

Analysing Multidimensional Poverty in Guinea:

A Fuzzy Set Approach

By

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1. Introduction

The Republic of Guinea has a population of 9.3 million, according to estimates from the year 2005, and an average density of 38.6 inhabitants per square kilometre. It is divided into four natural regions (the Low Guinea, the Middle Guinea, the High Guinea and the Forest Guinea) and eight administrative regions (Conakry, Labé, Boké, Kankan, Faranah, N'Zérékoré, Kindia and Mamou). The country is essentially agricultural and pastoral, with huge mining and energy potential that has not been harnessed.

Poverty has become a multidimensional phenomenon, which is unevenly spread among the socio-economic groups and the different regions in Guinea. In spite of some improvements noticed in recent years, various poverty indicators raise some concern. The Questionnaire of Basic Welfare Indicators (QBWI–QUIBB) research undertaken in 2002 on the welfare of the population revealed that 37.6% of households in Guinea believe that the state of the economy was worse in 2002 in comparison to 2001. The 2004 Human Development Index (HDI) of UNDP–PNUD ranked Guinea 160th among 177 countries.

In 2002, the Government of Guinea, with the support of the World Bank, developed a Poverty Reduction Strategy Document (PRSD–DSRP), which gave the main aspects to be considered in improving the welfare of the population. While these broad guidelines are diverse, the analysis of poverty is often based on a monetary approach. However, the monetary approach of analyzing poverty is not always enough to describe the multiple phenomena that can prevent a decent and peaceful life, because poverty is a multidimensional phenomenon. The limits of the one-dimensional approach have contributed to the development of multidimensional concepts of poverty. According to the capabilities approach of Sen (1985; 1987), the study of poverty should identify and analyze other attributes, not necessarily monetary, which directly impact individual welfare.

In other respects, the study on the poverty profile in Guinea, which was carried out during the analysis of data from the Full Survey on Living conditions of Households (FSLH–EIBC 1994/1995) was the first attempt towards thorough countrywide evaluation of poverty. All previous studies had been affected in one way or another by either lack of data or restriction to a given region, especially the capital city. The Full Base Survey on Poverty Assessment (FBSPA–EIBEP 2002–2003) was the second attempt after the FSLH in Guinea. Between 1994 and 2003, the incidence of poverty fell from 62.6% to 49.2%, but this result contrasts with the perception of households EIBEP (2002/2003).³

The FBSPA–EIBEP of 2002 reveals that 49.2% of the Guinean population is poor, while according to another survey part of the FBSPA, 93.2% of Guinean households

consider themselves poor. Therefore, there appears to be a significant difference between the level of poverty as measured in Guinea and the way it is perceived by the households. The impact of poverty as measured in Guinea is limited to the monetary dimension, while the causes raised by the households are far more complex. In fact, households consider lack of adequate means to feed oneself, lack of revenue, lack of jobs, lack of access to treatment, and housing problems as the indicators of poverty.⁴

To take into account the limits of the monetary approach and the perception of households about poverty, this paper will consider the phenomenon of poverty from a multidimensional point of view⁵. The measures of poverty would thus have to include both monetary and non-monetary dimensions for a better distinction of the poor.

The specific objectives are various. First, we determined a composite indicator of poverty in Guinea by identifying the variables (correlated) that contribute to the composite indicator. We then identified the socio-economic groups that are mostly affected, precisely those that are highly affected by poverty and contributing to a great extent to the overall poverty indicator. Finally, we measured the deprivations of households according to the main attributes defined: religion, the administrative and natural regions, and the genre to determine the most vulnerable groups or geographical zones. To do this, the contribution of each attribute to the poverty indicator of each group and the overall poverty indicator was defined. We followed the methodological programme of Dagum and Costa (2004), based on fuzzy sets, to achieve the objectives of the study.

2. Literature review

Two main measures of poverty exist in literature as follows: a theoretical approach (monetary or non-monetary), or empirical (axiomatic or non-axiomatic) (Ki et al., 2005; Ben Hassine, 2006; Bibi and El Lahga, 2006; Bourguignon and Chakravarty, 2003; Ambapour, 2006). This last approach identifies qualitative and quantitative measures of poverty.

Theoretical approaches to poverty

There are two main trends in the theoretical approaches to poverty: the monetary approach (utilitarian) and the non-monetary approach (non-utilitarian). The monetary approach, which is also called the one-dimensional approach, has been developed by Rowntree (1901) and Both (1969). This approach compares the concept of welfare with the notion of utility (Ravallion, 1994) which, once satisfied, can define the level of welfare. However, it is not always enough to render an account of multiple phenomena that can prevent any decent and peaceful life because poverty is a multidimensional phenomenon involving all the living conditions of households. The non-monetary approach considers welfare from the point of view of freedoms and fulfillments. This approach proposes and facilitates targeted politics. It prefers an assessment of the situation according to certain elementary faculties, such as the possibility of feeding or dressing oneself in an adequate way, and can only lend limited or even no attention to the information on the utility.

The non-utilitarian approaches are more diverse; there is the approach by basic needs (Rowntree, 1901) and the approach by capacities (Sen, 1985; 1987). The school of basic needs considers the things missing in the lives of the poor a small subset of goods and services, specifically identified and perceived as meeting the basic property of all human beings.⁶

The school of capacities considers poor a person who lacks the capacity to achieve a certain subset of functions. This approach indicates that if income is instrumentally important, other measures of welfare, such as nutritional status, are intrinsically important (Martinetti, 2000; Balamoune, 2004; and Ben Hassine, 2006).

Empirical approaches to multidimensional poverty measures

Measuring poverty still raises ethical problems (Bibi and El Lahga, 2006), and researchers are faced with a multitude of questions. Should a measure of poverty reflect the situation of poor people according to all attributes simultaneously, or must it

also take into account the deprivation of those who do not meet the minimum required for a single attribute?

How is the information relating to the many facets of individual deprivation aggregated to produce an overall measure of poverty? Should we build, as a first step, several one-dimensional measures then, secondly, put them together? Should we, instead, begin by measuring multidimensional deprivation at the individual level and then aggregate across all individuals? Could we consider the attributes that are included in the pursuit of poverty assessments as complementary or substitutable (Bibi, 2002; Bibi and El Lahga, 2006)?

The empirical literature has two main approaches to measuring multidimensional poverty. The first, described as axiomatic, is to measure, as a first step, the individual deprivation in terms of different attributes to build a composite indicator of poverty for each individual. The aggregation of these indicators across individuals provides a multidimensional index of poverty for the entire population (Bibi and El Lahga, 2006).

The second approach, described as non-axiomatic, is to measure the total deprivation of society in terms of each attribute separately and then aggregate the different indices for a one-dimensional index of multidimensional poverty.⁷ Although the ethical foundations of this second approach have not been explored, the indices obtained are not without axiomatic foundation.

The two approaches can be considered complementary ways of analyzing multidimensional poverty. (Bibi and El Lahga, 2006).

Poverty indicators based on an axiomatic approach

Bourguignon and Chakravarty (2002; 2003), Chakravarty et al. (1998), and Tsui (2002) are among the principal founders of this approach. In this approach, the process of aggregation is determined explicitly in terms of desirable properties (axioms) that the multidimensional measure of poverty must comply with.⁸

The multidimensional poverty indices of Bourguignon and Chakravarty (2002; 2003), Chakravarty et al. (1998) and Tsui (2002) are adapted to the multidimensional context of certain classes of poverty indices proposed in the context of one-dimensional poverty (Bibi and El Lahga, 2006). This is based on an axiomatic approach of the required properties of the composite index of poverty and a composite measure of poverty with reference to a poverty threshold for each primary indicator (Asselin, 2002). Chakravarty et al. (1998) use measures of poverty based on the union of the various attributes of poverty.

Poverty indicators from a non-axiomatic point of view

In this approach, we identify the non-axiomatic measures based on aggregate indicators of wellbeing (Human Poverty Index [HPI] developed by Anand and Sen, 1997 on behalf of UNDP; see also Dutta, I. et al., 2009) and those based on individual data, the most currently used in developing countries being the fuzzy sets and approaches of entropy and inertia (Ambapour, 2006).

Human Poverty Index

The Human Development Report published by UNDP (1997) argues that lack of income provides only a partial picture of the many factors that impact on the level of wellbeing of individuals (to have a long life and be healthy, well-fed, well-educated,

well-integrated into society, etc). UNDP proposes a new poverty measure that takes into account other indicators of wellbeing, including access to education, health, drinking water, lifespan, and child nutrition (Bibi and El Lahga, 2006). The Human Poverty Index (HPI) proposes an intermediate solution that is neither the union nor the intersection of different dimensions (Bibi and El Lahga, 2006).

The approach used in developing this index is not unfounded axiomatic because the index follows a number of axioms as principles of symmetry and concentration (Bibi and El Lahga, 2006). However, although the index makes it possible to synthesize several indicators of wellbeing into a single measure, the monetary dimension of poverty is not taken into account yet the monetary dimension is at least as important as the dimensions captured by the HPI (Bibi, 2002). For a measure of privation and standard living in a multidimensional framework based on aggregate data, see also Dutta, I. et al. (2009).

Composite indicators of entropy and inertia

In the case of the composite indicator of poverty among the methodological approaches of aggregation revealed by the literature, we have the approaches of entropy and inertia. The main limitations of this approach lie in the choice of parameters and weights used in the functional form of the composite indicator. If this approach is important because of the optimization criterion, the problem of determining the weight in a non-arbitrary way remains to be solved.

The approach of inertia is mainly based on multidimensional analysis techniques, also called factor analysis. A full description of these techniques is provided in Meulman (1992), Bry (1996) and Volle (1993). Among the major factor analysis techniques are the principal component analysis (PCA), the generalized canonical analysis (GCA), and multiple correspondence analysis (MCA).

The fuzzy set approach

The fuzzy approach of multidimensional poverty is based on the theory of fuzzy subsets for the construction of an index, including the different dimensions (attributes) of poverty (Cerioli and Zani, 1990; Cheli et al., 1994; Martinetti, 1994; Cheli and Lemmi, 1995; Miceli, 1998; Dagum, 2002). In this approach, the poverty of a person is identified by its degree of belonging to the fuzzy sets and, respectively, to each of the attributes of poverty (Costa, 2002). The degree of belonging is determined by the degree of possession of the attribute, which may take the value one, zero or values belonging to the interval $[0, 1]$. This approach allows us to identify the dominant dimensions of poverty, and provides the necessary elements for the development of socio-economic policies aimed at reducing this situation.

Cerioli and Zani (1990) proposed a first multidimensional approach based on the theory of fuzzy sets, which allows the elaboration of an index comprising the attributes of poverty. This method was further developed by Dagum (2002) in his "Program of Methodological Research". Dagum and Costa (2004) then introduced the one-dimensional indicators to measure the state of deprivation of each attribute for the whole population, which would help to measure the contribution of each dimension to

overall poverty. Mussard and Pi Alperin (2005) later proposed a synthetic decomposition that combined the role of groups of a population and the dimensions of poverty in the explanation of overall poverty.

Chakravarty (2006) made a careful analysis of the axioms that a fuzzy multidimensional poverty index must meet. He showed that the multidimensional poverty indices recently proposed by Chakravarty et al. (1998), Bourguignon and Chakravarty (2003) and Tsui (2002) could be reformulated in a fuzzy environment. Chakravarty (2006) also showed that fuzzy indices of multidimensional poverty derived from the decomposability into a sub-group that meets a number of axioms such as continuity, symmetry or anonymity, principle of population, monotonicity and, in some cases, the axioms of invariance of scale and the principles of transfer.

Fuzzy indices of poverty are in accordance with the decomposability by attribute, contrary to the indices of Tsui (2002). However, the two kinds of measurement are both based on the union of the different dimensions of poverty. The process of aggregation indices (Chakravarty et al., 1998; Bourguignon and Chakravarty, 2003; Tsui, 2002) requires the specification of a threshold for each dimension of poverty, but it is important to note that with the tests of stochastic dominance (Atkinson, 1987; Bourguignon and Chakravarty, 2002; Duclos et al., 2006), it is possible to make robust comparisons of multidimensional poverty that do not depend on arbitrary choices of poverty lines. Here, we adopt the methodology developed by Dagum and Costa (2004), supplemented with the decomposition methods of Mussard and Pi Alperin (2005), which is an alternative for measuring poverty in Guinea for the years 2002–2003.

3. Methodological approach

The theoretical base of the fuzzy sets

By summarizing the main concepts related to the multidimensional analysis of poverty based on the theory of fuzzy sets, and especially as per the work of Dagum and Costa (2004), we find that the method requires the definition of two concepts: i) economic entities or all households (a_i) in an economic area $A = \{a_1, \dots, a_1, \dots, a_n\}$; and (ii) a vector of order m of socio-economic attributes $X = \{X_1, \dots, X_j, \dots, X_m\}$, including economic, social, cultural or family attributes represented by qualitative or quantitative variables.

The choice of the set of socio-economic attributes compared with the state of poverty, for each gender and each area, will consist of a selection of socio-economic groups whose absence or partial ownership contributes to the state of poverty of households. For the choice of socio-economic attributes, we take into account the concern of households regarding their state of poverty; that is to say, we will include some dimensions that households name as the causes of their poverty (lack of income, housing problems, etc).

Let us call B a subset of A , such that each $a_i \in B$ provides a degree of deprivation in at least one of m attributes included in X . The function of belonging to the fuzzy subset B of the i -th household ($i = 1, \dots, n$) in comparison to the j -th attribute ($j = 1, \dots, m$) is defined by x_{ij} . The determination of x_{ij} is one of the main difficulties with this approach, and the weight associated with the different attributes.

For the determination of x_{ij} , several proposals were made in the literature, including those developed by Cerioli and Zani (1990), and by Cheli and Lemmi (1995). In this study, we use the proposal of Cheli and Lemmi (1995), which gives a more consistent consideration of the suitability of the complex nature of poverty and the measurement tool, namely the fuzzy sets (Fusco, 2005).

Cheli and Lemmi (1995) describe their approach as Totally Fuzzy and Relative (TFR). It is totally fuzzy because, unlike Cerioli and Zani (1990), it avoids the specification of lower and higher critical thresholds. It is completely relative because the degree of deprivation of each individual on a given attribute depends on its place in the distribution of the attribute, as opposed to the method of Cerioli and Zani, which determines a linear function of belonging. The determination of membership functions depends on whether the variables are dichotomous (possession or non-possession of lasting goods), categorical or ordinal (level of education) and continuous or quantitative (expenses).

In the case of dichotomous variables, such as the possession or non-possession of a good or the participation or non-participation in an activity, Cheli and Lemmi (1995) use the same principle as Cerioli and Zani (1990). We have $x_{ij} = 1$ for the modality, indicating

a disadvantage (non-possession, non-participation) and $x_{ij}=0$ for those indicating a lack of disadvantage (possession, participation).

Furthermore, regarding the quantitative and categorical variables for each attribute, these terms are arranged in ascending order of deprivation, where each is associated with a modality P_{ij} equivalent to its position in the rank. Thus, for an attribute with k terms, we will designate by $P_{ij}=1$ to the modality that has the lowest risk of poverty, $P_{ij}=2$ to the next, and so on until the modality that has the highest risk of poverty represented by $P_{ij}=k$. In fact, we associate to the modality of a variable that indicates the lower risk of poverty the corresponding lowest level of deprivation (P_{ij}). By naming P_j^q the $q = 1, 2, \dots, k$ modalities that P_j can take, we have the relation $P_j^q = q$; with P_j^1 the modality with the lowest risk of poverty. For categorical and quantitative variables, Cheli and Lemmi (1995) propose a membership function of the form:

$$x_{ij} = 0 \quad \text{if} \quad P_{ij} = P_j^1$$

$$x_{ij}^q = x_{ij}^{q-1} + \frac{F_j(P_j^q) - F_j(P_j^{q-1})}{1 - F_j(P_j^1)} \quad \text{if} \quad P_{ij} = P_j^q \quad (1)$$

where

F_j is the cumulative distribution function of the attribute j .

P_{ij} the degree of deprivation of the individual i with respect to the attribute j ;

P_j^1 the modality with the lower risk of poverty,

P_j^q the modality with the highest risk of poverty if $q = k$, and

x_{ij}^{q-1} is the membership function related to the modality $q-1$. In that case:

$x_{ij} = 1$ if the i -th household does not have the j -th attribute;

$x_{ij} = 0$ if the i -th household has the j -th attribute;

$0 < x_{ij} < 1$, if the i -th household has the j -th attribute of an intensity comprised between 0 and 1. The membership function of the i -th household to the fuzzy subset B can be defined as the average weight of x_{ij} :

$$\mu_B = (a_i) = \sum_{j=1}^m x_{ij} w_j \Big/ \sum_{j=1}^m w_j \quad [\text{weighted}] \quad (2)$$

The equation $\mu_B(a_i)$ measures the ratio of poverty of the i -th household, where w_j is the weight linked to the j -th attribute, and where:

$$0 \leq \mu_B(a_i) \leq 1.$$

The behavior of the membership function is as follows:

$$\mu_B(a_i) = 0, \text{ if } a_i \text{ possesses the } m \text{ attributes;}$$

$$\mu_B(a_i) = 1, \text{ if } a_i \text{ is totally deprived of the } m \text{ attributes; and}$$

$0 < \mu_B(a_i) < 1$, if a_i is partially or totally deprived of some attributes but not completely missing all the attributes.

The weight w_j represents the intensity of deprivation linked to the attribute j . It is an inverse function of the degree of deprivation of this attribute for the population of households. The smaller the number of private households for the attribute j , the more the greater the weight w_j . Cerioli and Zani (1990) define a function of intensity of deprivation given by the following relation:

$$w_j = \log \left[\frac{\sum_{i=1}^n g(a_i)}{\sum_{j=1}^m x_{ij} g(a_i)} \right] \quad [\text{weight for the attribute } j] \quad (3)$$

where $g(a_i)$ is the frequency (weight) associated with the observation of the a_i household of the population. The fuzzy poverty index of the set A is a weighted average of $\mu_B(a_i)$ which can be given by the relationship:

$$P_\alpha = \mu_A = \mu_B = \sum_{i=1}^n (\mu_B(a_i))^\alpha g(a_i) / \sum_{i=1}^n g(a_i) \quad [\text{poverty index}] \quad (4)$$

for alphas equal to 0, 1 and 2, where $g(a_i) / \sum_{i=1}^n g(a_i)$ is the relative frequency associated with the observation a_i of the sample. Equation 4 is equal to zero when all individuals are rich in all the attributes. Equation 4 is equal to 100 when, all individuals are denied for all the attributes.

As the index defined in (4) is not additively decomposable for alpha equal to 0 and 2, we assume that in what follows, alpha is equal to 1 in order to perform decompositions.

Parallel to the determination of the multidimensional poverty index of the i -th household and that of the overall population, the use of the fuzzy sets theory allows the calculation of a one-dimensional index for each of the considered j attributes:

$$\mu(X_j) = \sum_{i=1}^n x_{ij} g(a_i) / \sum_{i=1}^n g(a_i), j=1,2,...,m \quad [\text{Poverty in the attribute } j] \quad (5)$$

$\mu(X_j)$ defines the degree of deprivation of the j -th attribute for the population of n households. The overall fuzzy index of poverty can also be defined as a weighted average of a one-dimensional index for each attribute: the weighting is done for alpha equal to 1 in order to perform the decompositions.

$$P = \mu_A = \mu_B = \sum_{j=1}^m \mu(X_j) w_j / \sum_{j=1}^m w_j \quad [\alpha \text{ equal to 1 for this relation}] \quad (6)$$

The analysis of the results in (5) enables to identification of the correlates of poverty and the intervening structures to reduce it. The decomposition methods that follow will give more precision on the state of social exclusion.

Decomposition of the multidimensional index of poverty

We used the methods of decomposition of the fuzzy index of multidimensional poverty that have been introduced and developed in the work of Mussard and Pi Alperin (2005). We have considered the problem of non-separability, which affects decomposition in the calculation of the contributions of groups, and attributes of the poverty index.

Decomposition by groups

Another way to assess the pattern of poverty is to decompose the population into groups (Mussard and Pi Alperin, 2005). By dividing the total economic surface into R groups, S_r , of size $n_r (r = 1, ..., R)$, the intensity of poverty of the i -th household of S_r is given by:

$$\mu_B = (a_i^r) = \sum_{j=1}^m x_{ij}^r w_j / \sum_{j=1}^m w_j \quad [\text{weighted } x_{ij}^r] \quad (7)$$

where x_{ij}^r is the function of belonging to the B fuzzy subset of the i -th household ($i=1, \dots, n$) of S_r in relation to the j -th attribute ($j=1, \dots, m$).

The multidimensional index of poverty associated with the group S_r is then defined as follows

$$\mu^r = \sum_{i=1}^{n_r} \mu_B(a_i^r) g(a_i^r) / \sum_{i=1}^{n_r} g(a_i^r), \quad [\text{weighted } \mu_B = (a_i^r) \text{ for } \alpha=1] \quad (8)$$

The contribution of a group to total poverty is obtained by taking the difference between the overall poverty index in equation (4) for $\alpha = 1$ or in equation 6, and the poverty rate calculated when the terms of all attributes of this group of individuals are equal to 0:

$$C_r = P - P_r, \quad [\text{contribution of } r \text{ to the poverty index}] \quad (9)$$

where P_r is the poverty index calculated when we assume that the group S_r is poor in all attributes. This decomposition allows us to identify the most affected groups (regions, religion, gender, etc), and specifically the groups that contribute to an increase of the state of social exclusion.

Decomposition by attributes

Dagum and Costa (2004) introduced the decomposition by attribute by showing that it is possible to calculate the contribution of the j -th attribute to the overall poverty index. From the equations for the one-dimensional indices of poverty (5) and the weights associated with each attribute (3), the authors obtained the contribution (absolute) of the j -th attribute to the multidimensional poverty index. In this work, to take into account the problem of non-separability of calculating poverty through people we have calculated the contribution of an attribute to global poverty as the difference between the overall poverty index α given by Equation (4) for $\alpha = 1$ or (6), and the poverty rate calculated when we assume that people are not poor from the attribute:

$$C_j = P - P_j \quad [\text{contribution of } j \text{ to the poverty index}] \quad (10)$$

where P_j is the poverty index calculated when the terms of the attribute j is equal to 0 that is to say when people are not poor from the attribute j .

The unidimensional poverty index of the j -th attribute for the r -th group is given by the following equation:

$$\mu(X_j^r) = \frac{\sum_{i=1}^{n_r} x_{ij}^r g(a_i^r)}{\sum_{i=1}^{n_r} g(a_i^r)}. \quad (11)$$

To address the issue of non-separability of calculating poverty across individuals, the contribution of an attribute to the poverty of a group will be the difference between the poverty of the group given by Equation (8) and the poverty group recalculated if one assumes that group members are not poor in relation to that attribute.

The contribution (absolute) of the j -th attribute to the r -th group is:

$$C_j^r = \mu^r - \mu_j^r \quad [\text{contribution of } j \text{ to the poverty index of } r] \quad (12)$$

where μ_j^r is the poverty index calculated from the group when the terms of the attribute is null and μ^r is the poverty index of the group given by Equation (8).

Unlike the decomposition by group, this second type of decomposition allows decision-makers to obtain more information on the different dimensions of poverty, thereby allowing greater precision in the implementation of appropriate socio-economic policies in order to reduce the state of poverty. Here, we used the Equation (12) for the contribution of the j -th attribute of the group to the index of overall poverty. The simultaneous decomposition (Mussard and Pi Alperin, 2005) gives all combinations (attribute/group) that contribute to the poverty of the economic area. Ultimately, we find all the information necessary to reduce the intensity of poverty.

4. Empirical analysis of poverty characteristics in Guinea

In this section, we deal with the nature of data used, the choice of socio-economic attributes, and analysis of the results.

Data source and choice of socio-economic attributes

We used the methodology of Dagum and Costa (2004) while introducing a synthetic decomposition analysis that describes specific dimensions related to housing, level of instruction and annual expenses by households, and the groups – gender, regions, religion, place of residence – all of which contribute to an increase in overall poverty.

Data source

To achieve the objectives of the study, we used data from the full base survey on poverty assessment, which provides basic indicators of well-being. We had a representative sample of the population of 7,095 households.

The Full Base Survey on Poverty Assessment (FBSPA) is the second survey conducted in Guinea after the Full Budget-Consumption Survey (FBCS). Carried out over a period of 12 months (23 October 2002 to 22 October 2003) and on a national sample of 7,612 households,⁹ this survey is part of a planned series of studies related to the monitoring and evaluation of the implementation of the Poverty Reduction Strategy (PRS) and the Millennium Development Goals (MDGs). It was conducted at the same time as the survey on the Questionnaire of Basic Welfare Indicators (QBWI) and covering the same sample. The objective of these surveys is to monitor the implementation of these initiatives and assess their impact on the living conditions of households and poverty.

The FBSPA is a survey aimed at depicting the level reached for all the indicators of living standards of households and poverty during the year 2002, which is considered the first implementation year of the Poverty Reduction Strategy (PRS). The survey includes a questionnaire for households to collect detailed information on household composition, migration, education, health, employment, economic, agricultural and non-agricultural activities of the household members aged five and over, housing, transfers, income, social capital and the perceptions of households on poverty. It also includes a community questionnaire that addresses the availability and accessibility of basic services to the populations of the localities included in the sample. This survey, unlike the FBCS (1995), includes the administrative regions of the country.

Choice of socio-economic attributes

The choice of all socio-economic attributes, the most significant in determining the condition of poverty, is based on the literature on multidimensional poverty and the contents of the EIBEP database. Each attribute is chosen as an indicator of social exclusion and deprivation of every household.¹⁰ From the EIBEP questionnaire, we selected the following attributes:¹¹

1. Level of education (X_1)
2. Nature of the roof (X_2)
3. Materials for exterior walls (X_3)
4. Type of toilet (X_4)
5. Index of settlement (X_5)
6. Annual expenditure per household (X_6)
7. Type of housing (X_7)
8. Housing ownership (X_8)
9. Water supply (X_9)
10. Fuel for cooking (X_{10})
11. Lighting mode (X_{11})
12. Lasting goods (X_{12})

The base does not allow us to choose an attribute related to health. In fact, out of the over 7,095 households questioned about the time it takes to reach a health facility, only 4,000 responded. Table A12 in the appendix provides descriptive statistics on some attributes.

Therefore, we are giving the main results of the multidimensional method of measuring poverty, and those of the methods of decomposition.

Analysis of the results

Variable related to poverty

The index of multidimensional poverty in Guinea is 0.5448. In other words, 54.48% of households in Guinea are structurally poor. From the fuzzy one-dimensional indices of poverty, we have identified the dimensions that indicate the most important degree of deprivation of poor households. The major correlates of poverty in Guinea are fuel for cooking (83.59% of Guinean households are poor according to that attribute), the nature of the roof (81.39%), the level of education (80.38%), the lighting mode (77.86%), the materials of outer walls (76.48%), the lasting goods (75.92%), the type of toilet (72.86%) and the index of settlement (67.68%). When considering only dimensions such as fuel for cooking and nature of the roof, only two out of 10 people escape from poverty. This also applies to the level of education. Based on the lighting mode and settlement index, around seven persons out of 10 are considered poor.

These major correlates are followed by the attribute of type of housing (63.97%), water supply (63.05%) and the attribute of annual expenditure per household (54.09%), which indicate that more than half of the population is categorised as poor (Table 1).

The analysis in terms of relative contributions reveals that dimensions such as lasting goods (17.56%) and annual expenditure (10.52%) contribute a great extent to the overall poverty index. Indeed, the relative contribution is obtained by taking the ratio between absolute contribution (equation 10) and the sum of all absolute contributions, which is the index of overall poverty (0.5448). The absolute contribution of each attribute was calculated as the difference between the index of overall poverty and the poverty index obtained when the terms of this attribute are zero for all individuals. The removal order of attributes in the calculation of contributions is done according to their order of presentation in Table 1. The absolute contribution of attributes of durable goods and annual expenditure is higher compared to others. This is supported by the fact that the indices of poverty that one obtains after supposing that the households are not poor in comparison with these dimensions are weak.

In Table 1, the attribute housing ownership (X₈) shows the largest weight, $w_j = 29.62\%$. The number of private households deprived of this attribute is small (of 7,095 households, 5,054 are not deprived of this attribute). On applying the formula of equation (4) for alpha equal to 0, we get a poverty incidence of 100%. This means that no Guinean is rich in all the attributes. For alpha equals 2, we have an index of severity of poverty 0.3127. Table 1 is completed for alpha equals 1, which is to say that the intensity of poverty is 54.48%. Because of the diverse socio-economic behaviour of the sub-groups of the population, it can also be noticed that the influence of the attributes in determining the extent of poverty varies according to the selected group.

Table 1: One-dimensional Indexes of poverty, absolute and relative contributions and weight of attributes

Attributes	$\mu(X_j)^*$	absolute Contribution	relative Contribution	Weight of attributes $w_j/\text{total } w_j$
Level of Education (X ₁)	0.8038	0.0303	5.56%	3,77%
Nature of the Roof (X ₂)	0.8139	0.0289	5.30%	3,55%
Materials for exterior walls (X ₃)	0.7648	0.0354	6.49%	4,62%
Type of toilet (X ₄)	0.7286	0.0398	7.30%	5,46%
Index of settlement (X ₅)	0.6768	0.0455	8.36%	6,73%
Annual expenditure per household (X ₆)	0.5409	0.0573	10.52%	10,59%
Type of housing (X ₇)	0.6397	0.0493	9.04%	7,70%
Housing ownership (X ₈)	0.1794	0.0531	9.75%	29,62%
Water supply (X ₉)	0.6305	0.0501	9.20%	7,95%
Fuel for cooking (X ₁₀)	0.8359	0.0258	4.74%	3,09%
Lighting mode (X ₁₁)	0.7786	0.0336	6.17%	4,31%
Lasting goods (X ₁₂)	0.7592	0.0957	17.56%	12,60%
Total	0.5448	0.5448	100%	100%

* $\mu(X_j)$ is the one-dimensional index of poverty as per the j attribute.

Source: Author's calculations

Though these results provide the information needed to identify the correlates of poverty, the decomposition methods provide more accuracy in determining the multidimensional phenomenon of overall poverty. As such, the most affected socio-economic groups will be identified.

Decomposition by groups

The decompositions have been carried out on the basis of the following groups: (i) religion of the household; (ii) administrative region; (iii) natural area; (iv) gender of household head; (v) place of residence; and (vi) the size of the household. Table 2 presents the multidimensional poverty indices for each group after decomposition, and the absolute and relative contributions for each group to global poverty.

By religion and regions

The regional dimension is essential for the development of policies against poverty. It is important to know the level of deprivation according to the attributes of regions, and their contribution to the overall poverty index. Regarding religion, it is important to know whether there are differences between sub-groups of religion, whether in terms of overall indices or in terms of deprivation compared to the attributes.

Regarding decomposition by religion, households whose heads are neither Muslims nor Christians are the most vulnerable, with 58.58% of them structurally poor. Households whose head is Muslim or Christian are, respectively, 54.08% and 55.40% poor. In terms of contribution, households whose head is Muslim contribute up to 83.69% of the overall poverty. This is explained by the fact that Muslims account for 84.3% of the total population. Table A6 in the Appendix shows that there is a significant difference between the three indices when compared two by two at a level of 5% significance. These differences are not due to variability of sample of sub-groups (see Table A6*).

In terms of administrative regions, the poorest (most vulnerable) regions are N'Zérékoré (57.97%), Faranah (57.45%) and Labé (57.11%), followed by the regions of Kankan (55.87%), Mamou (55.20%) and Kindia (54.55%). Table A7 in the Appendix shows that there is no significant difference between the indices of N'Zérékoré, Faranah and Labé. These three regions have the same level of poverty, with a 5% risk of being wrong. Kankan, Mamou and Kindia have the same level of poverty, but they are less poor than Labé, Faranah and Nzérékore. There is a significant difference between the poverty indices of the capital, Conakry, and Boké and those of all the other regions.

The region of Boké, after Conakry (46.64%), is the least poor, with 52.07% of its inhabitants poor, see Table 2. This is not surprising since in Guinea, among the administrative regions, Conakry exempted, Boké is the most urbanized, with nearly one out of four households living in urban centres. Because of its natural endowment in mineral resources, this region has large mining companies and many attractions, including the National Park of Badiar, and possesses large entryways into Conakry, Labé and countries bordering Guinea. In terms of school enrollment, the region has the highest gross enrollment rate for girls in the country.

With regard to access to drinking water, there are water supply systems in all the urban centres (except in one of the prefectures of the region: Gaoual) and wells have been drilled in rural areas. Boké records a significantly higher level of access to drinking water compared to other areas, apart from Conakry. In terms of electricity, there is an imbalance between the northern region (where the situation is precarious) and the southern region of Boké (where the situation is relatively good).

Table 2: Multidimensional poverty indices for each decomposition, absolute and relative contributions for $\alpha = 1$

Decomposition		Multidimensional Index of poverty as per the group $r : \mu^r$	Absolute contribution	Relative contribution (%)
Religion	Muslim	0.5408	0.4560	83.69
	Christian	0.5540	0.0534	9.81
	Other	0.5858	0.0354	6.50
Administrative regions	Boké	0.5207	0.0498	9.14
	Conakry	0.4664	0.0742	13.62
	Faranah	0.5745	0.0517	9.49
	Kankan	0.5587	0.0621	11.39
	Kindia	0.5455	0.0770	14.13
	Labé	0.5711	0.0685	12.56
	Mamou	0.5520	0.0508	9.33
	N'Zérékoré	0.5797	0.1108	20.33
Natural regions	Conakry	0.4664	0.0742	13.62
	Lower Guinea	0.5285	0.1069	19.63
	Middle Guinea	0.5647	0.1391	25.54
	High Guinea	0.5665	0.0969	17.79
	Forest Guinea	0.5772	0.1276	23.42
Gender of the head of the household	Male	0.5437	0.4456	81.79
	Female	0.5496	0.0992	18.21
Place of residence	Conakry	0.4664	0.0742	13.62
	Other urban	0.5017	0.0651	11.94
	Rural	0.5702	0.4055	74.44
Size of the household	1 person	0.5250	0.0208	3.81
	2 persons	0.5397	0.0362	6.64
	3 persons	0.5612	0.0722	13.25
	4 persons	0.5663	0.0647	11.88
	5 persons	0.5395	0.3509	64.42

Source: Author's calculations

The situation in the region of N'Zérékoré can be explained by the fact that its high mining potential (iron, diamond) is largely under-exploited. In addition, access to drinking water and electricity is a persistent problem in the region. Here, wood is the most

commonly used cooking fuel. These realities are valid for most areas, except Conakry, but with varying intensities (DSRP, 2002). N'Zérékoré, Kindia and Conakry regions contribute most to global poverty (Table 2). The poverty multidimension of administrative regions is similar to that observed in monetary terms.¹² However, the region of Kankan is counted among the moderately poor regions in the multidimensional case, contrary to the monetary aspect where it is counted among the poorest.

Among the natural regions, the poorest region is the forest Guinea, where N'Zérékoré with 57.72% of poor is located, then Upper and Middle Guinea where Faranah, Kankan and Labé have, respectively, 57.45%, 55.87% and 57.11% of the poor. The less poor natural area is the special zone of Conakry (46.64%) followed by Lower Guinea, where Boké region is located, with 52.85% of the inhabitants poor. The poverty index of Boké is significantly different from that of Conakry and the other regions. The poverty index in Conakry is also significantly different from other indices. There is no significant difference between the indices of the regions of Middle and Upper Guinea (Table 2 for indices and Table A8 in the Appendix for differences).

The analysis in terms of contribution shows that regions of Middle and Upper Guinea contribute most to the national poverty index. A comparison with the results of the monetary approach shows the same trend, with an increase in poverty in the Forest Guinea region's multidimensional plan.

By gender, place of residence and size

The discrimination that may exist between men and women, and between rural and urban areas, led us to do a breakdown by gender and area of residence. Several studies have examined whether poverty increases with the size of the family.

The decomposition by gender shows that households headed by women have an index of 54.96%, while those headed by men have an index of 54.37%.

Referring to Table A9 in the Appendix, there is no significant difference between the two indices; therefore, women and men have the same level of poverty, with a 5% risk of being wrong. In monetary terms, households headed by women have a lower poverty rate than those headed by men.

With regard to contributions, households headed by men have a greater contribution to the state of poverty at 81.79% (Table 2).

The decomposition by area of residence such as Conakry, other urban centres and rural areas show that the rural area is the most poor with 57.02%. Table A10 in the Appendix shows that there is a significant difference between the index of rural areas and the other indices; therefore, poverty is a rural phenomenon in Guinea.

This is not surprising because of the striking disparities between urban and rural areas in terms of education, the possession of lasting goods, mode of lighting and fuel. Rural areas are responsible for the greatest contribution, 74%, to the country's poverty level. Thus, rural areas remain more affected than urban areas.

Based on the size of households, those with five or more persons have an index of 53.95% and households of four persons 56.63%, against 56.12% for those containing three persons and 53.97% for those with two persons. Households with one person have the lowest index, 52.50%. Table A11 in the Appendix shows that there is no significant

difference between the indices for households with two and one, one and five, and four and three persons. In monetary terms, poverty increases with household size, unlike the multidimensional plan.

Decomposition by attribute and group

Unlike the method of decomposition by group described earlier, the decomposition method we are presenting here will give us a greater indication of the deprivation of the different groups according to the dimensions of poverty. By considering the combination of groups and attributes, we can obtain the one-dimensional indices of poverty by attribute and group.

An analysis of the relative contributions of the one-dimensional indices of poverty in comparison to the different groups also provides a clear picture of the exclusion of each group with regard to the different attributes.

The values of the one-dimensional indices of poverty reflect the degree of deprivation of each attribute for the population of each group. We notice that the intensity of poverty is not the same in each population group and according to the selected dimension, because the values of the indices vary from one group to another. Thus, one can see that the variable consumption expenditure does not always reflect the state of poverty of the Guinean population. Dimensions such as the level of education (X_1), the nature of the roof (X_2), the materials of the exterior walls (X_3), the index of settlement (X_5), fuel for cooking (X_{10}), the mode of lighting (X_{11}), the supply of drinking water (X_9), and lasting goods (X_{12}) are dominant dimensions of the poverty phenomenon within the different groups.

Dimensions such as possession of lasting goods, nature of the roof, fuel for cooking, level of education, mode of lighting, materials of the walls, type of toilet and index of settlement are the main variables in relation to poverty within the Muslim group. However, for Christians, the main variables related to poverty are: lasting goods, fuel for cooking, materials of the walls, mode of lighting, type of toilet, nature of the roof, and drinking water supply. For the others who are neither Muslim nor Christian, the main correlates of poverty are the materials of the walls, fuel for cooking, lasting goods, type of toilet, mode of lighting, level of education, nature of the roof, and drinking water supply. The variables show that education is crucial for Muslims but not Christians, probably because Muslims emphasize the study of the Koran while Christians emphasize the study of the French language.

Table 3: One-dimensional indexes of poverty by attributes and religion

Religion	Attributes											
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
Muslims	0.8231	0.8268	0.7383	0.7124	0.6821	0.5323	0.6715	0.1786	0.6147	0.8227	0.7672	0.8610
Christians	0.6206	0.7279	0.8643	0.7751	0.6443	0.5279	0.4649	0.2212	0.6889	0.8647	0.8143	0.9108
Others	0.8266	0.7710	0.9756	0.8816	0.6544	0.6827	0.4747	0.1245	0.7568	0.9735	0.8807	0.9713

Source: Author's calculations. X_1 =Level of education, X_2 =Nature of the roof, X_3 =Materials for exterior walls, X_4 =Type of toilet, X_5 =Index of settlement, X_6 =Annals expenditure, X_7 =Type of housing, X_8 =Housing ownership, X_9 =Water supply, X_{10} =Fuel for cooking, X_{11} =Mode of lighting, X_{12} =Lasting goods.

Table 4: One-dimensional indexes of poverty by attributes and administrative region

Regions	Attributes											
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
Others	0.8266	0.7710	0.9756	0.8816	0.6544	0.6827	0.4747	0.1245	0.7568	0.9735	0.8807	0.9713
Boké	0.8080	0.8132	0.7753	0.7592	0.6640	0.5039	0.6240	0.1235	0.6453	0.8846	0.7954	0.8573
Conakry	0.5638	0.6859	0.3184	0.3958	0.7723	0.1825	0.5489	0.5139	0.1844	0.3640	0.3646	0.6746
Faranah	0.8412	0.8984	0.9171	0.8184	0.6898	0.6597	0.7553	0.1053	0.6272	0.9118	0.8847	0.9254
Kankan	0.8967	0.9216	0.9030	0.6996	0.5978	0.6754	0.8068	0.0752	0.6407	0.9466	0.9043	0.9147
Kindia	0.8649	0.8129	0.8037	0.7694	0.6183	0.5141	0.6272	0.1393	0.7664	0.9209	0.7881	0.8867
Labé	0.8080	0.8132	0.7753	0.7592	0.6640	0.5039	0.6240	0.1235	0.6453	0.8846	0.7954	0.8573
Mamou	0.5638	0.6859	0.3184	0.3958	0.7723	0.1825	0.5489	0.5139	0.1844	0.3640	0.3646	0.6746
N'Zérékoré	0.8412	0.8984	0.9171	0.8184	0.6898	0.6597	0.7553	0.1053	0.6272	0.9118	0.8847	0.9254

Source: Author's calculations. X_1 =Level of education, X_2 =Nature of the roof, X_3 =Materials for exterior walls, X_4 =Type of toilet, X_5 =Index of settlement, X_6 =Annals expenditure, X_7 =Type of housing, X_8 =Housing ownership, X_9 =Water supply, X_{10} =Fuel for cooking, X_{11} =Mode of lighting, X_{12} =Lasting goods.

On comparing the levels of deprivation, we notice that for the dimensions of the nature of the roof, types of toilet, index of settlement and type of housing, Muslims have the highest deprivation. The households whose head is neither Muslim nor Christian show the higher degree of deprivation with regard to dimensions such as level of education, materials of the walls, yearly expenses, drinking water supply, fuel for cooking, mode of lighting and lasting goods.

By analyzing the contributions from Table A1 of the Appendix, we notice that Muslim households make the largest contribution to the state of poverty, mainly in terms of type of housing (9.56%), settlement index (8.49%), level of education (5.73%) and nature of the roof (5.31%). We can conclude that these dimensions contribute to an increase in the state of exclusion within the Muslim group, and to the overall poverty index.

Regarding dimensions such as lasting goods (19.01%), materials of the walls (7.21%), housing ownership (11.83%) and type of toilet (7.64%), Christians have a greater contribution compared to Muslims. In view of the highest contributions, the dimensions of housing ownership, lasting goods, annual expenditure, and drinking water supply contribute to the growing of the state of exclusion of Christians, and also an increase of the overall poverty index.

Among the administrative regions, the dominant dimensions, or the main correlates of poverty, by region are:

- Boké:** fuel for cooking, lasting goods, nature of the roof, level of education, mode of lighting, materials of the walls, and type of toilet;
- Conakry:** index of settlement, possession of lasting goods, nature of the roof, type of housing, and housing ownership;
- Faranah:** lasting goods, materials of the walls, fuel for cooking, nature of the roof, mode of lighting, level of education, type of toilet and type of housing;
- Kankan:** fuel for cooking, nature of the roof, mode of lighting, materials of the walls, level of education, type of housing, type of toilet;
- Kindia:** fuel for cooking, lasting goods, level of education, nature of the roof, materials of the walls, mode of lighting, type of toilet, water supply;
- Labé:** fuel for cooking, lasting goods, level of education, mode of lighting, nature of the roof, type of roof, materials of the walls, water supply, type of housing, annual expenditure;
- Mamou:** fuel for cooking, level of education, lasting goods, mode of lighting, nature of roof, water supply, type of roof, materials of the walls; and
- N'Zérékoré:** lasting goods, materials of the walls, fuel for cooking, mode of lighting, type of toilet, level of education, nature of roof and water supply.

Apart from Conakry, dimensions such as water supply, mode of lighting, fuel for cooking, level of education, material of the walls and nature of roof are the main variables associated with poverty within the groups.

Compared to other regions, Conakry has the highest degree of deprivation in relation to the dimensions associated with housing (index of settlement, type of housing, and housing ownership). This result is not surprising, since Conakry is the capital city and the prices and rents of houses are expensive. N'Zérékoré has the highest indices as far as dimensions such as material of the walls and lasting goods are concerned. The degree of deprivation in terms of index of settlement, type of housing, level of education and water supply are higher in the region of Mamou. For the dimensions annual expenditure, fuel for cooking and type of toilet, the region of Labé has the highest degree of deprivation. Kankan region has the highest levels of deprivation in relation to dimensions such as nature of roof, mode of lighting and type of housing.

An analysis of contributions to the overall poverty index shows that the dimensions of lasting goods, annual expenditure, water supply and type of housing significantly increase the amount of overall poverty and the state of social exclusion in Labé. Dimensions such as housing ownership, index of settlement, and lasting goods greatly increase the state of social exclusion in the capital, Conakry, and thus contribute greatly to the overall poverty index. The mode of lighting also greatly increases the state of exclusion in the regions of N'Zérékoré and Kankan, while water supply is the highest contributor in the regions of Kindia, Labé, N'Zérékoré and Mamou (Table A2 in the Appendix).

Within the natural regions, the main characteristics of poverty, except in Conakry, are the level of education, material of the walls, nature of the roof, water supply, fuel for cooking, mode of lighting and lasting goods, which also vary from one region to another. In the capital city, Conakry, dimensions such as index of settlement, type of housing, nature of roof and lasting goods are the main characteristics of poverty, followed by type of housing and housing ownership, for which slightly more than half the population is not categorised as poor in the capital (see Table 5).

If we compare the degrees of deprivation in the regions according to the attributes, Conakry has the highest degree of deprivation with regard to dimensions such as index of settlement and housing ownership. Middle Guinea records the highest levels of deprivation in dimensions such as level of education, water supply, type of roof and fuel for cooking. High Guinea supersedes the other regions with regard to the dimensions of nature of the roof, mode of lighting, type of housing and annual expenditure per household. Forest Guinea records the highest indices for dimensions such as material of the walls and lasting goods.

In terms of contributions (Table A2 in the Appendix), lasting goods, annual expenditure, water supply, level of education and fuel for cooking contribute to a great extent to the state of social exclusion within the region of Middle Guinea. In High Guinea, the mode of lighting, annual expenditure per household, type of housing and nature of the roof are the dimensions of greatest concern compared to other regions.

With regard to gender (Table 6), the intensity of poverty is higher among women than among men. In fact, nine of the 12 attributes indicate that women have the higher index. The dimensions of level of education, possession of lasting goods, fuel for cooking, mode of lighting, nature of the roof and the material of the walls are the main characteristics of poverty that affect both male and female genders, but with greater intensity on women. As a result, women appear to be vulnerable regardless of the dimensions being considered.

Table 5: One-dimensional Indexes of poverty by attributes and natural region

Regions	Attributes											
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
Conakry	0.5638	0.6859	0.3184	0.3958	0.7723	0.1825	0.5489	0.5139	0.1844	0.3640	0.3646	0.6746
Lower Guinea	0.8361	0.7943	0.7750	0.7401	0.6297	0.4972	0.5933	0.1412	0.7220	0.8940	0.7720	0.8659
Middle Guinea	0.9077	0.8722	0.8018	0.8400	0.6873	0.6416	0.7297	0.0676	0.7632	0.9587	0.8791	0.9102
High Guinea	0.9013	0.9346	0.9104	0.7432	0.6366	0.6973	0.8229	0.0660	0.6449	0.9456	0.8988	0.9161
Forest Guinea	0.7558	0.7654	0.9230	0.8222	0.6707	0.6058	0.5055	0.1862	0.7086	0.9005	0.8777	0.9453

Source: Author's calculations. X_1 =level of education, X_2 =Nature of the roof, X_3 =Materials for exterior walls, X_4 =Type of toilet, X_5 =Index of settlement, X_6 =Annals expenditure, X_7 =Type of housing, X_8 =Housing ownership, X_9 =Water supply, X_{10} =Fuel for cooking, X_{11} =Mode of lighting, X_{12} =Lasting goods.

Table 6: One-dimensional Indexes of poverty by attributes and gender of the household

Gender	Attributes											
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
Men	0.7795	0.8132	0.7639	0.7210	0.6908	0.5432	0.6396	0.1886	0.6260	0.8295	0.7730	0.8637
Women	0.9139	0.8169	0.7692	0.7633	0.6134	0.5308	0.6401	0.1379	0.6506	0.8649	0.8039	0.9125

Source: Author's calculations. X_1 =Level of education, X_2 =Nature of the roof, X_3 =Materials for exterior walls, X_4 =Type of toilet, X_5 =Index of settlement, X_6 =Annals expenditure, X_7 =Type of housing, X_8 =Housing ownership, X_9 =Water supply, X_{10} =Fuel for cooking, X_{11} =Mode of lighting, X_{12} =Lasting goods.

The households headed by men have a higher degree of deprivation in terms of the dimensions of index of settlement, annual expenditure and housing ownership, whereas those headed by women indicate a higher deprivation in the other dimensions. In terms of contribution related to the dimensions of level of education, water supply, fuel for cooking, mode of lighting, nature of the roof, type of toilet and lasting goods, women have a state of exclusion higher than that of men. Thus, women make a greater contribution to the amount of overall poverty (see Table A3 in the Appendix) in these dimensions.

Regarding the place of residence, fuel for cooking, lasting goods, material of walls, mode of lighting, level of education, nature of the roof, type of toilet, water supply and type of housing are the main dimensions of the phenomenon of poverty in rural areas.

In urban areas, except Conakry, durable goods, nature of the roof, fuel for cooking, lighting mode, index of settlement, level of education and the materials for exterior walls are the dominant dimensions. In the capital, Conakry, one observes the same dimensions as in the natural and administrative regions. When we compare the areas of residence against the attributes, rural areas present the highest degree of deprivation for dimensions such as fuel for cooking, mode of lighting, material of the walls, level of instruction, nature of roof, type of toilet, water supply, type of housing, lasting goods and annual expenditure. In terms of contributions, dimensions such as level of education, nature of roof, type of toilet, water supply, fuel for cooking, mode of lighting, annual expenditure, materials for exterior walls and lasting goods contribute to the state of exclusion in rural areas, compared to Conakry and other urban areas (Table A4 in the Appendix).

The main correlates of poverty at the level of households with one person are possession of lasting goods (87.98%), nature of roof (77.26%), fuel for cooking (68.47%), type of toilet (66.42%), material of the walls (65.40%) and the mode of lighting (70.06%). We found similar correlates for households of different sizes (see Table 8), only that these dimensions are complemented by the index settlement and the supply of water for households with three persons or more.

A comparison of households according to their size in relation to the degree of deprivation for the different dimensions indicates that households with two persons show the highest index for the dimensions of level of education, type of housing, and lasting goods. Dimensions such as the nature of roof, material of the walls and index of settlement are typical to households with three, four and five persons, and which have the highest degree of deprivation. Households with five or more persons also show a higher degree of deprivation associated with dimensions such as annual expenditure and lighting mode.

An analysis in terms of relative contributions shows that the index of settlement, and annual expenditure per household contribute greatly to the state of exclusion of households consisting of five or more persons. For households with one person, it is the housing ownership, while for those with two persons, it is the level of education (Table A5 in the Appendix).

The pattern of distribution of poverty within the groups is not the same in terms of monetary and multidimensional poverty. In other words, the level of poverty varies from one group to another not only in monetary terms, but also in multidimensional terms.

Table 7: One-dimensional Indexes of poverty by attributes and Place of Residence

Place of residence	Attributes											
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
Conakry	0.5638	0.6859	0.3184	0.3958	0.7723	0.1825	0.5489	0.5139	0.1844	0.3640	0.3646	0.6746
Other urban	0.6561	0.7282	0.6009	0.5927	0.6785	0.3533	0.4970	0.3405	0.4534	0.7043	0.6810	0.7962
Rural	0.8844	0.8581	0.8946	0.8279	0.6551	0.6554	0.6860	0.0752	0.7625	0.9655	0.8890	0.9307

Source: Author's calculations. X_1 =Level of education, X_2 =Nature of the roof, X_3 =Materials for exterior walls, X_4 =Type of toilet, X_5 =Index of settlement, X_6 =Annuaux expenditure, X_7 =Type of housing, X_8 =Housing ownership, X_9 =Water supply, X_{10} =Fuel for cooking, X_{11} =Mode of lighting, X_{12} =Lasting goods.

Table 8: One-dimensional Indexes of poverty by attributes and size of the household

Size	Attributes											
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
1 person	0.6391	0.7726	0.6540	0.6642	0.2722	0.1101	0.6334	0.4659	0.5166	0.6847	0.7006	0.8798
2persons	0.8584	0.8256	0.7671	0.7517	0.3284	0.3129	0.6836	0.2598	0.6193	0.8096	0.7956	0.9177
3persons	0.8333	0.8295	0.7876	0.7655	0.6090	0.4135	0.6746	0.2360	0.6579	0.8587	0.7956	0.9073
4persons	0.8110	0.8294	0.7988	0.7583	0.5815	0.4999	0.6756	0.2293	0.6457	0.8229	0.7934	0.9114
5persons	0.8019	0.8225	0.7789	0.7482	0.7017	0.5481	0.6506	0.1893	0.6483	0.8526	0.7969	0.8924

Source: Author's calculations. X_1 =Level of education, X_2 =Nature of the roof, X_3 =Materials for exterior walls, X_4 =Type of toilet, X_5 =Index of settlement, X_6 =Annuaux expenditure, X_7 =Type of housing, X_8 =Housing ownership, X_9 =Water supply, X_{10} =Fuel for cooking, X_{11} =Mode of lighting, X_{12} =Lasting goods.

5. Conclusion and implications for economic policy

The approach of Dagum and Costa (2004), supplemented with the decompositions introduced by Mussard and Pi Alperin (2005), allowed us to measure the poverty index for each attribute and for the total population. These indices enabled us to identify the main variables in relation to poverty, which helped us understand the state of deprivation of the different groups, namely regions, religion, place of residence and gender. More than half the population of Guinea is structurally poor. Of the different attributes selected, fuel for cooking, type of roof, level of education, mode of lighting, material of the wall, lasting goods, type of toilet and the index of settlement emerged as the key correlates of poverty. These dimensions are followed by drinking water supply, type of housing and annual expenditure per household.

The group decompositions show that households whose head is neither Muslim nor Christian are the most vulnerable. From the administrative region point of view, the most vulnerable regions are N'Zérékoré, Faranah, Labé, Kankan and Mamou, as Conakry and Boké appear to be the least poor. When we take a look at natural regions, Forest Guinea, High Guinea and Middle Guinea seem to be the poorest. The decomposition by place of residence shows that poverty is a rural phenomenon in Guinea. Based on gender, the intensity of poverty is slightly higher among households headed by women. However, there is no significant difference between the indices of households headed by women and those headed by men.

The decomposition with a combination of attributes and groups shows that dimensions such as level of education, nature of the roof, material of walls, index of settlement, fuel for cooking, mode of lighting, water supply and lasting goods are the dominant dimensions of poverty within different groups as a whole. In the capital, Conakry, it is dimensions such as index of settlement, type of housing and housing ownership that are of most concern. Middle Guinea has the greatest degree of deprivation in line with the dimensions of level of education, water supply and fuel for cooking. High Guinea ranks first compared to other regions for dimensions such as nature of the roof, type of toilet, and annual expenditure per household. Forest Guinea has the highest indices in the dimensions of material of walls, mode of lighting, and lasting goods.

The decomposition attributes and area of residence show that rural areas have the greatest degree of deprivation for dimensions such as fuel for cooking, mode of lighting, material of the walls, level of education, nature of the roof, water supply and annual expenditure per household.

Regarding gender, the degree of deprivation is relatively higher among households headed by women for most of the attributes compared to those headed by men.

Some policy implications aimed at reducing poverty in Guinea can be put forward, despite the fact that we must keep in mind that the results of this study provide necessary but not sufficient conditions for intervention.

First, to increase the standards of living of the people, policies should take into account the mode of lighting, fuel for cooking, quality of construction, drinking water supply and level of education mainly in the regions of Faranah, Kankan, N'Zérékoré, Labé, Kindia, Mamou and Boké. For the region of Conakry, it is necessary to introduce social policies on habitat, including the construction of Habitat for Moderate Rental (HLM). For the natural regions, policies for access to education and better housing conditions should be considered, especially for the regions of Middle, Forest and Upper Guinea, where improvement of the quality of buildings is paramount.

Secondly, regarding gender, literacy, access to drinking water and improved sources of lighting and cooking fuel are a priority for households headed by women. With regard to households headed by men, issues related to housing and financial resources need to be addressed through policy.

Measures aimed at raising the living standards of rural households while promoting better access to materials for exterior walls, potable water, electricity, durable goods, education, financial resources and better fuels for cooking could alleviate poverty in rural areas.

Finally, this work has provided static results. However, a dynamic study would better analyze the phenomenon of poverty in Guinea.

Notes

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2. Correspondence: Fatoumata L. Diallo, CRES/UCAD B.P. 7988 Dakar Senegal. Email: faatdiallo@yahoo.fr
3. Since 2003, poverty has significantly worsened in Guinea PRSP-DSRP (2007).
4. See report FBSPA 2002-2003.
5. The collection of household poverty has been taken into account in the choice of socio-economic attributes. Among the selected attributes, we took the dimensions that households considered missing.
6. In the traditional approach of basic needs, basic amenities include: food, drinking water, sanitary facilities, housing, health services, basic education and a public transport service.
7. Pattanaik, P.K. (2009) shows that in the measure of poverty, the aggregation must first be done through the variables.
8. For an explanation of the different axioms, see Bibi (2002) or Bibi and El Lahga (2006).
9. It should be noted that 7,095 households have responded to the questionnaire of the survey.
10. The household is defined as a group of people, related or not, who usually live together and share some or all of their resources to meet their basic needs such as food and housing. These people recognize the authority of a single person as the head of the household (FBSPA 2002-2003).
11. In the Appendix, we find the levels of belonging of each socio-economic attribute selected for the purpose of this analysis.
12. The results of the monetary approach come from the report of the EIBEP 2002-2003.

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Appendix

Appendix A: Tables on the absolute and relative contributions of the attributes to the poverty indexes of the groups and to the overall poverty index.

Table 1.A: Absolute and relative (%) contributions to the overall poverty index of the One-dimensional Indexes of poverty by attributes and religion

Religions	Attributes											
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
Muslims	0.0310 5.73	0.0294 5.43	0.0341 6.31	0.0389 7.19	0.0459 8.49	0.0564 10.43	0.0517 9.56	0.0529 9.78	0.0489 9.04	0.0254 4.70	0.0331 6.12	0.0931 17.22
Christians	0.0234 4.22	0.0258 4.67	0.0400 7.21	0.0423 7.64	0.0434 7.83	0.0559 10.09	0.0358 6.46	0.0655 11.83	0.0548 9.89	0.0267 4.82	0.0351 6.34	0.1053 19.01
Others	0.0311 5.31	0.0274 4.67	0.0451 7.70	0.0481 8.21	0.0440 7.52	0.0723 12.35	0.0366 6.24	0.0369 6.29	0.0602 10.27	0.0301 5.14	0.0380 6.49	0.1161 19.82

Source: Author's calculations. X₁=level of education, X₂=Nature of the roof, X₃=Materials for exterior walls, X₄=Type of toilet, X₅=Index of settlement, X₆=Annuaux expenditure, X₇=Type of housing, X₈=Housing ownership, X₉=Water supply, X₁₀=Fuel for cooking, X₁₁=Mode of lighting, X₁₂=Lasting goods.

Table 2.A: Absolute and relative (%) contributions to the overall poverty index of the One-dimensional Indexes of poverty by attributes and administrative regions

Regions	Attributes											
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
Boke	0.0304 5.84	0.0289 5.55	0.0358 6.88	0.0414 7.96	0.0447 8.58	0.0534 10.25	0.0481 9.23	0.0366 7.03	0.0513 9.86	0.0273 5.25	0.0343 6.59	0.0885 16.99
Conakry	0.0212 4.55	0.0244 5.22	0.0147 3.16	0.0216 4.63	0.0520 11.14	0.0193 4.14	0.0423 9.06	0.1522 32.64	0.0147 3.14	0.0112 2.41	0.0157 3.37	0.0770 16.52
Faranah	0.0317 5.51	0.0319 5.55	0.0424 7.38	0.0447 7.78	0.0464 8.08	0.0699 12.16	0.0582 10.13	0.0312 5.43	0.0499 8.68	0.0282 4.91	0.0382 6.64	0.1019 17.75
Kankan	0.0338 6.04	0.0327 5.86	0.0417 7.47	0.0382 6.83	0.0402 7.20	0.0715 12.81	0.0621 11.12	0.0223 3.98	0.0510 9.12	0.0293 5.24	0.0390 6.98	0.0969 17.35
Kindia	0.0326 5.97	0.0289 5.29	0.0371 6.81	0.0420 7.70	0.0416 7.63	0.0545 9.98	0.0483 8.86	0.0413 7.56	0.0610 11.17	0.0285 5.22	0.0340 6.23	0.0958 17.57
Labe	0.0339 5.94	0.0312 5.46	0.0377 6.61	0.0474 8.30	0.0469 8.21	0.0748 13.09	0.0580 10.16	0.0155 2.71	0.0608 10.66	0.0297 5.20	0.0382 6.69	0.0969 16.97
Mamou	0.0349 6.33	0.0300 5.44	0.0346 6.27	0.0423 7.67	0.0457 8.28	0.0613 11.11	0.0513 9.29	0.0241 4.36	0.0627 11.35	0.0293 5.31	0.0372 6.73	0.0986 17.86
N'Zerekore	0.0288 4.96	0.0271 4.68	0.0428 7.38	0.0450 7.76	0.0453 7.82	0.0659 11.36	0.0383 6.60	0.0537 9.26	0.0580 10.01	0.0281 4.84	0.0379 6.53	0.1089 18.78

Source: Author's calculations. X₁=level of education, X₂=Nature of the roof, X₃=Materials for exterior walls, X₄=Type of toilet, X₅=Index of settlement, X₆=Annals expenditure, X₇=Type of housing, X₈=Housing ownership, X₉=Water supply, X₁₀=Fuel for cooking, X₁₁=Mode of lighting, X₁₂=Lasting goods.

Table 3.A: Absolute and relative (%) contributions to the overall poverty index of the One-dimensional Indexes of poverty by attributes and natural regions

Regions	Attributes											
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
Conakry	0.0212 4.55	0.0244 5.22	0.0147 3.16	0.0216 4.63	0.0520 11.14	0.0193 4.14	0.0423 9.06	0.1522 32.64	0.0147 3.14	0.0112 2.41	0.0157 3.37	0.0770 16.52
Lower Guinea	0.0315 5.96	0.0282 5.34	0.0358 6.78	0.0404 7.64	0.0424 8.02	0.0527 9.97	0.0457 8.65	0.0418 7.91	0.0574 10.86	0.0276 5.23	0.0333 6.30	0.0917 17.35
Middle Guinea	0.0342 6.05	0.0310 5.48	0.0371 6.56	0.0458 8.12	0.0463 8.19	0.0680 12.04	0.0562 9.95	0.0200 3.54	0.0607 10.75	0.0296 5.25	0.0379 6.72	0.0980 17.35
High Guinea	0.0339 5.99	0.0332 5.86	0.0421 7.43	0.0406 7.16	0.0428 7.56	0.0739 13.04	0.0634 11.19	0.0195 3.45	0.0513 9.05	0.0292 5.16	0.0388 6.84	0.0978 17.27
Forest Guinea	0.0285 4.93	0.0272 4.71	0.0427 7.39	0.0449 7.77	0.0451 7.82	0.0642 11.12	0.0389 6.74	0.0551 9.55	0.0564 9.76	0.0278 4.82	0.0379 6.56	0.1086 18.81

Source: Author's calculations. X₁=level of education, X₂=Nature of the roof, X₃=Materials for exterior walls, X₄=Type of toilet, X₅=index of settlement, X₆=Annuals expenditure, X₇=Type of housing, X₈=Housing ownership, X₉=Water supply, X₁₀=Fuel for cooking, X₁₁=Mode of lighting, X₁₂=Lasting goods.

Table 4.A: Absolute and relative (%) contributions to the overall poverty index of the One-dimensional Indexes of poverty by attributes and by the gender of the head of the household

Gender	Attributes											
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
Men	0.0294 5.40	0.0289 5.31	0.0353 6.49	0.0394 7.24	0.0465 8.55	0.0575 10.58	0.0493 9.06	0.0559 10.27	0.0498 9.16	0.0256 4.71	0.0333 6.13	0.0929 17.09
Women	0.0344 6.26	0.0290 5.28	0.0356 6.47	0.0417 7.58	0.0413 7.51	0.0562 10.23	0.0493 8.97	0.0408 7.43	0.0517 9.41	0.0267 4.86	0.0347 6.31	0.1082 19.68

Source: Author's calculations. X₁=Level of education, X₂=Nature of the roof, X₃=Materials for exterior walls, X₄=Type of toilet, X₅=Index of settlement, X₆=Annals expenditure, X₇=type of housing, X₈=Housing ownership, X₉=Water supply, X₁₀=Fuel for cooking, X₁₁=Mode of lighting, X₁₂=Lasting goods.

Table 5.A: Absolute and relative (%) contributions to the overall poverty index of the One-dimensional Indexes of poverty by attributes and by place of residence

Place of residence	Attributes											
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
Conakry	0.0212 4.55	0.0244 5.22	0.0147 3.16	0.0216 4.63	0.0520 11.14	0.0193 4.14	0.0423 9.06	0.1522 32.64	0.0147 3.14	0.0112 2.41	0.0157 3.37	0.0770 16.52
Other urbans	0.0247 4.92	0.0259 5.15	0.0278 5.54	0.0324 6.45	0.0457 9.10	0.0374 7.46	0.0383 7.63	0.1009 20.11	0.0361 7.19	0.0218 4.34	0.0294 5.86	0.0816 16.26
Rural	0.0333 5.84	0.0305 5.34	0.0414 7.25	0.0452 7.92	0.0441 7.73	0.0694 12.17	0.0528 9.27	0.0223 3.91	0.0606 10.64	0.0298 5.23	0.0384 6.73	0.1024 17.96

Source: Author's calculations. X₁=Level of education, X₂=Nature of the roof, X₃=Materials for exterior walls, X₄=Type of toilet, X₅=Index of settlement, X₆=Annals expenditure, X₇=Type of housing, X₈=Housing ownership, X₉=Water supply, X₁₀=Fuel for cooking, X₁₁=Mode of lighting, X₁₂=Lasting goods.

Table 6.A: Absolute and relative (%) contributions to the overall poverty index of the One-dimensional Indexes of poverty by attributes and by the size of the household

Size	Attributes											
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
1 person	0,0241 4,58	0,0274 5,23	0,0302 5,76	0,0363 6,91	0,0183 3,49	0,0117 2,22	0,0488 9,29	0,1380 (26,28	0,0411 7,83	0,0212 4,03	0,0302 5,76	0,0978 18,63
2 persons	0,0323 5,99	0,0293 5,43	0,0355 6,57	0,0410 7,60	0,0221 4,10	0,0331 6,14	0,0527 9,76	0,0769 14,26	0,0493 9,13	0,0250 4,64	0,0343 6,36	0,1081 20,04
3 persons	0,0314 5,59	0,0295 5,25	0,0364 6,49	0,0418 7,44	0,0410 7,30	0,0438 7,80	0,0520 9,26	0,0699 12,45	0,0523 9,32	0,0265 4,73	0,0343 6,12	0,1024 18,24
4 persons	0,0305 5,39	0,0295 5,20	0,0369 6,52	0,0414 7,31	0,0391 6,91	0,0530 9,35	0,0520 9,19	0,0679 11,99	0,0513 9,07	0,0254 4,49	0,0342 6,04	0,1049 18,53
5 persons	0,0302 5,59	0,0287 5,33	0,0352 6,52	0,0392 7,26	0,0516 9,57	0,0660 12,23	0,0479 8,88	0,0396 7,35	0,0501 9,29	0,0261 4,84	0,0335 6,20	0,0913 16,93

Source: Author's calculations. X₁=Level of education, X₂=Nature of the roof, X₃=Materials for exterior walls, X₄=Type of toilet, X₅=Index of settlement, X₆=Annuals expenditure, X₇=Type of housing, X₈=Housing ownership, X₉=Water supply, X₁₀=Fuel for cooking, X₁₁=Mode of lighting, X₁₂=Lasting goods.

Test comparison of two means

Tests of difference between the indices in Table 2 were made from a test comparing the average of two independent samples. Indeed, when we take two samples for example Muslims and Christians, or the regions of Conakry and Boke, or men and women, we will have two samples of size n_1 of X_1 and n_2 of X_2 .

We note $m_{X_1}, m_{X_2}, \sigma_{X_1}, \sigma_{X_2}$ as the theoretical averages and standard deviations of X_1 and X_2 respectively and $\bar{X}_1, \bar{X}_2, S_{X_1}, S_{X_2}$ as their corresponding empirical characteristics.

As the sample sizes (n_i) are large, we have $\sqrt{n_i} \frac{\bar{X}_i - m_{X_i}}{\sigma_{X_i}} \approx N(0,1) \text{ } i=1,2$

We tested $H_0 : m_{X_1} = m_{X_2}$ versus $H_1 : m_{X_1} \neq m_{X_2}$

Under the assumption of equality of means, we have $\frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{\sigma_{X_1}^2}{n_1} + \frac{\sigma_{X_2}^2}{n_2}\right)}} \rightarrow N(0,1)$

Moreover, as $\sqrt{\frac{\frac{\sigma_{X_1}^2}{n_1} + \frac{\sigma_{X_2}^2}{n_2}}{\frac{S_{X_1}^2}{n_1} + \frac{S_{X_2}^2}{n_2}}} \rightarrow 1$, then $t_{obs} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{S_{X_1}^2}{n_1} + \frac{S_{X_2}^2}{n_2}\right)}} \rightarrow t_{n_1+n_2-2}$

Decision rule : if $t_{obs} > t_{lu}$ at α , we reject H_0 .

By comparing the values of probabilities (p-value) the decision rule is as follows: if $p\text{-value} < \alpha$, we reject H_0 , therefore we conclude that there is a significant difference between the averages, in this instance the two indices.

The test was performed with STATA using the command "Lincom", which takes into account the weightings in the calculation of averages and standard deviations.

Table 7.A: Multidimensional indexes and test of difference for the group religion

Religions	Indexes	Probability ($P > t $)		
		Muslims	Christians	Others
Muslims	0.5408	-	0.047	0.000
Christians	0.5540	0.047	-	0.001
Others	0.5858	0.000	0.001	-

Source: Author's calculations.

Tableau 7.A*: Test of difference taking into account standard errors

Religions	Indexes	Standard Errors	Probabilité (P> t)		
			Muslims	Christians	Others
Muslims	0.5408	0.0018239	-	0.000	0.000
Christians	0.5540	0.0064049	0.000	-	0.000
Others	0.5858	0.0070027	0.000	0.000	-

Source: Author's calculations.

Table 8.A: Multidimensional indexes and test of difference for the group administrative region

Regions	Indexes	Probability (P> t)							
		Boke	Conakry	Faranah	kankan	Kindia	Labe	Mamou	N'Zerekore
Boke	0.5207	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Conakry	0.4664	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000
Faranah	0.5745	0.000	0.000	-	0.008	0.000	0.576	0.001	0.388
Kankan	0.5587	0.000	0.000	0.008	-	0.032	0.029	0.293	0.000
Kindia	0.5455	0.000	0.000	0.000	0.032	-	0.000	0.354	0.000
Labe	0.5711	0.000	0.000	0.576	0.029	0.000	-	0.004	0.135
Mamou	0.5520	0.000	0.000	0.001	0.293	0.354	0.004	-	0.000
N'Zerekore	0.5797	0.000	0.000	0.388	0.000	0.000	0.135	0.000	-

Source: Author's calculations.

Table 9.A: Multidimensional indexes and test of difference for the group natural region

Natural regions	Indexes	Probability (P> t)				
		Conakry	Lower Guinea	Middle Guinea	High Guinea	Forest Guinea
Conakry	0.4664	-	0.000	0.000	0.000	0.000
Lower Guinea	0.5285	0.000	-	0.000	0.000	0.000
Middle Guinea	0.5647	0.000	0.000	-	0.672	0.010
High Guinea	0.5665	0.000	0.000	0.672	-	0.026
Forest Guinea	0.5772	0.000	0.000	0.010	0.026	-

Source: Author's calculations.

Table10.A: Multidimensional indexes and test of difference for the group gender

Gender	Indeces	Probability (P> t)	
		Male	Female
Men	0,5437	-	0.206
Women	0,5496	0.206	-

Source: Author's calculations.

Table 11.A: Multidimensional indexes and test of difference for the group place of de residence

Place of residence	Indexes	Probability (P> t)		
		Conakry	Other urbain	Rural
Conakry	0,4664	-	0.000	0.000
Other urban	0,5017	0.000	-	0.000
Rural	0,5702	0.000	0.000	-

Source: Author's calculations.

Table 12.A: Multidimensional indexes and test of difference for the group size

Group size	Indeces	Probability (P> t)				
		1 person	2 persons	3 persons	4 persons	5 persons and more
1 person	0,5250	-	0.195	0.001	0.000	0.118
2 persons	0,5397	0.195	-	0.017	0.002	0.979
3 persons	0,5612	0.001	0.017	-	0.524	0.001
4 persons	0,5663	0.000	0.002	0.524	-	0.000
5 persons and more	0,5395	0.118	0.979	0.001	0.000	-

Source: Author's calculations.

Table13.A : Descriptive statistics on some attributes

Attributes	Modalities	Percentage (%)	Attributes	Modalities	Percentage (%)
Educational level	Without education	70,44	Type of housing		
	Personal house	37,62			
	Primairy	9,02			
	High school	9,85		Flat	20,28
	Vocational	4,99		Room/apartment	4,76
	University	5,69		Hut	22,55
Indexe of settlement	Under-populated	5,69		Hut and house	6,07
	Normal	38,87		Several houses	8,71
	Over-populated	55,43			
Housing ownership	Owner	71,23	Mode of lighting	Oil lamp	59,32
	Tenant	19,10		Gas lamp	0,61
	Free housing	7,84		Electricity from sogel	26,74
	Office housing	1,83		Power generator	0,79
				Firewood/candle/others	12,54
Drinking Water supply	Water tap in-house	12,35	Fuel for cooking	Wood	69,63
	Public water tap	8,26		Charcoal	29,01
	Neighbour's water tap	14,15		kerosene	0,44
	Drilling	25,86		Gas	0,16
	Developed source	7,19		Electricity	0,78
	Natural source	32,19			

Source: Author's calculations.

Appendix B: Functions of belonging for the socio-economic attributes selected

Education level

Modalities		Function of belonging	
		Fj	Xij
1-University	1	0.0569	0
2-Vocational	2	0.1068	0.0529
3-High school	3	0.2054	0.1574
4-Primary	4	0.2956	0.2530
5-Without education	5	1	1

Source: Author's calculations.

Nature of the roof

Modalities		Function of belonging	
		Fj	Xij
1-Concrete/cement	1	0.0079	0
2-Slates/tiles	2	0.0124	0.0057
3-Iron sheet	3	0.7044	0.7021
4-Thatch/straw	4	1	1

Source: Author's calculations.

Material of external walls

Modalities		Function of belonging	
		Fj	Xij
Stone bricks	1	0.0021	0
Cement bricks	2	0.2781	0.2766
Steady clay bricks	3	0.4342	0.4331
Baked bricks	4	0.4654	0.4643
Clay/clay brick	5	0.9903	0.9903
Bamboo/Wood	6	1	1

Source: Author's calculations.

Type of toilet

Modalities		Function of belonging	
		Fj	Xij
Ventilated and improved Latrines	1	0.0066	0
Flush	2	0.0400	0.0336
Bowl/bucket	3	0.0468	0.0404
Covered latrines	4	0.3346	0.3302
Non covered latrines	5	0.8004	0.7991
None	6	1	1

Source: Author's calculations.

Index of settlement

Modalities		Function of belonging	
		Fj	Xij
Under populated	1	0.0569	0
Normal	2	0.4457	0.4122
Over populated	3	1	1

Source: Author's calculations.

Annual expenditures by household

Modalities		Function of belonging	
		Fj	Xij
5th Quintile	1	0.2000	0
4th Quintile	2	0.4000	0.2500
3rd Quintile	3	0.6000	0.5000
2nd Quintile	4	0.8000	0.7500
1st Quintile	5	1	1

Source: Author's calculations.

Type of housing

Modalities		Function of belonging	
		Fj	Xij
Several houses	1	0.0871	0
Personal house	2	0.4633	0.4121
Flat	3	0.6661	0.6342
Room/apartment	4	0.7137	0.6864
Hut and house	5	0.7745	0.7530
Hut/other	6	1	1

Source: Author's calculations.

Housing ownership

Modalities		Function of belonging	
		Fj	Xij
Owner	1	0.7123	0
Office housing	2	0.7307	0.0637
Tenant	3	0.9216	0.7276
Free housing/other	4	1	1

Source: Author's calculations.

Mode of lighting

Modalities		Function of belonging	
		Fj	Xij
1-Power generator	1	0.0079	0
2- Gas lamp	2	0.0140	0.0061
3- Electricity from Sogel	3	0.2813	0.2756
4-Oil lamp	4	0.8746	0.8736
5-Fire wood / candle / other	5	1	1

Source: Author's calculations.

Possession of lasting goods

Modalities	Function of belonging	X_{ij}
Refrigerator	yes	0
	No	1
Car	Yes	0
	No	1
Television	Yes	0
	No	1
Radio	Yes	0
	No	1
Iron	Yes	0
	No	1

Source: Author's calculations.

Drinking water supply

Modalities		Function of belonging	
		Fj	Xij
1-Water tap in-house	1	0.1235	0
2-Public water tap	2	0.2061	0.0942
3-Neighbour's water tap	3	0.3476	0.2557
4-Drilling	4	0.6062	0.5507
5-Developed source	4	0.6781	0.6327
6-Natural source/other		1	1

Source: calculation of the writer.

Fuel for cooking

Modalities		Function of belonging	
		Fj	Xij
1-Gas	1	0.0016	0
2-Electricity	2	0.0093	0.0078
3-Kerosene	3	0.0137	0.0121
4-Charcoal	4	0.3037	0.3027
5-Wood /other	4	1	1

Source: Author's calculations.

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Abstract

This study examines the multidimensional aspect of poverty in Guinea, taking into account both the monetary and non-monetary dimensions of poverty. We use data from the Full Base Survey on Poverty Assessment (FBSPA, 2002-2003). The methodology relies on the fuzzy set approach of Dagum and Costa (2004), which is supplemented by the decomposition methods of Mussard and Pi Alperin (2005).

The main results that emerge are: i) the identification of the key variables associated with poverty; and ii) the identification of deprivation state according to selected attributes for different groups such as natural regions, administrative regions, area of residence, gender, religion and household size. The effect of attributes on the deprivation of each group and the global poverty index has also been tested.

Keywords: *Fuzzy Set, Decompositions, Multidimensional Poverty*

JEL Classification: *I32*