_C^t, by permuting each columns such that the rows dominate each other. We call the rows of this new distribution Y_C^t "classes".[8]

We first order class means in ascending order $\breve{\mu}_1^t \leq ... \leq \breve{\mu}_j^t \leq ... \leq \breve{\mu}_n^t$ and then express the *class OGIC* as follows:

[8]Note that calculating ex post IOp in this new distribution, as suggested in Section 2.1, is exactly equivalent to using the original distribution Y^t.

$$g^{o}_{Y_{\breve{\mu}}}\left(\frac{i}{n}\right)=\frac{\breve{\mu}_i^{t+1}}{\breve{\mu}_i^{t}}-1,\ \forall i\in\{1,...,n\} \tag{7}$$

The class OGIC plots, for each class, the variation in the set of final outcome open to individuals in the same class. It can be interpreted as the rate of economic development of each class in the population. $g^{o}_{Y_{\breve{\mu}}}\left(\frac{i}{n}\right)$ is horizontal if each class benefits (looses) in the same measure from growth.[9] It is negatively (positively) sloped if the initially disadvantaged classes get higher (lower) benefit from growth than those initially advantaged. Type OGIC and class OGIC are indeed equivalent if no re-ranking of types takes place in any tranche. In our numerical example we get two modified distributions Y_C^t, Y_C^{t+1}:

Time t

	l	m	h
class 1	2	3	6
class 2	4	8	9

Time $t+1$

	l	m	h
class 1	2	3	7
class 2	3	6	11

The class OGIC is only slightly decreasing signaling that the rate of growth in the lower class has been a little higher than in the upper class:

$$\textit{class OGIC}: (0.0909, 0.0909, 0.0909, -0.0476, -0.0476, -0.0476).$$

3 Growth and inequality of opportunity in Uganda

In this section we investigate the distributive impact of the consumption dynamic that took place in Uganda between 2009/10 and 2010/11. We first provide an assessment of this dynamic according to the equality of outcome perspective. We then move to the analysis of the consumption dynamic according to the EOp perspective, adopting the methodological tools introduced above. To this aim, we make use of two waves of the Uganda National Panel Survey (UNPS). The 2010/11 UNPS survey contains information about households and community conditions in 80 districts in Uganda.

[9] Note that tracking classes across time does not imply tracking individual outcomes: individuals remain in the same class only if, given their effort, the rank of their type in terms of outcome is the same at time t and $t+1$.

Out of the 7,400 households interviewed during the Uganda National Household Survey (UNHS) 2005/06, 3,200 households were selected for the UNPS and the same sample was maintained in both 2009/10 and 2010/11 panel surveys. The sample considered includes only household heads and their spouses.

In order to evaluate the impact of growth on the distribution of opportunities we have to choose an outcome variable and a set of circumstances beyond the individual control. As for the outcome, we choose per capita consumption, obtained by dividing the total household consumption by the number of its components and we express it in 2010 Ugandan Shilling. Concerning the second issue, instead, an ideal partition in types would include all possible characteristics beyond the individual control of household members such as gender, socioeconomic origin, ethnicity, area of birth. However, to obtain reliable estimates of IOp, we are forced to consider a limited number of circumstances. This issue is common to all empirical applications that estimate IOp. Because of the lack of information or due to the size of the sample, only a subsample of the real circumstances is considered. As discussed among others by Ferreira and Gignoux (2011), IOp estimates obtained using a subset of all possible circumstances should be interpreted as lower-bound estimates of the real IOp. The possible existence of unobserved circumstances guarantees that these estimates could only be higher if more circumstance variables were considered. Now, the UNPS contains a large set of circumstances, such as parental education, parental occupation, area of birth, or ethnicity. However, the large number of missing information about parental socioeconomic background of adult household members forces us to restrict the analysis to only two circumstances: ethnicity and urban/rural area of residence. We obtain a partition of 26 types whose members share the area of residence in terms of rural/urban area and ethnicity. Although 26 is clearly a subset of the real number of types in which Uganda could be partitioned, it represents an improvement if compared with the only one available estimate of IOp in the country, which is based on three types (Cogneau and Mesplé-Somps, 2008).

Given that circumstances beyond individual control should be exogenous characteristics, one may question the inclusion of a variable such as urban or rural residence, at least in part due to individual choice. The inclusion of this circumstances could in principle bias our estimate because a part of inequality due to choice - the choice to migrate - is ascribed to inequality of opportunity. The magnitude of this bias crucially depends on the number of individuals involved in internal migration movements. According to the International Organization for Migration (2013), internal migrants represent approximately 6 percent of the Ugandan population and internally displaced persons. They were more than a million in 2007, but they have been steadily decreasing in the following years: they were 140,000 in 2010 and less than 30,000 in 2011. For the case of Uganda the bias due to this intentional migration movement may be therefore sufficiently small.

Moreover, the choice of the two characteristics is guided by the Ugandan recent history in which ethnic origins and urban/rural divide have played an important role. Ugandans can be classified

into several ethnic groups, none constitutes a majority. Before the colonial period some inter-ethnic conflicts occurred in Uganda though not on a large scale. However, after independence ethnicity played a role in the civil conflicts and economic development. Today a first cleavage is between the Nilotic speakers in the North and Bantu speakers in the South. Secondly, different groups traditionally relied on different economic activities: pastoralism in the West and North, and agriculture in the lakes region. Finally different groups maintained different relationships with the central government, both during the British colonial period and after independence.

The rural-urban development gap is instead a consequence of the industrialization effort, promoted by the central governments in the first two decades after independence, characterized by a urban bias (Mukwaya et al., 2012). Notwithstanding the government focuses on rural development in recent years, the majority of rural areas, especially in the North, are still lagging behind in both income and access to services (World Bank, 2012).

Table 1 summarizes the partition into types based on rural/urban area of residence and ethnicity (Baganda, Bagisu, Bakiga, Banyakole, Basoga, Iteso, Langi, Lugbara, Acholi, Alur, Banyoro, Batoro, others). The sample sizes of each type in both years are reported in the third and fourth columns. The size of each type is crucial to obtain reliable estimates and, although we severely restrict the number of circumstances considered, some types have a sample size below 40, with a minimum of 29. In table 1 types are ranked according to the average per capita consumption[10] at the initial time (2009/10), it represents what Ferreira and Gignoux (2011) have named *opportunity profile*. Opportunity profiles are generally informative of which combinations of circumstances beyond individual control lead to the greatest opportunity deprivation in a given society. Interestingly the Uganda opportunity profile is clearly dominated by the circumstance of rural or urban area of residence: the 12 poorest types are characterized by residence in rural areas and only Baganda from rural areas has an average per capita consumption higher than some urban types. However, it is also clear that a lot of re-ranking is taking place from 2009/10 to 2010/11: only three types remain in the same position in the second period. The re-rankings that takes place during this growth process implies a jump of more than two positions but involves smaller groups, for which the measurement error tends to be larger. This also suggests the possibility of a conflict between the curves (as discussed in Section 2), because whenever there is re-ranking the anonymous versions of the OGIC - ex ante and ex post individual OGIC - tend to differ from their non-anonymous versions - type and class OGIC.

[10]Consumption is expressed in 2010-11 Ugandan Shellings applying and adjusting the value of consumption in 2009-10 according to prices.

Table 1: Opportunity profiles

Ethnicity	Urban-rural area of residence	Sample 2009-10	Sample 2010-11	Consumption 2009-10	Consumption 2010-2011
Langi	rural	369	391	491.869	586.7095
Bagisu	rural	210	219	538.6723	488.6648
Alur	rural	135	126	577.683	590.1815
Acholi	rural	60	39	593.5137	616.4105
Bakiga	rural	268	235	606.3148	581.9967
Iteso	rural	278	283	639.2758	605.054
other	rural	731	670	687.8807	737.6265
Batoro	rural	83	66	692.3269	849.8109
Basoga	rural	252	273	787.8073	768.6586
Lugbara	rural	183	187	832.2244	762.1089
Banyakole	rural	360	344	846.0995	734.6293
Banyoro	rural	82	68	867.2569	950.3998
Alur	urban	44	37	887.6543	621.2897
Acholi	urban	49	66	1139.604	1179.854
Langi	urban	42	56	1181.01	1297.808
Bagisu	urban	43	47	1416.486	1526.846
Basoga	urban	83	74	1494.073	1615.649
Baganda	rural	463	474	1495.571	1433.052
Banyakole	urban	79	56	1643.232	1968.298
other	urban	133	94	1785.886	1697.711
Batoro	urban	41	30	1899.953	2432.966
Baganda	urban	363	275	1919.631	2131.403
Banyoro	urban	45	31	2038.453	1576.877
Bakiga	urban	58	31	2048.745	1368.553
Iteso	urban	31	29	2203.869	2008.48
Lugbara	urban	36	33	2978.588	1918.748

Source: UNPS 2009/10-2010/11.
Note: Consumption is expressed in yearly per capita thousands 2010-11 Ugandan shillings.

3.1 Growth and inequality in Uganda

In the last decades, episodes of sizable growth have characterized Uganda's economy. Its performances have also been above the average among the other Sub-Saharan African countries.[11] Economic growth has been led mainly by strong private consumption growth rates and great performance of the export sectors (Matovu et al., 2011). The period between the second half of 2009 and the first of 2011 represents somehow an exception: if on the one hand the GDP grew by more than six percent on average, on the other, the agriculture GDP declined by 2.4 percent in the same period. Moreover, increasing food prices drove a surge in the CPI.[12] The generalized rise in prices reduced the value of per capita consumption, which decreased at an annualized rate of 3.0 percent in the same period. Moreover, Uganda has experienced a considerable increase in the level of inequality. This recent increase in inequality is witnessed by the GIC reported in Figure 1 and based on the UNPS waves 2009/10 and 2010/11.[13] The GIC reports the quantile specific percent growth rate in per capita consumption in the period covered by our sample. The GIC shows an increasing pattern: poorest quantiles experience a negative and sizable growth while richer quantiles experience a lower reduction in per capita consumption, far above the average growth rate, finally resulting in growing inequality. In our sample the mean logarithmic deviation of per capita consumption rose from 0.41 in 2009/10 to 0.45 in 2010/11. A widening gap between the rural and urban areas' pace of development, inequality in human capital investment, growing return to education, and limited employment created by the most dynamic sectors of the economy are among the main drivers of this increase in outcome inequality (Ssewanyan et al. 2004; Mukwaya et al., 2012).

3.2 Consumption dynamic and inequality of opportunity

In this context it appears of interest to understand how the same distributional dynamic has affected the growth of specific socio-economic groups and whether it has brought about the same increase in inequality of opportunity. To answer the first question we estimate the type and class OGIC, which track the outcome of individuals belonging to more or less advantaged groups. To answer the second question we estimate the ex ante and ex post OGIC, which show the possible EOp progressivity/regressivity of this consumption dynamic.

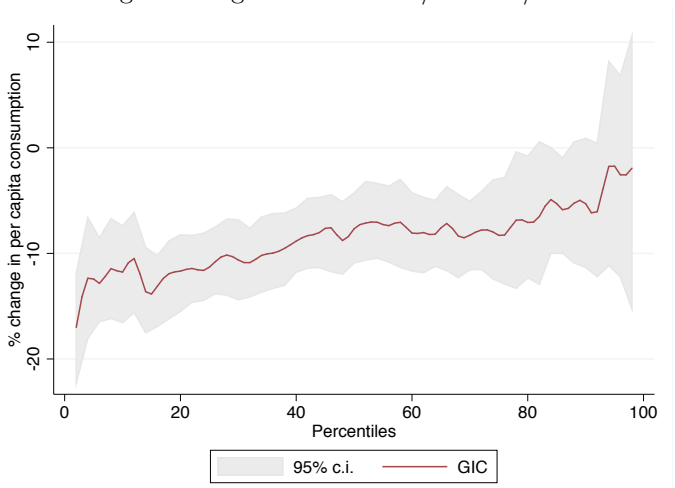
The type OGIC requires calculating each type's specific growth rate. As explained before this curve does not have a direct interpretation in terms of inequality of opportunity change, however, it shows how types with relatively poor opportunities have increased the value of their opportunity

[11] See World Bank (2012).

[12] According to the Uganda Bureau of Statistics (2013), the composite CPI was 144.58 between September 2009 and August 2010 and averaged at 161.70 between October 2010 and September 2011.

[13] For all estimates standard errors are obtained looking at the quantiles of the distribution of statistics obtained by 1,000 bootstrap resampling of the original dataset (Davison and Hinkley, 1997).

Figure 1: Uganda GIC 2009/10-2010/11



Source: Authors' elaboration based on UNPS 2009/10-2010/11.
Note: Standard errors are obtained through 1,000 bootstrap replications.

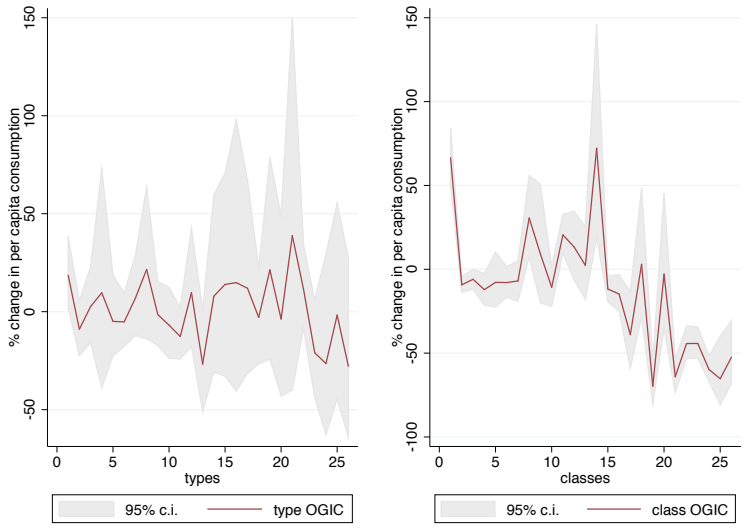
set in comparison to richer types. The case of Uganda 2009/10-2010/11 is reported in Figure 2 (left): the curve does not show a clear pattern. Among best performing types we find groups with very poor initial conditions, such as member of Langi born in rural areas (18 percent increase in per capita consumption), and groups with relatively good initial conditions, such as Batoro born in urban areas (21 percent increase in per capita consumption). Similarly, among the worst performing groups there are both rich and poor types, but with a prevalence of rich such as Lugbara and Bakiga born in urban areas (-27 percent and -26 percent respectively).

The interpretation of the class OGIC (Figure 2, right) is more complex, as each class contains individuals belonging to different types depending on the tranche considered. To draw the class OGIC, we further partition the distribution of types in five quantiles for each type, we then permute each column in such a way that the rows dominate each other. We then track the class exactly as we have done to obtain the type OGIC.

We first notice that the permutation takes place for the majority of the types: only for eight classes the rank of types and class is the same, the remaining 18 classes are made by individuals belonging to different types. This suggests that the ex ante approach may be not sufficient to correctly understand how the distribution of opportunities evolves over time in Uganda. To be part of an ethnic group and to come from an urban/rural area seems to have a very different meaning depending on the effort exerted (or possibly unobservable circumstances).

Moreover, the class OGIC in Figure 2 shows a rather clear declining pattern, suggesting that individuals in less advantaged classes gain more from the aggregated consumption dynamic than

Figure 2: Uganda type OGIC & class OGIC 2009/10-2010/11



Source: authors' elaboration based on UNPS 2009/10-2010/11.
Note: Standard errors are obtained through 1,000 bootstrap replications.

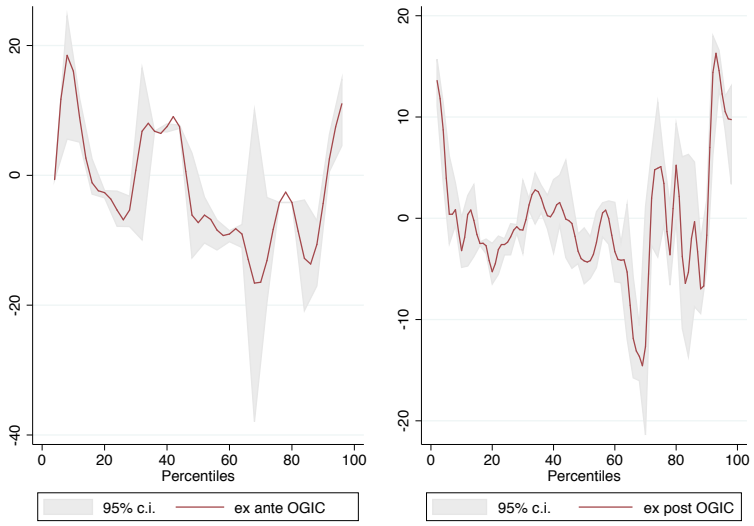
individuals belonging to richer classes. This means that if on average worst off types do not gain more from growth (the type OGIC is not decreasing), the worst off classes do: there is some progressive redistribution taking place when we go beyond an analysis based on the types' average output, that is when we move from the ex ante to the ex post approach.

The type and class OGIC show no evidence that increasing inequality was associated with growing IOp in Uganda. However, given that both type OGIC and class OGIC are non-anonymous, their patterns cannot be directly interpreted in terms of IOp reduction/increase. To evaluate the impact of consumption contraction on the distribution of opportunity requires the construction of the ex ante and ex post individual OGIC, which do have a direct interpretations in terms of IOp.

The ex ante and ex post individual OGIC are obtained calculating the coordinates of the GIC of the smoothed and standardized distributions Y_S^t, Y_S^{t+1} and Y_B^t, Y_B^{t+1} respectively.[14] The ex ante OGIC reported in Figure 3 (left) is not monotonic but shows a declining trend: with the exception of the very rich types, individuals belonging to worst off types improve their set of opportunity more

[14]Note that in order to obtain the counterfactual distribution Y_B, one needs first to substitute the outcome of a generic individual of type i and exerting effort j with the mean outcome of her cell (set of those in the same type and exerting the same effort). Only then the rescaling discussed at page 4 can be applied. This is because, empirically, there is a certain amount of inequality among individuals of the same type and exerting the same effort. It depends on the specific tranche partition adopted: the higher the number of the tranches, the better is the approximation of the effort exercised, and the lower is the residual inequality. That is, this inequality is due to the coarseness of tranches and can thus be attributed to effort.

Figure 3: Uganda ex ante & ex post OGIC 2009/10-2010/11



source: authors' elaboration based on UNPS 2009/10-2010/11.
Standard errors are obtained through 1,000 bootstrap replications.

than individuals belonging to better off types. This pattern suggests a reduction of ex ante IOp. Indeed, aggregated IOp declines from 0.1204 in 2009/10 to 0.1088 in 2010/11. In relative terms - the share of total inequality due to opportunity - the decline is larger, because of the increase in total inequality, relative IOp drops from 0.2936 to 0.2418.

The ex post OGIC Figure 3 (right), instead, shows a less clear trend. The consumption dynamic is much less progressive in terms of ex post opportunity. Although individuals in worst quantiles of the ex post standardized distribution do improve their situation over time, a large part of them does not. This result is not a contradiction of what shown in Figure 2: the class OGIC is based on a non-anonymous definition of class, while to measure IOp individuals are ranked according to the value of their opportunity set at each point in time. The final implication is an ambiguous effect on IOp in absolute terms: this is witnessed by the aggregated index of ex post IOp, which increases slightly from 0.1031 in 2009/10 to 0.1099 in 2010/11 (a difference not statistically significant). However, given the dramatic increase in the level of outcome inequality, ex post IOp as a share of total inequality tends to decline from 0.2512 to 0.2442 over the period considered.

4 Conclusion

Following a growth-to-inequality direction of causality, we have provided an evaluation of the recent distributional dynamics that have characterized the Ugandan economy, under the perspective of equality of opportunity. The analysis has been carried on applying the Opportunity Growth Incidence Curve framework (Peragine et al. 2014 and Brunori et al. 2015), a set of curves that allow to evaluate economic growth according to both the ex ante and ex post approaches to inequality of opportunity.

Using the two waves of the Uganda National Panel Survey (UNPS) - the 2009/10 and 2010/11 - it clearly appears that the consumption contraction has been heavily regressive hence bringing about to a net increase of outcome inequality. This result confirms what has been found by previous contributions. However, as soon as opportunities become the space of evaluation, this conclusion is reverted. While the type OGIC and the ex post OGIC do not show a clear progressive/regressive impact of growth, the class OGIC and the ex ante OGIC do show a progressive impact of growth on the distribution of opportunities. In aggregated terms while inequality increased by 10 percent in one year, ex post IOp has remained stable and ex ante IOp has declined. In relative terms both the ex ante and ex post approach indicates that the share of total inequality due to opportunities has declined.

A causal interpretation of these conflicting trends is beyond the scope of this exercise, however, if the increase in inequality is due to the emergence of more dynamic sectors, this inequality may only in part be due to factors beyond individual controls and could in principle be due to increasing return to effort and merit. A second possible explanation for this inequality of opportunity reducing effect might be identified in the role played by the education policies that have been in place in Uganda, such as the introduction of the Universal Primary Education policy. As previous studies have shown, this is linked to a strong statistically significant increase in the enrollment rate especially in rural areas (see Duclos et al. 2013).

As soon as new data will be available, it will be possible to understand whether the outcome-opportunity conflict follows a specific trend over time and to study the mechanism through which this conflict is generated.

References

Appleton, S. (2001). Education, incomes and poverty in Uganda in the 1990s, University of Nottingham, *mimeo*.

Benin, S., Thurlow, J., Diao, X., Kebba, A., Ofwono, N. (2008). *Agricultural growth and investment options for poverty reduction in Uganda*, Intl Food Policy Res Inst.

Brunori, P., Ferreira, F.H.G., Peragine, V. (2013). Inequality of opportunity, income inequality and economic mobility. Some international comparisons, World Bank Policy Research Working Paper n. 6304.

Brunori P., Palmisano, F., Peragine, V. (2015). Inequality of opportunity in Sub Saharan Africa. University of Bari, *mimeo*.

Checchi, D., Peragine, V. (2010). Inequality of opportunity in Italy, *Journal of Economic Inequality*, 8(4), 429-450.

Cogneau, D., Mesplé-Somps, S. (2008). Inequality of opportunity for income in five countries of Africa, in J. Bishop and B. Zheng (eds.) *Research on Economic Inequality*, Volume 16, Emerald Group Publishing Limited, 99-128.

Davison, A.C., Hinkley, D.V. (1997). *Bootstrap methods and their application*, Cambridge University Press.

Duclos, J.Y., Kiconco, A., Levine, S., Enyimu, J., Rodriguez, A. W., Musisi, A. (2013). Universal primary education in Uganda: equity in opportunities and human capital investment, PEP-Working Papers 2013/17.

Ferreira, F.H.G., Gignoux, J. (2011). The measurement of inequality of opportunity: theory and an application to Latin America, *Review of Income and Wealth*, 57(4), 622-657.

Ferreira, F.H.G., Peragine, V. (2015). Equality of opportunity, in M. Adler and M. Fleurbaey (eds), *Handbook of well being and public policy*, Oxford University Press (forthcoming).

Fleurbaey, M. (2008). *Fairness, responsibility and welfare*, Oxford University Press.

Fleurbaey, M., Peragine, V. (2013). Ex ante versus ex post equality of opportunity, *Economica* 8(317). 118-30.

Fleurbaey, M., Peragine, V., Ramos, X. (2015). Ex post inequality of opportunity comparisons, University of Bari, *mimeo*.

Foster, J.E., Shneyerov, A.A. (2000). Path independent inequality measures, *Journal of Economic Theory*, 91(2), 199-222.

International Organization for Migration (2013). Migration in Uganda: A rapid country profile 2013, IOM Mission to Uganda, Plot 6A Bukoto Cresent Republic of Uganda.

Matovu, J.M., Twimukye, E., Musisi, A., Levine, S. (2011). Assessing development strategies to achieve the Millennium Development Goals in Uganda, Project Final Report, UNDP-RBA, UN Department of Economic and Social Affairs (UNDESA) and World Bank.

Mukwaya P., Bamutaze Y., Mugarura S., Benson T. (2012). Rural-urban transformation in Uganda, Uganda Strategy Support Program Working Paper, available at: http://www.ifpri.org.

Peragine, V., Palmisano, F., Brunori, P. (2014). Economic growth and equality of opportunity, *World Bank Economic Review*, 28(2), 247-281.

Ramos, X., Van de gaer, D. (2012). Empirical approaches to inequality of opportunity: Principles, Measures and Evidences, Working Paper 259. ECINEQ.

Ravallion, M., Chen, S. (2003). Measuring pro-poor growth, *Economics Letters* 78(1), 93-99.

Roemer, J.E. (1998). *Equality of opportunity*. Harvard University Press, Cambridge, MA.

Roemer, J.E., Trannoy, A. (2013). Equality of opportunity, No. 1921. Cowles Foundation for Research in Economics, Yale University.

Ssewanyana, N.S., Okidi, A.J., Angemi, D., Barungi, V. (2004). Understanding the determinants of income inequality in Uganda, Working Paper CSAE, University of Oxford.

The Republic of Uganda (2013). Millennium Development Goals Report for Uganda 2013, available at: http://www.ug.undp.org.

Uganda Bureau of Statistics (2013). Uganda national panel survey 2010-2011. Wave 2 Report, Kampala, June 2013. available at: http://www.ubos.org.

World Bank (2012). Poverty trends in Uganda: who gained and who was left behind?, Inclusive growth policy note; no. 1, DECRG: Agriculture & Rural Devt. Working Paper.

World Bank (2006). World Development Report 2006: equity and development, Washington, DC:World Bank.