DETERMINANTS AND TREND OF CHILD WELLBEING STATUS IN CAMEROON

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ABSTRACT

The main objective of this study is to measure and analysis the trend of children wellbeing in Cameroon based on the most recent Cameroonian Multiple Indicators Cluster Surveys (MICS3 in 2006 and MICS4 in 2011). We use a Multiple Component Analysis (MCA)-based Child Wellbeing Status Index (CWSI) from a non-monetary approach and make comparisons using stochastic dominance tests. Our results show that child poverty is explained by poor health conditions especially in terms of vaccination, inappropriate method of waste disposal, either public shared latrine, open pit latrines or open bucket latrines. In houses where they live, the floor is dirt, sand or dung. They live in houses with more than five people per room and with mud flooring (shelter deprivation), and are unable to read or write, and do not enroll in school. Our analysis of the trend of child poverty from 2006 to 2011 shows an increase of the poverty rate. Certainly due to the level of economic performance in Cameroon during the period that make the government unable to provide more facilities to children in term of increasing its social investment. Finally, it should be noted that, health, housing characteristics and sanitation are the main dimension of child wellbeing in Cameroon. Such results could help drawing policy makers' attention on this population and it may be a criterion for the allocation of public funds with regards to social investment, within the context of the post-2015 development agenda.

Keys word: Child wellbeing, composite index, stochastic dominance, Cameroon.
JEL Classification: C, D, I3, J13.

SECTION 1. INTRODUCTION AND BACKGROUND

Nowadays, poverty has become a priority for public policies in developing countries. Therefore, poverty analysis is standing as a major preoccupation and a challenge for Governments around the world, their development Partners, and the entire international

community. In other to design appropriate strategies to reduce poverty, they need a significant amount of information concerning poverty. For example, who the poor are, where they are, how many are they, what their characteristics are, etc. At the time of writing this paper, poverty is therefore a topical issue and stands as a major concern within the international community and for national governments around the world, and the government of Cameroon in particular. Indeed, meeting in September 2015 during the Millennium Development Summit, stakeholders and leaders of about 189 members states of the United Nations Organization reviewed progress accomplished in the march toward attainment of the Millennium Development Goals (MDGs) adopted in 2000. Due to the mitigated results regarding the wellbeing dimensions and children concern of MDGs (MDG1, MDG2, and MDG4), we are now moving forward to Sustainable Development Goals (SDGs) that emphasize reducing poverty and inequality in a multidimensional way. SDGs s based on an agendaofinclusive growth and sustainable development. As far as Cameroon is concerned, its authorities are on the same path, with the ongoing Growth and Employment Strategy Paper (GESP)[4], incorporating SDG's into strategic framework where the main focus is on poverty reduction through promoting inclusive growth and employment (decent work). From the last 4 Cameroonian Households Consumption Surveys (CHCS) data, it appears that, according to the monetary criterion, 53 out of 100 Cameroonians were poor in 1996 (CHCS 1), against 40 out of 100 in 2001 (CHCS2), that is a decrease of 13 percent of the number of poor within 5 years. We also notice between 2001 and 2007 (CHCS3), a stability of monetary poverty rate around 40% at the national level (from 40.2% in 2001 to 39.9% in 2007). Between 2007 and 2014 (CHCS4), the poverty rate decreased to 37.5%. As far as inequality is concerned, it decreases from 40.4% in 2001 to 39% in 2007. The contrast occurs between 2007 and 2014 where there has been rather an increase of the level on the Gini index measuring inequality from 0.39 to 0.44. This measurement, however, cannot answer, what is the level of child poverty and especially from a non-monetary point of view. To the best of our knowledge, no Cameroonian studies paid attention to this subject. Therefore, the main research question of our study is: What are the determinants and tendency of child wellbeing from a non-monetary point of view in Cameroon? The main objective of this study is to measure the evolution of child wellbeing status in Cameroon using the latest MICS and a Child Wellbeing Status Index (CWSI) based on the Multiple Component Analysis (MCA) from a non-monetary view and making comparisons using stochastic dominance tests. We also aim to highlight implications of determinants and trend of child wellbeing status on social protection in Cameroon. Our data are MICS 3 of 2006 and MICS4 of 2011 from the National Institute of Statistics.

[4] Growth and Employment Strategy Paper, (2009), 167 pages.

SECTION 2. JUSTIFICATION OF THE STUDY

The persistence of child poverty and increasing inequality in Cameroon explain the importance and the interest of this study. Then for meaningful evidence- based policy analysis, it is important not only to look at overall child poverty, and compare countries or regions at a single point in time, but also to understand the distribution among the poor children, , and the dynamics of their wellbeing status.

SECTION 3. THEORETICAL AND EMPIRICAL LITERATURE REVIEW

Many studies on poverty in Cameroon have been conducted. They have been interested in monetary and non-monetary poverty, spatial analysis of poverty, poverty in term of basic needs, gender, income redistribution, or poverty as far as living conditions and potentialities are concerned, the importance of social religious capital in the eradication of poverty. In short we can say that poverty in Cameroon in a multidimensional view has attracted the attention of the scientific community.

With regard to income poverty, we have studies as those of the World Bank (Cameroon, diversity growth and poverty reduction, [2000][5] , [2001, 2002, 2005][6]), reports of the first Cameroonian Households Consumption Survey (CHCS 1 in 1996) conducted by the Division of Statistics and National Account, Njinkeu et al. (1996), the 2001 report of the United Nations Development Program (UNDP) concerning human development, Dubois and Amin (2000), Fambon S. et al. (2001), Emini et al. [2000, 2004, 2005, 2008 and 2009], and Feunou K. (2007). This last study particularly is interested in gender discrimination in Cameroon as far as monetary poverty and women activities in the labor market are concerned. All those studies generally lead to the finding that poverty is more acute in rural areas and unequally distributed between the different regions of Cameroon. They also show that inequalities in income distribution are more visible in towns and that the increase of women involvement or participation in urban informal sector activities with low yields is proof of the feminization of poverty in Cameroon. In addition, the differential pro poor growth is very important between the regions of the countries in term of monetary and non monetary poverty. Other studies, such as Fambon S. et al. (2000)[7] highlight a poverty line through the Food Energy Intake (FEI) method. Nembot D. et al[8]. analyze the impact of equivalence scales on the spatial distribution of poverty in Cameroon following a dynamic approach.

[5] See Kamgnia Dia et al. (February 2003).
[6] Manga and Epo, 2007.
[7] Foko T. et al. (2006).
[8] Ningaye P. (2005).

The dynamics of poverty in Cameroon also attracted the attention of many researchers. We can distinguish, among others, the National Institute of Statistics (NIS, 2002) which studies the dynamic of poverty between 1996 and 200 and Feubi Pamen et al. (2010) on the dynamic of monetary poverty between 2001 and 2007. As far as the impact of a trade liberalization policy on poverty is concerned, we can refer to Emini et al. (2010). Using a General Computable Equilibrium model with micro simulation, results show that the liberalization scenario leads to an increase of the number of poor. The simple dominance analysis shows an increase of the poverty level among the group of poor and an increase of the contribution of rural poverty to the national poverty.

Since each group of the population can have a different perception of poverty, many authors like Baye M. (2003), Ningaye et al. (2005) and Ndongo O. et al.; (2006) draw their attention to the impact of cultural aspects in the description of poverty in Cameroon, ethno-cultural diversity and the multidimensional poverty differential, or the influence of religion and social capital (social religious capital) on reducing household poverty. Their results show that cultural characteristics and norms can perpetuate or reduce the transmission of poverty in society, and that religious variables have a positive impact on household poverty in the city of Yaounde.

Some other studies were based on the construction of a Poverty Composite Index (PCI) for a better understanding of the multidimensional nature of poverty. Namely we have Foko T. et al. (2007) and Njong (2007). This last one concludes that non-monetary poverty affects 80.9% of households while 39,6% of them are facing monetary poverty. Foko T. et al. (2007) present the profile of multidimensional non-monetary poverty in Cameroon and test its concordance with the existing monetary poverty profile. They lead to the conclusion that poor living conditions result in the exclusion of households from the consumption of certain basic commodities, due to their unavailability or low accessibility. It tends to better reflect the poverty status of households as they perceive it. These results call for joint strategies against poverty, especially target as far as the life cycle of individuals is concerned, the agro-ecological zone and different socio-economic groups.

Until today very few studies have focused on the evolution and trends of non-monetary poverty in Cameroon. Namely we have in this case, Emini et al. (2009) on the spatial analysis of pro-poor growth through a double monetary and non-monetary approach and Emini et al. (2010) on the impact of the 2008-2009 global economics crisis on child poverty in Cameroon. We also have Feubi Pamen (2010, 2013 and 2015) focusing on the dynamics of non-monetary poverty with a Multiple Component Analysis (MCA) approach coupled with stochastic dominance tests. Their results show that non-monetary poverty decreased in Cameroon from 2001 to 2007 in urban areas and in the whole country only in middle household's class. For

the poor and the rich, non-monetary poverty increased in urban areas and all over the country, and in rural areas for all households. In terms of evidence-based policy advice, they then suggest improving accessibility to basic infrastructures, potable water, electricity and quality of housing in rural areas, and greater jobs creation in urban areas, where inequalities are most noticeable and increasing. All those studies focused on household non-monetary poverty. They were not interested in children non-monetary poverty and its evolution. In this paper, we use a MCA-based Child Wellbeing Status Index (CWSI) from a non-monetary view to highlight determinants of children wellbeing. Then stochastic dominance tests enable us to make inter-temporal comparisons of the evolution of children wellbeing in Cameroon, between 2006 and 2011.

SECTION 4. ANALYTICAL FRAMEWORK AND DATA

4.1 METHOD

Despite the abundance of literature, the concept of poverty is generally precise. But, analysts recognize that there is no absolute and universal definition of poverty [Ravallion (1996), World Bank (2001), Asselin (2002)] and even no uniform approach to measuring poverty. Therefore we encounter several definition of poverty which refer either to monetary aspect (income gap), material (absence of certain goods or commodities), food (insufficient food calories), health (lack of access to adequate health care), cultural (illiteracy), … This multidimensional nature of poverty is now the subject of a consensus. Then poverty can be define as a lack, a deficiency or deprivation of material elements, such as the inability to achieve a certain level of wellbeing that we can capture with monetary, physical, or material resources.

In this analysis, we define child poverty in the sense of the Basic Needs approach. The Basic Needs approach has been promoted by the International Labor Organization (ILO) in 1970s. This approach analyzes poverty in terms of satisfaction criteria of certain basic needs that are socially defined in each community. For example, these essential needs for a given child are adequate food, good health, able to read and write, adequate housing, good clothing, etc. Then, in the same view as Asselin and Dauphin (2000), we can say that, poor children are those who are deprived of basic commodities seen as prerequisite for the achievement of a certain quality of life[10].

Regarding poverty measurement, various approaches found in the economic literature on poverty, either in a one dimensional framework (Foster et al., 1984, 1988, 1990 and 2010) or

[10] Foko T. et al. (2006), page 5.

in a multidimensional framework (axiomatic and non-axiomatic approaches)[11] . Non-axiomatic approaches can be divided into two categories. A first approach where the methodology consists in using an aggregate indicator in each dimension studied to construct a poverty measure such as the Human Development Index (HDI) or the Human Poverty Index (HPI) of the United Nations Development Program (UNDP, 1997). This approach uses several one dimensional wellbeing index to build up an aggregate poverty measure across the entire population. The second category of non-axiomatic approach is where indicators related to each dimension are directly aggregated at the level of primary units. These approaches are based on the construction of a multidimensional index. They are commonly used for measuring multidimensional poverty. In others words, it is to build a Wellbeing Composite Index (WCI) also often called a Micro-multidimensional Wellbeing Index.

Let us recall that, multidimensional approach of poverty has raised considerable challenges in the measurement of its dimensions and on the best way to render them indicators that would be easily usable by policymakers. Condensing multiple dimensions into a single index offers the advantage of summarizing the complexity of the problem in a simple way. However, the pertinence of a single composite index is still a debatable issue. According to Ravallion (2011), one of the main criticisms towards this kind of multidimensional measure is related to the way to assign relative weights to each dimension, which indicates the trade-offs between the dimensions of well-being. Hoang Dat et al. (2016) argue that, although multidimensional approach to study child poverty has received growing attention, weights of different dimensions in constructing single aggregation indices have not been properly investigated. Using young lives data, their study attempts to fill this gap by examining a weight estimation method which takes into account the children's perspectives. This approach consists of computing analytical weights from estimated parameters of a subjective well-being regression model, where children's subjective well-being is explained by their achievement in dimensions included in multidimensional poverty indices. By doing so, weights reflect value judgments of children on what is a good life and are not based on a normative approach. More generally, weights are often defined on children's perspectives reflecting particular value judgments on what is a "good life", although it is very likely that individuals in a society disagree on the most appropriate weights assigned to various dimensions of their well-being.

There are several approaches of constructing a WCI, like the scoring method and the non linear Principal Component Analysis (PCA). Commonly used approaches are, the information theory, the fuzzy set approach and the inertia approach[12]. In this paper, we focus especially on

[11]See Koloma Y.(2008) and Feubi . P. (2010).
[12] See Feubi Pamen et al. (2010).

this last method. In fact, the inertia approach has its foundations in static mechanics[13]. It is based on data analysis techniques [Benzecri et al. (1970), Bertier P. et al. (1975), Caillez and Pages J. (1976), Volle (1978)]. The objective of data analysis is to extract the information in a more simplified and orderly form, to summarize the information using new independent variables called latent variables, to bring out proximity between variables and between individuals. The main methods of the inertia approach are the Principal Component Analysis (PCA), the Multiple Component Analysis (MCA), the Factorial Component Analysis (FCA) and the Generalized Canonical Analysis (GCA).

Our MCA-based Child Wellbeing Status Index (CWSI) from a non-monetary view is then computed so as to allow transformation of qualitative into quantitative variables and to avoid arbitrariness in choosing child wellbeing indicators. In the same line as Lebart L. et al., (1994, 2006)[14], let us consider

I = Set of children i on whom living conditions information's are available. $Card\ I = n$. This is the total number of children.

Q= Set of children's questionnaires. We assume that when a child is considered to have answered to a question or to have made choice regarding living conditions, in fact it is the household-head who provides the information/makes the choice for him.

J_q = Set of all possible answers to question q..

$J = \cup \{J_q \,/\, q \in Q\}$ is the set of answers (response modalities) to all questions, $Card\ J = p$.

X= Table of responses with n rows and p columns; $x_{ij} = 1$ or $x_{ij} = 0$ according to the modality chosen by child i for the given question . Such a table is called a complete disjunctive table. It is the juxtaposition of Q sub-tables :$X = [X_1, X_2, \ldots . X_q \ldots . X_Q]$.

The MCA is the analysis of the table X or the one of the table $B = X'X$ called a Burt contingency table, with the general term: $b_{jj'} = \sum_{i=1}^{n} x_{ij} x_{ij'}$. There is an equivalence between the two analysis.

The margins in rows of the table X are constant and equal to the number of questions (Q): $x_i = \sum_{j=1}^{p} x_{ij} = Q$. The margins in columns correspond to the number of children who have choosen the modality j of the question q : $x_j = \sum_{j=1}^{p} x_{ij}$. For each sub-table X_q , the total number is : $x_q = \sum_{j \in q} x_{.j} = n$. The sum of margins gives the total number x (total effective) of the table X, that is: $x = \sum_{i=1}^{n} \sum_{j=1}^{p} x_{ij} = nQ$. We fit each child i with an identical mass/weight equals to $m_i = \frac{1}{n}$ and each modality j is weighted by its frequency $m_j = \frac{x_{.j}}{nQ}$

As far as the Khi-Deux ($\boldsymbol{\chi^2}$) distance is concerned, in the set $\mathbb{R}^n$ of real number, the distance between two modalities is expressed as $d^2(j, j') = \sum_{i \in I} n \left(\frac{x_{ij}}{x_{.j}} - \frac{x_{ij'}}{x_{.j'}} \right)^2$. In the set $\mathbb{R}^p$, the

[13] See André Picard (2006), « Mécanique des corps rigides : Statique ».
[14] Bibi S. (2002).

distance between two children $i\ and\ i'$ is given by: $d^2(i,i') = \frac{1}{Q}\sum_{j\in J}\frac{n}{x_{.j}}\left(x_{ij} - x_{i'j}\right)^2$. The distance between the modality j and the centre of gravity of the cloud g is: $d^2(j,g) = nd^2(j,g) = n\sum_{i=1}^{n}\left(\frac{x_{ij}}{x_{.j}} - \frac{1}{n}\right) = \frac{n}{x_{.j}} - 1$

As far as factorial axis, factor and inertia(variance) are concerned, we denote by D the matrix of order (j,j') with the same diagonal elements (number corresponding to each modality) like B, to find the factorial axis, we diagonalize the matrix: $V = \frac{1}{Q}X'XD^{-1}$.Then, in the set $\mathbb{R}^p$, the equation of the α^{th} factorial axis u_α is : $\frac{1}{Q}X'XD^{-1}u_\alpha = \lambda_\alpha u_\alpha$. The equation of the α^{th} factor φ_α can be written as: $\frac{1}{Q}D^{-1}X'X\varphi_\alpha = \lambda_\alpha\varphi_\alpha$. Similarly, the equation of the α^{th} factor ψ_α in the set $\mathbb{R}^n$ is: $\frac{1}{Q}XD^{-1}X'\psi_\alpha = \frac{1}{Q}XD^{-1}X' = \lambda_\alpha\psi_\alpha$. Between the two factors we have the following transition relations: $\varphi_\alpha = \lambda_\alpha^{-1/2}D^{-1}X'\psi_\alpha$ and $\psi_\alpha = \frac{1}{Q}\lambda_\alpha^{-1/2}X\varphi_\alpha$. The factorial coordinate of child i on the axis α is: $\psi_{\alpha i} = \lambda_\alpha^{-1/2}\sum_{j=1}^{p}\frac{x_{ij}}{x_{i.}}\varphi_{\alpha j} = \frac{1}{Q}\lambda_\alpha^{-1/2}\sum_{j\in p(i)}\varphi_{\alpha j}$

Where $p(i)$ is the set of modalities choosen by child i. The coordinate of the modality j on the axis α is $\varphi_{\alpha j} = \lambda_\alpha^{-1/2}\sum_{i=1}^{n}\frac{x_{ij}}{x_{.j}}\psi_{\alpha i} = \frac{1}{x_{.j}}\lambda_\alpha^{-1/2}\sum_{i\in I(j)}^{n}\psi_{\alpha i}$, where $I(j)$ is the set of children who choose the modality j.Then, the inertia $I_n(j)$ of the modality j is:$I_n(j) = m_j d^2(j,g) = \frac{1}{Q}\left(1 - \frac{x_{.j}}{n}\right)$. While the inertia of the question is: $I_n(q) = \sum_{j\in J_q} I_n(j) = \frac{1}{Q}\left(J_q - 1\right)$. We deduce that the total inertia is : $I_T = \sum_q I_n(q) = \sum_{j=1}^{p}\frac{x_{.j}}{nQ}d^2(j,g) = \frac{P}{Q} - 1$

The total inertia depends only on the number of variables and modalities, and not on the relations between two given variables for example. Concerning the functional form of our CWSI, let's consider Q primary indicators that reflect living conditions of a given child such as health dimensions, sanitation facilities or access to safe drinking water (see table 1). Our objective is to aggregate these indicators into a single composite index that has the property of being a good summary of the information provided by the initial indicators, as far as child wellbeing is concerned. The basic idea is then to summarize the information provided by these qualitative indicators into a single index denoted $CWSI_i$. Assuming the above-mentioned notations and considering that J_q is the number of modalities of the indicator q; W_j^q is the weight given to the modality $j, j \in J_q$ and determined in a non arbitrary way through the MCA; x_j^q is a variable that takes the value 1 when the child i choose the modality j and it takes the value 0 $(zero)$ in the contrary. Finally the CWSI for a child i is $CWSI_i = \frac{\sum_{q=1}^{Q}\sum_{j\in J_q}W_j^q x_j^q}{Q}$

Table 1: Dimensions and indicator of child wellbeing

Dimensions	Living conditions and households characteristics	Childhood health (Health status-Health determinants-Health system)	Development and education of the child
Primary indicators	-Access to food, safe drinking water -Sources of drinking water -Distance to fetch water- sanitation facilities- Dwelling/Shelter- Basic social service, Environment and Equipment of house -Distance to social basic infrastructures.…	-Vaccination of the EPI-Vitamins-Child mortality-Sleeping under a mosquito net-Child mortality-Malnutrition.	Child enrolment-Preschool education program-Toys.…

Source: Authors from MICS data.

For the child i, this index is simply an average of the weight of the binary variable x_j^q . The weight W_j^q given to each component of the index $CWSI_i$ is the normalized score (score[15]/ $\lambda_1^{1/2}$) of the modality x_j obtained after implementation of a MCA. We use the MCA to determine the weight W_j^q as suggested by Asselin (2002) for data as MICS including binary variables representing different modalities or primary indicators reflecting children demographic, health and living conditions.

The CSWI is finally obtained through successive MCA on the set of relevant children wellbeing variables, mainly on the basis of the First Factorial Axis Ordinal Consistency (FAOC)[16]. This property consists, for a partial indicator, to see its ordinal structure of wellbeing followed by the ordinal structure of coordonates of its modalities on the first factorial axis. This criterion clearly describes a situation of wellbeing. Variables having the FAOC property obey the rule that the welfare decrease from a situation of wealth to a situation of severe deprivation along the first factorial axis. If some variables are then rejected because of the FAOC criterion, they can be reconsidered by new combinations of modalities. Another MCA is then performed in order to improve on the explanatory power of the first factorial axis, and so on and forth until obtaining final variables really describing child wellbeing status.

We also compute a non-monetary poverty line so as to appreciate the link between determinants of child wellbeing status and social protection in Cameroon. We use a non-arbitrary method of determining this threshold consisting in children's classification into two groups according to the inertia criterion. Let us denote by a partition of the set I of children

[15] A score is the factorial coordinates on the first axis.

[16]There are others criteria such as, measures of discrimination, spreading on the first factorial axis, the high frequency of non-response and very low frequency of certain modalities.

into q classes ($q = 2$), Q is finite set of non empty parts q of I with an empty intersection and whose union is I. It is written as

$$\forall\, q \in Q: q \subset q, q' \subset Q: q \cap q' = \emptyset \iff q \neq q'; I = \cup \{q \,/\, q \in Q\}$$

g_q is the centre of gravity of the class q. The inertia of the class q with respect to its own center of gravity g_q is: $I_n(q) = \sum_{x_i \in q} m_q d^2(x_{i,} g_q)$ and this quantity is called « within – class inertia». Assuming that g_q are provided with weight m_q, we can define the inertia of g_q with respect to the centre of gravity g of the cloud $N(I)$: $I_n(g_q) = \sum_q m_q d^2(g_q, g)$ is called « between class inertia ». We then assume that: $I_n(g) = I_n(q) + I_n(g_q)$

The overall quality of a partition is related to the homogeneity within classes. $I_n(g)$ being a constant quantity, it is therefore to minimize the quantity relating to the within class inertia or to even maximize the quantity related to the between classes inertia. The non-monetary poverty threshold is then $CWSI\ threshold = max C_i^P m_i^P + min C_i^R m_i^R$

In this relationship, maxC_i^P is the maximum value of the CWSI in the firs class with the corresponding weight m_i^P, minC_i^R is the minimum value of the CWSI in the second class, m_i^Pi, and the corresponding weight is m_i^R.

4.2 COMPARISON THROUGH TIME

As far as comparing evolution of child wellbeing status between 2006 and 2011, we use the stochastic dominance approach introduced by Hadar J. and Russell W. R. (1969 and 1971) in the context of behavior under uncertainty, and as suggested by Atkinson (1987). With this method, we can rank unambiguously two child poverty distribution on a very large range of variation of poverty line. Let us then consider two distributions $MICS3$ and $MICS4$ of welfare level which the cumulative functions are respectively F^{MICS3} and F^{MICS4}. We assume them to be continuous over a given interval, for example $[0 \ldots \ldots \ldots x]$. Let' s set $D^1(x) = F(x)$ and $D^s(x) = \int_0^x D^{(s-1)}(y)dy$ for all $s \geq 2$, with $s \in \mathbb{N}$

Distribution $MICS4$ stochastically dominates the distribution $MICS3$ at the s^{th} order if and only if $D^s_{MICS3}(x) \geq D^s_{MICS4}(x)$ for all low welfare threshold of the interval concerned. To demonstrate the dominance conditions, we make repetitive use of the integration by parts of the above functions. This process involves the use of stochastic dominance curves $D^s(x)$ for orders of dominance $s = 1, 2, 3, \ldots \ldots$ $D^1(x)$ is simply the cumulative distribution function, $F(x)$, namely, the proportion of children underneath the poverty line x. It is draw with the low income rate on the vertical axis the low welfare threshold on the horizontal axis, that allows the low welfare threshold to vary from zero (0) to an arbitrarily selected maximal value (threshold) of welfare. The higher order curves are iteratively defined as above, that is

$$D^s(x) = \int_0^x D^{(s-1)}(y)dy$$

Thus $D^2(x)$ is simply the area underneath the cumulative distribution function curve for a range of incomes between 0 and x. The graph of $D^2(x)$ is usually considered as the deficit curve of welfare with respect to the low welfare threshold and the graph of $D^3(x)$ is the gravity curve of the low welfare. Define like that, $[D^s(x)]$ dominance curves may seem complicated to calculate. There is a very useful link between the dominance curves and the well-known FGT indices, that greatly facilitates the computation of $D^s(x)$. Since the two density curves can be very closed each other, it is necessary to determine if their difference is statistically significant. Different hypothesis that could be used in a test procedure of stochastic dominance are proposed in the literature[17]. For example, if we use a null hypothesis of non dominance of $MICS4$ over $MICS3$, $H_0: D^s_{MICS4}(x) - D^s_{MICS3}(x) \geq 0$ for all "x" in a given intervall. If the null hypothesis is rejected, we can legitimately infer the dominance of $MICS4$ on $MICS3$. We can show that such a hypothesis is asymptotically bounded by the nominal level of a test founded on the standard normal distribution. The test is based on the approach of the "t" minimum statistic proposed by Kaur, Prakasa-Rao and Singh (1994) for the null hypothesis against the alternative hypothesis of dominance. These authors calculate the statistical "t" for each observed value of "x" in the sample considered and reject the null hypothesis of non dominance and accept the alternative hypothesis of dominance if the value of "t" is significant at 5%. This method is often interpreted as an « union –intersection » test, because the dominance of $MICS4$ over $MICS3$ can only occurs if the statistical "t" for the difference in any orderd couple is significant[18]. In fact, it often happens that two distributions of welfare overlap in the range of interest. If necessary, we observe two closed intervals and obtain two statistical "t" minimum of opposite sign. If the statistical "t" minimum are both significant at a significance level, we conclude that $MICS4$ dominates $MICS3$ on a range of income distribution $\left[Z^{MICS4}_{min} \ldots\ldots\ldots\ldots Z^{MICS4}_{max}\right]$, as well as the dominance of $MICS3$ on $MICS4$ between $\left[Z^{MICS3}_{min} \ldots\ldots Z^{MICS3}_{max}\right]$.

4.3 DATA OF THE STUDY

The data used in this study are drawn from the 3rd Multiple Indicators Cluster Survey (MICS) and the 4th MICS coupled with the Demographic and Health Survey (DHS), conducted respectively in 2006 and 2011. These surveys are being conducted in Cameroon since 2000s.

[17] See Davidson and Duclos (2000, 2006).

[18] Il s'agit du contraire d'un test d'union-intersection (Bishop, Smith, et Formby, 1991, par exemple), où la dominance de B sur A peut être déclarée s'il existe au moins une valeur de x telle que $D_A(x) - D_B(x)$ est rejetée.

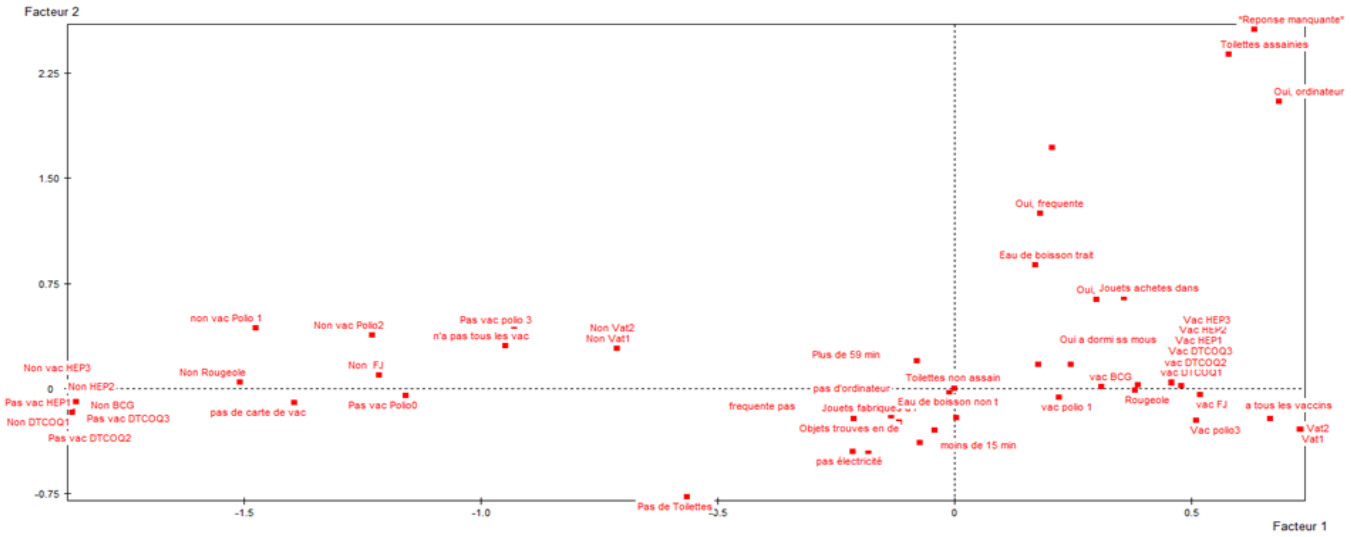
It is a nationally representative survey and covers the urban and rural areas of 12 regions[19]. MICS data include 6,362 (May to June 2006) and 42,312 (January to August 2011) children aged between 0 and 60 months and who were alive at the time of the interview and for whom we had complete information. The sampling frames of both MICS3 and MICS4 are based on the 1987 General Census of Population and Housing (GCPH) augmented to correct for its age in 2005. Surveys are carried out by the National Institute of Statistics (NIS) in collaboration with the National Committee for Fighting against Aids (NCFA), the Central Bureau of Census and Population Studies (BUCREP), Centre Pasteur du Cameroon (CPC), ORC Macro (Calverton Maryland, U.S.A), , UNICEF, USAID, UNFPA and the World Bank. These surveys are similar in a number of aspects (objective, strata, the partitioning of the various regions, and the sampling techniques used)

SECTION 5. RESULTS AND DISCUSSION

In this section we highlight the main findings in terms of MCA and stochastic analysis. Regarding the MCA, in 2006 (figures 1 and 2), poor children have poor health conditions especially with no vaccine, they are not enroll in school and have inappropriate method of waste disposal, either public shared latrine, open pit latrines or open bucket latrines. In houses where they live, the floor is dirt, sand or dung and there is even no electricity.

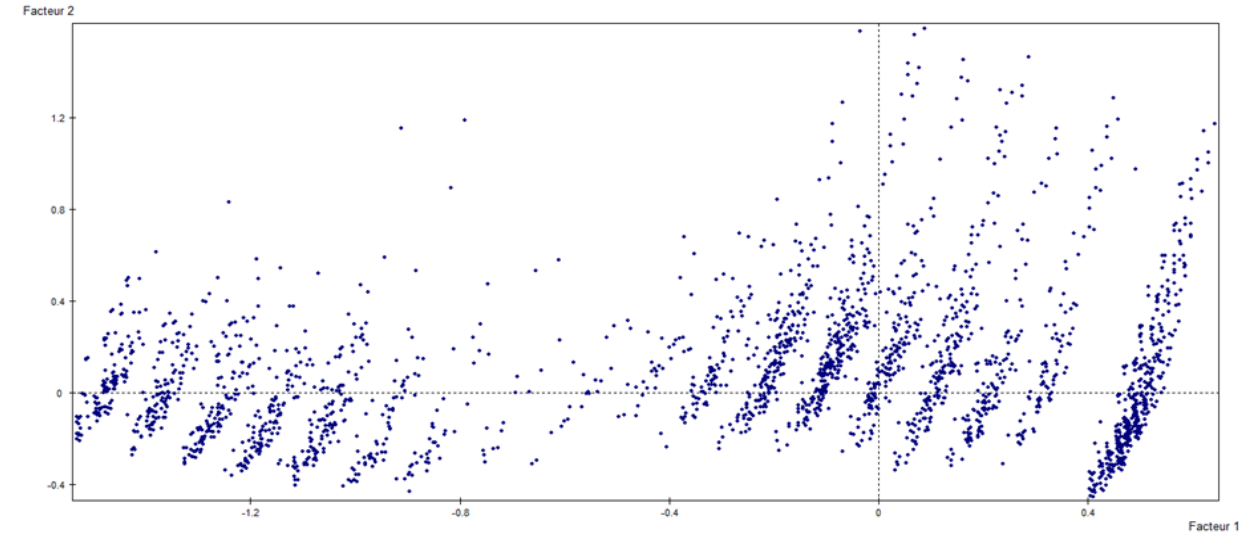
Figure 1: The final cluster of child wellbeing determinants in 2006

[19] Cameroon has 10 administrative regions, but for the survey purpose the 2 main cities (Yaounde and Douala) are taken each like a region.



Source: Authors

<u>Figure 2</u>: The final cluster of children population in 2006



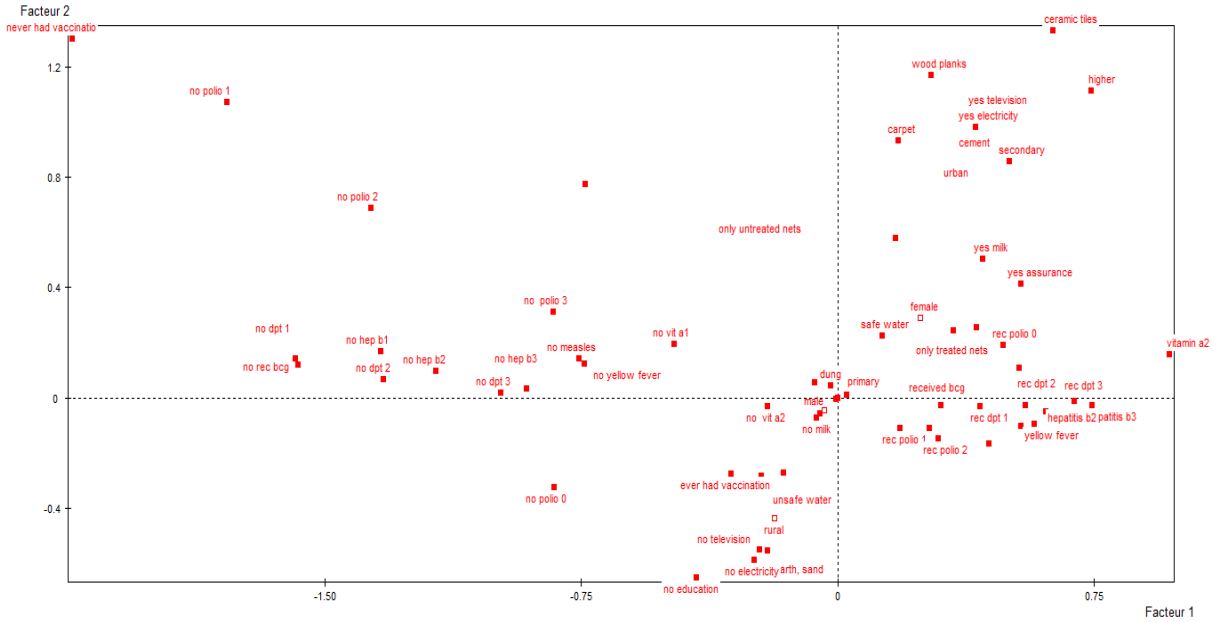
Source: Authors

In 2011, the successive MCA implemented on 42,3127 children characterized by 14 variables and 81 modality leads to an upward of the explanatory of the first factorial axis up to 12.43% and for the second factorial axis it is 5.5% and less than 5% for all other axes. This wide gap between the percentage of inertia of the first axis and the second tells us already about the layout of the cluster of children in Cameroon. It is unidirectional and therefore the first factorial axis sums up the children's living conditions. In addition, let's mention that, lower values of CWSI are equivalent to better living conditions of Cameroonian children in 2011.

Figures 3 and 4 show that variables explaining child poverty are on the left and those describing non poverty are on the right. That is living in accommodation with more than five persons per room and with mud flooring (shelter deprivation), being unable to read or write,

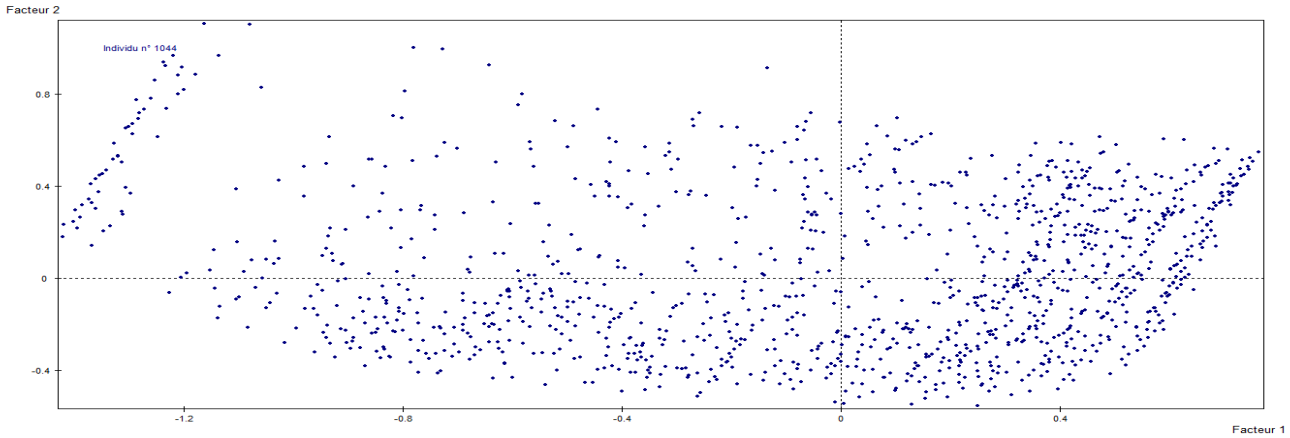
not enroll in school.The most important characteristics of those poor children is that they are experiencing poor health condition with no vaccination ,namely those usually required through the Expanded Immunization Program (EPI)

Figure 3: The cluster of child wellbeing variable in 2011



Source: Authors

Figure 4: The cluster of children population in 2011



Source: Authors

To make a comparison of the child wellbeing between 2006 and 2011, we determine a poverty threshold from a classification. The bar histogram shows an important gap between the first and the second bar; and also between the second and the third bar. This result leads us to believe that a partition of the sample into three classes will provide more relevant information. We first tested a partition in two classes, the result was not satisfactory. The

partition of the sample in three classes permitted us to define an extreme multidimensional poverty line and a poverty line.

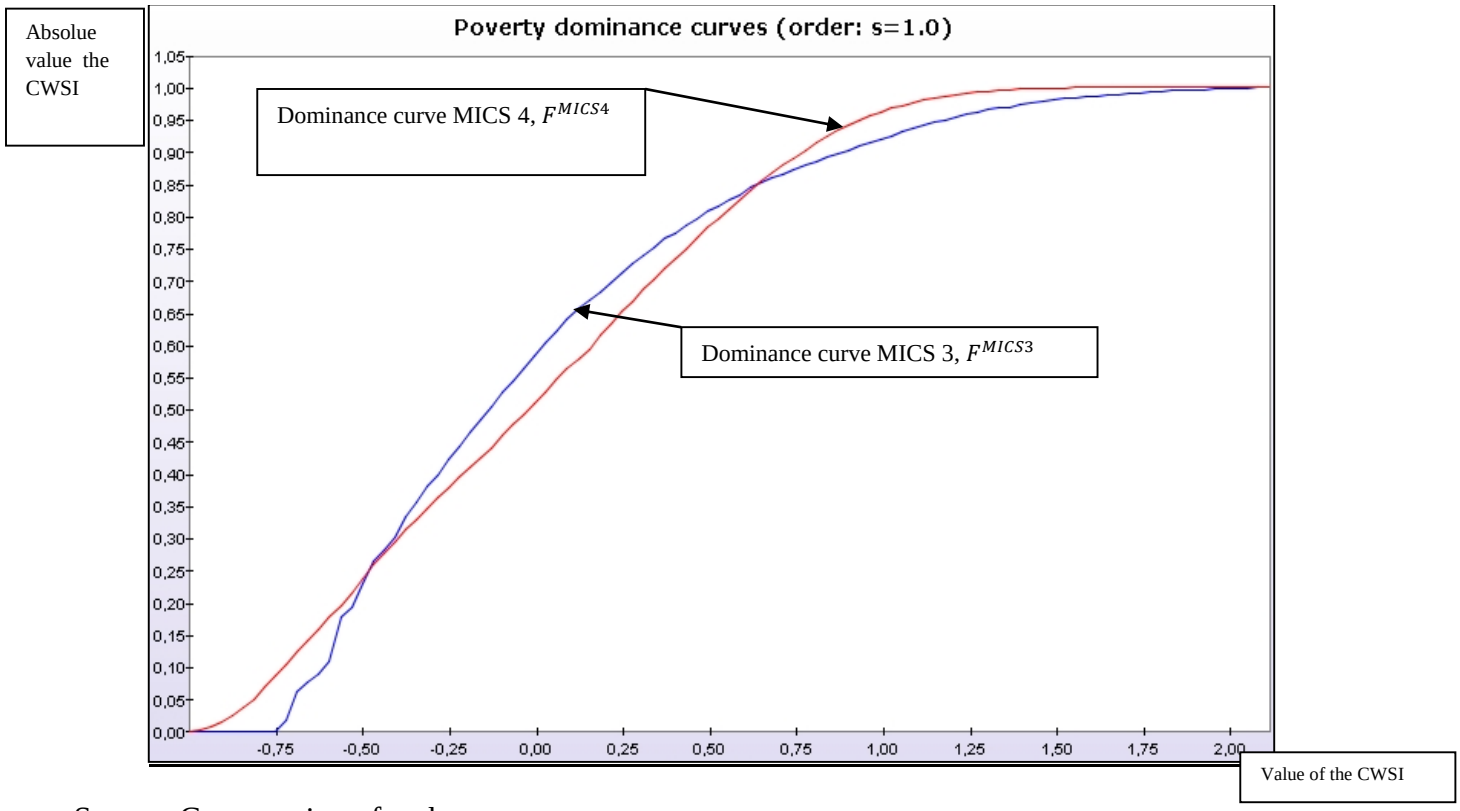
The first class (classe1/3) that can be qualified as extreme poverty consists of children with poor living condition (those children don't even have a vaccination report card, not enroll in any school program, they have no toy , their household have no toilet, no electricity , no computer, and children does not sleep under a mosquitoes net, household members take more than 1 hour to get water and they don't drink potable). This group of children represents 19.71% of the sample that is a child out of four.

We can qualify the second class as a class of poverty. It is made of children who received some vaccine but not polio vaccine, yellow fever and vitamin A. Their toys are from some used raw materials. They live in poor households but benefiting of some basics needs concerning health, also the conditions of a good development are somewhat taken into account. A child out of two is concerned by this form of poverty (48.0%).

The last class, the one of the non poor children, consists of children living households where all conditions are gathered for a good development and a good health. They are up to 51.71 percent.

As far as stochastic analysis is concerned, our analysis of the trends of child poverty from 2006 to 2011 shows that, early poor children in 2006 became more deprived in 2011. Certainly due to low economic performances of Cameroon between the two date that make the government unable to provide more facilities to households in term of increasing its social investments. In fact many children remain out of social net protection and their proportion is increasing.

Figure 5: Stochastic dominance curves of child poverty between 2006 and 2011



Source: Computation of authors

Finally, it should be noted that, health conditions, housing characteristics and sanitation are considerable dimension of child wellbeing in Cameroon. In fact those children are remaining out of social protections nets. We hope that such results could help to draw policy makers' attention to this vulnerable population and that it may be as a criterion an optimal allocation of public funds with regards to social investments within the context of the post-2015 development agenda.

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