Multidimensional Spatial Poverty Comparisons in Cameroon

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Abstract

The study investigates poverty comparisons across the various strata and urban/rural areas in Cameroon. A composite poverty indicator is constructed using multiple correspondence analysis by taking into account 33 non-monetary indicators that have been identified as describing a real poverty situation. The composite poverty indicator is combined with per capita consumption to estimate poverty measures showing that income poverty affects 39.6% of households, whereas 80.6% of households are poor in the non-monetary dimension. The incidence of multidimensional poverty is estimated to be at 81.3%. Decomposition of the Chakravarty indexes fails to establish robust regional poverty orderings and comparisons. By resorting to the stochastic dominance approach we find that bi-dimensional poverty for urban areas is robustly lower than that for rural areas. Between regions, there is clear evidence that bi-dimensional poverty in Yaounde/Douala is less than other regions and that the Rural Savannah is the poorest region of the country for a wide range of poverty lines and a broad class of poverty measures. The discriminatory measures of variables reveal that water, sanitation, housing materials, level of education and roads are the major indicators of non-monetary poverty in Cameroon. Policy should therefore, in addition to promoting income-generating activities, focus on these variables and target the rural areas as well as the northern regions to better alleviate poverty in Cameroon.

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1. Introduction

Although most poverty analysts still limit their attention to income poverty, the multidimensionality of poverty is widely recognized in the literature. Income is limited as an indicator of wellbeing because it does not capture public goods, non-market goods and the problems of distorted or imperfect markets. For this reason, Sen (1976, 1985, 1992) and Bourguignon and Chakravarty (2002) have concluded that income as the sole indicator of wellbeing is inappropriate and should be supplemented by other variables, for example, housing, literacy, provision of public goods and so on.

Even when studies use more than one indicator of wellbeing, poverty comparisons are either made independently for each indicator or made using an arbitrarily defined aggregation of the multiple indicators into a composite index. In either case, aggregation across multiple welfare indicators and across the welfare statuses of households requires aggregation rules that are arbitrary in one way or the other. Multidimensional poverty comparisons also require the estimation of multidimensional poverty lines, a procedure that is problematic even in a one-dimensional setting.

This study finds its interest and credit in conceiving poverty from a multidimensional perspective. The purpose of the study is twofold: to address the issue of assigning arbitrary weights to poverty variables in the measurement of multidimensional poverty and to conduct multidimensional poverty comparisons to the particular question of spatial poverty in Cameroon. The poverty comparisons use the dominance approach initially developed by Atkinson (1987) and Foster and Shorrocks (1988) in a unidimensional context and subsequently elaborated by Duclos et al. (2006a/b/c/d). By using stochastic dominance methods we endeavour to make poverty comparisons that are robust to a wide range of poverty lines and also valid for a broad class of poverty measures. In the multidimensional context, this includes robustness over the manner in which multiple indicators interact to generate overall household wellbeing. The main objective of the study is to measure and conduct multidimensional poverty comparisons in Cameroon. Specifically, the study aims to:

- Identify the different non-monetary poverty indicators.
- Measure multidimensional poverty.
- Conduct spatial poverty comparisons (across rural/urban areas and regions).
- Check the consistency of such poverty comparisons and orderings.
- Propose policy recommendations.

2. Theoretical Framework

The theoretical foundations on poverty dominance presented in this subsection are developed in Duclos and Makdissi (2000), and Younger (2003). In addition, we draw extensively from the work of Duclos et al. (2003, 2006a/b/c/d).

Univariate poverty dominance methods

Although the objective is to make multidimensional poverty comparisons, it is easier to grasp the concept of poverty dominance when poverty is measured in one dimension. Consider the case where we intend to investigate whether poverty is lower for A than for B. The traditional method to answer this question is to establish a poverty line, choose a poverty index (e.g., the Foster-Greer-Thorbeck – FGT – index), calculate poverty at these two points and compare. The basic drawback of this method is that it depends on the poverty line/measure that is chosen. Setting the poverty line is an arbitrary process, and it is possible that choosing a different poverty line/measure will reverse the poverty rankings (Garcia, 2003).The dominance approach to poverty analysis aims to avoid these problems by making poverty comparisons that are robust to the poverty line/measure selected.

Suppose that we have two distributions with cumulative density functions (CDFs), F(x) and G(x), respectively. These particular CDFs are also called poverty incidence curves because each point on the curve gives the proportion of the population below the poverty line. Then, F(x) first-order stochastically dominates G(x) if G(x)•eF(x). In other words, G(x) is everywhere above distribution F(x) as displayed in Figure 1.

In this case, the headcount poverty index (P_0) will always be higher for the first distribution than the second. Foster and Shorrocks (1988) and Duclos et al. (2006c) have shown that this sort of poverty comparison is robust to the choice of the poverty line for all poverty measures that respect two conditions: that of being non-decreasing and anonymous. By non-decreasing, we mean that if one person's income increases, then the poverty measure cannot increase as well. By anonymous, we mean that it does not matter which person occupies which position or rank in the income distribution. We may call this class of poverty measures$_1$.

If the CDFs intersect as shown in Figure 2, however, then the ranking is ambiguous. Observe in Figure 2 that if the poverty line is set at z_b, then G(x) will lie above F(x). If it is set at z_a, however, F(x) will lie above G(x). We cannot therefore unambiguously state that one distribution exhibits poverty dominance, as their rankings depend on where the poverty line is drawn.

Figure 1: First order poverty dominance

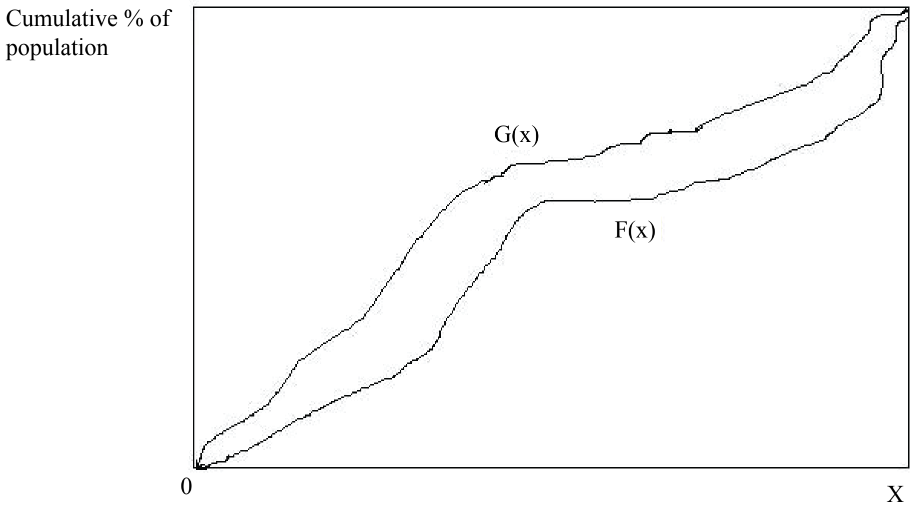
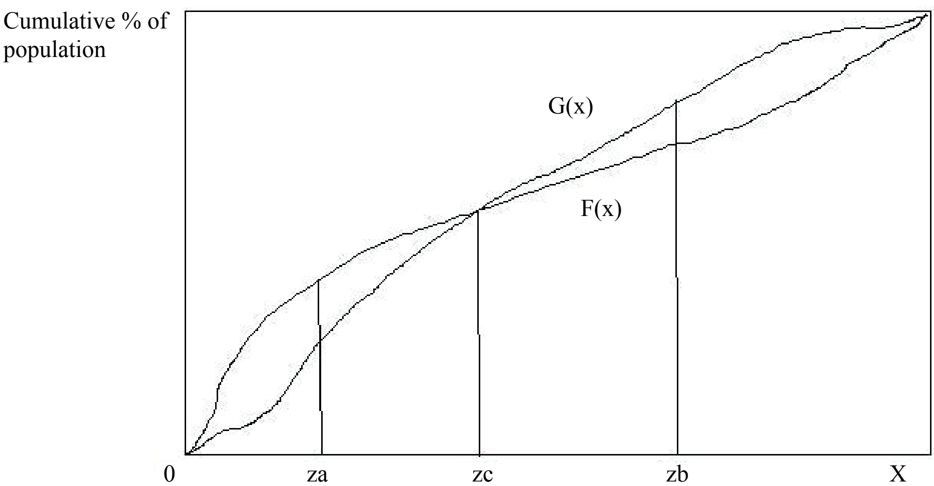


Figure 2: Crossing of cumulative density functions



There are two ways to deal with this problem. First, we could restrict the range of the poverty line over which we seek dominance, that is, look for dominance in an interval up to the point where the CDFs cross. Second, we could impose restrictions on the range of applicable poverty measures. This will enable us make poverty comparisons for a smaller class of poverty measures. To restrict the class of poverty measures we add the condition that the poverty measure must respect the Pigou-Dalton transfer principle[1] (see Duclos, 2006a; Bourguignon and Chakravarty, 2003). Once this condition is added, we can compare the areas under the CDFs. This leads us to a second type of dominance known as second-order stochastic dominance. We say that F(x) second-order stochastically dominates G(x) for all poverty lines if the area under F(x) is less than the area under G(x) for all poverty measures that respect the poverty axioms of additivity, non-decreasing, anonymity and Pigou–Dalton transfer. We may call this associated class of poverty measures$_2$. Note that the second-order dominance is checked not by comparing the CDFs themselves, but by comparing the integrals below them. Upon integrating the CDFs we obtain poverty depth (deficit) curves that we can compare to see if one is everywhere above the other.

If the poverty deficit curves also cross, then we proceed to a more restricted set of poverty measures. The restriction here is imposed by the inclusion of one additional poverty axiom; the principle of transfer sensitivity.[2] The assumption of transfer sensitivity leads us to third-order poverty dominance. To make dominance comparisons for this class of poverty measures, denoted as $_3$, we compare the areas under the poverty deficit curves by integrating the CDFs again (equivalent to integrating the poverty deficit curves) and checking to see if the resulting poverty severity curves exhibit dominance, that is, if one is entirely below the other. If so, then we have third-order poverty dominance. It is possible to continue integrating the curves in this manner until one dominates the other.

Bi-dimensional poverty dominance methods

In addition to the stochastic dominance conditions, which we have discussed in the univariate case above two new concepts come up in the multivariate context: union versus intersection and substitutes versus complements. These are discussed in turn, along with the case of bi-dimensional dominance.

Union versus intersection

First, we need to distinguish between union and intersection definitions of poverty. These definitions identify those over which we wish to aggregate individual poverty statuses to obtain aggregate poverty indexes. The union definition considers that persons are in poverty if they are poor in either of the two dimensions. The intersection definition, on the other hand, considers them to be in poverty only if they are poor in both of the two dimensions.

Substitutes versus complements

In the measurement of multidimensional poverty, problems arise relating to the multiple and often complex interactions among the set of attributes. Thorbecke (2005) gives an extensive overview of these issues. Variables can be substitutes or complements. If dimensions are substitutes it means that an individual can trade off one attribute for another and remain on the same iso-utility space. This implies that the marginal utility of one attribute decreases as the quantity of the other increases. This is, for instance, the case of private and public healthcare when both are providing similar services: the marginal value of having access to good private doctors decreases as the amount of good public healthcare increases. On the other hand, if attributes are complements, an increase in the amount of one raises the marginal utility of the other. Thorbecke (2005) gives a good example of complementarity between attributes, in the case where more education increases the present discounted value of the future income stream.

The correlation among poverty attributes introduces a concept which Bourguignon and Chakravarty (2003: 31) refer to as "non-decreasing poverty under correlation increasing switch". A correlation increasing switch or rearrangement is the case when attributes are exchanged between persons and the transformation is such that the person who has more of one attribute has more of others when the transfer is made. In this case, some persons can even cross the poverty line and reduce the number of the poor; meanwhile the gap among some poor persons may become wider.

To illustrate the property, consider a two-person two-attribute case. Suppose that $x_{11} > x_{21}$ and $x_{12} < x_{22}$. Now consider a switch of attribute 2 between the two persons. This switch increases the correlation between the attributes because person 1 who had more of attribute 1 now has more of attribute 2 as well. Now, suppose that attributes 1 and 2 are substitutes, or, in other words, that one attribute may compensate for the lack of another. Then, increasing the correlation between the two attributes would not decrease poverty. Indeed, the switch does not modify the marginal distribution of each attribute but reduces the extent to which the lack of one attribute may be compensated for by the availability of the other. An analogous argument will establish that poverty should not increase under a correlation increasing switch if the two attributes are complements.

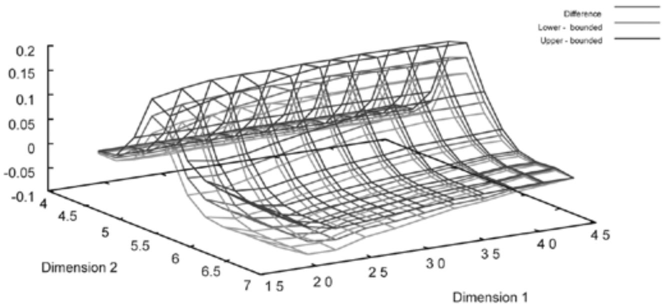
Bi-dimensional dominance

If we have two measures of wellbeing rather than one, then we have a three-dimensional graph, with one measure of wellbeing on the x-axis, a second on the y-axis and their joint cumulative density function on the z-axis. As depicted in Figure 3, The CDF is now a surface rather than a line and we can compare one surface to another.[3]

If one such surface is everywhere below another, then poverty in the first distribution (sample) is lower than poverty in the second for a broad class of poverty measures. That class, which we denote as $_{1,1}$ to indicate that it is first-order in both dimensions of wellbeing, respects the same poverty axioms as in the univariate case of non-decreasing in each dimension and anonymous – and one more: that the two poverty indicators be substitutes in the poverty measure. This means that an increase of wellbeing in one dimension should have a greater effect on poverty, the lower the level of wellbeing in the other dimension. For example, if government is able to improve healthcare, then overall poverty should reduce the most if the people are very poor in the income dimension.

Practically, it is difficult to plot a three-dimensional graph to generate the dominance surfaces, and see the differences among them, but we can plot the differences directly. If this difference is always positive or always negative, then we know that one or the other of the distributions has lower poverty for all poverty lines and for a large class of poverty measures, $_{1,1}$. If the surfaces cross, we then proceed to higher-orders of dominance just as we did in the univariate case. This can be done in one or both dimensions of well-being and the restrictions on the applicable class of poverty measures are similar to the univariate case.

Figure 3: Cumulative density surfaces



Empirical review

Studies on poverty in Cameroon seem to have been initiated by international organizations. UNDP (1998) used a composite index to study the poverty profile in Cameroon. The resulting Human Poverty Index showed that 38.1% of the Cameroon population is poor. The report equally showed that poverty is not only a rural phenomenon, but is increasingly becoming an urban issue.

Individual authors have also carried out poverty studies in Cameroon, among them Abessolo (2001) and Njinkeu et al. (1997). Njinkeu et al. (1997) attempted to link labour markets to poverty through a nationwide survey covering formal/informal and regional categories. Abessolo (2001) analyses poverty in relation to the structure of the labour market by focusing only on the case of Yaoundé. Lynch (1991) analyses poverty in Cameroon with the objective of examining the socioeconomic characteristics of the population by income class and regions and estimating demand parameters for policy analysis. Among other things, her study estimates household welfare, develops a poverty profile and presents some measures of inequality that are used to depict the nature of income distribution. Amin (2001) shows that Cameroon's poverty is mainly a rural phenomenon and attempts to bring out the rural-urban linkages based on the 1996 Cameroon Household Survey (ECAM I) data. This study, however, is based only on the consumption patterns of the households.

Other recent studies of poverty in Cameroon include: Amin and Dubois (1999); Kamgnia and Timnou (2001); Fambon et al. (2004); and Fambon and Baye (2002). These studies use the 1983/84 and the 1996 household survey data and are unanimous on the fact that the bulk of the poor are in the rural areas. The poverty indicators established in these studies have been limited to the FGT poverty indexes. The National Institute of Statistics (2002), and Fambon and Baye (2002) have produced results on the regional distribution of poverty levels in the country. These studies are univariate analyses irrespective of the fact that many writers (Atkinson and Bourguignon, 1982; Maasoumi, 1986; Lachaud, 1999) have insisted on the necessity of defining poverty as a multidimensional concept rather than relying on a single variable such as income/consumption expenditure per capita.

In building poverty profiles for Cameroon reasonable attempts have been made to establish the poverty line, as in Kamgnia and Timnou (2002), Fambon and Baye (2002), and Baye (2004). Results from such poverty studies are frequently sensitive to the choice of the poverty line and poverty measure. Since these choices are typically at the discretion of the analysts, it could be suggested that the results obtained are not robust. Different results could be obtained by the choice of a different poverty line/measure. Few firm conclusions can be drawn if poverty trends differ substantially when different poverty measures are applied or the position of the poverty line is changed.

From a multidimensional perspective, few poverty studies have been carried in Cameroon. Tachi (2003) identifies the indicators with regard to four non-monetary aspects of poverty and distributes households according to indicator modalities. He concludes that 5.21% of Cameroonian households witness all forms of poverty, whereas 57.34% experience at least one of the forms. Ningaye and Ndjanyou (2006) use factor analysis to identify up to six facets of poverty in addition to monetary poverty and construct a composite poverty indicator for each household.

Even though multidimensional poverty studies are just beginning in the country, much research in this direction has been carried out elsewhere. Razafindrakoto (2001) applies factor analysis on indicators gathered in Madagascar and concludes that poverty in this context has six dimensions: monetary poverty, existence poverty, human poverty, social exclusion poverty, financial poverty and subjective poverty. Ki et al. (2005) use a multiple correspondence analysis to construct a composite poverty indicator in Senegal and find that three forms of non-monetary poverty exist in that country: vulnerability to shocks, poverty in infrastructure and poverty in comfort. Silber (2007) dwells on the surveys of multidimensional poverty measurement and has greatly contributed to the literature.

Duclos et al. (2006a/b/c) have developed the dominance tools to multidimensional poverty measurement and comparisons. The dominance approach is used by Bibi (2003) to compare poverty between Egypt and Tunisia on two dimensions: household expenditures per capita as a proxy for income deprivation and the number of rooms per capita as a proxy for housing deprivation.

3. Research methodologies and data

In the context of this study, we construct a composite indicator from multiple categorical indicators. The main variables taken into account are: education, nutrition, health, sanitation, drinking water, housing, access to energy, and possession of durable consumer goods. We now need to resort to a technique that allows us to aggregate the indicators in order to have an overall view of multidimensional non-monetary poverty.

Construction of a composite poverty indicator

We use factor analysis for the construction of the composite poverty indicator (C_i). This multivariate statistical approach is attractive for two reasons. First, it cleans the data of inter-variable correlations and thereby reduces the numerous variables in the data set to a minimal optimal level without loss of information. This step is very important given that we have several variables with potential overlap. It is therefore necessary to check for inter-relations and interactions among the variables so as to avoid multiple counting. Second, factor analysis generates the weights attached to the attributes. The advantage of using factor analysis is that it allows the data themselves to determine the optimal weights associated with each attribute, rather than making assumptions. In a nutshell, factor analysis helps eliminate arbitrariness in the selection of variables and in the determination of the weights used for the computation of the composite indicator. The factor analysis technique most appropriate in this study is multiple correspondence analysis (MCA), since the study is based on data from the 2001 Cameroon Household Survey (ECAM II) that captured dichotomous and categorical (continuous and discrete) variables at the same time. MCA can be used to codify this information in binary form of 0/1.

The construction of the composite poverty indicator is aimed at defining a composite indicator for each household, using factor analysis techniques. Asselin (2002) defines the functional form of the composite poverty indicator as follows:

$$C_i = \frac{\sum_{k=1}^{K} \sum_{j_k=1}^{J_k} W_{j_k}^{k} I_{j_k}^{k}}{K} \qquad (1)$$

where

K = number of categorical indicators

J_k = number of categories or modalities for indicator k

$W_{j_k}^{k}$ = the weight (normalized first axis score, score/λ_1) of category j_k

λ_1 = the square root of eigenvalue on first factor axis

$I_{j_k}^{k}$ = the binary variable 0/1, which has the value 1 when household i has the category j_k.

The weights given by MCA correspond to the standardized scores on the first factor axis. When all the variable modalities have been transformed into binary indicators coded 0/1, giving a total of P binary indicators, the composite index for a given household i can be written as:

$$C_i = \frac{1}{K}(W_1 I_{i1} + W_2 I_{i2} + ... + W_p I_{ip})$$

where W_p = the weight (score of first standardized axis, (score/λ_1)) of category p, and $I_{p,}$ = binary indicator 0/1, which takes on the value 1 when the household has the modality, and 0 otherwise. The composite index value reflects the average global welfare level of a household.

The estimated *Ci* (proxy for non-monetary dimension of poverty) will be combined with per capita consumption (monetary dimension of poverty) in order to estimate poverty indexes and test for spatial bi-dimensional poverty dominance in Cameroon.

Chakravarty poverty indexes

Bourguignon and Chakravarty (2002) and Chakravarty et al. (1998) provide our roadmap for establishing multidimensional poverty indexes, which will then enable us to estimate the incidence of multidimensional poverty. In order to determine poverty, a poverty threshold *z* is set for each poverty dimension *j.* Person *i* is poor with respect to dimension *j* if $x_{ij} < z_j$, where x_{ij} is the quantity of attribute *j* possessed by person *i*. Aggregating the set of poor across dimensions may lead to double counting. Chakravarty et al. (1998) resolve this problem by defining the poverty variable ¡, where

$\rho(x_i, z) = 1$ if $\exists$ j $\in$ (1,2,…,m): $x_{ij} < z_j$ and ¡(x_i, z) = 0 otherwise.

Then the headcount of those who are poor in any dimension is H = Óρ(x_i, z).

The problem with the union headcount index is that if a person suffers multiple deprivations, and improves in one dimension but remains poor in another, the *H* will remain constant; the same will occur if a person who is poor in one dimension becomes impoverished in others.

Thus Chakravarty et al. (1998) redress these issues by elaborating the following multidimensional poverty measure of *k* dimensions:

$$P_\theta(X,z) = \frac{1}{n}\sum_{j=1}^{k}\sum_{i\in S_j}\alpha_j\left(1-\frac{x_j}{z_j}\right)^{\theta_j} \qquad (3)$$

where S_j is the set of households who are poor with respect to attribute *j,* and where è$_j$ ≥ *0*, á$_j$ *>0* and Óá$_j$=1.

This is a multidimensional extension of the FGT poverty measure, where è$_j$ captures the aversion to inequality in poverty and á$_j$ is the poverty weighting parameter, i.e., it is the weight given to dimension *j* in the overall poverty measure. This will enable us to estimate the incidence of multidimensional poverty in the country.

However, this model involves a large number of arbitrary assumptions. Not only will the parameters á and è of the index need to be fixed, but poverty thresholds in many dimensions need to be specified. We compute the index for a number of illustrative values for these parameters and thresholds to demonstrate how the choice of weights, the poverty aversion parameter, and the poverty thresholds affect the resultant index.

The Chakravarty et al. (1998) multidimensional poverty indexes are additive across subgroups and attributes. First, this shows that if the population is divided into regions or subgroups then overall poverty is the weighted average of the regional or subpopulation poverty levels.

In this case, the contribution of subgroup *i* to overall poverty is expressed as:

$$\mathrm{Con}_i = \left(\frac{ni}{n}\right) * \left(\frac{p(Xi,z)}{P(X,z)}\right) \qquad (4)$$

where n_i is number of households in subgroup *i*, $p(X_i,z)$ is the poverty index of subgroup *i*, and $P(X,z)$ is the overall poverty index.

Second, it is additive across variables. This shows the contribution of each attribute to overall poverty. Global poverty is a weighted mean of the poverty levels of the indicators or attributes retained in the study.

$$\mathrm{Con}_j = a_j * \frac{p(x_j,z_j)}{P(X,z)} \qquad (5)$$

where $p(x_i,z_i)$ is the poverty index of attribute *j*.

Dominance tests

As mentioned above in the discussion of the conceptual framework, it is often difficult to draw figures and visualize the differences in the dominance surfaces.[3] Practically, to test for differences between the surfaces we follow the approach by Bishop et al. (1991) and Duclos et al. (2006a/c/d). They suggest that when testing for dominance we calculate test statistics for a number of points within the relevant dominance surfaces. If this difference is always of the same sign (positive or negative) and significant, then dominance holds for all poverty lines and measures. Testing multidimensional dominance above the first order leads to difficulties of interpretation of the associated classes of poverty measures. We therefore refrain from doing so in this study. We also conduct statistical testing to take into account the design of the survey.

Data

The analysis of poverty in this study is based on the ECAM II data because of its detailed multivariate nature designed to measure poverty and living conditions of the population. The ECAM II data are obtainable from the National Institute of Statistics. Six strata or regions were demarcated in the survey: Yaoundé, Douala, Other Towns (towns with at least 50,000 inhabitants), Rural Savannah (comprising the rural localities of the Far North, North and Adamaoua provinces), Rural Forest (comprising the rural regions of the Centre, South and East provinces), and Rural High Plateaux (comprising the rural localities of West, North West and South West provinces). The survey was also conducted in urban, semi-urban and rural areas. It used a sample of 12,000 households, of which 10,992 were actually visited.

Selection of a preliminary set of variables

From the ECAM II questionnaire we carried out a first exploratory phase that consisted of visualizing and extracting those variables that take into account non-monetary aspects of poverty. Most questions in the ECAM II data may involve double counting, for example, time and/or distance to nearest health centre, capture the same non-poverty phenomenon: access to health infrastructure. It would be double counting to consider these questions to describe two distinct poverty situations. It should be noted that not all variables in the ECAM II data set describe a poverty situation – that is, a situation of relative deprivation, social exclusion, or insufficient capability of a household or individual to reach acceptable living standards. Again, some sections in the questionnaire structure provide information only to identify vulnerable social groups and geographical areas. At this first exploratory phase, we selected a preliminary set of 48 variables that theoretically capture various dimensions of non-monetary poverty. With this rationale and procedure, we intended to reduce arbitrariness and omissions in our choice of variables. The variables are displayed in Appendix A, Table A1.

4. Results and discussion

Given that the first subset of data from the household survey contained several dimensions of poverty, we organized the available information in order to renderit manageable. First, the household survey may not have the same quantity of data for each dimension. For instance, it may have four variables relating to health, but only one relating to nutrition. If we were to aggregate the variables without any prior transformation, we would effectively give health issues a four times higher weight than nutrition in the overall poverty index. Second, there would inevitably be a problem of comparability. Different indicators are given in different scales and therefore are not numerically comparable (Kukly, 2004). Third, different variables may be inter-related. Including overlapping or correlated variables without prior statistical adjustment would thus make the indicators liable to a problem of multiple-counting.

Final selection of poverty variables

To deal with these problems we treat the data in such a way as to arrive at an optimal number of variables – one that is sufficiently large to capture all the relevant information and sufficiently small to avoid the problems mentioned above. To achieve this we use a factor analysis of multiple correspondence analyses. As noted, factor analysis enables us to reduce the number of variables in a data set without loss of information. What this does is to "extract" the common information – the principal components – contained in the data by applying a variance maximizing rotation on the original variable space, thus reducing the data to a small number of variables that have a high degree of internal correlation, but are uncorrelated with each other (Lelli, 2001). The use of MCA requires that we transform and recode some of the variables. We therefore proceeded to transform the quantitative variables (for example, distances with regard to basic infrastructure) into qualitative and ordinal ones so that all variables to be analysed are of this nature. Later on, modalities with marginal scores (frequencies) are merged with neighbouring modalities to keep the number of modalities for a given indicator as low as possible.[4] Finally, the coding of the variable modalities starts with the value 1, and is kept sequential (there are no gaps in the integer codes). The modalities have been arranged to translate an evolution of a situation of poverty towards non-poverty.

Having transformed and recoded the variables, we subjected the preliminary set of 48 variables to MCA with the objective of identifying those non-monetary poverty variables that permit the most to distinguish the poor from the non-poor. There are two main criteria to be considered here. First is the principle of the first axis ordinal consistency (FAOC). According to this principle, indicator modalities describing a real poverty situation should have growing scores on the first factor axis, which is the axis of poverty (Asselin, 2002). A second-order criterion deals with the discriminating power of the variables. A discriminating power is a measure of dispersion in each of the factor axes. It is the variance of the factor scores obtained by the variable modalities and measures the explanatory power of the variable in the axis. Variables not satisfying the FAOC criterion and/or having very low discriminatory scores were dropped, yielding 33 variables with 83 modalities to be used in this study. These are displayed in Appendix Table A2. Table 1 gives the discrimination measures of the retained variables.

Table 1: Discrimination measures and contributions to the construction of the first axis

No	Variables	Discrimination measures	Contributions (%)
1	Sources of water supply	0.616	7.67
2	Type of toilet	0.594	7.39
3	Floor material	0.558	6.94
4	Source of lighting	0.541	6.73
5	Possession of TV set	0.487	6.07
6	Level of education	0.431	5.36
7	Wall material	0.424	5.28
8	Number of times deprived of water	0.415	5.16
9	Number of times deprived of electricity	0.388	4.84
10	Possession of refrigerator	0.371	4.62
11	Distance to nearest tarred road	0.322	4.01
12	Possession of mobile phone	0.299	3.72
13	Can read and write	0.278	3.46
14	Roof material	0.266	3.31
15	Possession of musical appliance	0.223	2.78
16	Possession of gas stove	0.204	2.54
17	Possession of a car	0.198	2.46
18	Distance to health centre	0.196	2.44
19	Classify your household	0.195	2.43
20	Possession of fixed telephone	0.154	1.92
21	Disposal of household waste	0.147	1.83
22	Possession of saving	0.140	1.74
23	Do you think your household is poor	0.122	1.52
24	Possession of kerosene stove	0.110	1.37
25	Distance to nearest govt school	0.104	1.29
26	Type of health centre	0.065	0.81
27	No. of times child is expelled from school	0.051	0.64
28	Distance to nearest source of water	0.039	0.48
29	Possession of habitat	0.039	0.48
30	Is Cameroon a poor country	0.033	0.42
31	Possession of motorcycle	0.020	0.25
32	Sick during past 2 weeks	0.003	0.03
33	Monthly income covers household exp.	0.003	0.03
	Total	8.036	100

Source: Calculations with SPSS version 10.1 using ECAM II data.

Values on the first axis, which is the axis of poverty, show that the variables that have contributed the most to the construction of this axis are: source of drinking water (0.616) and type of toilet (0.594). The variables that contributed the least to the formation of the first axis are: sick during past two weeks (0.003) and monthly income covers household expenditure (0.003). The eigenvalue (total inertia) of each axis provides an interesting reference point for the analysis of the discrimination measures. It is the mean value of all the discrimination values for this axis and the most informative in terms of poverty (Asselin, 2002). It is 0.187 when we submit the 48 variables to MCA, and improves to 0.251 when redundant variables are dropped. The higher the eigenvalue, the better the variables explain the poverty situation.

Construction of composite index for each household

As expressed by Asselin (2002), the functional form of the composite poverty indicator can be written as:

$$C_i = \frac{1}{K}\left(W_1 I_{i1} + W_2 I_{i2} + \ldots + W_P I_P\right)$$

where all variable modalities have been transformed into a dichotomous nature with either 0 or 1; the weights (W_1,...,W_p) correspond to the standardized scores[5] on the first factor axis. The weights (factor scores) attributed to the variable modalities are presented in Appendix Table A3. The weight of a given poverty category is the simple average of the composite poverty scores (standardized) of the population units belonging to the corresponding poverty group. These weights resolve the arbitrariness of weighting coefficients inherent in the axiomatic approaches. Using these weights we compute the composite indicator of each household.

The composite index has been criticized for being negative in its lowest part. It can be made positive by a translation using the absolute value of the average C_{min} of the minimal categorical weight $W^k_{\min}$ of each indicator. Asselin (2002) expresses this average minimal weight as:

$$C_{\min} = \frac{\sum_{k=1}^{K} W^k_{\min}}{K}$$

In this study, C_{min} is estimated to be -16.99, and we then add the absolute value of this average to the composite indicator of each household to obtain the new positive composite indicator scores.

Interpretation of the Ci

For the construction of a CPI from categorical indicators, the monotonicity axiom must be respected. The composite poverty indicator must be monotonically increasing in each of the primary indicators (Asselin, 2002). The axiom just means that if a population unit *i* improves its situation for a given primary indicator, then its composite poverty value *Ci* increases: its poverty level decreases (larger values mean less poverty or, equivalently, welfare improvement). The monotonicity axiom translates into the FAOC principle. This means that the axis has growing factor scores indicating movement from a poor to a non-poor situation. For each of the ordinal variables, the MCA calculates a discrimination measure on each of the factor axes. It is the variance of factor scores of all the modalities of the variable on the axis selected and measures the intensity with which the variable explains the axis (see Table 1).

Classification of households

Having computed the CPI for each household, we need to separate the poor households from the non-poor. To achieve this, we resort to a multivariate technique called the *k*-means clustering method. The term *k*-means describes an algorithm that aims to identify natural groupings amongst the sampling units (e.g., households) so that units within each group (cluster) are similar to one another while dissimilar units are in different groups (Everitt and Dunn, 2001). To conduct a cluster analysis, two decisions have to be made. First, a measure of similarity (or distance) amongst the units being clustered must be determined. Similarities are a set of rules that serve as criteria for grouping or separating items. The most straightforward way of computing distances between objects in a multidimensional space is to compute Euclidean distances. This is simply the geometric distance in the multidimensional space and is computed as:

$$\text{distance }(x,y) = \left[\sum_i (x_i - y_i)^2\right]^{\frac{1}{2}}$$

A distance measure reflects how far apart any pair of groupings is.

Once a distance or similarity measure has been determined, a decision has to be made regarding the method of clustering. Since our objective is to split a large population size (10,992) households into poor and non-poor clusters, the *k*-means clustering algorithm is most appealing (see Appendix B for an overview of cluster analysis). In general, the *k*-means method will produce exactly *k* different clusters of greatest possible distinction. The programme will start with *k* random clusters, and then move households between these clusters with the goals of (i) minimizing variability within clusters and (ii) maximizing variability between clusters.

In this study we divide the population units into *k*=2 clusters of poor and non-poor, so that households within a cluster are closer to one another than they are to the households in the other cluster. The classification of households into poor and non-poor clusters is displayed in Table 2.

Table 2: Classification of households

Cluster	Maximum *Ci* value	Minimum *Ci* value	Frequency
Non-poor	43.21	21.94	2130
Poor	21.93	1.28	8862
Total	43.21	1.28	10992

Source: Summary statistics from C_i per household based on ECAM II data.

From this typology of households we may derive a non-monetary poverty threshold that permits separating the poor cluster from the non-poor. To achieve this, we add the weighted maximum *Ci* value in the poor class to the weighted minimum *Ci* value in the rich class.[6] This technique has been used by Ningaye and Ndjanyou (2006) and Ki et al. (2005). In applying this formula we obtain a multidimensional non-monetary poverty threshold of 21.93, below which a household may be considered poor. The *Ci* values range from a minimum of 1.28 to a maximum of 43.21. The *Ci* should be interpreted as a numerical value that reflects the average global welfare level of a household in the non-monetary dimension. It should be noted that the higher the *Ci* value, the higher the level of welfare attained by the household.

Chakravarty poverty indexes

Income poverty in Cameroon has been set at 185,490 CFA francs per year (National Institute of Statistics (2002). We have in this study established the non-monetary poverty threshold at 21.93. In addition to assuming other thresholds, we evaluate the Chakravarty poverty indexes for some illustrative values of α and è. The resultant indexes are reported in Table 3.

The first two columns of Table 3 show the level of poverty measured separately for the composite index (*Ci*) and income dimensions. The first row shows that 39.6% of households live below the income poverty line, whereas 80.6% are poor in the non-monetary dimension. In the multidimensional case, 81.3% of households are poor in at least one of the dimensions (union headcount). From these figures we derive that 38.9% of households are poor in both dimensions (intersection headcount).

In the other rows, we are not counting the number of the poor but aggregating their poverty shortfalls in the two dimensions. We may check that the multidimensional indexes are higher when more weight is given to the dimension having the higher one-dimensional index. Thus, we observe in Table 3 that when more weight is given to the non-monetary dimension, its index rises from 16.8 to 26.9, while the multidimensional $P_{è}$ increases from 23.6 to 29.6. Also, the multidimensional $P_{è}$ tends to fall when the poverty aversion parameter rises. For example, observe that when è=*1* in row 2 rises to è=*2* in row 5 for fixed values of α, the multidimensional $P_{è}$ falls from 23.6 to 12.6. This is explained by the fact that the P_2 index weights the poverty gaps by the gaps themselves, thus awarding a lower weight to the dimension with the smaller shortfall. It is easy to verify from Table 3 that the $P_{è}$ measures depend on the values specified for a and Þ. It is also interesting to notice that for fixed values of a and è, the $P_{è}$ measures vary when different thresholds are set. Observe that when we consider the average values of the dimensions as poverty thresholds (the thresholds change from z_1=21.93 and z_2= 185490 to z_1*= 16.56 and z_2*=405834 respectively, the union head count changes from 81.3 to 59.7. This clearly shows that the Chakravarty et al. (1998) model is sensitive to the parameters α and è, and poverty thresholds.

Table 3: Chakravarty poverty indexes

Parameter values	One dimensional poverty index (%)		Multidimensional poverty index (%)	One dimensional poverty index (%)		Multidimensional poverty index (%)
è = 0	Ci	Income		Ci	Income	
Union head count	z_1=21.93	z_2= 185490	81.3	z_1*=16.56	z_2*= 405834	59.7
	80.6	39.6		55.4	28	
è = 1, α_1=0.5, α_2=0.5	16.8	6.8	23.6	5.7	21.5	27.2
è = 1, α_1=0.8, α_2=0.2	26.9	2.7	29.6	9.2	8.6	17.8
è = 1, α_1=0.3, α_2=0.7	10.1	9.5	19.6	3.4	30.2	33.6
è = 2, α_1=0.5, α_2=0.5	9.4	3.2	12.6	2.6	13.5	16.1
è = 2, α_1=0.8, α_2=0.2	15.1	1.3	16.4	4.2	5.4	9.6
è = 2, α_1=0.3, α_2=0.7	5.6	4.5	10.1	1.6	18.9	20.5

Source: Computed by author from ECAM II data.

The Chakravarty et al. (1998) multidimensional indexes are decomposable across subgroups/dimensions.[7] The additive property across the dimensions is shown in Table 4 by observing that the multidimensional index (for è$\geq$1) is the weighted sum of the poverty levels in the two dimensions. For decomposition across regions, we use Equation 4 to decompose the Chakravarty indexes by area of residence and by strata so as to check the sensitivity of the contribution of each different region to total poverty according to some illustrative values of α and è. The results are reported in Tables 4 and 5.

Table 4: Decomposition of Chakravarty indexes by area of residence

		Ci threshold (z_1)=21.93; Income poverty line (z_2) = CFAF 185,490					
		α_1=0.5; α_2=0.5		α_1=0.8; α_2=0.2		α_1=0.3; α_2=0.7	
è = 1	**Frequency**	**P_1 (%)**	**Contribution (%)**	**P_1 (%)**	**Contribution (%)**	**P_1 (%)**	**Contribution (%)**
Urban	4,975	10.9	20.9	13.3	20.3	9.3	21.6
Semi-urban	2,137	20.3	16.7	25.3	16.4	16.9	16.8
Rural	3,880	41.7	62.4	52.8	63.3	34.2	61.6
Total	10,992	23.3	100	29.6	100	19.6	100

è = 2	Frequency	P_2 (%)	Contribution (%)	P_2 (%)	Contribution (%)	P_2 (%)	Contribution (%)
Urban	4,975	4.6	12.9	3.9	14.3	3.5	15.8
Semi-urban	2,137	11.2	13.3	8.9	13.9	7.5	14.5
Rural	3,880	34.1	73.8	25.6	71.8	19.9	69.7
Total	10,992	16.3	100	12.6	100	10.1	100

Source: Computed by author from ECAM II data.

It is easily observed in Table 4 that the rural area contributes the most to the depth and severity of multidimensional poverty than do the semi-urban and urban areas.

Table 5: Decomposition of Chakravarty indexes by stratum

		Ci threshold (z_1)=21.93; Income poverty line (z_2) = CFAF 185,490					
		α_1=0.5; α_2=0.5		α_1=0.8; α_2=0.2		α_1=0.3; α_2=0.7	
è = 1	**Frequency**	**P_1 (%)**	**Contribution (%)**	**P_1 (%)**	**Contribution (%)**	**P_1 (%)**	**Contribution (%)**
Yaoundé	1,095	5.6	2.9	7.8	3.0	4.1	2.7
Douala	1,118	6.2	3.3	8.8	3.5	4.4	3.0
Other Towns	2,762	12.0	15.6	16.0	15.6	9.3	15.7
Rural Forest	1,646	24.6	19.2	33.5	19.6	18.6	18.7
Rural High Plateau	2,321	24.1	26.5	31.1	25.6	19.4	27.5
Rural Savannah	2,050	33.5	32.6	45.0	32.7	25.9	32.4
Total	10,992	19.2	100	25.7	100	14.9	100.0
è = 2	**Frequency**	**P_2 (%)**	**Contribution (%)**	**P_2 (%)**	**Contribution (%)**	**P_2 (%)**	**Contribution (%)**
Yaoundé	1,095	1.4	1.5	1.9	1.5	1.1	1.6
Douala	1,118	1.6	1.8	2.3	1.9	1.2	1.8
Other Towns	2,762	4.1	11.5	5.4	11.0	3.3	12.2
Rural Forest	1,646	11.9	19.7	16.6	20.3	8.7	19.0
Rural High Plateau	2,321	11.1	26.0	14.4	24.8	8.9	27.5
Rural Savannah	2,050	19.0	39.4	26.7	40.6	13.9	37.9
Total	10,992	9.0	100.0	12.3	100.0	6.8	100.0

Source: Computed by author from ECAM II data.

A closer look at Table 5 reveals that the Rural Savannah followed by Rural High Plateau and Rural Forest regions contribute the most to the depth and severity of multidimensional poverty of Cameroon households. Yaoundé, Douala and other towns are the least affected. We, however, observe that the contribution of each area/region is sensitive to the poverty thresholds and parameters, which have been set in an arbitrary manner. Consequently, we have to test for the robustness of our results.

Bi-dimensional dominance sensitivity tests

In this section we apply dominance tests to the question of spatial poverty comparisons in order to check the consistency of the results obtained using the Chakravarty poverty measures. To minimize the number of tables necessary to present our results, we follow Duclos et al. (2006b) to report only the t-statistics for the differences between the two dominance surfaces, suppressing reporting of the surfaces themselves and their difference. Testing for the differences at each point over the entire domain would be extremely time consuming, so we test at each decile of the combined samples in each dimension, yielding a 10x10 grid of points.[8] Because dominance surfaces are smoothly increasing functions, testing at only a few points should not have much effect on the results, as it is unlikely that the surfaces would change signs and then change back again between two points on the grid (Duclos et al., 2003). In what follows, we test for a significant difference at each point of the grid, and reject the null of non-dominance of A by B only if the test-statistics have the same sign and are significantly different from zero at the 5% level. A positive sign indicates that A's dominance surface is significantly below that of B; a negative sign indicates the opposite, and zero indicates that the difference is not significant. The bi-dimensional dominance tests were carried out with the help of DASP version 1.3.[9] The sampling design was set in order to take into consideration clustering and stratification.

Urban versus rural comparisons

Our first comparison is for urban versus rural areas. We have established that rural areas are poorer than urban areas when measuring welfare in the Chakravarty framework. Table 6 shows that the same conclusion holds for all bi-dimensional poverty measures in $_{1,1}$, and for all possible poverty frontiers.

This is because the dominance surfaces differ significantly at every point of the grid. The differences in the dominance surfaces have the same positive sign and are significantly different from zero, indicating that the urban surface was significantly below the rural surface. Consequently there is unambiguously less bi-dimensional poverty in urban than in rural areas of Cameroon for all poverty measures and all reasonable poverty lines.

Table 6: Differences in urban and rural dominance surfaces

Ci	Differences between dominance surfaces									
43.21	1	1	1	1	1	1	1	1	0	0
26.51	1	1	1	1	1	1	1	1	1	0
21.77	1	1	1	1	1	1	1	1	1	1
19.14	1	1	1	1	1	1	1	1	1	1
17.30	1	1	1	1	1	1	1	1	1	1
15.67	1	1	1	1	1	1	1	1	1	1
13.85	1	1	1	1	1	1	1	1	1	1
12.07	1	1	1	1	1	1	1	1	1	1
10.29	1	1	1	1	1	1	1	1	1	1
8.27	1	1	1	1	1	1	1	1	1	1
0.00	5.07	5.19	5.29	5.37	5.45	5.53	5.62	5.73	5.89	7.23
Log expenditure per capita*										

Notes: 1 indicates urban surface was significantly below rural surface; -1 indicates the opposite and 0 indicates no difference; significance level 5%. *We use log here to reduce the standard deviations between the distributions and also to linearize the expenditure per capita distribution.

Regional poverty comparisons

We conduct pairwise bi-dimensional poverty comparisons between Yaoundé and every other region on one hand, and between Rural Savannah and other regions, on the other hand. This selective pairwise comparison is guided by the fact that these two strata have generally been regarded as the richest and poorest regions, respectively. Between regions, there is clear evidence that bi-dimensional poverty in Yaoundé and Douala is less than in other regions.[10] When we compare Rural Savannah with other regions, we find that its dominance surface is consistently above those of others and the difference almost always significant (see Appendix Table A3). This indicates that Rural Savannah is the hardest hit by bi-dimensional poverty. This finding corroborates the results of Fambon and Baye (2002) and National Institute of Statistics (2002) who conclude, on the basis of monetary poverty, that the Rural Savannah is the poorest region in Cameroon. Dominance comparisons between Yaoundé and Douala (Appendix Table A4) show that the signs change within the grid; thus we are unable to conclude that bi-dimensional poverty is lower in one region than another.

5. Conclusion and policy recommendations

A brief review of the results of our study suggests the need for development of a number of socioeconomic policies to reduce the incidence, intensity and severity of multidimensional poverty in Cameroon. Like poverty itself, the policy approach needs to be multidimensional – with roles for all development actors from the state to non-government organizations and the people themselves.

Conclusion

Because poverty is multidimensional, the monetary approach is not always sufficient to account for all the facets of this phenomenon. A multidimensional analysis therefore becomes necessary if we truly want to identify the poor, as well as the strategies to combat this scourge. This study used multiple correspondence analyses to construct a composite poverty indicator by taking into account 33 non-monetary indicators identified as describing a real poverty situation. Drawing on the Chakravarty et al. (1998) model, we estimated poverty measures showing that income poverty affects 39.6% of households, whereas 80.6% of households are poor in the non-monetary dimension. Our results corroborate those of Ningaye and Ndjandyou (2006), who conclude that more than 60% of Cameroon households are poor in the non-monetary dimension whereas only 40% suffer deprivation in the monetary dimension. The incidence of multidimensional poverty – that is, households that are poor in terms of either income or non-monetary poverty – is estimated to be at 81.3%.

Decomposition of the Chakravarty poverty indexes permitted the comparison and ordering of the regions in terms of poverty, but firm conclusions cannot be drawn from the Chakravarty model because it is sensitive to the choice of the weighting coefficients, poverty aversion parameters and poverty thresholds. Consequently, we resorted to the stochastic dominance method to test for the sensitivity of the results. Our bi-dimensional spatial poverty comparisons give an unambiguous ordering: Yaoundé and Douala are less poor than Other Towns, which is less poor than Rural High Plateau, which is less poor than Rural Forest, which on its part is less poor than the Rural Savannah region. That is, we can be sure that bi-dimensional poverty is higher in the Rural Savannah region than the others for a wide range of poverty lines and for a broad class of poverty measures. Comparisons between Yaoundé and Douala are inconclusive, however. In addition, we find that bi-dimensional poverty for urban areas is robustly lower than semi-urban areas, which is lower than rural areas.

Policy recommendations

Our results are valuable for policy considerations from two major perspectives: First, the bi-dimensional spatial poverty decomposition reveals the regional poverty ratios and the contribution of each substratum to overall poverty. The fundamental policy orientation arising from this is that it provides the opportunity of targeting specific regions or zones which are the most deprived. Second, the discriminatory measures reported in this study (Table 1) indicate the explanatory power of each variable in the construction of the composite poverty indicator.

The discriminatory measures here play a fundamental role as predictors of the main sources of poverty in the non-monetary dimension. Consequently, to reduce non-monetary poverty it is necessary to focus on the variables with high discriminatory measures. From the discriminatory analysis, we observe that water, sanitation (type of toilet), housing materials, electricity, level of education and distance to tarred roads are the major covariates of non-monetary poverty in Cameroon. On the basis of these findings, we propose the following pro-population policy recommendations for tackling multidimensional poverty in Cameroon:

- Improve access to safe drinking water: Our results corroborate the findings by National Institute of Statistics (2002) that the rural regions particularly face a problem of adequate water supply as well as one of water quality. This partly stems from geological and ecological conditions in certain regions. But lack of adequate policy in the water subsector is also to blame. To address this critical challenge, policy makers should seek to enhance access to drinking water for all regions. In particular, policy should seek to increase the present drinking water coverage by rehabilitating and extending water supply plants including the construction of boreholes and water wells in rural regions/areas and most especially in the northern regions of the country.

- Extend coverage in electricity power to rural regions and zones: Steps need to be taken to improve the country's capacity to generate electricity through a variety of appropriate means, from hydroelectric power plants to thermal stations so as to extend electricity coverage in the country. Specifically, the Rural Electrification Agency should take up its role to extend electrical energy to rural areas where the demand is considerably high.

- Strengthen human capacity: We have discerned from the findings of this study that education constitutes a major poverty predictor in Cameroon. A social strategy of capacity building and enhancing human resources is strongly recommended. Such a strategy should aim to promote basic education for all by broadening educational access and improving the quality of education. The literacy rate must be improved in the northern regions by building more schools. Doubtless, this together with free and compulsory primary education imply a major public awareness operation to convince people of the need to send children to school, especially girls.

- Improve housing and sanitation conditions: Our results reveal that floor/wall material and toilet facility constitute major poverty indicators. Most houses in Cameroon are built in any shape, style and size, and may face any direction. The result is that some people's living rooms face other people's pit latrines or garbage dumps. There are no sewers in poor neighbourhoods. Quite often, water for drinking and cooking comes from wells that are close to pit latrines. Waste disposal is an important parameter for assessing minimum acceptable housing standards. There are limited funds for waste disposal and mountains of garbage tend to accumulate in the streets. To meet this challenge, it is essential to develop a social habitat promotion programme particularly in urban areas. Cameroon has a national housing policy but it is very inefficiently managed. Taxes on building materials should be revised downward as an effort towards the implementation of a policy to support low-cost housing.

- Develop the road infrastructure: Government should strive to interconnect all regions of the country so as to integrate all segments of the population – including those in rural areas – into the economy. To attain this goal there should be new investments to extend the present road network. The second leg concerns rehabilitation of deteriorated networks and periodic maintenance of the entire road network, which is in a deplorable state.

- Promote income-generating activities: It has emanated from this study that 39.6% of households are deprived in the expenditure per capita variable. One policy orientation to remedy this situation is the promotion of income-generating activities especially through self-employment among the poor. This in turn requires both improving the capacity of the poor to generate sufficient income to meet basic needs and simplifying administrative procedures to help informal sector businesses create jobs. The state should support the incentives of the poor in promising sectors such as food crop production, agro-processing and small-scale livestock by reviewing the contemporary inhibitive tax rates.

Anti-poverty measures should target the rural zones and the rural regions of the Rural Savannah, Rural Forest and Rural High Plateau to better alleviate poverty in the country.

Notes

1. The Dalton transfer principle in its simple form requires that when an attribute transfer is made from a poor person to an even poorer person, then poverty should fall.

2. Transfer sensitivity principle says that if we make two equal but offsetting transfers, one from a richer to a poorer person, and the other from a poorer to a richer person, the poverty should decline.

3. The three-dimensional diagram is drawn using the DASP software.

2. This discussion draws heavily on Duclos et al. (2006a/b/d).

4. We acknowledge that in the course of doing this, the selection of modalities is subject to some degree of arbitrariness.

5. SPAD uses this formula, whereas SPSS normalizes the score by the eigenvalue (score/ λ_1)

6. This may be expressed as $[CPI_1.n_1 + CPI_2.n_2]/N$, where CPI_1 is the maximum CPI value in the poor class; n_1/N is the relative frequency (weight) of the poor class; CPI_2 is minimum CPI value in rich class; and n_2/N is the relative frequency of the rich class.

7. The Chakravarty union headcount ratio does not respect the additive property. It would be double counting if it does so.

8. Note that these deciles are defined over the entire sample, even when we compare one sub sample with another (urban vs rural area for example). This ensures that the grid for all the comparisons is the same.

9. DASP: Distributive Analysis Stata Package by Arrar, A. and Duclos, J.Y ; Universite Laval; June 2007.

10. Note that to save space not all the dominance tables have been reported here.

References

Abessolo, Y. 2001. "Segmentation du marché du travail urbaine et pauvreté dans les pays en développement: Le cas du Cameroun". Revue Africaine des Sciences …conomiques et de Gestion, Université de Yaounde II, 3(1): 81–111.

Amin, A.A. 2001. Rural Poverty and Agricultural Development in Cameroon. Colloquium organized by UNESCO, Paris.

Amin, A.A. and J.L. Dubois. 1999. Where We Stand at Cameroon Poverty Profile. Reducing the Current Poverty and Tempering the Increase in Inequality. World Bank Study.

Asselin, L.M. 2002. Composite Indicator of Multidimensional Poverty. Available on http:/www.pep-net.homeip.net/NEW-PEP/GROUP/PMMA/pmma-train/files/Multi-Dim-Pov-Doc%201.pdf

Asselin L.M and Vu Tuan Anh. 2005. "Multidimensional poverty in Vietnam 1993–1998, according to CBMS indicators". *Vietnam Socio-Economic Development Review,* 41(Spring 2005): 145-169

Atkinson, A.B. and F. Bourguignon. 1982. "The comparison of multidimensional distributions of economic status". *Review of Economic Studies,* 49: 183–201.

Atkinson, A.B. 1987. "On the measurement of poverty". *Econometrica,* 55(4): 749–64.

Baye, M.F. 2004. "Non-parametric estimates of poverty lines: Measuring rural-urban contributions to poverty changes in Cameroon". Paper presented at the CSAE Conference on Growth, Poverty Reduction and Human Development in Africa, Centre for the Study of African Economies, Oxford.

Bibi, S. 2003. "Comparing Multidimensional Poverty between Egypt and Tunisia". Centre Interuniversitaire sur le Risque, les Politiques Economiques et l'Emploi (CIRPEE) Working Paper 04-16; Tunisia.

Bishop, J.A., J. Formby and W.J. Smith. 1991. "Lorenz dominance and welfare: Changes in the US distribution of income, 1967—1986". *Review of Economics and Statistics,* 73: 134–39.

Bourguignon, F. and R. Chakravarty. 2002. "Multidimensional poverty orderings". Département et Laboratoire d'Economie Théorique et Appliqué (DELTA) Working Papers 02–22; available on http://www.delta.ens.fr/abstract/wp200222.pdf

Bourguignon, F. and R. Chakravarty. 2003. "The measurement of multidimensional poverty". *Journal of Economic Inequality,* 1: 25–49.

Chakravarty, S. R., D. Mukherjee and R. Ranade. 1998. "On the sub-group and factor decomposable measures of multidimensional poverty". *Research on Economics Inequality,* 8: 175–94.

Duclos, J.Y. and P. Makdissi. 2000. Sequential Stochastic Dominance and the Robustness of Poverty Orderings. Cahier de Recherche, Département d'Economique, Université Laval.

Duclos, J.Y., D. Sahn and S. Younger. 2003. "Robust multidimensional poverty comparisons". Cahier de Recherche/Working Paper No. 03–04, January. Cornell University

Duclos, J.Y., D. Sahn and S. Younger. 2006a. "Robust multidimensional poverty comparisons". *The Economic Journal, 116 (October): 943–68.*

Duclos, J.Y., D. Sahn and S. Younger. 2006b. "Robust multidimensional poverty comparisons with discrete indicators of wellbeing". Centre Interuniversitaire sur le Risque, les Politiques Economiques et l'Emploi (CIRPEE) Working Paper 06-28; Université Laval, Quebéc, Canada.

Duclos, J.Y., D. Sahn and S. Younger. 2006c. "Robust multidimensional spatial poverty comparisons in Ghana, Madagascar, and Uganda". *The World Bank Economic Review,* 20 (1): 91–113.

Duclos, J.Y., D. Sahn and S. Younger. 2006d. "Using an Ordinal Approach to Multidimensional Poverty Analysis". Département d'Economie and CIRPEE, Université Laval, Canada.

Everitt, B.S. and G. Dunn. 2001. *Applied Multivariate Data Analysis.* London: Arnold.

Fambon, S. and F. Baye. 2002. "Income distribution and poverty in Cameroon". Paper presented at the United Nations University-World Institute for Development Economics Research (UNU-WIDER) Conference on Spatial Inequality in Africa, September 2002, Helsinki- Finland.

Fambon, S., F.M. Baye, I. Noumba, I. Tamba and A.A. Amin. 2004. Dynamique de la Pauvreté et de la Répartition des Revenus au Cameroun Durant les Années 80 et 90, Collaborative Final Report, AERC, Nairobi, Kenya.

Foster, J.E. and A.F. Shorrocks. 1988. "Poverty orderings and welfare dominance". *Social Choice Welfare,* 5: 761–98.

Garcia, R.D. 2003. Multidimensional Poverty. Available on http://website1.wider.unu.edu/conference/conference-2003-2/conference%202003-2-papers/papers-pdf/Garcia%20Diaz%20020503.pdf

Kamgnia, B. and J.P. Timnou. 2001. "Pauvreté au Cameroun: …volution dans une conjoncture d'ajustement économique". Rapport final, Projet présente au CREA, Nairobi –Kenya, June 2001.

Ki, J.B., S. Faye and B. Faye. 2005. "Multidimensional poverty in Senegal: A non-monetary basic needs approach". Final Report, Poverty Monitoring, Measurement and Analysis (PMMA) Working Paper No. 2005-05; Poverty and Economic Policy (PEP) Network, Université Laval Quebéc, Canada.

Kukly, W. 2004. Measuring Standard of Living in the UK – An Application of Sen's Functioning Approach Using Structural Equation Models. University of Cambridge and Max Planck Institute of Research into Economic Systems, Jena, Germany.

Lachaud J.P. 1999. "Le différentiel spatial de pauvreté au Burkina Faso: Capacité versus dépenses". Revue Africaine des Sciences Economiques et de Gestion, Presses Universitaires de Yaoundé, 2(1): 5–37.

Lelli, S. 2001. Factor Analysis vs. Fuzzy Sets Theory: Assessing the Influence of Different Techniques on Sen's Functioning Approach, Center of Economic Studies; Katholieke Universiteit Leuven, Discussion Paper No. 21.

Lynch, S. G. 1991. "Income Distribution, Poverty and Consumer Preference in Cameroon. Cornell Food and Nutrition Policy Program". Working Paper Series No. 6. Washington, D.C.

Maasoumi, E. 1986. "The measurement and decomposition of multidimensional inequality", Econometrica, 54: 771–9.

National Institute of Statistics, 2002. Preliminary results of ECAM I and ECAM II, Ministry of Economic Affairs, Programming and Regional Development, Cameroon.

Ningaye P. and L. Ndjanyou. 2006. "Multidimensional poverty in Cameroon: Its determinants and spatial distribution". Final Report to AERC presented during the 2006 December Biannual Workshop, Nairobi, Kenya.

Njinkeu, D., G. Kobou and I. Noumba. 1997. "Structural adjustment and poverty in Cameroun: A labour market analysis". Final report submitted to Institut Culture, Economie et Géopolitique (ICEG) de Progammes des Nations Unies pour le Développement (PNUD) Yaoundé.

Razafindrakoto, M.R. 2001. Les Multiples Facettes de la Pauvreté dans un Pays en Développement:

Le case de Malgache.Développement et Insertion Internationale, Cahier de Recherche 01-06; Université Malgache.

Sen, A.K. 1976. "Poverty: An ordinal approach to measurement". *Econometrica,* 44: 219–31.

Sen, A.K. 1985. *Commodities and Capabilities*. Amsterdam: North Holland.

Sen, A.K. 1992. *Inequality Re-examined.* Cambridge, Massachusetts: Harvard University Press.

Silber, J. 2007. "Measuring poverty: Taking a multidimensional perspective". *Hacienda Publica Espanola,* 182(3): 29–73.

Tachi, S. 2003. "Analyse de la pauvreté au Cameroun: Une approche multidimensionelle".
Revue Africaine des Sciences Economiques et de Gestion, 2: 17–42.

Thorbecke, E. 2005. "Multidimensional poverty: Conceptual and measurement issues". Paper prepared for The Many Dimensions of Poverty, International Conference, UNDP International Poverty Centre, Brasilia, 29–31 August.

Tsui, K.Y. 2002. "Multidimensional poverty indices". Social Choice and Welfare, 19: 69–93.

UNDP. 1998. *Human Development Report in Cameroon.* Yaoundé: United Nations Development
Programme.

Younger, S.D. 2003. "Growth and poverty reduction in Uganda, 1992–2000: A multidimensional
analysis of changes in living standards". Strategies and Analysis for Growth and Access (SAGA) Working Paper; available on http://www.saga.cornell.edu/images/wp151.pdf

Appendix

Table A1: Preliminary list of 48 non-monetary variables from ECAM II data

Variable description	SPSS var. code
Education	
Can read/write a simple phrase	S03q2
Level of education	S03q10
Health	
Sick in the past two weeks	S02q2
Type of health centre	S02q7
Last consultation period	S0q3
Live-birth in the past 12 months	S05q22
Appreciation of self health status	S02q10
Drinking water	
Source of drinking water	S07q6
Distance to nearest source of water	S09q2-11
Housing and sanitation	
Nature of roofs	S07q12
Nature of walls	S07q11
Nature of floor materials	S07q113
Type of toilet	S07q10
Disposal of household waste	S07q9
Energy	
Type of lighting	S07q7
Source of energy for cooking	S07q8
Communication	
Possession of TV set	S07q16-14
Possession of radio set	S07q16-03
Perceptions of living conditions	
Mind that Cameroon is a poor country	S10q2
People from your village/quarter are poor	S10q3
Living standard in relation to neighbours	S10q5
Mind that your household is poor	S10q8
Classification of your household	S10q9
Is monthly expenditure covered by income	S10q10
How people feel about their living standard with respect to their parents	S10q6
Financial situation	
Number of times household is deprived of water because of unpaid bills	S10q11-a
Number of times household is deprived of electricity because of unpaid bills	S10q11-b
Number of times child is expelled from school because of unpaid fees	S10q12
Evolution of living standard since 1996	S10q14
Has a household member savings	S12q24

Continued next page

Table A1: Continued

Variable description	SPSS var. code
Convenience goods and other assets	
Possession of fixed phone	S07q16-01
Possession of mobile phone	S07q16-02
Possession of gas stove	S07q16-11
Possession of kerosene stove	S07q16-12
Possession of refrigerator	S07q16-04
Possession of bicycle	S07q16-07
Possession of car	S07q16-13
Possession of musical chain	S07q16-16
Possession of iron	S07q16-15
Possession of motorcycle	S07q16-09
Possession of plots of exploitable land	S12q1
Possession of non-exploitable land	S12q5
Possession of habitation	S12q8
Access to basic infrastructure	
Distance to nearest public primary school	S09q2-01
Distance to nearest public secondary school	S09q2-03
Distance to nearest health centre	S09q2-06
Distance to nearest food market	S09q2-08
Distance to nearest tarred road	S09q2-10

Source: Compiled by author from ECAM II questionnaire.

Table A2: Factor scores of variable modalities

Variables / Modalities	Scores		
	1	2	3
1. SICK IN THE PAST 2 WEEKS			
SI01 - Yes	-0.07	0.02	0.01
SI02 - No	0.04	-0.01	0.00
2. TYPE OF HEALTH CENTER			
TY01 - tradi/others	-0.54	-0.22	0.12
TY02 - modern health	0.12	0.05	-0.02
3. CAN READ AND WRITE A SIMPLE PHRASE			
CA01 - No	-0.79	-0.49	0.75
CA02 - Yes	0.34	0.21	-0.32
4. LEVEL OF EDUCATION			
LE01 - None	-0.79	-0.53	0.89
LE02 - Primary	-019	0.23	-0.67
LE03 - Secondary	0.44	0.40	-0.10
LE04 - Higher education	1.49	-0.83	0.15
5. SOURCE OF DRINKING WATER			
SO01 - Stream/others	-0.87	-0.57	-0.52
SO02 - Spring/Wells	-0.38	-0.04	0.24
SO03 - Public taps	0.23	0.74	0.26
SO04 - Individual taps	1.72	-1.26	-0.17
6. SOURCE OF LIGHTING			
SO01 - Wood/Others	-1.20	-1.20	2.51
SO02 - Kerosene lamp	-0.81	-0.31	-0.24
SO04 - Electricity	0.63	0.28	0.06

Continued next page

Table A2: Factor scores of variable modalities ... Continued

Variables / Modalities	Scores		
	1	2	3
7. TYPE OF TOILET			
TY01 - No toilet/others	-1.22	-1.22	1.57
TY02 - Unconstructed latrine	-0.58	-0.10	-0.39
TY03 - Constructed latrines	0.27	0.55	0.27
TY04 - Flush toilet	1.89	-1.47	-0.15
8. WALL MATERIAL			
WA02 - Mud bricks	-0.51	-0.13	-0.01
WA03 - Planks/carrabot	0.01	0.78	-0.25
WA04 - Concrete/Cement/Stones	0.92	-0.07	0.11
9. ROOF MATERIAL			
RO01 - Thatches/Mats/Others	-1.21	-1.08	0.64
RO02 - Zinc Sheets/Tiles	0.16	0.20	-0.10
RO03 - Cement	1.10	-0.81	0.00
10. FLOOR MATERIAL			
FL01 - Mud/Wood/Others	-0.84	-0.45	-0.10
FL02 - Cement	0.45	0.45	0.10
FL03 - Tiles	1.96	-1.93	-0.26
11. POSSESSION OF FIXED PHONE			
FI01 - NO	-0.07	0.06	0.01
FI02 - YES	2.35	-2.36	-0.40
12. POSSESSION OF MOBILE PHONE			
MO01 - NO	-0.17	0.09	0.00
MO02 - YES	1.72	-0.90	0.07
13. POSSESSION OF GAS COOKER			
GA01 - NO	-0.20	-0.05	-0.04
GA02 - YES	1.01	0.25	0.24
14. POSSESSION OF KEROSENE STOVE			
KE01 - NO	-0.22	-0.20	-0.09
KE02 - YES	0.48	0.45	0.21
15. POSSESSION OF TV SET			
TV01 - NO	-0.40	0.08	-0.01
TV02 - YES	1.20	-0.23	0.06
16. THINK CAMEROON IS A POOR COUNTRY			
CA01 - YES	-0.21	-0.11	-0.14
CA02 - NO	0.14	0.07	0.09
17. THINK YOUR HOUSEHOLD IS POOR			
HH01 - YES	-0.15	0.07	-0.03
HH02 - NO	0.76	-0.44	0.13
HH03 - Don’t know	0.88	-0.25	0.24
18. CLASSIFY YOUR HOUSEHOLD			
CL01 - Very poor	-0.53	-0.03	-0.18
CL02 - Poor	-0.06	0.13	0.07
CL03 - Neither poor nor rich	0.74	-0.27	0.05
19. DO MONTHLY INCOME COVER EXPENDITURE OF HOUSEHOLD MEMBERS			
EX01 - NO	-0.05	0.05	0.20
EX02 - YES	0.06	-0.07	-0.24
20. DISTANCE TO NEAREST WATER SOURCE			
DW01 - dwater>1km	-0.41	-0.39	-0.55
DW02 - dwater<500m	-0.02	0.09	0.24

Continued next page

Table A2: Factor scores of variable modalities... Continued

Variables / Modalities	Scores 1	2	3
21. NUMBER OF TIMES DEPRIVED OF WATER BECAUSE OF UNPAID BILLS			
DE01 - depwate>3	-0.24	0.17	0.03
DE02 - depwate<3	1.72	-1.26	-0.17
22. NUMBER OF TIMES CHILD IS EXPELLED FROM SCHOOL BECAUSE OF UNPAID BILLS			
EX01 - expelsc>2	-0.04	0.27	-0.57
EX02 - expelsc<2	0.34	-0.12	0.14
23. DISTANCE TO NEAREST HEALTH CENTER			
DH01 - dhealth>3km	-081	0.69	-0.27
DH02 - 1km<dhealth<3km	0.04	0.11	-0.12
DH03 - 500m<dhealth<1km	0.25	0.30	0.06
DH04 - dhealth<500m	0.41	0.22	0.22
24. DISTANCE TO NEAREST TARRED ROAD			
DT01 - dtarroad>10km	-0.76	-0.47	-0.39
DT02 - 1km<dtarroad<10km	-0.25	-0.03	-0.07
DT03 - dtarroad<500m	0.60	0.29	0.22
25. NUMBER OF TIMES DEPRIVED OF ELECTRICITY BECAUSE OF UNPAID BILLS			
DE01 - depelec>2	-0.42	0.04	0.02
DE02 - 1<depelec<2	0.60	0.33	-0.27
DE03 - Never	0.99	-0.25	0.07
26. DISTANCE TO NEAREST GOVT SCHOOL			
DG01 - dgovtsc>3km	-0.82	-0.85	-0.10
DG02 - 1km<dgovtsc<3km	0.09	0.15	-0.09
DG03 - dgovtsc<1km	0.16	0.10	0.16
27. POSSESS A HABITATION			
HA01 - No	-0.80	0.04	0.03
HA02 - Yes	0.47	-0.23	-0.17
28. POSSESSION OF A REFRIDGERATOR			
FR01 - No	-0.23	0.11	0.00
FR02 - Yes	1.61	-0.78	0.02
29. POSSESSION OF A MOTORCYCLE			
MO01 - No	-0.04	-0.01	0.01
MO02 - Yes	0.60	0.10	-0.16
30. POSSESSION OF A CAR			
CA01 - No	-0.10	0.08	0.02
CA02 - Yes	1.97	-1.69	-0.28
31. POSSESSION OF A MUSICAL APPLIANCE			
MU01 - No	-0.15	0.07	0.01
MU02 - Yes	1.47	-0.69	-0.05
32. POSSESSION OF SAVINGS			
SA01 - No	-0.29	-0.05	0.13
SA02 - Yes	0.47	0.08	-0.21
33. DISPOSAL OF HOUSEHOLD WASTE			
WA01 - Thrown into Bush	-0.25	-0.05	-0.08
WA02 - Removed by Vehicle	0.56	0.11	0.19

Source: Calculated with SPAD 4.1 using ECAM II data.

Table A3: Dominance test results for Rural Savannah and Rural Forest regions

Ci	Differences between dominance surfaces									
43.21	-1	-1	-1	-1	-1	-1	-1	0	0	1
26.51	-1	-1	-1	-1	-1	-1	-1	0	0	1
21.77	-1	-1	-1	-1	-1	-1	-1	1	0	0
19.14	-1	-1	-1	-1	-1	-1	-1	1	1	1
17.30	-1	-1	-1	-1	-1	-1	-1	1	1	1
15.67	-1	-1	-1	-1	-1	-1	-1	1	1	0
13.85	-1	-1	-1	-1	-1	-1	-1	-1	1	0
12.07	-1	-1	-1	-1	-1	-1	-1	-1	1	1
10.29	-1	-1	-1	-1	-1	-1	-1	1	1	1
8.27	-1	-1	-1	-1	-1	-1	-1	1	1	1
0.00	5.07	5.19	5.29	5.37	5.45	5.53	5.62	5.73	5.89	7.23
Log expenditure per capita										

Note: 1 indicates that Rural Savannah surface was significantly below Rural Forest surface; -1 indicates the opposite and 0 indicates no difference; significance level 5%.

Table A4: Dominance test results for Yaoundé and Douala

Ci	Differences between dominance surfaces									
43.21	1	1	1	1	1	1	1	0	-1	0
26.51	1	1	1	1	1	1	1	1	0	0
21.77	1	1	1	1	1	1	1	1	0	1
19.14	1	1	-1	1	1	1	1	1	1	1
17.30	1	1	-1	0	1	1	0	0	1	1
15.67	1	1	-1	0	1	-1	1	1	1	1
13.85	1	1	1	0	1	-1	-1	-1	1	1
12.07	1	1	1	1	1	-1	-1	-1	1	1
10.29	1	1	1	1	1	-1	-1	-1	1	1
8.27	1	1	1	1	1	1	1	1	1	1
0.00	5.07	5.19	5.29	5.37	5.45	5.53	5.62	5.73	5.89	7.23
Log expenditure per capita										

Note: 1 indicates Yaoundé surface was significantly below Douala surface; -1 indicates the opposite and 0 indicates no difference; significance level 5%.

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