# How Does Inequality of Opportunities Affect the Distribution of Economic Wellbeing in Cameroon

Fotso Koyeu, Fourier Prevost and Ningaye, Paul and Talla Fokam, Dieu Ne Dort

Dschang School of Economics and Management, Dschang School of Economics and Management, Dschang School of Economics and Management

6 March 2019

# How Does Inequality of Opportunities Affect the Distribution Economic Wellbeing in Cameroon

Fourier Prevost FOTSO KOYEU, Paul NINGAY and Dieu Ne Dort TALLA FOKAM*

Dschang School of Economics and Management, University of Dschang

**Abstract**

*The objective of this study is to measure the empirical effects of inequality of opportunities (IOP) on the distribution of economic wellbeing, which is captured by consumption per adult equivalent of households in Cameroon. To this effect, we apply both the parametric and non-parametric approaches to measure the magnitude of IOP, and Shapley's method for its decomposition. The results show that IOP has an estimated effect of 25% in 2001 and 35% in 2007. Its main sources are the agro-ecological zone with a contribution of 45.59% in 2001 and 44% in 2007, the place of residence with a contribution of 31.22% in 2001 and 29.49% in 2007, and the distance relative to a good road with a contribution of 12.57% and 13.83%, respectively. We recommend that the government should reinforce national integration policies for local agricultural product markets. She should also extend in rural areas, vocational training that characterizes human capital in urban areas; and she should expand and improve road infrastructure, especially in rural areas.*

**Keywords:** Inequality of Opportunities, Human Development, Wellbeing

**JEL Classification:** D63, I38, O15

* Correspondence: Fourier Prevost Fotso Koyeu, Dschang School of Economics and Management, University of Dschang, Cameroon, email: prevostfotso@gmail.com ;

Paul NINGAYE, Associate Professor of Economics, Dschang School of Economics and Management, Faculty of Economics and Management University of Dschang, Cameroon, email: paningaye@yahoo.fr;

Dieu Ne Dort TALLA FOKAM, Dschang School of Economics and Management, University of Dschang, Cameroon, email: dtallafokam@yahoo.fr.

# 1. Introduction

According to the United Nations Development Program (UNDP, 2014), Cameroon has a Human Development Index (HDI) value of 0.504. The country is ranked 152nd out of 157 countries considered. When the HDI value is adjusted for inequality, it loses 32.84% of its value and the new value is only 0.472. In addition, the country loses two places in its ranking. This very uneven distribution of human development indicators is detrimental to the country's development, which is losing 0.5 to 1% of GDP growth per capita per year; compared to the average of sub-Saharan countries due to inequalities (Klasen, 2008). Aware of this situation, the government has made the fight against inequality the major condition for its emergence by 2035. This is a government position that has recently attracted particular interest for research on the distribution of living conditions in Cameroon. This research has taken three orientations.

In the first orientation, the National Institute of Statistics (NIS, 2008) and authors such as Fambon (2005) and Baye (2010) measure the extent of income inequality using the Gini indices of Theil and Atkinson and apprehends its effects on the evolution of poverty by the decomposition methods of Shapley (1953), Ravallion and Datt (1992) and kakwani (1997). In the second orientation, Foko *et al.,* (2007), Njong and Chouapi (2009), measure multidimensional inequality in two stages. They first build a well-being composite indicator (WCI) that aggregates monetary and non-monetary indicators. Then they apply to the WCI one-dimensional inequality measures. In the third orientation, Tameko and Baye (2011), Njong and Chouapi (2012) measure the distribution of inequality and polarization. The common feature of all these works is that they explain the inequalities in Cameroon only by the variations observed in the socio-economic conditions of the individuals without distinguishing those that fall under their responsibility from those which relate to the circumstances.

However, according to Roemer (1998), Peragine (2004), and Ramos and Van de Gaer (2012), two types of factors explain the inequalities we observe on the distributions of human development indicators. Factors for which individuals are not responsible or circumstances and factors for which individuals are held accountable and which relate to their efforts or choices. In contexts where IOP are very pronounced, the social status of the parents, for example, conditions the level of individual monetary incomes. In general, the IOP that individuals face in a society need to be highlighted for three reasons. First, IOP constitute an unacceptable social injustice because ideally, only the efforts of individuals explain inequalities (Kolm, 1996). Second, only economic policies designed to reduce IOP are worthy of attention as the state should only compensate for IOP and allow individuals to compensate for the inequalities associated with their efforts (Arneson, 1989). Third, according to the World Bank (2005), Ferreira and Gignoux (2008) countries with high IOP experience low rates of economic growth because investments in human development are discouraged. On the contrary, inequalities linked to personal efforts encourage investment in human capital, resulting in high rates of economic growth. The only study in the Cameroonian context that alluded to IOP is that of Baye and Epo (2013) with concerns very different from ours because their main objective is to evaluate the impact of human capital endowment (measured by education and health) on the distribution of monetary well-being.

Following these conceptual and empirical foundations, the main objective of this study is to assess the effects of IOP on the distribution of monetary well-being in the Cameroonian context. Three specific objectives are then set: (i) to measure the extent of IOP on the distribution of wellbeing over the periods 2001 and 2007 by applying parametric and non-parametric approaches (Ferreira *et al*., 2011, Marrero, 2013 ); (ii) to identify the sources of inequalities by the decomposition method of Shapley (1953), and (iii) formulate policies to combat such inequalities.

The rest of the paper is organized as follows: Section 2 is devoted to the literature review, Section 3 to the methodology, Section 4 to the empirical estimates, Section 5 to the interpretation of the results and Section 6 to the conclusion with policy recommendations.

## 2. Literature Review

The literature review discusses the conceptual underpinnings of IOP, its policy scope, and the fundamentals of its measurement.

In relation to the conceptual foundations, the notion of IOP has its origins in the political philosophy initiated by Rawls (1971) whose objective is the search for an ethically acceptable social order. To this regard, the search for equality in the welfare or utility offered by the welfarist tradition is strongly criticized because it does not hold individuals accountable for their responsibilities, preferences or choices. Authors then began to search for the most appropriate framework where well-being and hence inequality should be assessed. The main contributions are those of Rawls (1971) who proposes the framework of primary goods; Dworkin (1981) that of resources; Cohen (1989) that of access to benefits and Arneson (1989) that of opportunities. Sen (1985 and 1992) proposes two frameworks comprised of capacities and functioning.

Roemer (1998) drew on this pioneering work to explain the notion of IOP in two stages. First, he distinguishes two frameworks comprised of “circumstances” which are factors that impose themselves on individuals and “variables under control” to individuals. Then, he explains that the inequalities observed on the indicators of well-being reflect the differences in the circumstances and the variables under control. There is equality of opportunity when the distribution of well-being within groups of individuals with the same circumstances does not vary between groups formed on the basis of the same circumstances (Ferreira and Gignoux, 2008). On the contrary, there is IOP when the distribution of the indicators of well-being depends on the circumstances of the individuals (Hassine, 2011). Examples of circumstances depend on the context but include the status of parents, gender, ethnicity, and place of birth as well as the physical and mental characteristics inherited at birth. The variables under control comprise the efforts but also the choices of individuals such as the type of marriage (polygamous or monogamous), or the number of children. We can include luck. It is understandable that controlled variables can become circumstances for future generations.

As the scope of policy is concerned, it should be noted that since the work of Roemer (1998), the general tendency has been for public authorities to fight against IOP rather than against inequalities of the variables under control. In effect, when they want to fight against the

inequalities linked to individual efforts, public authorities, as is the case in Cameroon, generally apply two types of policies. The first is fiscal and consists in subjecting citizens to progressive taxes in order to compensate for low wages. The second is based on quotas that allow groups disadvantaged by their poor performance to still be present in all public bodies and all training schools for the preparation of future leaders. According to Hassine (2011), such strategies that directly target equality of well-being indicators result in the demotivation of individuals' efforts, the discouragement of investing in human resources and the annihilation of innovation.

In general, it is more appropriate to fight against IOP than against inequalities under control for at least two reasons. The first, based on social justice, distinguishes just inequalities from unjust inequalities. For Peragine (2004), Ferreira and Gignoux (2008), some inequalities may be considered fair if the circumstances are equitable and other inequalities will be considered unfair if the circumstances that explain them are unfair. In fact, the social and political preferences of individuals are strongly influenced by their perceptions of the role played by circumstances and efforts in distribution. For example, individuals who believe that individual efforts are decisive for social success favor lower taxation of income than individuals who link social success to the origin of parents (Alesina and Angeletos, 2005). On a wider scale, countries with high IOP practice higher taxation rates, unlike countries with low IOP(Ramos and Van de Gaer, 2012).

The second reason is founded on the negative link between IOP and economic growth (World Bank, 2005, Marrero *et al*., 2013). In as much as the origins of inequalities (circumstances against efforts) influence individual motivations and political orientations, they have an impact on the economic performance measured by growth. In this way, inequalities due to circumstances are reflected in the under-accumulation of human capital and low economic growth. On the other hand, the inequalities due to efforts encourage individuals to invest in human capital and thus have a positive effect on growth.

Haven explained and justified the concept of IOP, it is necessary to discuss the foundations of its algebraic measurement. In the first discussions, authors have established that it is difficult to identify all the circumstances in a context, especially as there is are no specific databases. Therefore, the household consumption surveys databases used can only measure the lower bound of IOP, as is the case in this chapter. However, such surveys databases are still instructive in explaining the magnitude of IOP in their context (World Bank, 2009). The second discussions indicate that a number of principles must guide measurements of IOP (Ramos and Van de Gaer, 2008). The principle of compensation is the most important of these principles as it leads to concrete proposals for measurement. Following this principle, IOP have to be eliminated and can be measured according to two approaches (Ferriera *et al*., 2015). The ex-post approach looks at the differences in an indicator of well-being between individuals with the same characteristics of respondents. The ex-post compensation then seeks to ensure that the indicators of well-being are equal between individuals with the same efforts as far as possible. Because one must observe responsibilities and efforts, this approach is difficult to implement. On its part, the ex-ante approach considers that there is equality of opportunity if all individuals are confronted with the same circumstances. As a result, the ex-ante compensation prefers a redistribution of the *types* most favored by the circumstances to the most disadvantaged *types*.

It should be noted that a *type* is a set of individuals with the same circumstances. This approach is more operational because suffices to know the circumstances and the indicators of well-being to measure the IOP.

## 3. Research Methodology

Given that circumstances are mostly ordinal socio-economic variables and that the well-being indicator is a continuous variable, measuring the degree of IOP associated with it is inspired by the methodological framework developed by Peragine (2004), Bourguignon, Ferreira and Menéndez (2007), Tartakowsky and Nunez (2007), Ferreira and Gignoux (2008) and Checchi and Peragine (2010). This framework permits to measure the IOP using the parametric approach and non-parametric approaches. It also permits the decomposition of IOP in the first case by sources.

Let $y_i$ be a continuous distribution of a well-being indicator. Its values can be explained by a set of variables measuring circumstances represented by $C_i$, a set of variables of measurement of efforts and choices $E_i$ and the unmeasured factors $v_i$. The factors that depend on individuals are choices in terms of the number of children, for example. The measurement function of $y_i$ can be represented by:

$$y_i = f(C_i,\ E_i,\ v_i) \tag{1}$$

The degree of IOP can be measured by the extent to which the conditional distribution of $y_i$ over circumstances differs from the distribution function of $y_i$ [$F(y|C) \neq F(y)$]. This IOP can be measured using the non-parametric and parametric approaches. Each of these approaches has its advantages and disadvantages. The first does not require a functional form but is not decomposable according to circumstances. The second requires a functional form but is decomposable according to circumstances. For this reason, we apply both of them to ensure the consistency of the results.

### *3.1. The Parametric Method of IOP*

Following the parametric approach, IOP on a well-being indicator ($y_i$) is the inequality that exists on this indicator when controlling for all other factors other than the circumstances. The first step in calculating this inequality is to specify the model of equation (1). According to Bourguignon, Ferreira and Menéndez (2007), the following log-linear function is appropriate:

$$\ln(y_i) = C_i\alpha + E_i\beta + v_i \tag{2}$$

with $E_i = AC_i + \varepsilon_i$ (since circumstances also influence efforts)

Where $\alpha$ and $\beta$ are vectors of the coefficients, $A$ is a matrix of coefficients that specify the effects of circumstances on the efforts and $\varepsilon_i$ is an error term. Equation (2) can be written in a reduced form as follows:

$$\ln(y_i) = C_i\delta + n_i \tag{3}$$

Where $\delta = \alpha + \beta A$ and $n_i = v_i + \varepsilon_i \beta$. The estimation method is that of the ordinary least squares within the framework of a multiple. In effect, the problem to solve is to calculate by an aggregation process, the predicted values of consumption for each individual given a number of circumstances. These circumstances are ordinal or qualitative variables. If it were simply to explain *y*, the analysis of variance would be considered because it compares the means of *y* between the modalities of the qualitative variables. The only constraint in our situation is that indicator variables must be created for the modalities. For example, the residential area variable that has two modalities (rural, urban) must be entered into the model by a binary variable corresponding to urban; rural being considered as a reference modality.

From the coefficients $\hat{\delta}$ estimated in (3), we can calculate a counterfactual distribution $\hat{z}_i$ where inequality is only due to the circumstances. It is simply obtained by ignoring the error term $n_i$ and $\hat{z}_i = exp[C_i \hat{\delta}]$. Total inequality is given by $\theta^d = I(\{\hat{z}_i\})$ and the proportion of IOPin total inequality by $\theta^d = I(\{\hat{z}_i\})/I(\{y_i\})$. In addition to calculating the value of the IOP, (3) also permit to decompose it by sources.

### *3.2. The Decomposition Method of IOP Using the Shapley Value*

The value of Shapley (1953) is part of the cooperative game theory and has been introduced and applied in development economics by authors such as (Shorrocks, 1999, Chantreuil and Trannoy, 1999, Baye, 2010). An indicator *I* (inequality or poverty) is determined by *K=1,2,...,m,...,q* factors. We are interested in the contribution of coalitions or subsets of the factors to the formation *I*. For every factor *m* ($m \notin S$), its marginal contribution is given by $F(S \bigcup \{m\}) - F(S)$ where *F(S)* is the function which makes it possible to generate the index *I*, $S \subseteq K - \{m\}$, that is, it represents coalition not containing *m*. The effective contribution of the factor *m* is the weighted average of all its marginal contributions, whereas each marginal contribution depends on the rank of *m* in *S*. Supposing that the coalition *S* contains *s* elements, its weight is the probability that the first elements of *S* are *s*. It is the ratio between all the arrangements not containing *m*, that is, [*s!(Q-s-1)!*] and the total number of possible arrangements, that is, $q!$. Ultimately, the contribution of the factor *m* is given by:

$$\phi_m^S(K,F) = \sum_{s=0}^{q-1} \sum_{S \subset K-\{m\}} \frac{s!(q-s-1)!}{q!} F(S \bigcup \{m\}) - F(S) \qquad (4)$$

Inspired by the value of Shapley (1953), Shorrocks (1999) developed a unified framework for distributional analysis called Shapley decomposition. Let us consider a well-being indicator $y_i$ explained by *K=1,2,...,k,...,K* factors; the inequality of the factor *k* can be evaluated by analyzing a counterfactual distribution by answering the following question: what would be the inequality in the distribution $y_i$ if the factor *k* were eliminated? Considering $CV^2$ as a measure of inequality, Shorrocks' (1999) conclusion is that:

$$s_k = \frac{cov(y, y_k)}{var(y)} \qquad (5)$$

Where *cov* =covariance, *var* = variance and $y_k$ is the estimated counterfactual distribution using the factor *k*, all others being constant. Ferreira *et al.,* (2011) propose the application of the unified framework of Shorrocks (1999), that is to say, the decomposition by the counterfactual distribution to IOP by considering the variance as a measure of inequality. [5] can then be written:

$$\theta^d = \frac{Var(C_i\delta)}{var\ (y_i)} \tag{6}$$

Note should be taken that $\hat{\delta}$ values are estimated without logarithmic transformation. According to authors, this measure of IOP is attractive in several respects: (i) it is simple to compute; (ii) it measures the lower bound of IOP in inequality total and, (iii) finally, it is decomposable according to the variables of measurement of the circumstances so that one can write that:

$$\hat{\theta}^d = \sum_j \hat{\theta}^j = \sum_j (Vary)^{-1}\left[\delta_j^2 varC_j + \frac{1}{2}\sum \delta_k\delta_j cov(C_kC_j)\right] \tag{7}$$

$(Vary)^{-1}\delta_j^2 varC_j$ gives the contribution of the factor *j* when it varies and the other factors are constant, while $(Vary)^{-1}\delta_j^2 varC_j$ gives the contribution of the factor *j* when all other factors vary while it remains constant. It is to some extent the average of Shapley's marginal contributions to Shorrocks' decomposition. Wendelspiess and Soloaga (2013) parameterize the decomposition of Ferreira *et al,*. (2011) in Stata. We will apply it.

### *3.3. The Non-Parametric Method of IOP*

The nonparametric approach is based on a division of the total population into two partitions. The first partition based on efforts divides the population into *sections* of individuals having the same efforts. This approach, which is consistent with the ex-post conception of IOP is difficult to implement so long as the efforts are unobservable. The second partition divides the population into categories of measurement variables of circumstances or types so that an individual belongs to only one group. Members of the same type have the same circumstances. This approach is the one adopted in this research.

Following the *type* approach, IOP is measured by inequality between the *types*. This inequality can be estimated directly by performing a smoothing that leads to consider a constant as a reference to the value of efforts ( $\overline{E}$ ). The smoothed distribution denoted $\{u_c\}$ is obtained by replacing the values $y_i$ observed on individuals by the means $u_c$ of the types to which they belong. This process eliminates all intra-type inequalities. Thus, the inequality on $\{u_c\}$ measures only inequality due to circumstances. If we consider *I* as a measure of inequality, the value of IOP is given by:

$$\theta_{types}^d = I(\{u_c\}) \tag{8}$$

Expressed in relative value, the proportion of IOP in the total inequality of $y_i$ is given by:

$$\theta_{types}^{d} = \frac{I(\{u_c\})}{I(F(y))} \tag{9}$$

This measurement said to be direct because it measures the IOP on the variables for measurement of circumstances.

IOP can also be obtained indirectly through a standardized distribution obtained by replacing the values $y_i^c$ observed on individuals $i$ in the types $c$ by $z_i^c = \frac{\mu}{\mu_c} y_i^c$ where μ is the overall average of $y_i$ and $\mu_c$ is as previously defined, is the average of yi on the types $c$. The standardized distribution eliminates all inter-type inequalities and leaves only intra-type or effort-related inequalities. We can then calculate the IO Pas follows (Ramos and Van de Gaer, 2012):

$$\theta_{types}^{ind} = I(F(y)) - I(\{z_i^c\}) \tag{10}$$

Expressed in relative value, the proportion of IOP in the total inequality of $y_i$ is given by:

$$\theta_{types}^{ind} = 1 - \frac{I(\{z_i^c\})}{I(F(y))} \tag{11}$$

The direct method and the indirect or residual method may give different results. The only measure of inequality that gives the same results with both methods is the GE(0) entropy measure. We will apply that method.

### *3.4. The Data*

The data analyzed comes from two survey databases of national scope called ECAM2 and ECAM3 or Cameroon's Household Consumption Survey (CHCS), carried out by the National Institute of Statistics of Cameroon in 2001 and 2007. Their main objective was, on the one hand, to update the poverty profile and the different indicators of living conditions of households established in 2001 and, on the other hand, to evaluate the effectiveness of the main programs and policies implemented in within the framework for the fight against poverty. Geographically, therefore, the field covered by ECAM2 and ECAM3 was the national territory and its operations covered all ordinary households (as opposed to collective households: boarding schools, barracks, hospitals, convents) residing all over the national territory, excluding members of the diplomatic corps and their households. The collection of information was done using a questionnaire structured in several sections. This questionnaire covered a wide range of aspects of living conditions such as the composition and characteristics of households, health, education, economic activity and income, domestic chores, environment, housing and equipment, migration and mobility, access to infrastructure, perception of standard of living and governance, land and non-land assets, and agriculture and rural activities.

Through these different sections, several variables for the measurement of circumstances are identifiable. It is obvious that the results of ECAM2 and ECAM3 surveys do not contain all the possible circumstances in the Cameroonian context. Those that are available will only permit us to measure a part, considered as the lower limit of IOP. This is nonetheless very informative of the extent of IOP in the context. In both the ECAM2 and ECAM3 databases, the unit of

observation is the household and the exploitable sample concerned 10992 households in 2001 and 11391 households in 2007.

# 4. Results

## *4.1. Circumstances of Final Consumption*

In the 2001 and 2007 household databases, the monetary well-being indicator is an aggregate of household consumption per adult-equivalent constructed in three stages. First, we calculate a consumption aggregate at the household level. This aggregate includes: food expenditures (including meals taken outside the household), non-monetary food consumption resulting from self-consumption and donations, acquisition value of non-durable goods and services, an estimate of the value in use of durable goods and the imputed value of housing for households owning or housed free of charge by a third party. Then, to account for differences in household composition, it is normalized by dividing the consumption aggregate by the number of adult-equivalent of the household. Finally, we proceed to a final normalization by dividing it by a spatial deflator, which takes into account the differences in the cost of living between the regions.

With these calculations, the indicator of monetary well-being is a quantitative variable, having in 2007 an average of 433,436 francs and a standard deviation of 408,721.7 francs. Its minimum was 82,113.79 francs. Since the poverty line was 269,443 francs a year, the incidence of poverty was estimated at 39.9%. In 2001, this variable had an average of 373,163.9 francs, a standard deviation of 462,207.2 and a minimum of 20,570.88. With a poverty line of 232,547 francs, the incidence of poverty was 40.2%. Exploratory analyzes lead us to consider 7 circumstances (Table 1), hypothetically explanatory of the inequality on the monetary indicator.

**Table 1: Circumstances of wellbeing in 2001 and 207**

| N° | Circumstances≠ | Modalities | 2001 | | 2007 | |
|---|---|---|---|---|---|---|
| | | | Size | % | Size | % |
| 1 | Agro-ecological zone | Yaounde | 1 095 | 9.96 | 1 022 | 8.97 |
| | | Douala | 1 118 | 10.17 | 1 049 | 9.21 |
| | | Other towns | 2 762 | 25.13 | 4 294 | 37.70 |
| | | Rural forest | 1 646 | 14.97 | 1 135 | 9.96 |
| | | Rural highland | 2 321 | 21.12 | 2 353 | 20.66 |
| | | Rural savana | 2 050 | 18.65 | 1 538 | 13.50 |
| 2 | Area of residence | Rural | 6,017 | 54.74 | 6 365 | 55.88 |
| | | Urban | 4 975 | 45.26 | 5 026 | 44.12 |
| 3 | Sex of head of household | Feminine | 2 681 | 24.39 | 3 044 | 26.70 |
| | | masculine | 8 311 | 75.61 | 8 350 | 73.30 |
| 4 | Distance to road | Far from road | 2 970 | 27.02 | 1 271 | 13.02 |
| | | Near to road | 8 022 | 72.98 | 8 489 | 86.98 |
| 5 | Distance to water point | Far from water point± | 4 044 | 36.79 | 3 798 | 33.34 |
| | | Near to water point | 6 948 | 63.21 | 7 593 | 66.66 |
| 6 | Distance to market | Far from market | 1 834 | 16.68 | 2 799 | 24.57 |
| | | Near to market | 9 158 | 83.32 | 8 592 | 75.43 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | Handicap | Other_handicapØ | 12 | 0.11 | 50 | 0.44 |
| | | Speech_handicap | 65 | 0.59 | 39 | 0.34 |
| | | Hearing_handicap | 67 | 0.61 | 65 | 0.57 |
| | | Visual_ handicap | 366 | 3.35 | 348 | 3.06 |
| | | Movement_handicap | 288 | 2.09 | 215 | 1.89 |
| | | Non_handicapped | 10 193 | 93.25 | 10 674 | 93.71 |

≠ The distance from the electrical connection was measured in 2007 but not in 2001. We abandoned it.
± "Far" means a distance greater than the national average and "Near" means a distance less than the national average.
Ø in other disabilities, we can include the mentally ill.
Source: Computed by authors

### *4.2. IOP by the Parametric Approach*

We consider the 7 circumstances described in Table 1. The implementation of the method requires above all to estimate the coefficients δ using equation [3] in 2001 and 2007 respectively. The results are reported in Table 2.

Table 2: Weightings of the calculation of the conditional income to opportunities

| N° | Name of opportunity | Modalities | 2001 | | 2007 | |
|---|---|---|---|---|---|---|
| | | | $\delta$ | p | $\delta$ | p |
| 1 | agro-ecological zone | Yaoundé | -# | | - | - |
| | | Douala | -0.008 | 0.00 | -0.022 | 0.00 |
| | | Other towns | -0.314 | 0.00 | -0.312 | 0.00 |
| | | Rural forest | -0.442 | 0.00 | -0.213 | 0.00 |
| | | Rural highland | -0.097 | 0.00 | -0.215 | 0.00 |
| | | Rural savannah | -0.147 | 0.00 | -0.260 | 0.00 |
| 2 | Area of residence | Rural | - | - | - | - |
| | | Urban | 0.576 | 0.00 | 0.66 | 0.00 |
| 3 | Sex of head of household | Feminine | - | - | - | - |
| | | Masculine | -0.030 | 0.00 | -0.0257 | 0.00 |
| 4 | Distance to road | Far from road | - | - | - | - |
| | | Near road | 0.132 | 0.00 | 0.0815 | 0.00 |
| 5 | Distance to water point | Far from water point± | - | - | - | - |
| | | Near water point | 0.060 | 0.00 | 0.1038 | 0.00 |
| 6 | Distance to market | Far from market | - | - | - | - |
| | | Near market | 0.065 | 0.00 | 0.03 | 0.00 |
| 7 | Handicap | Other handicapØ | - | - | - | - |
| | | Speech handicap | -0.047 | 0.00 | -0.23 | 0.00 |
| | | Hearing handicap | 0.005 | 0.30 | 0.27 | 0.00 |
| | | Visual handicap | 0.019 | 0.00 | 0.27 | 0.00 |
| | | Movement handicap | 0.017 | 0.00 | 0.26 | 0.00 |
| | | Nonhandicapped | 0.023 | 0.00 | 0.37 | 0.00 |
| | Frequency | | 12.3 | 0.00 | 12.763 | 0.00 |
| | $R^2$ | | 0.205 | 0.00 | 0.34 | 0.00 |
| | Number of observations | | 10 992 | | 11 391 | |

# The ordinal or qualitative variables are entered into the model by binary indicator variables. The first of these dummies is the reference and its coefficients are not estimated.

Source: Computed by authors

To interpret the results of such regressions, reference should be made to the work of Melissa (1993) and Roberto (2013) who discuss the meaning to be given to the coefficients of multiple regression with dummy variables. They explain that in such a context, the regression coefficient is the difference of the mean of the explained variable between the estimated modality and the reference modality. All this under the constraint of an equal distribution of the explained variable on the modalities of the other variables. Thus, it is likely to vary with the number of variables of the model. In 2007 for example, the coefficient of *urban* = 0.66 (= is equal the average of the final consumption in *urban* areas - the average of final consumption in *rural* areas > 0). This means that on average, well-being is higher in urban than in rural areas. On this basis, the coefficients of the regressions of the indicator variables of circumstances are consistent with the poverty statistics in Cameroon and tend to confirm that circumstances are not neutral in the distribution of monetary well-being. Therefore, the movement from Yaoundé to other agro-ecological zones leads to a decrease in consumption resulting in negative coefficients. They are -31, -21, -21 and -26 respectively for other cities, rural forest, rural high highland and rural savannah. Infrastructure plays a very important role because people who live close to a paved road or in good condition, a water supply point and a market have a significant increase in their well-being compared to those who live far from these same infrastructures. As expected, the well-being of the non-disabled is significantly higher than that of the disabled. However, the type of disability greatly influences the variation of well-being because those with movement handicap or disabilities only increase their consumption by 0.26 compared to other types of disabilities. This increase is 0.27 for the handicapped of the auditory or visual system. Another result of Cameroonian statistics that is confirmed is the drop in well-being measured by consumption when moving from male-headed households to those headed by women (-3). In general, the trends for 2007 are confirmed in 2001.

From the coefficients of Table 2 and as explained in the methodological section, we calculate a counterfactual distribution $\hat{z}_i$ where the inequality is due to opportunities simply by ignoring the error $n_i$ (_cons) and $\hat{z}_i = \exp[C_i\widehat{\delta}]$. IOP is calculated on this distribution and the decomposition of Shapley (equation 7) proposed by Ferreira, Gignoux and Aran (2011) is applied. All these three phases namely the computation of the counterfactual distribution, the computation of inequality on this distribution and the decomposition of Shapley can be executed by the algorithm parameterized in stata11. Table 3 summarizes them for both periods.

It shows that the IOP is estimated at 25% in 2001 and 35% in 2007. IOP, therefore, tends to increase, which is undesirable. Decomposition makes it possible to identify the sources of IOP. First of all, there is the agro-ecological zone which contributes 45.59% to the IOP in 2001 and 44% in 2007. It is followed by the place of residence with 31.22% in 2001 and 29.49% in 2007. Next comes the distance to a road in good condition with 12.57% and 13.83%, respectively, over the same periods. Distance from the market also plays a significant role in the distribution of income with scores of 6.59% and 3.47%.

Table 3: IOP in Wellbeing and its Decomposition

| | | 2001 | | 2007 | |
|---|---|---|---|---|---|
| | | Absolute | Relative % | Absolute | Relative % |
| | IOP | 0,06934 | 25 | 0.0855 | 35 |
| | Decomposition | | | | |
| 1 | Agro-ecological zone | 0.032439 | 45.59 | 0.038129 | 44.0 |
| 2 | Area of residence | 0.000025 | 31.22 | 0.000064 | 29.49 |
| 3 | Sex of head of household | 0.022215 | 0.19 | 0.025654 | 0.97 |
| 4 | Distance to road | 0.000135 | 12.57 | 0.000847 | 13.83 |
| 5 | Distance to water point | 0.004692 | 1.25 | 0.003022 | 6.57 |
| 6 | Distance to market | 0.008946 | 6.59 | 0.012028 | 3.47 |
| 7 | Handicap | 0.000888 | 0.04 | 0.005715 | 0.07 |
| | Total | | 100 | | 100 |

Source: Computed by authors

### *4.3. IOP by the non-parametric approach*

Consider again the 7 circumstances of Table 1. The nonparametric approach is based on the constitution of *types*. A type is a set of individuals with the same circumstances. Algebraically, we expect to have 6 x 6 x 2 x 2 x 2 x 2 x 2 = 1 152 *types*, where 6, 6, 2, 2, 2, 2 and 2 are respectively the numbers of the modalities of the 7 opportunities. But in practice, only 412 types were obtained because of impossible combinations. For example, the *rural_savannah-urban* combination is impossible because an individual cannot be at the same time in the rural agro-ecological zone and in urban areas. Table 4 illustrates the *types* of constitution by presenting the 18 main types in 2007 which represent about 50.50% of the sample.

Table 4: Major Types for 2007

| N° | Types | Size | Cumulative% |
|---|---|---|---|
| 1 | oth_ urba femi non_ nwat nroa nmar± | 752 | 7.70 |
| 2 | oth_ urba masc non_ fwat nroa nmar | 603 | 13.88 |
| 3 | doua urba masc non_ nwat nroa nmar | 528 | 19.29 |
| 4 | yaou urba masc non_ nwat nroa nmar | 483 | 24.24 |
| 5 | ru_h rura masc non_ nwat nroa nmar | 283 | 27.14 |
| 6 | ru_s rura masc non_ nwat nroa nmar | 228 | 29.48 |
| 7 | ru_s rura masc non_ fwat froa fmar | 209 | 31.62 |
| 8 | oth_ urba femi non_ fwat nroa nmar | 208 | 33.75 |
| 9 | ru_h rura masc non_ fwat froa fmar | 198 | 35.78 |
| 10 | ru_h rura masc non_ fwat froa nmar | 193 | 37.76 |
| 11 | doua urba masc non_ fwat nroa nmar | 176 | 39.56 |
| 12 | ru_h rura masc non_ fwat nroa nmar | 163 | 41.23 |
| 13 | yaou urba femi non_ nwat nroa nmar | 162 | 42.89 |
| 14 | ru_f rura masc non_ nwat nroa nmar | 160 | 44.53 |
| 15 | oth_ urba masc non_ nwat nroa fmar | 155 | 46.12 |
| 16 | doua urba femi non_ nwat nroa nmar | 154 | 47.70 |
| 17 | ru_h rura femi non_ nwat nroa nmar | 145 | 49.19 |
| 18 | yaou urba masc non_ fwat nroa nmar | 128 | 50.50 |

± The name of a type is constituted by the first 4 letters of the names of the modalities of the 7 circumstances. For example, type 1 is named *oth_ urba femi non_ nwat nroa nmar* and refers to individuals from other towns, living in urban area, of feminine sex, non-handicapped or disabled, near to a water point, near to a road and near to a market,.

Source: Computed by authors

The types are of different sizes, which reflect the representativeness of the socio-economic groups in the two databases. But this does not pose a problem for the estimation of IOP because what matters is the distribution of the averages of the indicator of well-being in these different types. These averages also differ with a minimum of 40,307.05 and a maximum of 3,079,894 in 2001 as against 90,625.07 and 4,717,147 francs in 2007. After generating the standardized distributions in both databases by replacing $y_i$ with $\{u_c\}$ and applied the inequality index GE(0), the results indicate that in 2001, I(F(Y))=0.274379 and I($\{u_c\}$)=0.0729. This is the IOP in absolute value. In relative value, IOP=0.0729/0.274379=26%. In 2007 on the contrary, I(F(Y) =0.247387 and I({uc})= 0.088253. It is the IOPin absolute value. In relative value, IOP=0.088253/ 0.247387=35.6%.

In order to be able to calculate a value of IOP by the indirect approach according to the equations [10] and [11], it is first necessary to calculate a standardized distribution (ztype) obtained by replacing the values $y_i^c$ observed on individuals *i* in types *c* by $z_i^c = \frac{\mu}{\mu_c} y_i^c$ where $\mu$ is the general mean of $y_i$ and $\mu_c$ is the mean of $y_i$ on type *c*. In 2001 *ztype* is calculated on 10,992 individuals and has an average of 339,654 francs. I (F (Y) = 0.274379 and I (ztype) = 0.200726. I (op) = 0.274379 - 0.200726 = 0.073653 in absolute value or ≈ 27% in relative value. Value very close to the 26% obtained in the direct approach. In 2007, *ztype* is calculated on 11,391 individuals and has an average of 433,353.8 francs I(F(Y =0,247387 and I(ztype)=0,161349. I(op)=0.247387 - 0.161349 =0.086038 or ≈35% close to the 35.6% of the direct method.

## 5. Discussion of Results

Table 5 summarizes the results of the empirical estimates and shows a concordance of trends between the non-parametric and parametric approaches, reflecting certain robustness of the results. In general, two findings emerge from these results. The first is that IOP tend to increase over time even though the distribution of well-being tends to be more egalitarian in the population as a whole (0.27 in 2001 and 0, 25 in 2007). According to the parametric approach, they increased from 25% in 2001 to 35% in 2007. The other methods confirm this evolution trend. The second is that the extent of IOP in relation to the monetary indicator of well-being in Cameroon is similar to that of some countries like Turkey with 31%, according to Ferreira *et al.,* (2011). On the contrary, it is very high compared to that of a number of countries such as Egypt wherein, it has a downward trend; passing from 22% in 1988 to 15% in 2006 (Hassine, 2011).

As a discussion of the results of this section, we ask ourselves the following two questions: What are the most decisive opportunities in the distribution of well-being? What explains their scores? The first question finds its answer in Table 5, where it appears that IOP has its source in two main factors: First is the agro-ecological zone, which accounts for 45.59% of inequalities

of opportunities in 2001 and 44% in 2007. Second is the place of residence, with 31.22% in 2001 and 29.49% in 2007. The other factors play a negligible role. These are results that have explanations.

Table 5: Summary of IOP based on the monetary indicator of well-being

| | 2001 | | 2007 | |
|---|---|---|---|---|
| | Absolute | Relative | Absolute | relative |
| Inequality on final consumption | 0.274379 | | 0.247387 | |
| Direct nonparametric approach of IOP | 0.0728 | 26% | 0.088253 | 35.6% |
| Residual nonparametric approach of IOP | 0.073653 | 27% | 0.086038 | 35% |
| The parametric approach of IOP | 0.06934 | 25% | 0.0855 | 35% |

Source: Computed by authors

Apart from the major cities of Douala and Yaoundé, the agro-ecological zones were considered to take into account climatic conditions and soil characteristics. They specialize rural in areas in specific crops, which then constitute their main source of income. In this perspective, Cameroon has three zones. There is the southern forest zone, which includes the Center, East, Littoral, South and South-West regions. Located in the maritime and equatorial zones, this region is conducive to the cultivation of cocoa, oil palm, banana, rubber, and tobacco. Secondly, we have the western highlands comprising the West and North-West regions. They are rich in volcanic soils and therefore conducive to growing coffee and vegetables. Finally, there is the Sudano-Sahelian north, which includes the regions of Adamaoua, North, and Far-North. It is a savannah zone characterized by a hot and dry tropical climate. It is therefore conducive to raising cattle, growing cotton, onion, millet, potatoes, white yams, and groundnuts. Because the different products do not have the same prices both at the national and international level, the agro-ecological diversity can explain in part the distribution of the monetary incomes of the populations.

The weight of the area of residence on the distribution of income is explained by the disparity of employment structures between urban and rural areas. In Cameroon, the informal agricultural sector is dominant with 53.0% of employed workers. It is followed by the informal non-agricultural sector with 37.5%. The formal private sector employs only 3.7% of this population and 5.8% for the public sector. The analysis shows that the urban environment is characterized by a predominance of the non-agricultural informal sector (69.9% in employment) whereas in rural areas it is rather the informal agricultural sector (75%). The formal sector (public, private) which is supposed to provide better conditions of activity is more a characteristic of the urban than of the rural area. Among those employed (with aged 10 years or older), 11.4% are in the public sector and 8.3% in the formal private sector. In rural areas, these proportions are respectively 3% and 1.3% in the public and in the formal private sector. However, the annual expenditure per adult equivalent in a household where the head belongs to the informal agricultural sector is only 291,630 francs, compared with 506,290 francs for the formal non-agricultural sector. It is 787,466 for the formal private sector and 719,084 francs for the public sector.

Elsewhere, we can also notice that the rural area is very handicapped in terms of human capital. Thus, if we define vocational training as the set of activities of adaptation of man to his work aiming at the acquisition of knowledge, skills and to know how to be, Cameroonian surveys show that 42.2% of people living in urban areas have already received vocational training compared to 18.4% in rural areas. This is a situation that pushes rural people to low productivity jobs. This situation may be aggravated by the lack of infrastructure, which conditions the existence of certain types of jobs. Consider, for example, electricity. Rural populations are on average 6.7 km from an electrical connection against 400 meters on average for urban.

## 6. Conclusion

From the observation that human development indicators are very unequally distributed in Cameroon, the main objective of this study was to measure the empirical effects of IOP on the distribution of economic wellbeing. To achieve this goal, we applied the parametric and the nonparametric approaches to final household consumption. The results show that IOP has an estimated of 25% in 2001 and 35% in 2007. This tendency toward an increase is undesirable. Shapley's method of decompositions identifies the sources of these IOP as being: (i) the agro-ecological zone which accounts for 45.59% of IOP in 2001 and 44% in 2007; (ii) the area of residence with 31.22% in 2001 and 29.49% in 2007; (ii) the distance from a road in good condition with 12.57% and 13.83% respectively over the same periods and (iv) the distance from the market also plays a significant role in the distribution of income with scores of 6.59% and 3.47%. Given that the influence of the agro-ecological zones is mainly due to the spatial specialization of the populations in the specific agricultural productions, we recommend policies of national integration of the markets for the local agricultural products. We also recommend that vocational training that characterizes human capital in urban areas be extended in rural areas in order to increase the productivity of their jobs. Last, we recommend the promotion of infrastructural development, especially roads in rural areas**.**

## References

Alesina A. and G. M. Angeletos (2005), 'Fairness and Redistribution', *American Economic Review,* Vol. 95, No. 4, pp. 960-980.

Arneson, R. (1989), 'Equality of opportunity for Welfare', *Journal of Economic Theory*, No.2, pp. 244-263.

Baye, M.F. (2010), 'Growth, Redistribution and Poverty changes in Cameroon: A Shapley decomposition analysis', *Journal of African Economies*, Vol. 15, No.4, pp. 543-570.

Baye, M.F. and N.B. Epo (2013), 'Impact of human capital endowments on inequality of outcomes in Cameroon', *Review of Income and Wealth*, DOI: 10.1111/roiw.12077

Bourguignon, F., Ferreira F. and M. Menéndez (2007), 'Equity, efficiency and inequality traps: A research Agenda', *Journal of Economic Inequality*, Vol. 5, N°2, pp. 235-256.

Chantreuil, F. and A. Trannoy (1999), 'Inequality Decomposition Values: the Trade-off Between Marginality and Consistency', mimeo, Université de Cergy-Pointoise.

Checchi, D. and V. Peragine (2010), 'Inequality of opportunity in Italy', *Journal of Economic Inequality*, Vol. 8, No.4, pp. 429-450.

Cohen G. A. (1989), 'On the currency of egalitarian justice', Ethics, No. 99, pp. 906-944.

Dworkin R. (1981), 'What is inequality? Equality of welfare', *Philosophy and Public Affairs*, Vol. 10, No.3, pp. 185-246.

Fambon, S. (2005), 'Croissance Économique, pauvreté et inégalité des revenus au Cameroun', *Revue d'Économie du Développement*, Vol. 19, No. 1, pp. 91-122.

Ferreira, F. H. and J. Gignoux (2008), 'The measurement of inequality of opportnity : Theory and application to Latin America', *Policy Research Working* Paper 4659, World Bank.

Ferreira, F. H., Gignoux, G. J and M. Aran, (2011), 'Measuring inequality of opportunity with imperfect data: the case of Turkey', *J Econ Inequal*, DOI 10.1007/s10888-011-9169-0

Foko Tagne B., F. Ndém and R. Tchakoté. (2007), 'Pauvreté et Inégalité des Conditions de Vie au Cameroun : une approche micro-multidimensionnelle'. Cahier de Recherche PMMA 2007-2, PEP-PMMA.

Hassine, B. N. (2011), 'Inequality of opportunity in Egypt', *The World Bank economic Review,* Vol.26, No. 2, pp. 265-295.

Institut National de Statistique (INS), (2008), 'Conditions de vie des populations et profil de pauvreté au cameroun en 2007 : Rapport principal de l'ECAM3', Août 2008

Kakwani, N. (1997), 'On Measuring Growth and Inequality Components of Poverty with Application to Thailand', Discussion Paper, School of Economics, The University of New South Wales.

Klasen, S. (2008), 'Gender inequality, Growth, and Poverty Reduction in Cameroon: Evidence and Policy Issues', Etude commandée par la GTZ Cameroun.

Kolm, S. (1996), *Modern theories of justice*, The MIT Press, Cambridge, Massachusette.

Marrero, Gustave A. et Rodriguez juan G. (2013), 'Inequality of opportunity and Growth', *Journal of Development Economics*, Vol. 104, pp. 104-122.

Melissa, H. A. (1993), *Regression with Dummy Variables*, Sage Publication, London

Njong M. A. and P. R. Tchouapi (2009), 'Dynamic analysis of inegality and polarization in Cameroon: A multidimensional approach based on a wealth index'. New proposal to AERC. May.

Njong M. A. and P. R.Tchouapi (2012), 'Patterns and Trends of partial income Inequality and Income Polarization in Cameroon', African Economic Research Consortium (AERC).

Peragine, V. (2004), 'Measuring and implementing Equality of opportunity for income', *Social Choice Welfare*, No. 22, pp. 187-210.

Ramos, X. and D. Van de Gaer (2012), 'Empirical Approaches to inequality of opportunity: principes, measurement and evidence' ECINEQ WP 2012-259.

Ravallion, M. and G. Datt (1992), 'Growth and Redistribution Components of Changes in Poverty Measures. A Decomposition with Application to Brazil and India in the 1980s', World Bank LSMS Working Paper 83.

Rawls, J. (1971), *A theory of justice*, Harvard University Press, Cambridge.

Roberto, P. (2013), *Econometrics for DUMMIES*, John Wiley & Sons, New Jersey

Roemer, J. E. (1998), *Equality of Opportunity*, Cambridge, MA: Havard University Press.

Sen, A. (1985), *Commodities and Capabilities*, North-Holland, Amsterdam.

Sen, A. (1992), *Inequality re-examined*, Harvard University Press, Cambridge.

Shapley, L. S. (1953), 'A Value for n-Person Games, in H.W. Kuhnm and A.W. Tucker (eds), Contributions to the Theory of Games', Vol. 2, Princeton University Press.

Shorrocks, A. F. (1999), 'Decomposition Procedures for Distributional Analysis: A Unified Framework Based on Shapley Value', Mimeo: Department of Economics, University of Essex

Tameko, N. C. Y. and M. F. Baye (2011), 'Inégalité et polarisation des dépenses au Cameroun pendant et après les programmes d'ajustement structurel', Économie Appliquée, tome LXIV, No 4, pp. 119-145.

Tartakowsky Andrea and Nunez Javier (2007), 'Inequality of outcomes vs. Inequality of opportunities in a developing country', *Estudios de Economia*, Vol. 34, No 2, pp. 185-2002.

UNDP (2014), *Human Development Report: Sustaining Human Progress, Reducing Vulnerabilities and Building Resilience,* UNDP, New Work.

Wendelspiess, F. and I. Soloago (2013), 'IOP: stats module to compute different measures of inequality of opportunity for dichotomous, ordered and continuous outcome variables', EconPapers.repec.org.

World Bank (2005), *Rapport sur le Développement dans le Monde : Equité et Développement*, Banque mondiale, Washington.

World Bank (2009), *Measuring Inequality of opportunities in Latin America and the Caribbean,* The World Bank, Washington.