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Stellenbosch Economic Working Papers : 3 / 2004


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## ABSTRACT

This paper sets out the reasoning behind the fuzzy set approach to poverty measurement as a means to address both vertical and horizontal vagueness of poverty. The linear approach of Cerioli and Zani and the totally fuzzy and relative approach of Cheli and Lemmi are discussed and applied to the Eastern Cape Province, South Africa, using data from Census 96. The results indicate different experiences of poverty in the Eastern Cape. It is shown that the traditional money metric approach does not accurately identify the most deprived in society, indicating the importance of other non-metric dimensions in poverty measurement.



***Keywords****: multidimensional poverty, deprivation, well being, vagueness, measurement, fuzzy, Eastern Cape, South Africa*

**JEL classification: I23; D30; C49; C81**

## 1. INTRODUCTION

South Africa entered a new era in 1994 when political freedom was achieved for every citizen of the country. The government has since then fought the "Second Struggle". The backbone of this struggle is that every citizen should have economic freedom: freedom from want, freedom from poverty.

Many studies have been done since then to help in this struggle by trying to identify those persons and households that are poor,[1] aided by increased gathering of information regarding the well being of citizens. The most widely known information gathering is the population census every 5 years, complemented by a number of other surveys every year on a randomly selected sample of the population, such as the October Household Survey (OHS) and the General Household Survey. Most of these studies use income or expenditure as the yardstick identifying individuals and households who should be considered poor. The government also use this method to measure poverty in South Africa (RSA, 1998: 4-6), while it's approach to addressing this problem is "through advancing the capabilities of disadvantaged communities, households and individuals by improving their assets, both physical and social" (RSA, 1998:2). One could rightfully ask: why measure one way and address the problem in another? Would it not be more efficient to measure poverty the same way it is addressed?

Some studies were done to address this issue, but they only look at poverty from a national perspective, with the smallest geographical area being the provinces.[2] This paper aims to use the fuzzy approach to poverty measurement, used in Ngwane et al (2001a) and Qizilbash (2001), to take this one step further, and look at poverty within a province: the Eastern Cape. The Eastern Cape is identified in all the studies mentioned above, to be the province with the biggest number of poor and the province where poverty is most severe. For example, the average annual household income in the Eastern Cape in 1995 was R26 042, nearly 40% lower than the national average. To add to this, the Eastern Cape also has the highest income inequality, with a Gini-coefficient of 0.6, higher than the national average of 0.57 (Ngwane et al, 2001c:70).

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[1] See Alderman et al (2000), Hirschowitz et al (2000), RSA (1998), Klasen (2000), Leibbrandt & Woolard (1999), May (1998), Ngwane et al (2001b) to name but a few of these.

[2] See Klasen (2000), Nqwane et al (2001a) and Qizilbash (2001).

There are mainly two problems when measuring poverty: identifying those people in the population who are poor and constructing an index of poverty using the available information on the poor (Sen, 1976:1). The fuzzy approach used in this paper addresses both these problems, as will become clear later on. One should rightfully ask whether this method of measuring poverty adds value to the other, more conventional methods, such as the poverty rate. The hope is that it does.

This paper starts off by giving a definition to what is meant by poverty. This is followed by a critical look at the different methods used in measuring poverty, especially how they relate to the definition of poverty. The last part of that section is devoted to explaining the methodology of the fuzzy approach to poverty measurement. A description of the data that will be used in this study is then provided, followed by a quick overview of the demographics of the Eastern Cape Province. In the penultimate section, the results of the study are discussed, with the focus on the differences between geographical areas of the Eastern Cape. This is followed by a summation of our study in the last section.

## 2. DEFINING POVERTY

Ask ten different people to define poverty and one would probably get ten different answers. Poverty means different things to different people. Some people will define poverty as the absence of a car or fridge, while for others it will be the lack of formal housing or employment. If one were to consult the Oxford English dictionary (1989), one would find six definitions for poverty. Poverty, and being poor, are described by expressions such as “deficiency in”, “lacking of”, “scantiness”, “inferiority”, “want of”, “leanness or feebleness”, and many more. Experiences of poverty differ from person to person, from one area to another, and across time. Poverty in India differs from poverty experienced in Canada, and poverty in the USA today is different from the poverty in the USA 50 years ago. It is clear that there is no single definition for poverty, for poverty is a vague concept (Qizilbash, 2000:3).

It is, however, necessary to find a proper definition for poverty, one that gives a true reflection of what poverty is and one that is as inclusive as possible, before any measurement of poverty can begin. One way of trying to find a proper definition is by asking individuals to define poverty to get an idea of what constitutes poverty. This is what the South African Participatory Poverty Assessment (SA-PPA) did. The SA-PPA (May, 1998:38-48) found that

the poverty definitions given by the poor differ from that given by the non-poor. The poor characterize poverty as isolation from the community, lack of security, low wages, lack of employment opportunities, poor nutrition, poor access to water, having too many children, poor education opportunities and misuse of resources. The non-poor see poverty as a lack of income and a result of the bad choices by the poor. It is therefore not easy to get a precise definition of poverty that will suit every situation.

The other option is to consult the vast literature on poverty. Though there is a big debate in the literature as to whether poverty should be viewed as absolute or relative; or whether it should be measured as necessities or capabilities or functions; or whether it is only a monetary phenomenon,[3] there is a general consensus that poverty is multidimensional. This is clearly expressed by the definition of poverty given by the World Bank (2002):

> *"Poverty is hunger. Poverty is lack of shelter. Poverty is being sick and not being able to see a doctor. Poverty is not being able to go to school and not knowing how to read. Poverty is not having a job, is fear for the future, living one day at a time. Poverty is losing a child to illness brought about by unclean water. Poverty is powerlessness, lack of representation and freedom."*

It is interesting to note that the definition of what poverty is has changed little over the last century, as the following definition by Godard (1892:5-6) clearly indicates:

> *"Roughly, we may define poverty as "An insufficiency of necessaries"; or more fully, as "An insufficient supply of those things which are requisite for an individual to maintain himself and those dependent upon him in health and vigour." And the degree of poverty will obviously be determined by the extent of the insufficiency. Of course, this leads to the further question as to what things are requisite: and it must at once be stated that there is no sharply defined line between necessaries and unnecessaries… Obviously, however, an adequate supply of wholesome food and suitable clothing, and a sanitary dwelling, with sufficient sleeping apartments, are amongst the first requisites. To these must be added the means of obtaining some amount of education. Recreation also, … and leisure to enjoy it … And freedom…"*

No new or separate definition to poverty will be presented in this paper. Instead, the above definitions will be adopted, illustrating the multidimensional and vague or fuzzy nature of poverty. Particularly, poverty will be regarded as a special case of the measurement of well-being throughout this essay, meaning "… poverty and the poor are associated with a state of

[3] See Hagenaars (1991), Maxwell (1999), Rein (1970), Sen (1976) and Sen (1983).

want, with deprivation; … such deprivation is related to the necessities of life" (Boltvinik, 1998: 2). As such, the state of deprivation will indicate the state of poverty. In other words, the more deprived a person is, the poorer that person is.

There is no consensus as to what these necessities of life or the dimensions of poverty should be or how many there are. Nutrition, shelter, safety, clothing and health are certainly important dimensions of well-being, but so too are income, education, literacy, sanitation and clean drinking water, to mention but a few. The uncertainty continues, since some dimensions contribute more to poverty than others, depending on time and place. This is what Qizilbash (2000) calls the horizontal vagueness of poverty. Neither is there consensus on where or how to distinguish between the poor and the non-poor in each dimension. Individuals differ in their nutritional requirements depending on age, sex, height and weight for example, resulting in no clear threshold where nutritional poverty starts or where it ends. There is also no consensus as to when education is enough, as the requirements of society may differ from place to place. This is the vertical vagueness of poverty according to Qizilbash (2000). This vagueness of poverty contributed to a large extent to the debate and difficulty in measuring poverty, which is the topic of the next section.

## 3. APPROACHES TO POVERTY MEASUREMENT

### 3.1 Traditional Approach

In the traditional approach to poverty measurement, the poor are defined as all those individuals or households who fall below some critical level required to maintain a minimum standard of living in some dimension or for some indicator of poverty. This dimension or indicator is assumed to be a good proxy for actual poverty. The critical level is called the poverty line (z). All those individuals or households above the poverty line are classified as non-poor.

There are two distinct features that characterize the traditional approach to poverty measurement.

The *first* feature is that it is uni-dimensional, as it only looks at one indicator or dimension of poverty. The dimensions of poverty that are most often studied are the money-metric dimensions: income and consumption/expenditure. Income is considered the means to

acquire the necessities for a minimum standard of living, while consumption indicates whether the necessities are actually purchased. Income is more variable over time than consumption, because of factors such as seasonal employment and savings, the latter result in consumption smoothing taking place. Consumption is, therefore, often chosen rather than income, as it is considered a more accurate indicator of the average standard of living enjoyed by the individual or household. Another dimension that is often studied, and used mostly in the medical fraternity, is that of nutrition, or under-nutrition in the case of the poor.[4] It is clear that the traditional approach does not take into consideration the horizontal vagueness of poverty with its single dimensional approach.

The *second* feature of the traditional approach is the distinct classification of the population into two groups: poor and non-poor, according to the poverty line. The researcher chooses this poverty line, depending on what the aim of the study is. It could be absolute, relative or subjective, or any combination of these. A subjective poverty line can be determined by asking the poor where the critical level between poor and non-poor should be. A relative poverty line is dependent on the distribution of income of the population and could be something like half the median income of the population. An absolute poverty line, on the other hand, is predetermined and independent of the population's income. This kind of poverty line could be based on some minimum wage level, the cost of a basket of goods considered to be essential to maintain a minimum standard of living, or, in the case of nourishment, the minimum calories and vitamins necessary for a healthy living, or any other basis the researcher chooses. There is a trade-off between keeping the poverty line simple enough to understand and at the same time objective and scientific enough to validate the poverty rates calculated. Lanjouw (1998) shows that this is no easy path to follow as there are numerous methods to determine poverty lines.[5] The question of horizontal vagueness of poverty is addressed to some degree when the costs of other poverty indicators, such as shelter, nutrition and energy, are included in the basket of necessities when determining the absolute poverty line. The notion of vertical vagueness is, however, not addressed because a clear distinction is made between the poor and the non-poor.

[4]Nutrition-based poverty measurement is included here because it shares the same characteristics as the money-metric poverty measurements. See Gopalan (1997) for a study of under-nutrition as a method for measuring poverty.

[5] For a more detailed discussion about the determination of poverty lines, see Boltvinik (1998), Lanjouw (1998) and Madden (2000).

The usefulness of the traditional approach lies in its interpretability. The traditional approach shows the extent of poverty through three poverty indices:

- the poverty rate, also called the headcount ratio,
- the poverty gap or poverty ratio, and
- an index measuring the severity or intensity of poverty.

The poverty rate is the number of poor people expressed as a percentage of the whole population.

The poverty gap is the aggregate shortfall of the income of the poor from the poverty line, i.e. the total amount or income necessary to lift the poor to the poverty line. The poverty gap is often expressed as a percentage or ratio of the poverty line, where the average poverty gap per unit is expressed as a percentage of the poverty line.

Sen (1976) criticized the poverty rate as insensitive to the extent of the shortfall of the poor's income relative to the poverty line, and poverty gap/ratio as insensitive to the number of the poor. He developed a method that aimed to measure the intensity of poverty. This method was a combination of the poverty rate, the poverty gap and income inequality. A fair quantity of methods have been developed since then, with the most widely used and commonly known of these being the Foster-Greer-Thorbeck method (1984)[6] and the Sen-Shorrocks-Thon method (Osberg, 2000; Myles and Picot, 2000).[7] The debate that ensued from Sen's (1976) work regarding poverty measurement has resulted in a number of axioms being developed to measure the quality of poverty indices. These are summarized by Hagenaars (1991:149) as the following:

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[6] The FGT method to creating poverty indices uses the following formula:

$$P_\alpha(y,z) = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^\alpha$$

where $z$ is the poverty line, $y_i$ the income of the i[th] household and q the number of household where $y_i \leq z$. The poverty rate is where $\alpha=0$, the poverty ratio when $\alpha=1$ and the severity of poverty is measured when $\alpha=2$. The aggregate poverty gap is simply the poverty ratio multiplied by z and n.

[7] According to Osberg (2000), the SST index of poverty intensity is a combination of the poverty rate, the poverty gap ratio, and the inequality in the poverty gaps. The formula Osberg gives is as follows:

SST = (RATE)*(GAP)*(1 + G(X))

where RATE is the headcount ratio, GAP the poverty gap ratio, and G(X) the Gini index of inequality of the poverty gap among all people, where the poverty gap of the non-poor is set equal to zero, i.e. their income is set equal to the poverty line. See Myles and Picott (2000) and Osberg (2000) about the use of the SST index.

*Symmetry Axiom*: Poverty depends on the income levels of anonymous persons; if the same distribution of incomes is found, but with other persons, this should not affect poverty.

*Monotonicity Axiom*: A reduction in income of a person below the poverty line must increase the poverty index.

*Transfer Axiom*: A pure transfer of income from a person below the poverty line to anyone who is richer must increase the poverty index.

*Population Homogenity Axiom*: If two or more identical populations are pooled, the poverty index should not change.

*Focus Axiom*: A change in the income distribution of the non-poor should not change the poverty index.

*Transfer Sensitivity Axiom*: The increase of a poverty index as a result of a transfer of a fixed amount of money from a poor person to a richer person should be decreasing in the income of the donor and vice versa.

*Subgroup Monotonicity Axiom*: The poverty index should increase when poverty in a subgroup increases and vice versa.

*Decomposability Axiom*: The poverty index should be a weighted average of the poverty indices, applied to specific subgroups, within the population (with weights equal to the population share).

An unwritten rule of any useful poverty index is it has to be interpretable or understood. A poverty index can adhere to all the axioms above, but be hard to interpret. According to Myles and Picot (2000), this is the reason why so few indices measuring the severity or intensity of poverty have actually been used in public debate, though these indices may be theoretical and statistically more sound than the poverty rate and poverty gap/ratio indices.

There are many advantages to the traditional approach to poverty measurement. It is easy to interpret, especially the poverty rate and poverty gap. The wide research on methods

measuring the intensity or severity of poverty has resulted in these indices being used more often and being better understood. Another advantage for this approach is that it is fairly easy to calculate the required figures. It is also handy because it is easy to compare changes in poverty over time, if the poverty line is the same or determined in the same way, and the welfare indicator stays unchanged.

A shortcoming of the traditional approach to poverty measurement is that it studies only one dimension of poverty at a time, though there is wide agreement that there are many dimensions contributing to poverty. If only one dimension is studied, it could give a distorted image of the actual problem, as Klasen (2000) discovered for coloured people in South Africa, where expenditure based poverty is 33%, while the multidimensional deprivation approach measures the poverty rate at only 12%. Another shortcoming of this approach is that it makes a clear distinction between the poor and the non-poor. In Crothers' (1997:506) words "… there is no single point at which poverty suddenly impinges: rather, there is a continuum." In reality, there is no clear distinction. After all, it would be presumptuous to classify a person earning R340 p.m. as poor, while a person earning R342 p.m. is classified as non-poor, when the poverty line is R341 p.m. per person. Indeed, the poverty line is often the most contentious part of this approach, as there are numerous problems associated with it.[8] For instance, the poverty line must cover "… a wide range of different social situations, and it is particularly difficult to run a poverty line across all of them" (Crothers, 1997:506). Another shortcoming of this approach is the numerous choices the researcher has to make during the research, with every choice open to criticism (Leibbrandt and Woolard, 1999:38).[9] To overcome the shortcomings of the traditional approach, the multidimensional approach was developed, which is the topic of the next section.

### 3.2 The Multidimensional Approach

The multidimensional approach developed because of the need to measure poverty more directly through its many dimensions, rather than indirectly through a single indicator that serves as a proxy for actual poverty, such as consumption or income. The work by Sen

[8] See Lanjouw (1998).

[9] Some of the choices the researcher has to make are the unit of measure, whether it should be households or individuals; the dimension to be studied: income, expenditure, welfare, nutrition, or something else; how to determine the poverty line and where to draw it; and what data source to use, to name but a few.

(1983) on capabilities and functions played a significant role in promoting the use of this approach to poverty measurement. In the words of Klasen (2000:33),

> *"The [multidimensional approaches] have relied on work by Rawls, Sen, and others to emphasize that poverty should be seen in relation to the lack of important "basic goods" (Rawls) or "basic capabilities" (Sen), some of which cannot be purchased with money as they are under-provided in a market system. Financial resources, they contend, are just one of several means to achieve well-being and therefore efforts should be directed at measuring well-being outcomes directly, rather than focus on one of its imperfect proxies."*

The multidimensional approach, therefore, address the notion of horizontal vagueness of poverty with the inclusion of other poverty indicators or dimensions in measuring a person's well being. If a number of these basic capabilities or basic needs are not met, then that person would be regarded as poor or deprived. It is no coincidence then, that this approach is also referred to in the literature as the unsatisfied basic need (UBN) approach (Ngwane et al, 2001b; Boltvinik, 1998) or the deprivation approach (Klasen, 2000; Madden, 2000). Some authors tend to refer to those that are poor according to this method as the deprived, to distinguish them from the poor of the traditional approach.[10] This method will also be applied in this paper, with those identified as poor according to the multidimensional approach being labelled as deprived.

This approach certainly offers a broader and more accurate picture of poverty than the traditional approach. It does, however, also have shortcomings. There is no consensus on what dimensions of well-being should be included in a poverty analysis. Klasen (2000), for instance, includes education, health, housing, nutrition, water, employment and safety as the dimensions of "core poverty", while Qizilbash (2000:20) argues that health, nutrition and sanitation should be the core dimensions of poverty. But as Qizilbash (2000) rightly points out, there is some arbitrariness in deciding which dimensions to include. The researcher is often constrained by the availability of data, which grew enormously over the last decade or so because of more detailed household surveys and better technology.

There is no set standard or method on how to measure multidimensional poverty, as the panorama of methods developed to measure poverty or deprivation this way, clearly indicates. Boltvinik (1998) categorizes the different methods into 21 categories, with many methods actually falling between some of his categories. For instance, he distinguishes between

[10] See Klasen (2000) and Maxwell (1999).

methods that list the different poverty dimensions or indicators separately, such as the Human Development Indicators and the Swedish Approach to Welfare, and methods that create a composite index for overall poverty, such as the Human Development Index (HDI) and Human Poverty Index (HPI) of the UNDP. The debate that surrounds composite indices is the problem of weights that the different dimensions contribute to overall poverty. Certainly, some dimensions contribute more to poverty than others. It would be ideal to ask the people to decide on the importance of the various dimensions to their overall well being, but poverty or deprivation differs between people and across time. Thus, there will never be consensus as to the exact weight the different dimensions or indicators should carry. The HDI for instance, assigns equal weights to the three dimensions it uses in constructing the index.[11]

Another feature of many multidimensional poverty indices is that of a poverty threshold in each dimension. These indices, therefore, do not account for the vertical vagueness of poverty. A reason for the poverty threshold is to overcome the "lack of a unique measurement yardstick" (Boltvinik, 1998:5) – not an issue in the traditional money-metric approach – to help construct a composite index. The poverty rate in each dimension is then used to construct the index. The development indices by Statistics SA, the Household Infrastructure Index and the Household Circumstances Index, are good examples of these (Hirschowitz et al, 2000). In these indices, the different provinces are ranked in each dimension, and then the different dimensions combined to construct a single index, with the weights calculated using the principal components technique.[12] These indices are developed to compare geographical areas or population groups with each other, rather than to identify poor households or individuals.

Many of the existing multidimensional indices offer more advantages than the traditional approach, by measuring poverty directly, but there are still a few shortcomings as mentioned above. The fuzzy approach - the approach used in this paper - falls under the multidimensional approach as it looks at various dimensions of poverty simultaneously. It offers the advantage of not only addressing the horizontal vagueness of poverty, but the vertical vagueness of poverty as well.

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[11] The three indicators used to construct the HDI, each weighing a third, are: (i) longevity, as measured by life expectancy at birth; (ii) educational attainment measured by adult literacy and the combined gross primary, secondary and tertiary enrolment ratio, with the latter weighing a third and the former two thirds to educational attainment; and (iii) income, as measured by GDP per capita, in purchasing power parity in US$ (Statistics SA, 1998b:1).

[12] See Hirschowitz et al (2000) for more detail about these indices.

### 3.3 The Fuzzy Approach

Fuzzy sets, as developed by Zadeh (1965) and expanded by Dubois and Prade (1980), allow for the treatment of vague concepts such as poverty. Fuzzy sets are, therefore, an ideal framework to address both the issues of vertical vagueness of poverty and horizontal vagueness of poverty by allowing every individual some degree of deprivation in each dimension of poverty. This allows us to identify those that are highly deprived – the absolute poor – and also those slightly less deprived, i.e. those individuals or households who lie at the margins of poverty. The following section gives an intuitive definition to fuzzy sets, which will be followed by a more formal definition.

Suppose there is a population where some members are poor and others not, based on some indicator or some set of indicators. According to the traditional approach, the set of poor is a crisp set, i.e. you either belong to the set of the poor, or not, depending on some critical level, e.g. the poverty line. There are no "partially poor people". The fuzzy approach, on the other hand, allows people some degree of belonging to the set of poor people. The fuzzy approach has two critical levels instead of one: a minimum level, below which a person absolutely belongs to the set of poor people, and a maximum level, above which a person absolutely does not belong to the set of poor people. If a person were to fall between these two levels, he or she then partially belongs to the set of poor people. Fuzzy sets also allow for more than one dimension of poverty to be used in measuring the poverty status of a person, because the measurement yardstick is simply the degree of "membership" to the set of poor people in each dimension. The overall membership function acts as a deprivation indicator showing each household's overall deprivation relative to its surroundings.

Formally, let X be a set $x \in X$ and A a fuzzy subset of X defined as

$$A = \{ x, \mu_A(x) \} \quad \text{for all } x \in X$$

where $\mu_A(x)$ is the mapping of X to the interval [0, 1], indicating the degree of membership of x to A.[13] $\mu_A(x)$ is called the membership function (m.f.). If $\mu_A(x) = 0$, then x does not belong to A, but if $\mu_A(x) = 1$, then x completely belongs to A. If, however, $0 < \mu_A(x) < 1$,

[13] Mapping X to the interval [0, 1] is to assign a real value between 0 and 1 for each $x \in X$.

then x partially belongs to A, with the degree of membership to A increasing the closer $\mu_A(x)$ is to 1.

Let X = { $X_1$ , $X_2$ , … , $X_k$ } be a set of k indicators or dimensions of poverty in a population consisting of n individuals and P be the fuzzy subset of the poor in the population. Let $\delta(x_{ij})$ be the membership function for the $i^{th}$ individual in dimension $X_j$. Therefore

$$\begin{cases} \delta(x_{ij}) = 0 \\ \delta(x_{ij}) = 1 \\ 0 < \delta(x_{ij}) < 1 \end{cases}$$

This depends, respectively, on whether the person is absolutely non-poor in dimension $X_j$, the person completely belongs to P, or the person partially belongs to P to some degree. Suppose now there are m categories of deprivation in dimension $X_j$, i.e. $X_j = \{ x_j^1, x_j^2, ..., x_j^m \}$. For easier analysis, it would be best if these categories were arranged in increasing order with respect to the risk to poverty, so that $x_j^{(1)}$ denotes the least risk of poverty and $x_j^{(m)}$ the most risk to poverty in dimension $X_j$. Therefore, $X_j = \{ x_j^{(1)}, x_j^{(2)}, ..., x_j^{(m)} \}$, where $x_j^{(1)} < x_J^{(2)} < ... < x_j^{(m)}$ with respect to the risk to poverty. Furthermore, let $w_j$ denote the weight that dimension $X_j$ contribute to overall poverty, with $\sum_{j=1}^{k} w_j = 1$.

There are two definitions for the membership function in the literature. Cerioli and Zani (1990) proposed the first definition. They indicated that there should be a minimum critical level $(x_j^{(\min)})$ below which an individual should be considered absolutely poor and a maximum critical level $(x_j^{(\max)})$ above which an individual should be considered absolutely non-poor.[14] Those cases where the indicator of poverty is continuous, $x_j^{(\min)}$ and $x_j^{(\max)}$ are specific values. Where indicators are ordinal, $x_j^{(\min)}$ and $x_j^{(\max)}$ will coincide with those categories the researcher identified as the boundaries to the vague area of poverty with respect to that indicator. If the individual's deprivation were to fall between these two levels, the

[14] Cerioli and Zani (1990) originally explored the case where the indicators of poverty were in decreasing order with respect to the risk of poverty, as income and expenditure indicators often are. Arranging the dimensions or indicators in increasing order with respect to the risk of poverty, makes for easier understanding.

membership function will be a linear function between $x_{ij}$, $x_j^{(\min)}$ and $x_j^{(\max)}$. Therefore, the definition for the membership function proposed by Cerioli and Zani is as follows:[15]

$$(1) \quad \delta(x_{ij}) = \begin{cases} 1 & if \quad x_{ij} \le x_j^{(\min)} \\ \dfrac{x_j^{(\max)} - x_{ij}}{x_j^{(\max)} - x_j^{(\min)}} & if \quad x_j^{(\min)} < x_{ij} < x_j^{(\max)} \\ 0 & if \quad x_{ij} \ge x_j^{(\max)} \end{cases}$$

The other definition for the membership function was proposed by Cheli and Lemmi (as in Qizilbash, 2001, and Miceli, 1998). They have two main criticisms to the definition proposed by Cerioli and Zani. The first is that deciding on the minimum and maximum critical levels are still very arbitrary and, therefore, open to the same criticism the traditional approach to poverty measurement contends with. Instead, they let these critical levels coincide with the minimum and maximum values or categories in each dimension. The other criticism they had was that the linear approach could give too much importance to some rare category in a dimension that could easily result in an over- or underestimation of actual poverty. Their solution was to let the poverty rating of each category in every dimension be determined by the number of individuals experiencing the same level of deprivation. They therefore call their approach the totally fuzzy and relative (TFR) approach to poverty measurement, with the membership function defined as follows:[16]

$$(2) \quad \delta(x_{ij}) = \begin{cases} 0 & x_{ij} = x_j^{(1)} \\ \delta(x_j^{(\lambda-1)}) + \dfrac{F(x_j^{(\lambda)}) - F(x_j^{(\lambda-1)})}{1 - F(x_j^{(1)})} & \text{if} \quad x_{ij} = x_j^{(\lambda)}, \lambda = 2,..., m \end{cases}$$

The membership function of every individual to overall poverty, i.e. across all the dimensions $X_1,\ldots,X_k$, is defined as follows:

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[15] In this paper, $x_j^{(\min)}$ and $x_j^{(\max)}$ will be the highest and lowest categories in Xj, avoiding the issue of critical levels altogether.

[16] Though it is not applicable in this paper, Cheli and Lemmi (as in Miceli, 1998) propose that for continuous dimensions of poverty, instead of the categorical dimensions used here, the following membership function should apply

$$\delta(x_{ij}) = \begin{cases} F(x_{ij}) \\ 1 - F(x_{ij}) \end{cases}$$

depending on whether the dimension is increasing or decreasing with respect to the risk of poverty.

$$(3)\quad \delta_p(x_i) = \frac{\sum_{j=1}^{k} w_j \delta(x_{ij})}{\sum_{j=1}^{k} w_j} \quad \forall i = 1,...,n$$

The choice of how to define $w_j$ is rather arbitrary. One would feel that some indicators of poverty are more important than others. Klasen (2001) lists seven "core" indicators of poverty: education, health, housing, nutrition, water, employment and safety, which he considers more important than other indicators, such as sanitation and transport. The ideal would therefore be that the individuals themselves should decide on the importance of each indicator to overall poverty. This is, however, not always possible and the definition argued by Cerioli and Zani (1990) would seem to be a reasonable substitute (Miceli, 1998:14). Cerioli and Zani (1990:276) argued that $w_j$ should be an "inverse function of the number of individuals in the reference population which show the corresponding poverty symptom." Filippone et al (2001:10) support this argument, because it gives "more importance to the items that are more diffused (and for which, symmetrically, deprivation is lower) and therefore more representative of the lifestyle prevailing in society." This line of thought coincides with the relative concept of poverty.

The method most often used for determining the weight in accordance with the preceding argument is as follows:

$$(4)\quad w_j = \log\left(\frac{1}{\bar{\delta}(x_j)}\right) \qquad \text{where} \qquad \bar{\delta}(x_j) = \frac{1}{n}\sum_{i=1}^{n} \delta(x_{ij})$$

i.e. $\bar{\delta}(x_j)$ is the average deprivation experienced in dimension $X_j$. Filippone et al (2001) list two advantages this definition has over a more common $w_j = \frac{1}{\bar{\delta}(x_j)}$:

- it has a minimum value of 0, i.e. when everyone falls into the lowest category or below $x_j^{(\min)}$ and would thus not feel relatively deprived, and
- the logarithm does not allow excessive importance for extremely rare poverty indicators.[17]

[17] It should be noted that $w_j$ is not defined when $\bar{\delta}(x_j) = 0$, i.e. when no person is deprived or poor in dimension $X_j$. If everybody is non-poor in dimension Xj, then dimension $X_j$ makes no significant contribution to a study of poverty and should, therefore, not be included. For other possible definitions for $w_j$, the interested reader should consult Filippone et al (2001).

To get an overall picture of poverty in a geographical area or some subset of the population, the fuzzy approach allows for the creation of a global poverty index (GPI) by simply calculating the mean poverty for that area or subset, i.e.

$$(5)\quad GPI = \frac{1}{n}\sum_{i=1}^{n}\delta_P(x_i)$$

when the size of the corresponding population is n. The GPI can be interpreted as the average deprivation in the population or the average degree by which individuals belong to the subset of the poor.

## 4. DATA

The focus of this paper is to look at deprivation within the Eastern Cape and how it differs within the province. The only dataset that is big enough to gain significant results for smaller geographical areas and at the same time covering some dimensions of poverty at the household level is the Census 96 dataset, as produced by Statistics SA (1998a). This dataset allows us to study deprivation in each of the seven districts of the Eastern Cape.[18] The data had to be reorganized into these seven districts as the new demarcation occurred only in 1998, after Census 96.[19]

The statistical unit to be used will be the household, rather than the individual. The reason is that most of the variables or dimensions that will be used were measured at household level, rather than the level of individuals. It must be noted that it would be better if poverty could be measured at the individual level, rather than the household level, as intra household inequality could exist in many households[20] and household size must have an influence on the usage of the various resources within a household.[21] Unfortunately, the data do not indicate the quantity of resources available to each household, but only the quality of resources. It

[18] The seven districts are the Nelson Mandela metropolis (Metro) and the Western (DC 10), Amatole (DC 12), Chris Hani (DC 13), Umkwahlamba (DC 14), O.R. Tambo (DC 15) and Alfred Nzo (DC 14) District Councils, as in Table 2.

[19] There were 14 old TRCs that were split up into two or more new district councils, consisting roughly of 12.5% of households or 15% of the population of the Eastern Cape. This was considered too big a percentage to exclude, and as such, were allocated to the new districts in which the largest area of the old TRCs had fallen.

[20] Adult members of the household, for instance, benefit more than the children in the household from resources such as income and telephone access.

[21] Larger households benefit from economies of scale when consuming resources and children uses fewer resources on average than adults (Leibbrandt and Woolard, 1999:38-39)

would also complicate matters further if one tries to account for household size in each dimension, because there are different ways of adjusting for the household size. Klasen (2000) points out that the method used for adjusting household size can have a considerable impact on the results of the poverty analysis.

The different dimensions or indicators of poverty that are used in this analysis are presented in Table 1. A further variable included in this study is crowding, i.e. the number of persons per room in each household. The contention is that the more persons there are for each room in the household, the poorer or more deprived that household is, i.e. each household member has less space (Cheli, 1995). Also presented in Table 1 are the different categories in each dimension, ranked in increasing order with respect to poverty. This ranking corresponds to the rankings used by Klasen (2000), Qizilbash (2001) and Ngwane et al (2001a), with one exception. Klasen and Qizilbash adopted the same ranking for energy source for cooking: electricity, gas, paraffin/coal, dung and then wood. I differ with this ranking: wood should rank higher than animal dung as the source of cooking, simply because wood would be chosen if one were to choose between using dung or wood for cooking food.[22] Klasen's energy indicator will be labelled Energy, while the new energy indicator, with dung being the worst category, will be labelled as Energy2.

## 5. THE DEMOGRAPHICS OF THE EASTERN CAPE

The Eastern Cape consists of 38 municipalities, six district councils (DC) and one metropolis, the Nelson Mandela metropolis (Metro). The seven districts – the six district councils and the Metro – differ considerably from each other, as shown in Table 2 and Table 3.

[22] This is a personal observation. Both these rankings will be used and tested to see whether or not it makes a significant difference.

**Table 1 The distribution within each district and dimension**

| Dimension | Description | Rank | Categories | Metro | DC 10 | DC 12 | DC 13 | DC 14 | DC 15 | DC 44 | Province |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dwelling | Type of dwelling | 1 | House or flat | 67.5% | 67.5% | 44.2% | 44.9% | 51.0% | 19.6% | 19.3% | **42.2%** |
| | | 2 | Single room or flatlet | 4.0% | 4.6% | 4.0% | 4.1% | 6.2% | 5.9% | 4.8% | **4.7%** |
| | | 3 | Traditional Hut | 0.8% | 14.5% | 36.6% | 44.3% | 35.6% | 71.8% | 73.6% | **41.5%** |
| | | 4 | Shack | 26.8% | 12.3% | 14.3% | 6.0% | 6.3% | 1.9% | 1.7% | **10.8%** |
| | | 5 | Homeless | 1.0% | 1.0% | 0.8% | 0.6% | 0.9% | 0.8% | 0.6% | **0.8%** |
| Crowding | Number of persons per room | 1 | 0.25 | 6.9% | 7.8% | 5.0% | 4.3% | 4.7% | 4.1% | 3.8% | **5.1%** |
| | | 2 | 0.5 | 20.0% | 17.7% | 11.8% | 10.1% | 9.8% | 7.6% | 9.0% | **12.0%** |
| | | 3 | 0.75 | 15.3% | 11.5% | 8.1% | 7.3% | 6.7% | 6.3% | 7.0% | **8.9%** |
| | | 4 | 1 | 21.3% | 18.5% | 19.7% | 17.9% | 18.4% | 18.9% | 19.5% | **19.4%** |
| | | 5 | 1.5 | 15.2% | 15.2% | 13.6% | 14.0% | 13.1% | 16.3% | 16.4% | **14.9%** |
| | | 6 | 2 | 11.1% | 13.7% | 15.7% | 16.6% | 15.9% | 19.4% | 18.3% | **16.0%** |
| | | 7 | 2.5 | 3.6% | 5.1% | 6.2% | 6.9% | 5.9% | 8.2% | 7.2% | **6.3%** |
| | | 8 | 3 | 3.4% | 5.2% | 7.6% | 8.2% | 8.8% | 8.7% | 8.7% | **7.2%** |
| | | 9 | 4 | 1.9% | 2.9% | 5.6% | 6.5% | 6.8% | 5.5% | 5.0% | **4.9%** |
| | | 10 | More than 4 | 1.5% | 2.3% | 6.8% | 8.4% | 9.9% | 4.8% | 5.1% | **5.4%** |
| Energy | Main source of energy for cooking - Klasen (2000) | 1 | Electricity | 64.7% | 41.8% | 23.0% | 12.6% | 10.2% | 5.4% | 2.1% | **23.3%** |
| | | 2 | Gas | 2.4% | 6.9% | 3.0% | 3.2% | 3.2% | 3.5% | 2.6% | **3.3%** |
| | | 3 | Coal/Paraffin | 32.0% | 31.1% | 35.5% | 32.1% | 40.6% | 19.0% | 23.6% | **29.6%** |
| | | 4 | Dung | 0.0% | 0.0% | 4.7% | 13.2% | 7.8% | 6.7% | 6.3% | **5.5%** |
| | | 5 | Wood | 1.0% | 20.3% | 33.7% | 38.9% | 38.2% | 65.4% | 65.3% | **38.3%** |
| Energy2 | Main source of energy for cooking - New ranking | 1 | Electricity | 64.7% | 41.8% | 23.0% | 12.6% | 10.2% | 5.4% | 2.1% | **23.3%** |
| | | 2 | Gas | 2.4% | 6.9% | 3.0% | 3.2% | 3.2% | 3.5% | 2.6% | **3.3%** |
| | | 3 | Coal/Paraffin | 32.0% | 31.1% | 35.5% | 32.1% | 40.6% | 19.0% | 23.6% | **29.6%** |
| | | 4 | Wood | 1.0% | 20.3% | 33.7% | 38.9% | 38.2% | 65.4% | 65.3% | **38.3%** |
| | | 5 | Dung | 0.0% | 0.0% | 4.7% | 13.2% | 7.8% | 6.7% | 6.3% | **5.5%** |
| Income | Derived household income | 1 | R8001 or more | 8.7% | 4.5% | 3.6% | 2.0% | 1.7% | 1.7% | 0.8% | **3.5%** |
| | | 2 | R6001-R8000 | 4.5% | 2.6% | 1.9% | 1.1% | 0.9% | 0.8% | 0.4% | **1.8%** |
| | | 3 | R4501-R6000 | 6.3% | 4.0% | 2.8% | 1.7% | 1.1% | 1.2% | 0.8% | **2.7%** |
| | | 4 | R3501-R4500 | 5.5% | 3.8% | 2.9% | 2.0% | 2.1% | 1.6% | 1.2% | **2.8%** |
| | | 5 | R2501-R3500 | 7.3% | 4.8% | 3.9% | 2.7% | 2.3% | 2.1% | 1.8% | **3.7%** |
| | | 6 | R1501-R2500 | 12.2% | 9.4% | 7.6% | 5.0% | 4.5% | 4.3% | 3.9% | **6.8%** |
| | | 7 | R1001-R1500 | 11.7% | 11.3% | 9.2% | 6.7% | 6.1% | 5.7% | 5.4% | **8.1%** |
| | | 8 | R501-R1000 | 13.1% | 21.9% | 17.2% | 16.8% | 17.0% | 14.9% | 15.3% | **16.0%** |
| | | 9 | R201-R500 | 12.6% | 23.0% | 22.8% | 24.8% | 26.3% | 23.6% | 26.8% | **22.1%** |
| | | 10 | R1-R200 | 3.7% | 6.2% | 9.9% | 15.7% | 18.8% | 15.9% | 17.5% | **12.0%** |
| | | 11 | None | 14.3% | 8.6% | 18.3% | 21.5% | 19.2% | 28.2% | 26.2% | **20.6%** |
| Water | Type of water access | 1 | Tap in dwelling | 63.9% | 40.5% | 26.4% | 17.7% | 12.3% | 4.6% | 2.6% | **24.7%** |
| | | 2 | Tap on premises | 20.4% | 26.0% | 8.8% | 8.6% | 9.7% | 4.8% | 3.2% | **10.4%** |
| | | 3 | Public tap or tanker | 14.8% | 22.2% | 29.3% | 23.4% | 29.3% | 11.3% | 14.1% | **20.1%** |
| | | 4 | Rain-water tank / Borehole / Well | 0.7% | 6.7% | 2.6% | 4.4% | 6.8% | 2.6% | 11.2% | **3.7%** |
| | | 5 | Dam / River / Stream | 0.1% | 4.6% | 33.0% | 45.8% | 41.9% | 76.7% | 68.8% | **41.0%** |
| Telephone | Type of telephone access | 1 | In dwelling or cellular | 44.7% | 31.8% | 15.4% | 8.0% | 7.1% | 2.1% | 0.4% | **15.6%** |
| | | 2 | Nearby neighbour or work | 8.8% | 21.6% | 9.5% | 10.1% | 8.6% | 2.5% | 1.8% | **7.9%** |
| | | 3 | Public telephone | 41.4% | 38.5% | 29.0% | 19.7% | 22.0% | 12.7% | 10.1% | **24.7%** |
| | | 4 | Another place not nearby | 1.4% | 2.1% | 5.6% | 9.3% | 8.5% | 6.3% | 16.4% | **6.4%** |
| | | 5 | No access | 3.6% | 6.0% | 40.6% | 52.9% | 53.8% | 76.4% | 71.3% | **45.4%** |
| Refuse | Refuse Removal | 1 | Municipality - Once a week | 92.4% | 64.0% | 33.5% | 22.4% | 20.8% | 6.8% | 1.3% | **34.3%** |
| | | 2 | Municipality - less often | 0.9% | 1.7% | 3.4% | 1.2% | 1.3% | 1.2% | 0.5% | **1.7%** |
| | | 3 | Communal refuse dump | 1.4% | 4.1% | 2.2% | 2.1% | 2.1% | 0.8% | 1.2% | **1.8%** |
| | | 4 | Own refuse dump | 3.5% | 27.0% | 38.8% | 40.0% | 57.0% | 56.2% | 74.1% | **40.2%** |
| | | 5 | No rubbish disposal | 1.8% | 3.3% | 22.1% | 34.3% | 18.8% | 35.1% | 23.0% | **22.0%** |
| Sanitation | Toilet facilities | 1 | Flush or Chemical | 84.0% | 41.0% | 35.4% | 18.0% | 11.6% | 6.1% | 1.1% | **30.8%** |
| | | 2 | Pit latrine | 1.8% | 27.6% | 33.9% | 34.8% | 41.1% | 43.2% | 69.9% | **33.8%** |
| | | 3 | Bucket latrine | 12.0% | 21.5% | 2.8% | 7.0% | 10.1% | 2.5% | 1.6% | **6.3%** |
| | | 4 | Other | 2.3% | 9.9% | 27.8% | 40.2% | 37.1% | 48.2% | 27.3% | **29.1%** |
| Employment | Employment status of the household head | 1 | Employed | 55.5% | 55.8% | 35.7% | 24.3% | 25.7% | 19.1% | 15.0% | **32.6%** |
| | | 2 | Not economically active | 14.4% | 8.1% | 17.0% | 17.8% | 17.5% | 20.6% | 19.4% | **17.2%** |
| | | 3 | Unemployed | 30.1% | 36.0% | 47.4% | 58.0% | 56.9% | 60.2% | 65.6% | **50.2%** |
| Education | Education of household head | 1 | Above Matric | 10.6% | 8.3% | 6.4% | 4.4% | 3.9% | 3.4% | 2.6% | **5.8%** |
| | | 2 | Matric | 14.6% | 9.9% | 8.4% | 6.2% | 4.8% | 5.5% | 3.5% | **7.9%** |
| | | 3 | Incomplete Secondary | 43.3% | 24.9% | 29.1% | 23.9% | 24.1% | 22.5% | 29.3% | **28.7%** |
| | | 4 | Primary complete | 8.9% | 8.8% | 9.6% | 8.4% | 8.8% | 6.9% | 10.8% | **8.7%** |
| | | 5 | Primary incomplete | 14.2% | 24.6% | 20.7% | 25.1% | 29.3% | 22.9% | 36.1% | **22.7%** |
| | | 6 | No schooling | 8.4% | 23.3% | 25.8% | 31.9% | 29.1% | 38.8% | 17.6% | **26.0%** |

Source: Census 96

Table 2 gives the approximate land size, population size, number of households, population density, average household size and the population according to race, gender, age and urbanization for the province as a whole, and for the different districts. It can be seen from Table 2 that the population of the Eastern Cape in 1996 was nearly 6,3 million people, living on an area of approximately 160 000 sq. km, or 40 people per sq. km. The population distribution according to race shows that there were nearly 5,5 million Africans, 464 000 Coloureds, 327 000 Whites and 20 000 Indians. More than half the population, i.e. 3,2 million, were under 20 years of age, while only 370 000 people were above the age of 65, i.e. ten times more young people than elderly.

Focussing on the different districts in the Eastern Cape, one can see stark differences between the districts. From Table 2 we see that DC 10 is approximately 22 times larger than the Nelson Mandela metropolis, but 60 times less densely populated, or 8 persons per sq. km to the 497 persons per sq. km of the Metro. There are nearly one more person per household in DC 15 than there are in the Metro, with the average household size in DC 15 being 4,81 and that of the Metro being 3.91.

**Table 2 Demographics of the Eastern Cape - frequencies**

| | | Eastern Cape Province | Nelson Mandela Metro | Western DC 10 | Amatole DC 12 | Chris Hani DC 13 | Ukwahlamba DC 14 | O.R. Tambo DC 15 | Alfred Nzo DC 44 |
|---|---|---|---|---|---|---|---|---|---|
| **Land Size (sq. km)** | | **156 325** | 1 952 | 44 960 | 23 577 | 36 830 | 25 324 | 15 947 | 7 734 |
| **Population Size** | | **6 290 006** | 969 771 | 363 585 | 1 657 373 | 822 891 | 327 868 | 1 604 411 | 544 107 |
| **No of Households** | | **1 332 342** | 226 201 | 83 179 | 356 096 | 175 353 | 67 984 | 307 377 | 116 152 |
| **Population Density** | | **40.24** | 496.77 | 8.09 | 70.30 | 22.34 | 12.95 | 100.61 | 70.35 |
| **Household Size** | | **4.36** | 3.91 | 3.98 | 4.22 | 4.53 | 4.34 | 4.81 | 4.47 |
| **Race** | **African** | **5 439 880** | 538 133 | 184 720 | 1 512 671 | 768 971 | 306 915 | 1 588 035 | 540 435 |
| | **Coloured** | **464 120** | 235 992 | 129 322 | 50 603 | 31 538 | 10 547 | 5 154 | 964 |
| | **Indian** | **19 762** | 11 100 | 1 110 | 5 214 | 711 | 97 | 1 351 | 179 |
| | **White** | **327 081** | 173 548 | 46 066 | 79 969 | 18 129 | 8 831 | 269 | 269 |
| | **Other** | **36 925** | 10 998 | 2 367 | 8 916 | 3 542 | 1 478 | 7 364 | 2 260 |
| **Gender** | **Male** | **2 901 091** | 464 404 | 175 874 | 768 623 | 376 870 | 150 208 | 723 016 | 242 096 |
| | **Female** | **3 386 293** | 505 034 | 187 559 | 888 063 | 445 630 | 177 498 | 880 769 | 301 740 |
| **Urbanization** | **Urban** | **2 047 633** | 851 916 | 231 674 | 569 591 | 217 611 | 69 789 | 92 773 | 14 279 |
| | **Rural** | **3 637 142** | 21 317 | 94 417 | 902 959 | 559 366 | 218 148 | 1 349 067 | 491 869 |
| **Age** | **Children (0-19)** | **3 202 726** | 366 584 | 148 811 | 797 162 | 449 027 | 181 602 | 939 408 | 320 132 |
| | **Youth (20-34)** | **1 323 294** | 271 445 | 92 483 | 363 766 | 148 670 | 59 331 | 294 815 | 92 784 |
| | **Middle Age (35-64)** | **1 341 648** | 273 503 | 94 550 | 376 705 | 162 498 | 62 805 | 273 744 | 97 843 |
| | **Elderly (65+)** | **368 769** | 48 538 | 22 940 | 105 454 | 54 940 | 20 972 | 84 771 | 31 154 |
| | **Unspecified** | **53 312** | 10 435 | 4 572 | 14 251 | 6 955 | 2 475 | 11 817 | 2 807 |

**Table 3 Demographics of the Eastern Cape - percentages**

| | | Eastern Cape Province | Nelson Mandela Metro | Western DC 10 | Amatole DC 12 | Chris Hani DC 13 | Ukwahlamba DC 14 | O.R. Tambo DC 15 | Alfred Nzo DC 44 |
|---|---|---|---|---|---|---|---|---|---|
| **Land Size (sq. km)** | | **100.00%** | 1.25% | 28.76% | 15.08% | 23.56% | 16.20% | 10.20% | 4.95% |
| **Population Size** | | **100.00%** | 15.42% | 5.78% | 26.35% | 13.08% | 5.21% | 25.51% | 8.65% |
| **No of Households** | | **100.00%** | 16.98% | 6.24% | 26.73% | 13.16% | 5.10% | 23.07% | 8.72% |
| **Population Density (relative to prov.** | | **1.00** | 12.35 | 0.20 | 1.75 | 0.56 | 0.32 | 2.50 | 1.75 |
| **Household size (relative to prov. Ave.)** | | **1.00** | 0.90 | 0.91 | 0.97 | 1.04 | 1.00 | 1.10 | 1.03 |
| **Race** | **African** | **86.52%** | 55.49% | 50.81% | 91.27% | 93.45% | 93.61% | 99.12% | 99.33% |
| | **Coloured** | **7.38%** | 24.33% | 35.57% | 3.05% | 3.83% | 3.22% | 0.32% | 0.18% |
| | **Indian** | **0.31%** | 1.14% | 0.31% | 0.31% | 0.09% | 0.03% | 0.08% | 0.03% |
| | **White** | **5.20%** | 17.90% | 12.67% | 4.83% | 2.20% | 2.69% | 0.02% | 0.05% |
| | **Other** | **0.59%** | 1.13% | 0.65% | 0.54% | 0.43% | 0.45% | 0.46% | 0.42% |
| **Gender** | **Male** | **46.14%** | 47.90% | 48.39% | 46.40% | 45.82% | 45.84% | 45.08% | 44.52% |
| | **Female** | **53.86%** | 52.10% | 51.61% | 53.60% | 54.18% | 54.16% | 54.92% | 55.48% |
| **Urbanization** | **Urban** | **36.02%** | 97.56% | 71.05% | 38.68% | 28.01% | 24.24% | 6.43% | 2.82% |
| | **Rural** | **63.98%** | 2.44% | 28.95% | 61.32% | 71.99% | 75.76% | 93.57% | 97.18% |
| **Age** | **Children (0-19)** | **50.92%** | 37.77% | 40.95% | 48.10% | 54.62% | 55.50% | 58.55% | 58.77% |
| | **Youth (20-34)** | **21.04%** | 27.97% | 25.45% | 21.95% | 18.08% | 18.13% | 18.37% | 17.03% |
| | **Middle Age (35-64)** | **21.33%** | 28.18% | 26.02% | 22.73% | 19.77% | 19.20% | 17.06% | 17.96% |
| | **Elderly (65+)** | **5.86%** | 5.00% | 6.31% | 6.36% | 6.68% | 6.41% | 5.28% | 5.72% |
| | **Unspecified** | **0.85%** | 1.08% | 1.26% | 0.86% | 0.85% | 0.76% | 0.74% | 0.52% |

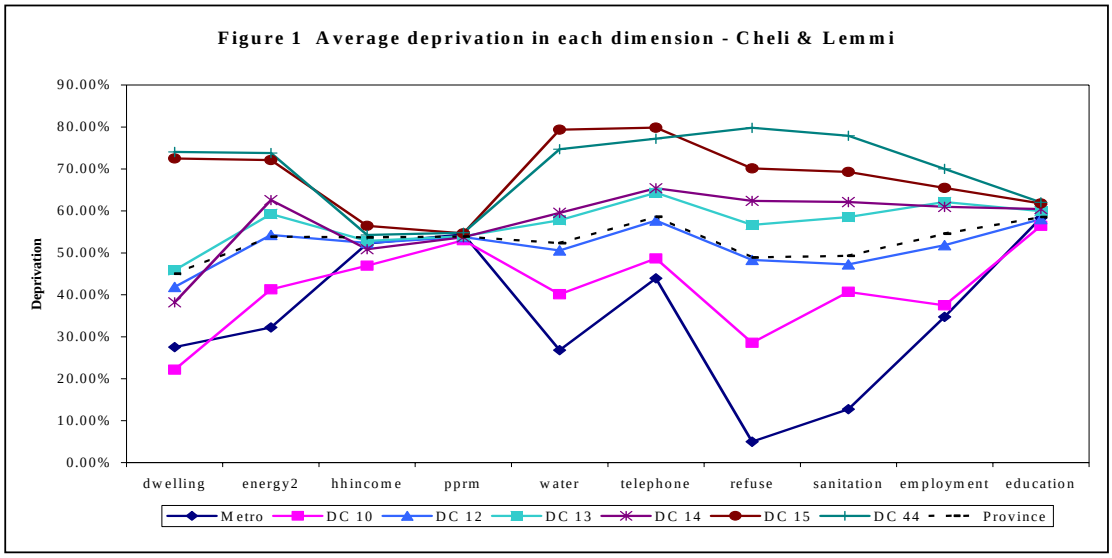
The first 3 rows of Table 3 show the land size, individual and household populations in the seven districts as a percentage of the whole population of the Eastern Cape, while rows 4 and 5 show the population density and household size of the seven districts relative to the provincial averages. The rest of Table 3 indicates the division of the population within each district according to race, gender, age and urbanization. From column one of Table 3 we see that 54% of the population are female and 64% of the whole population live in rural areas. Looking at the distribution within each district, we see that in DC 12, 91% of the population are African and 4,8% are White. DC 12 has nearly 27% of the provincial population living on only 15% of the land, resulting in a population density 1.75 times the provincial average. In DC 13, 72% of the population live in rural areas, in contrast to DC 10, where only 29% of the population live in rural areas. In DC 15 and DC 44, 99% of the population are African, whereas the population in DC 10 consists of 50,8% African 35,6% Coloureds and 12,7% Whites.

## 6. EMPIRICAL ANALYSIS

The distribution of household resources differs considerably between the different districts of the Eastern Cape, as is shown in Table 1. In the Metro, 67.5% of households live in formal brick houses or flats and 26.8% in informal dwellings or shacks, while only 19.3% of

households in DC 44 live in formal housing and nearly 74% in traditional huts. In DC 13 nearly 45% of the population live in brick houses and 44.3% in traditional huts.

Looking at the other dimensions, Table 1 indicates that 65% of households in the Metro use electricity for cooking, while over 65% of the population in DC 15 and DC 44 use wood for cooking. Furthermore, only 4.6% of households in DC 10 use a dam, river or stream as their main water source, while 46%, 42%, 77% and 69% of households in DC 13, DC 14, DC 15 and DC 44 respectively use a dam, river or stream as their main water source. Table 1 also shows that only 37% of households in DC 12 have refuse removal, while 39% of households have their own refuse dump and 22% of have no refuse disposal.




It is clear from Table 1 that there are considerable differences in households' circumstances between the various districts of the Eastern Cape. The result is a stark difference in the average deprivation experienced in each dimension between the different districts. This is clearly illustrated by the Figure 1, where the membership function – the degree to which a household belongs to the set of poor people – is determined according to the relative method of Cheli & Lemmi, described by Equation 2, and Figure 2, where the membership function is determined by the linear method of Cerioli & Zani, described in Equation 1. One would expect the average deprivation experienced in the Metro and DC 10 to be lower than the other districts, since these are the only two districts that contain no part of the former 'homelands'. This is indeed the case. The greatest deprivation is experienced in DC 15 and DC 44, the two districts that solely contain areas of the former Transkei. It is interesting to note that the average deprivation in the Eastern Cape as a whole for each dimension is around 50%, using the relative method of Cheli & Lemmi, but varies from 30% to 71% using the linear method

of Cerioli & Zani. The 5% deprivation experienced in the Metro for refuse removal is due to the fact that the municipality removes 92% of households' rubbish weekly. This is in sharp contrast to the deprivation of nearly 80% for households in DC 44 with respect to refuse removal, where 98% of households receive no municipal refuse removal. The smallest differences in average deprivation between the various districts occur in the household income, persons per room and education of household head dimensions.

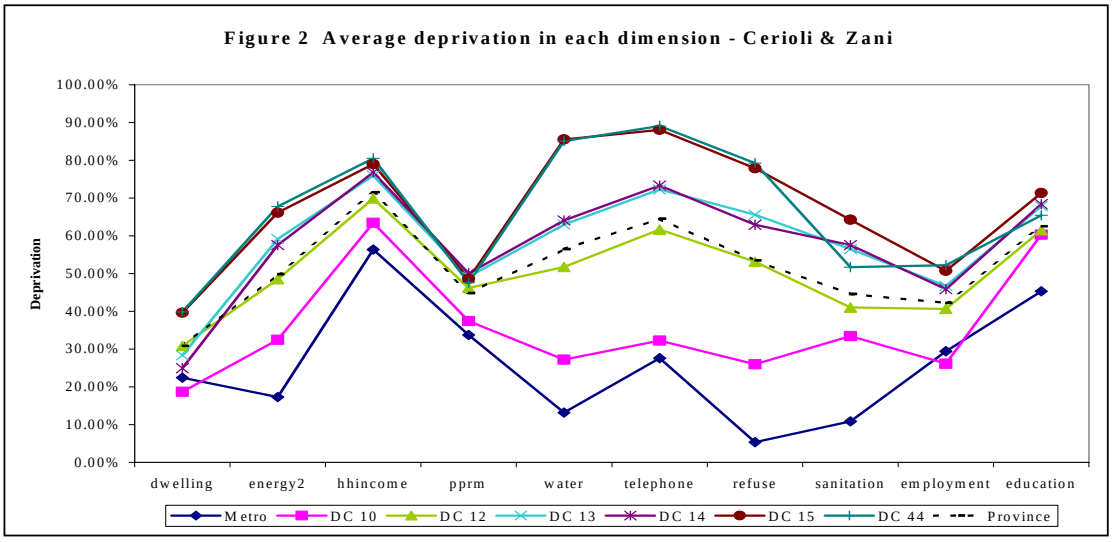
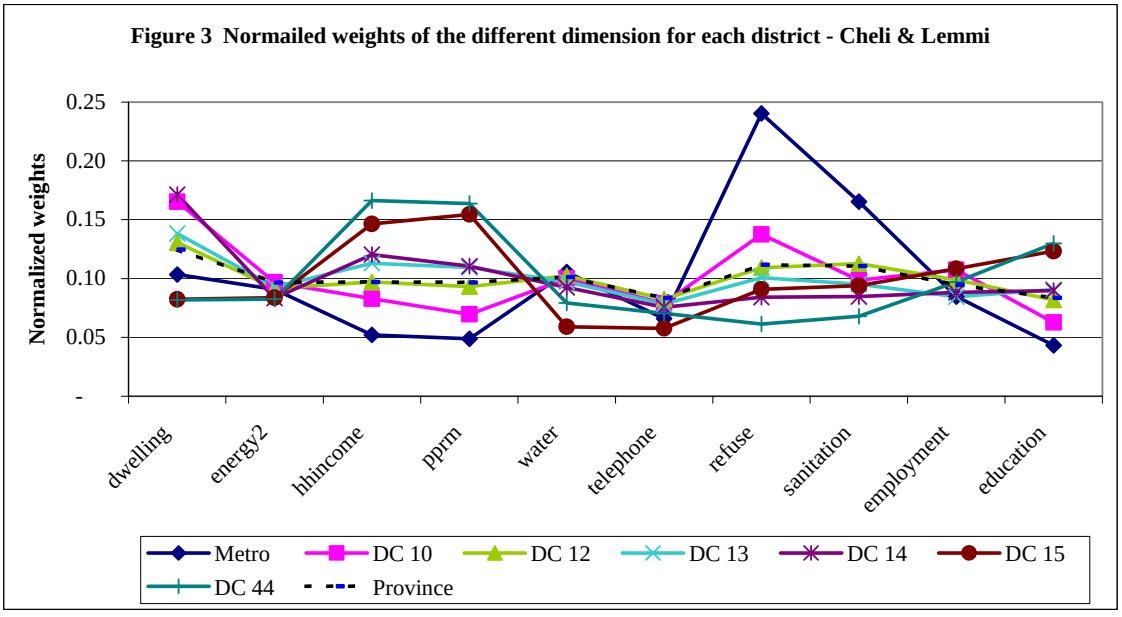


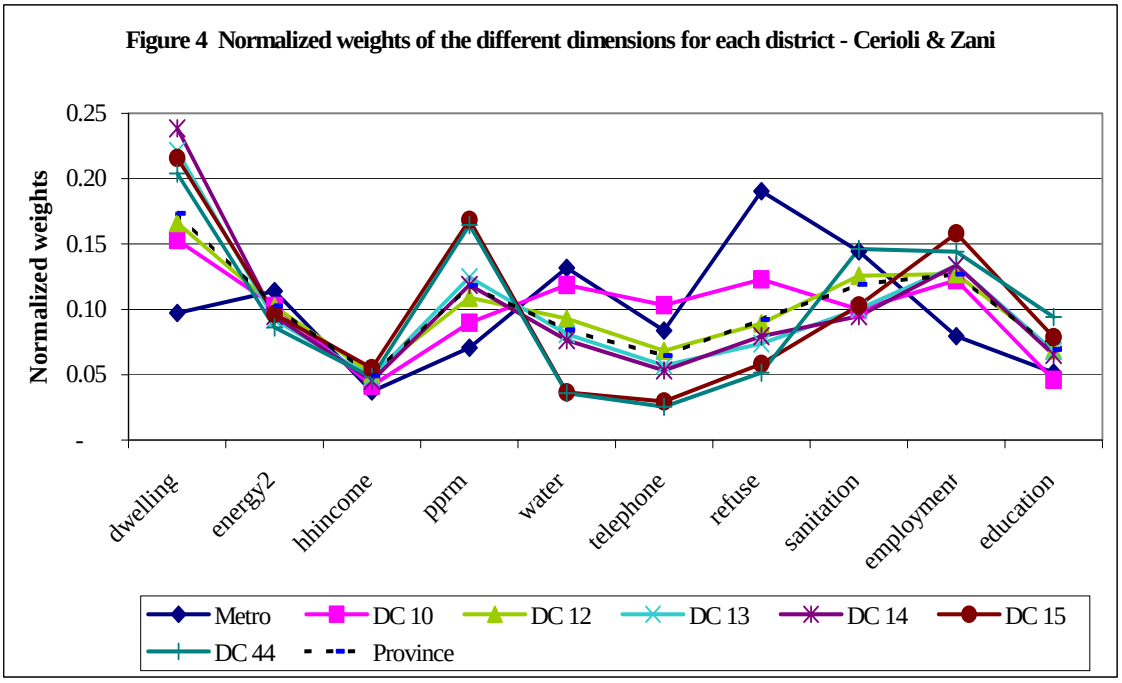

Figure 3 shows the normalized weights of the various dimensions under study according to the Cheli and Lemmi method. From this graph it is clear that the various districts give nearly the same weight to energy2, telephone access and employment of the household head with respect to overall deprivation. With regards to the other dimensions there is very little




symmetry. The Metro gives the highest importance to refuse removal and sanitation, while

for DC 10 it is the type of dwelling and refuse removal. In DC 12, the dimension weights are more evenly balanced, with the type of dwelling and sanitation just weighing a bit more than the other dimensions with respect to overall deprivation. In DC 13 and DC 14, the two dimensions that carry the most weight are the type of dwelling and household income. This is mainly due to the low level of income and the lack of formal brick houses in these areas. The low average household income and overcrowded households contribute over 30% to overall deprivation in DC 15 and DC 44. For the province as a whole, the weight spread was more even, with the type of dwelling and refuse removal weighing slightly more than the rest. Education weighed the least in the Metro, DC 10 and DC 12; while in DC 13, 14 and 15, telephone access weighed the least. For DC 44 it was refuse removal. Education was the dimension weighing the least to overall deprivation in the province.

**Figure 4 Normalized weights of the different dimensions for each district - Cerioli & Zani**



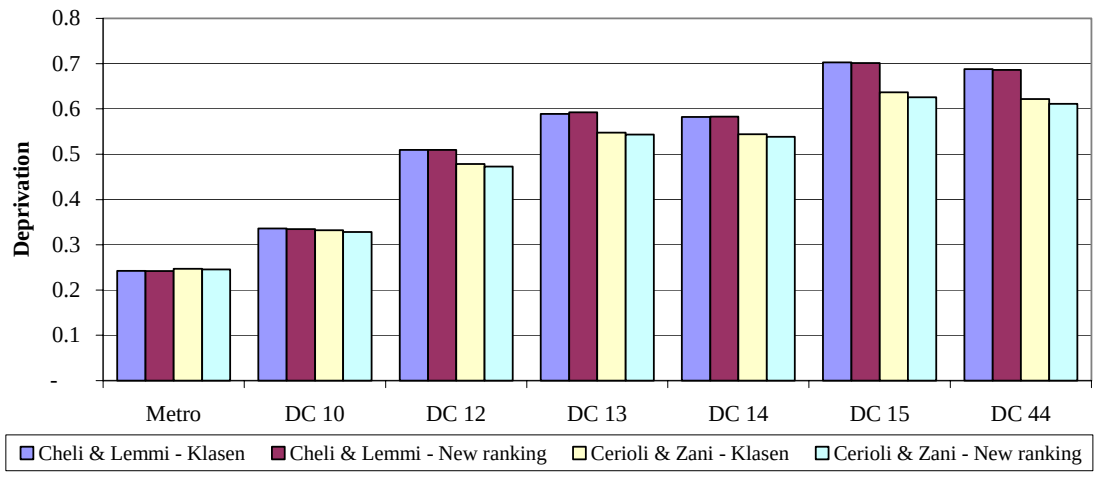

The results obtained using the method of Cerioli and Zani is somewhat different. This is shown in Figure 4, where it can be seen that for the whole province, except the Metro, the type of dwelling the household lived in contributed the most with respect to it being deprived or not. The employment status of the household head also weighed more than the other dimensions in all the districts except the Metro, resulting in it carrying the second highest weight in the province. In the Metro the same dimensions as those according to the CL method, namely refuse and sanitation, carried the most weight. The other dimensions also carrying a lot of weight in the districts were refuse removal in DC 10, sanitation in DC 12 and DC 44, and crowding in DC 13, DC 14, DC 15 and DC 44. Household income carries the

least weight with respect to deprivation in DC 10, DC 12, DC 13, DC 14 and the Metro, as well as the province. For DC 15 and DC 44, telephone access carries the least weight.

Are the results obtained above important? Yes, they are, as they show that household income is not the most important contributor to overall deprivation, but that there are other dimensions of well being that carry a lot more weight with respect to household deprivation. It also clearly shows us that poverty or deprivation is experienced differently in different areas, even within a province, such as the Eastern Cape.

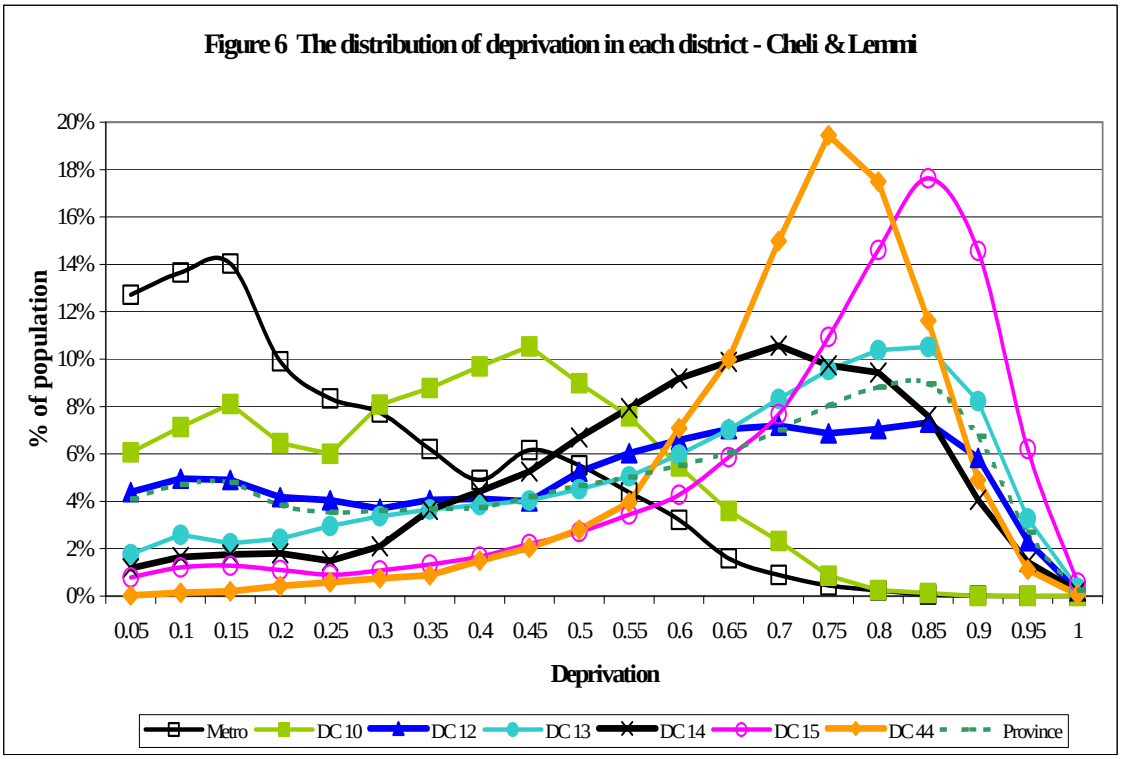
It is important to take a single scale of weights if we want to compare the overall deprivation of various subgroups within the province. Using different weighting scales for the various districts will only result in incomparable datasets. The weights of the various dimensions or indicators for the province as a whole were selected as the basis to make comparison possible.

**Figure 5 The average deprivation in each district according to the Cheli & Lemmi and Cerioli & Zani methods**




The average deprivation in the various districts is given in Figure 5. It is clear that the Metro had the lowest average deprivation and DC 15 the highest in the province, with deprivation in the Metro about 24%, while deprivation in DC 15 stood at 70% and 63% depending on whether the Cheli & Lemmi method or Cerioli & Zani method is used. One can see a clear difference in the average deprivation level between the two methods used for calculating deprivation within a dimension, with a difference of nearly 7% in DC 15 and DC 44. For the province as a whole, the average deprivation according to the Cheli & Lemmi method is 4.5% higher than the deprivation obtained according to the Cerioli & Zani method. In the rest of the paper, only the results of the Cheli & Lemmi method will be presented, as the deprivation

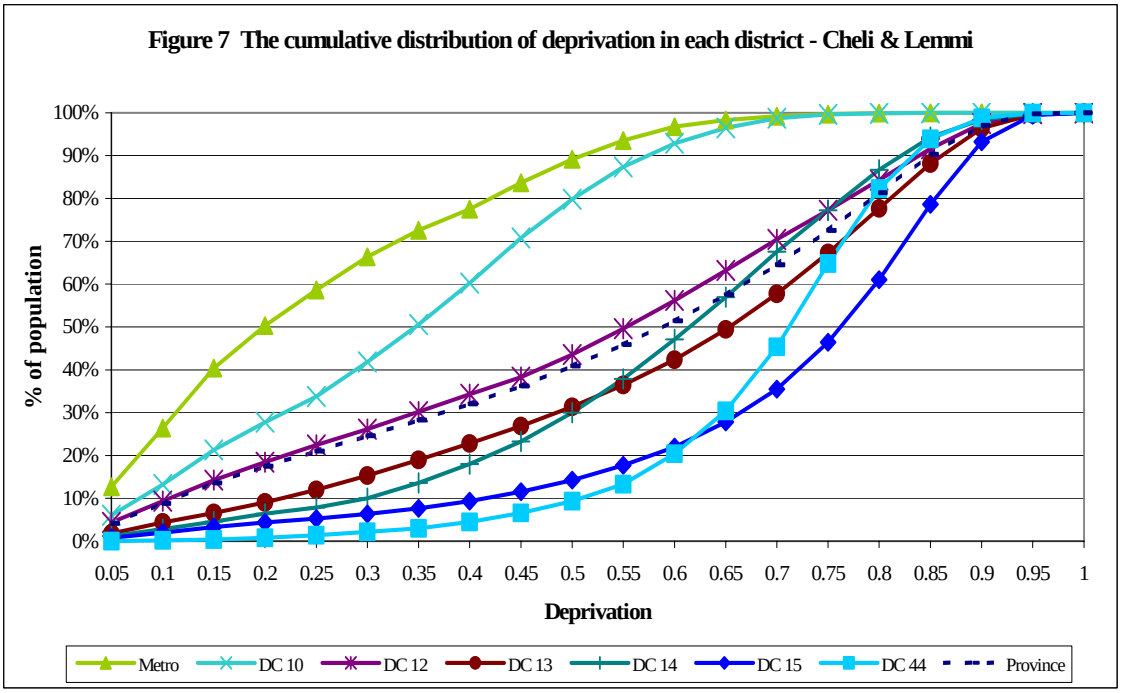
results using the Cerioli & Zani method tend to be lower by roughly the same margin as above. There is very little difference between the results obtained using the ranking of Klasen for the energy dimension, or the new ranking discussed earlier, with the average difference using the Cheli & Lemmi method being 0.003% and for the Cerioli & Zani method 0.64%. Therefore, all further analysis will only be done on the new ranking in the energy dimension, i.e. where using dung for cooking ranks lower than using wood with respect to poverty.




It is useful to look at the distribution of deprivation within each district, presented in Figure 6. From this graph we can see that the majority of the population in the Metro experience relatively low deprivation compared to the deprivation experienced by the population of DC 15 or DC 44. Indeed, only 10% of the population of the Metro are 51% or more deprived, in contrast to the 90% of the population in DC 44 that are more than 50% deprived. In DC 10, 90% of the population are less than 57% deprived, while 80% of the households in DC 15 are more than 57% deprived. We can also see from Figure 6 that the variance of deprivation is less in DC 44 than in DC 15, despite them having nearly the same mean (as shown in Figure 5). The standard deviation for deprivation in DC 15 and DC 44 is 0.199 and 0.136 respectively. The same applies to DC 13 and DC 14, where the means are nearly the same, but deprivation in DC 14 is more centred around the mean than in DC 13. The result is a standard deviation in DC 14 of 0.203 and a standard deviation in DC 13 of 0.240. Figure 7 shows the

cumulative distribution of deprivation in each of the districts, which emphasizes the fact that deprivation is the highest in DC 15 and DC 44, and the lowest in DC 10 and the Metro.

**Figure 7 The cumulative distribution of deprivation in each district - Cheli & Lemmi**




Until now we have looked at the average deprivation and the distribution of deprivation in the various districts. We turn our attention now to the average deprivation experienced by households according to their characteristics. The results are given in Table 4. The expectation is that overall deprivation will be higher as ranking increases in each dimension, i.e. the closer we get to absolute deprivation in each dimension. For instance, we will expect households with a tap on the premises to have lower overall deprivation than households using a dam or river as their main water supply. Furthermore, from the earlier results we would expect deprivation to increase the further east the district is situated in the province, with the Metro being the most west, followed by DC 10, DC 12, DC 13, DC 14, D15 and DC 44 the most eastern district in this context. This is indeed the case in the dwelling dimension, where deprivation is lowest in the Metro and DC 10 and highest in DC 15 and DC 44. Households living in formal brick houses are on average 31.5% deprived, while homeless households are on average 55.5% deprived. An interesting result is that households living in traditional dwellings are more deprived than households living in shacks or that are homeless, except in the Metro. The average deprivation for people living in traditional huts in the Eastern Cape is 76%. A reason for this is the fact that shacks tend to be situated in urban areas, where other services such as refuse collection, sanitation, water and electricity are more easily available. Traditional huts, on the other hand, are situated mostly in the rural areas

**Table 4 Average deprivation in each district according to household characteristics - Cheli & Lemmi method**

| Dimension | Description | Rank | Categories | Metro | DC 10 | DC 12 | DC 13 | DC 14 | DC 15 | DC 44 | Province |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dwelling | Type of dwelling | 1 | House or flat | 0.1451 | 0.2623 | 0.3135 | 0.4153 | 0.4667 | 0.4691 | 0.5421 | **0.3152** |
| | | 2 | Single room or flatlet | 0.2142 | 0.2941 | 0.3391 | 0.4647 | 0.5419 | 0.4381 | 0.5249 | **0.3932** |
| | | 3 | Traditional Hut | 0.4016 | 0.5157 | 0.7493 | 0.7743 | 0.7475 | 0.7859 | 0.7353 | **0.7596** |
| | | 4 | Shack | 0.4691 | 0.5128 | 0.5273 | 0.6313 | 0.5985 | 0.6396 | 0.6266 | **0.5180** |
| | | 5 | Homeless | 0.3789 | 0.4941 | 0.5342 | 0.6142 | 0.6750 | 0.6927 | 0.6809 | **0.5546** |
| Crowding | Number of persons per room | 1 | 0.25 | 0.1398 | 0.1584 | 0.2992 | 0.3964 | 0.3717 | 0.4723 | 0.5567 | **0.3102** |
| | | 2 | 0.5 | 0.1620 | 0.2218 | 0.3495 | 0.4457 | 0.4689 | 0.6193 | 0.6293 | **0.3627** |
| | | 3 | 0.75 | 0.1618 | 0.2479 | 0.3417 | 0.4486 | 0.4888 | 0.6368 | 0.6450 | **0.3736** |
| | | 4 | 1 | 0.2598 | 0.3556 | 0.4692 | 0.5496 | 0.5553 | 0.6312 | 0.6434 | **0.4920** |
| | | 5 | 1.5 | 0.2716 | 0.3728 | 0.5120 | 0.5775 | 0.5834 | 0.7288 | 0.6934 | **0.5478** |
| | | 6 | 2 | 0.3500 | 0.4228 | 0.5798 | 0.6471 | 0.6271 | 0.7433 | 0.7158 | **0.6172** |
| | | 7 | 2.5 | 0.3350 | 0.4238 | 0.6170 | 0.6734 | 0.6434 | 0.7877 | 0.7413 | **0.6564** |
| | | 8 | 3 | 0.3809 | 0.4621 | 0.6436 | 0.6961 | 0.6415 | 0.7586 | 0.7262 | **0.6642** |
| | | 9 | 4 | 0.4011 | 0.4761 | 0.6612 | 0.6945 | 0.6561 | 0.7680 | 0.7411 | **0.6793** |
| | | 10 | More than 4 | 0.4322 | 0.5142 | 0.6805 | 0.7359 | 0.6841 | 0.7633 | 0.7583 | **0.7009** |
| Energy2 | Main source of energy for cooking - New ranking | 1 | Electricity | 0.1346 | 0.1800 | 0.1430 | 0.1813 | 0.2182 | 0.1845 | 0.3052 | **0.1510** |
| | | 2 | Gas | 0.2734 | 0.2648 | 0.3272 | 0.3049 | 0.3514 | 0.3709 | 0.4208 | **0.3285** |
| | | 3 | Coal/Paraffin | 0.4368 | 0.4415 | 0.4905 | 0.5253 | 0.5397 | 0.5730 | 0.6115 | **0.5069** |
| | | 4 | Wood | 0.5303 | 0.4891 | 0.7436 | 0.7337 | 0.7043 | 0.7866 | 0.7287 | **0.7461** |
| | | 5 | Dung | - | - | 0.7760 | 0.7811 | 0.7381 | 0.8083 | 0.7504 | **0.7812** |
| Income | Derived household income | 1 | R8001 or more | 0.0482 | 0.0880 | 0.1302 | 0.3115 | 0.2794 | 0.3738 | 0.5370 | **0.1458** |
| | | 2 | R6001-R8000 | 0.0714 | 0.0984 | 0.1490 | 0.2495 | 0.1972 | 0.3542 | 0.4240 | **0.1489** |
| | | 3 | R4501-R6000 | 0.0880 | 0.1085 | 0.1718 | 0.2275 | 0.2602 | 0.3329 | 0.4472 | **0.1642** |
| | | 4 | R3501-R4500 | 0.1132 | 0.1464 | 0.2202 | 0.2926 | 0.3582 | 0.4023 | 0.5175 | **0.2283** |
| | | 5 | R2501-R3500 | 0.1390 | 0.1735 | 0.2324 | 0.2994 | 0.3260 | 0.4303 | 0.4814 | **0.2440** |
| | | 6 | R1501-R2500 | 0.1939 | 0.2485 | 0.3129 | 0.3759 | 0.4000 | 0.5189 | 0.5504 | **0.3240** |
| | | 7 | R1001-R1500 | 0.2448 | 0.3131 | 0.3940 | 0.4513 | 0.4676 | 0.5805 | 0.5914 | **0.4038** |
| | | 8 | R501-R1000 | 0.2992 | 0.3860 | 0.5322 | 0.5730 | 0.5669 | 0.6892 | 0.6616 | **0.5422** |
| | | 9 | R201-R500 | 0.3426 | 0.4231 | 0.6179 | 0.6343 | 0.6095 | 0.7239 | 0.6961 | **0.6173** |
| | | 10 | R1-R200 | 0.4044 | 0.4537 | 0.6521 | 0.6963 | 0.6378 | 0.7403 | 0.7056 | **0.6745** |
| | | 11 | None | 0.4384 | 0.4767 | 0.6755 | 0.7123 | 0.7035 | 0.8014 | 0.7541 | **0.6999** |
| Water | Type of water access | 1 | Tap in dwelling | 0.1453 | 0.1797 | 0.1659 | 0.2312 | 0.2514 | 0.1699 | 0.3702 | **0.1688** |
| | | 2 | Tap on premises | 0.3261 | 0.3846 | 0.3491 | 0.3902 | 0.4226 | 0.3399 | 0.4107 | **0.3555** |
| | | 3 | Public tap or tanker | 0.5111 | 0.4668 | 0.5645 | 0.5876 | 0.5548 | 0.6101 | 0.6297 | **0.5645** |
| | | 4 | Rain-water tank / Borehole / Well | 0.3783 | 0.4548 | 0.5395 | 0.5975 | 0.5992 | 0.5882 | 0.6605 | **0.5808** |
| | | 5 | Dam / River / Stream | 0.5728 | 0.5620 | 0.7601 | 0.7656 | 0.7238 | 0.7722 | 0.7262 | **0.7579** |
| Telephone | Type of telephone access | 1 | In dwelling or cellular | 0.1116 | 0.1637 | 0.1242 | 0.1583 | 0.1646 | 0.1171 | 0.2329 | **0.1261** |
| | | 2 | Nearby neighbour or work | 0.2453 | 0.3862 | 0.4193 | 0.4054 | 0.4219 | 0.4329 | 0.4826 | **0.3812** |
| | | 3 | Public telephone | 0.3491 | 0.4033 | 0.4164 | 0.4608 | 0.4765 | 0.4797 | 0.5797 | **0.4172** |
| | | 4 | Another place not nearby | 0.4381 | 0.4859 | 0.6042 | 0.6256 | 0.5848 | 0.6639 | 0.6505 | **0.6220** |
| | | 5 | No access | 0.4480 | 0.5069 | 0.7178 | 0.7314 | 0.6983 | 0.7653 | 0.7170 | **0.7320** |
| Refuse | Refuse Removal | 1 | Municipality - Once a week | 0.2223 | 0.2809 | 0.2291 | 0.2642 | 0.3426 | 0.2084 | 0.2418 | **0.2374** |
| | | 2 | Municipality - less often | 0.4342 | 0.3703 | 0.2633 | 0.3805 | 0.3755 | 0.2999 | 0.3002 | **0.3065** |
| | | 3 | Communal refuse dump | 0.3962 | 0.3683 | 0.4657 | 0.4238 | 0.4417 | 0.5498 | 0.5138 | **0.4475** |
| | | 4 | Own refuse dump | 0.4439 | 0.4248 | 0.6186 | 0.6381 | 0.6285 | 0.6994 | 0.6745 | **0.6470** |
| | | 5 | No rubbish disposal | 0.6198 | 0.5711 | 0.7712 | 0.7687 | 0.7295 | 0.8169 | 0.7637 | **0.7812** |
| Sanitation | Toilet facilities | 1 | Flush or Chemical | 0.1876 | 0.1685 | 0.2135 | 0.2078 | 0.2174 | 0.1680 | 0.2394 | **0.1956** |
| | | 2 | Pit latrine | 0.4656 | 0.4444 | 0.5984 | 0.6167 | 0.5934 | 0.6536 | 0.6624 | **0.6200** |
| | | 3 | Bucket latrine | 0.5007 | 0.3878 | 0.4354 | 0.4190 | 0.4274 | 0.4363 | 0.4081 | **0.4436** |
| | | 4 | Other | 0.6033 | 0.5555 | 0.7712 | 0.7672 | 0.7169 | 0.8236 | 0.7795 | **0.7810** |
| Employment | Employment status of the household head | 1 | Employed | 0.1681 | 0.2938 | 0.2975 | 0.3484 | 0.4092 | 0.4219 | 0.4918 | **0.2956** |
| | | 2 | Not economically active | 0.2811 | 0.3666 | 0.6230 | 0.6618 | 0.6304 | 0.7630 | 0.7109 | **0.6346** |
| | | 3 | Unemployed | 0.4333 | 0.4746 | 0.6250 | 0.6878 | 0.6750 | 0.7772 | 0.7478 | **0.6599** |
| Education | Education of household head | 1 | Above Matric | 0.0532 | 0.0784 | 0.1396 | 0.2200 | 0.2564 | 0.2719 | 0.4020 | **0.1502** |
| | | 2 | Matric | 0.1144 | 0.1323 | 0.2248 | 0.2959 | 0.2970 | 0.3787 | 0.4933 | **0.2311** |
| | | 3 | Incomplete Secondary | 0.2379 | 0.2723 | 0.4335 | 0.5322 | 0.5394 | 0.6193 | 0.6460 | **0.4456** |
| | | 4 | Primary complete | 0.3234 | 0.3657 | 0.5394 | 0.6102 | 0.5910 | 0.6880 | 0.6869 | **0.5481** |
| | | 5 | Primary incomplete | 0.3679 | 0.4240 | 0.6107 | 0.6525 | 0.6288 | 0.7468 | 0.7241 | **0.6292** |
| | | 6 | No schooling | 0.4081 | 0.4641 | 0.6806 | 0.6927 | 0.6584 | 0.8071 | 0.7544 | **0.7041** |

Source: Census 96 and Own calculations

**Table 5 Average deprivation in each district according to household characteristics - Cerioli & Zani method**

| Dimension | Description | Rank | Categories | Metro | DC 10 | DC 12 | DC 13 | DC 14 | DC 15 | DC 44 | Province |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dwelling | Type of dwelling | 1 | House or flat | 0.1433 | 0.2568 | 0.2951 | 0.3880 | 0.4366 | 0.4239 | 0.4884 | **0.2959** |
| | | 2 | Single room or flatlet | 0.2448 | 0.3268 | 0.3581 | 0.4709 | 0.5321 | 0.4439 | 0.5109 | **0.4043** |
| | | 3 | Traditional Hut | 0.3879 | 0.4852 | 0.6698 | 0.6934 | 0.6695 | 0.6937 | 0.6496 | **0.6751** |
| | | 4 | Shack | 0.4792 | 0.5118 | 0.5293 | 0.6167 | 0.5914 | 0.6166 | 0.5974 | **0.5202** |
| | | 5 | Homeless | 0.4258 | 0.5213 | 0.5594 | 0.6253 | 0.6786 | 0.6774 | 0.6740 | **0.5716** |
| Crowding | Number of persons per room | 1 | 0.25 | 0.1356 | 0.1548 | 0.2738 | 0.3611 | 0.3367 | 0.4137 | 0.4879 | **0.2815** |
| | | 2 | 0.5 | 0.1631 | 0.2171 | 0.3230 | 0.4074 | 0.4262 | 0.5447 | 0.5531 | **0.3330** |
| | | 3 | 0.75 | 0.1695 | 0.2470 | 0.3195 | 0.4111 | 0.4478 | 0.5651 | 0.5702 | **0.3468** |
| | | 4 | 1 | 0.2629 | 0.3458 | 0.4369 | 0.5032 | 0.5061 | 0.5645 | 0.5710 | **0.4533** |
| | | 5 | 1.5 | 0.2718 | 0.3610 | 0.4681 | 0.5236 | 0.5327 | 0.6406 | 0.6116 | **0.4967** |
| | | 6 | 2 | 0.3493 | 0.4076 | 0.5321 | 0.5852 | 0.5722 | 0.6571 | 0.6331 | **0.5598** |
| | | 7 | 2.5 | 0.3376 | 0.4170 | 0.5664 | 0.6143 | 0.5936 | 0.7002 | 0.6599 | **0.5971** |
| | | 8 | 3 | 0.3949 | 0.4656 | 0.6024 | 0.6438 | 0.6001 | 0.6877 | 0.6571 | **0.6162** |
| | | 9 | 4 | 0.4193 | 0.4816 | 0.6258 | 0.6503 | 0.6256 | 0.7060 | 0.6802 | **0.6382** |
| | | 10 | More than 4 | 0.4595 | 0.5294 | 0.6496 | 0.6927 | 0.6543 | 0.7113 | 0.7074 | **0.6652** |
| Energy2 | Main source of energy for cooking - New ranking | 1 | Electricity | 0.1342 | 0.1785 | 0.1447 | 0.1800 | 0.2130 | 0.1829 | 0.2969 | **0.1508** |
| | | 2 | Gas | 0.2959 | 0.2846 | 0.3358 | 0.3152 | 0.3553 | 0.3709 | 0.4099 | **0.3367** |
| | | 3 | Coal/Paraffin | 0.4457 | 0.4375 | 0.4762 | 0.4988 | 0.5131 | 0.5334 | 0.5595 | **0.4884** |
| | | 4 | Wood | 0.5060 | 0.4605 | 0.6604 | 0.6538 | 0.6312 | 0.6908 | 0.6403 | **0.6600** |
| | | 5 | Dung | - | - | 0.7016 | 0.7106 | 0.6736 | 0.7291 | 0.6825 | **0.7081** |
| Income | Derived household income | 1 | R8001 or more | 0.0510 | 0.0913 | 0.1284 | 0.2993 | 0.2766 | 0.3475 | 0.4961 | **0.1419** |
| | | 2 | R6001-R8000 | 0.0741 | 0.1031 | 0.1463 | 0.2400 | 0.1915 | 0.3336 | 0.3926 | **0.1460** |
| | | 3 | R4501-R6000 | 0.0936 | 0.1164 | 0.1721 | 0.2260 | 0.2579 | 0.3203 | 0.4243 | **0.1651** |
| | | 4 | R3501-R4500 | 0.1204 | 0.1543 | 0.2221 | 0.2887 | 0.3484 | 0.3843 | 0.4850 | **0.2273** |
| | | 5 | R2501-R3500 | 0.1485 | 0.1833 | 0.2378 | 0.2991 | 0.3188 | 0.4128 | 0.4559 | **0.2457** |
| | | 6 | R1501-R2500 | 0.2068 | 0.2582 | 0.3149 | 0.3695 | 0.3934 | 0.4898 | 0.5153 | **0.3222** |
| | | 7 | R1001-R1500 | 0.2587 | 0.3175 | 0.3894 | 0.4372 | 0.4517 | 0.5421 | 0.5463 | **0.3948** |
| | | 8 | R501-R1000 | 0.3086 | 0.3807 | 0.5037 | 0.5386 | 0.5358 | 0.6270 | 0.6005 | **0.5096** |
| | | 9 | R201-R500 | 0.3380 | 0.4060 | 0.5642 | 0.5802 | 0.5641 | 0.6459 | 0.6209 | **0.5625** |
| | | 10 | R1-R200 | 0.3892 | 0.4216 | 0.5838 | 0.6216 | 0.5762 | 0.6473 | 0.6201 | **0.5995** |
| | | 11 | None | 0.4241 | 0.4496 | 0.6082 | 0.6360 | 0.6307 | 0.7004 | 0.6577 | **0.6239** |
| Water | Type of water access | 1 | Tap in dwelling | 0.1447 | 0.1777 | 0.1686 | 0.2259 | 0.2466 | 0.1708 | 0.3479 | **0.1684** |
| | | 2 | Tap on premises | 0.3315 | 0.3796 | 0.3578 | 0.3893 | 0.4201 | 0.3595 | 0.4031 | **0.3602** |
| | | 3 | Public tap or tanker | 0.5259 | 0.4587 | 0.5367 | 0.5530 | 0.5255 | 0.5604 | 0.5685 | **0.5372** |
| | | 4 | Rain-water tank / Borehole / Well | 0.3794 | 0.4461 | 0.5115 | 0.5671 | 0.5690 | 0.5533 | 0.6157 | **0.5495** |
| | | 5 | Dam / River / Stream | 0.5302 | 0.5168 | 0.6738 | 0.6822 | 0.6464 | 0.6808 | 0.6385 | **0.6704** |
| Telephone | Type of telephone access | 1 | In dwelling or cellular | 0.1114 | 0.1635 | 0.1263 | 0.1598 | 0.1685 | 0.1193 | 0.2278 | **0.1268** |
| | | 2 | Nearby neighbour or work | 0.2569 | 0.3784 | 0.4076 | 0.4004 | 0.4188 | 0.4208 | 0.4557 | **0.3758** |
| | | 3 | Public telephone | 0.3546 | 0.3968 | 0.4111 | 0.4420 | 0.4636 | 0.4566 | 0.5326 | **0.4094** |
| | | 4 | Another place not nearby | 0.4559 | 0.4811 | 0.5737 | 0.5892 | 0.5584 | 0.6124 | 0.5952 | **0.5827** |
| | | 5 | No access | 0.4341 | 0.4710 | 0.6391 | 0.6536 | 0.6263 | 0.6747 | 0.6320 | **0.6495** |
| Refuse | Refuse Removal | 1 | Municipality - Once a week | 0.2248 | 0.2814 | 0.2319 | 0.2627 | 0.3431 | 0.2214 | 0.2548 | **0.2399** |
| | | 2 | Municipality - less often | 0.4677 | 0.3746 | 0.2852 | 0.4101 | 0.4013 | 0.3355 | 0.3209 | **0.3315** |
| | | 3 | Communal refuse dump | 0.4448 | 0.3855 | 0.4988 | 0.4488 | 0.4597 | 0.5326 | 0.5017 | **0.4698** |
| | | 4 | Own refuse dump | 0.4417 | 0.4016 | 0.5668 | 0.5831 | 0.5742 | 0.6234 | 0.6018 | **0.5852** |
| | | 5 | No rubbish disposal | 0.6101 | 0.5303 | 0.6881 | 0.6886 | 0.6547 | 0.7192 | 0.6716 | **0.6942** |
| Sanitation | Toilet facilities | 1 | Flush or Chemical | 0.1884 | 0.1695 | 0.2188 | 0.2062 | 0.2183 | 0.1783 | 0.2402 | **0.1982** |
| | | 2 | Pit latrine | 0.4504 | 0.4167 | 0.5411 | 0.5506 | 0.5328 | 0.5738 | 0.5826 | **0.5523** |
| | | 3 | Bucket latrine | 0.5207 | 0.4002 | 0.4438 | 0.4291 | 0.4334 | 0.4576 | 0.4192 | **0.4579** |
| | | 4 | Other | 0.6086 | 0.5372 | 0.7044 | 0.7019 | 0.6636 | 0.7357 | 0.7090 | **0.7089** |
| Employment | Employment status of the household head | 1 | Employed | 0.1759 | 0.2896 | 0.2938 | 0.3383 | 0.3897 | 0.3955 | 0.4526 | **0.2892** |
| | | 2 | Not economically active | 0.2700 | 0.3529 | 0.5584 | 0.5928 | 0.5706 | 0.6663 | 0.6225 | **0.5652** |
| | | 3 | Unemployed | 0.4479 | 0.4825 | 0.5994 | 0.6520 | 0.6440 | 0.7170 | 0.6919 | **0.6265** |
| Education | Education of household head | 1 | Above Matric | 0.0565 | 0.0838 | 0.1412 | 0.2208 | 0.2481 | 0.2646 | 0.3782 | **0.1499** |
| | | 2 | Matric | 0.1254 | 0.1434 | 0.2298 | 0.2931 | 0.2963 | 0.3704 | 0.4666 | **0.2339** |
| | | 3 | Incomplete Secondary | 0.2398 | 0.2708 | 0.4072 | 0.4872 | 0.4930 | 0.5562 | 0.5761 | **0.4139** |
| | | 4 | Primary complete | 0.3336 | 0.3664 | 0.5077 | 0.5627 | 0.5543 | 0.6201 | 0.6156 | **0.5121** |
| | | 5 | Primary incomplete | 0.3693 | 0.4138 | 0.5636 | 0.5978 | 0.5801 | 0.6650 | 0.6429 | **0.5752** |
| | | 6 | No schooling | 0.3987 | 0.4420 | 0.6173 | 0.6289 | 0.6052 | 0.7107 | 0.6648 | **0.6332** |

Source: Census 96 and Own calculations

where the above listed services are absent. Indeed, households living in shacks in the Metro are less deprived than households living in brick houses in DC 44. Another interesting result from the first dimension in the Metro is that homeless households are less deprived than households living in shacks in the Metro.

We see that a household with more rooms than persons is on average less than 50% deprived, while a household with more persons per room is on average more than 50% deprived. Furthermore, households using wood or dung for cooking are 5 times more deprived than households using electricity for cooking. It should be noted that households using electricity for cooking have approximately the same level of deprivation across all the districts, except DC 44.

As one would expect, the more income the household generates, the less deprived the household is. The average household living in the Metro and earning more than R8000 p.m. is only 5% deprived, while the average household in the Metro earning no income is 44% deprived. Our expectation that households in districts situated further eastward are more deprived, no matter what their income level is, is also met, with households in DC 44 being more than 40% deprived, no matter their income. An interesting observation of these results is that even if households earn no income, they are on average only 70% deprived. The earlier expectations also hold for water, with households having a tap in the dwelling being only 17% deprived, while households using a dam or river as the main water source are 76% deprived. The same could be said for the dimensions of telephone access, sanitation and refuse removal.

We see in Table 4 that the more educated the household head, the less deprived the household tends to be. We can also see that households living in the Metro and where the household head has no education, the average deprivation is 41%, nearly the same as a household living in DC 44 where the household head has a degree or diploma. Furthermore, the average deprivation for households living in DC 12, DC 13, DC 14, DC 15 and DC 44 and where the household head has less than primary education is above 60%. There is a significant difference between the average deprivation of households where the household head is employed, unemployed or not economically active in the Metro and DC 10. In DC 12 and further eastward, there is a big difference in the average deprivation of households depending on whether the household head is employed or unemployed, but little difference in average deprivation between households where the household head is not economically active or

unemployed. A reason for this could be that in the Metro and DC 10 more than 50% of household heads are employed, but in the other districts, 50% or more of household heads are not economically active. Table 5 gives the deprivation measured according to the Cerioli & Zani method, showing deprivation slightly lower than that discussed above.

**Figure 8 The average deprivation in each district according to the urban/rural divide - Cheli & Lemmi**

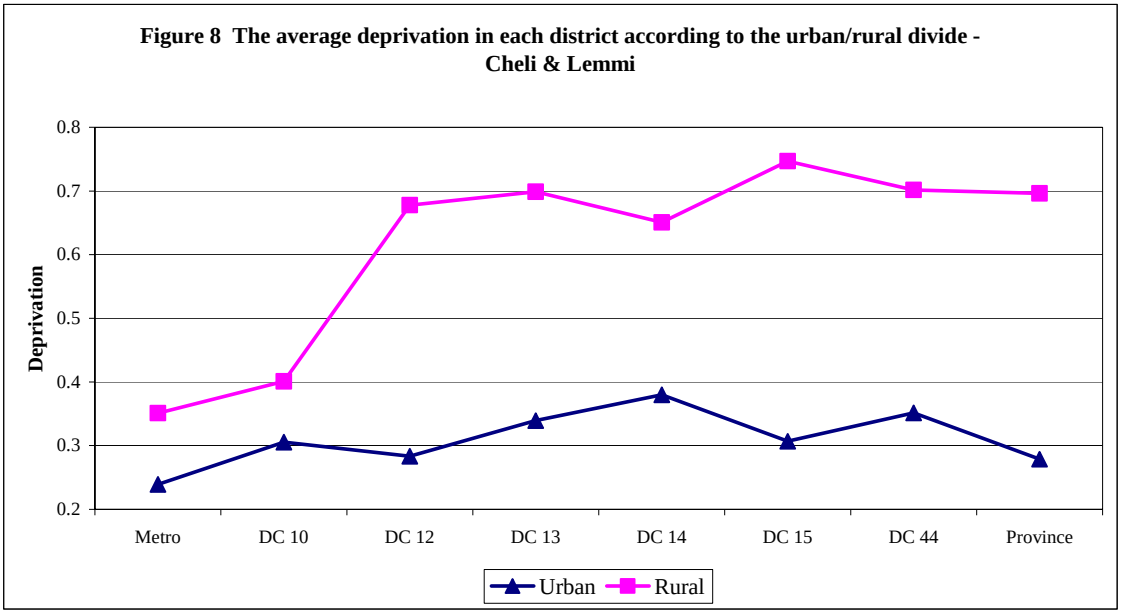
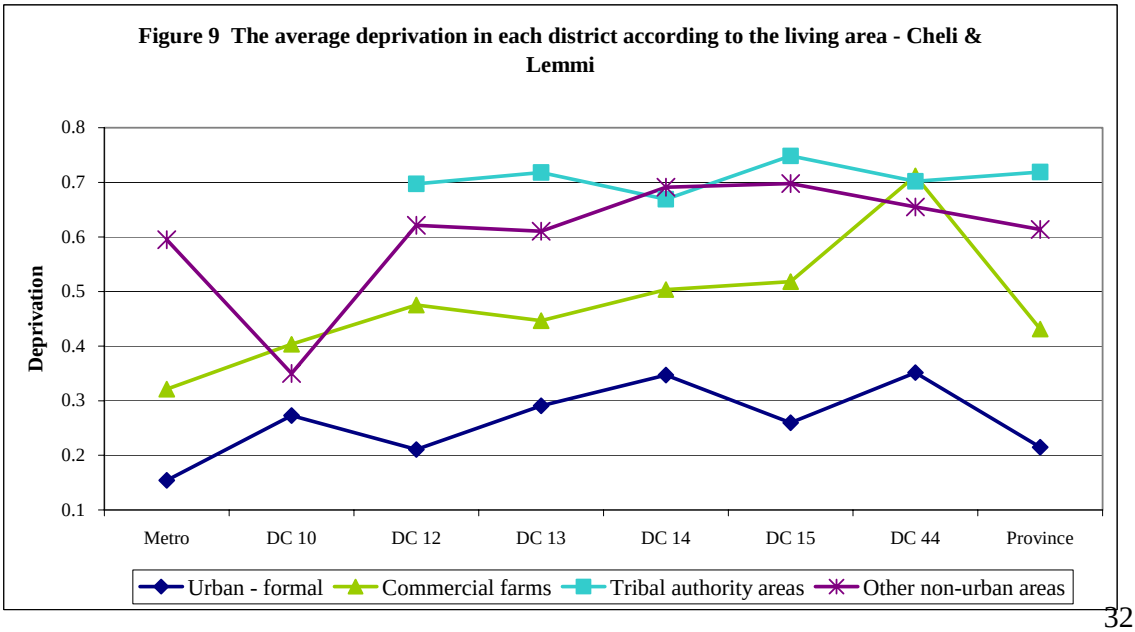


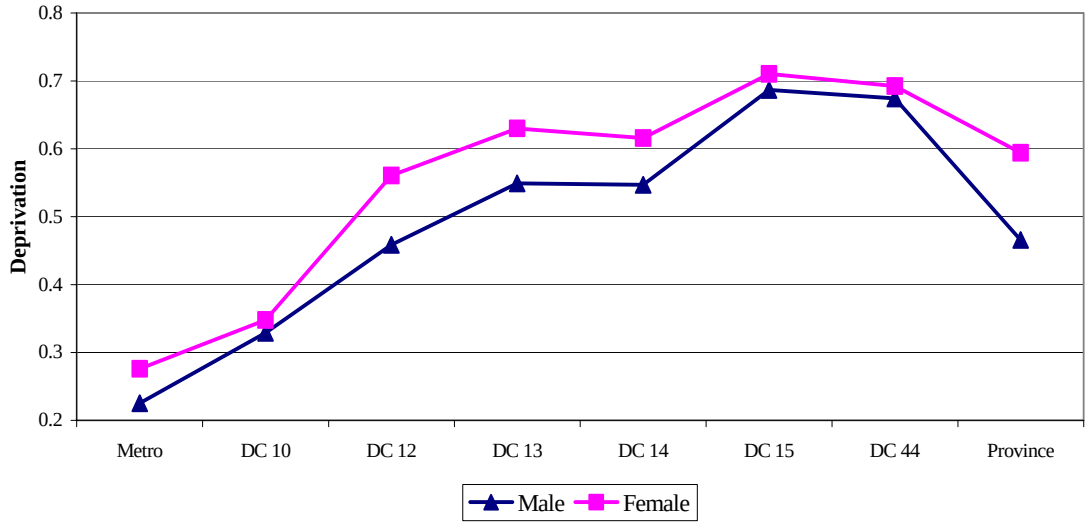

Figure 8 shows a clear difference between the average deprivation of households in rural areas and the households living in urban areas in the Eastern Cape. The average deprivation for households in urban areas in all the districts is between 0.2 and 0.4, with a marginal increase the further east the district is situated. The average deprivation in urban areas of the province is approximately 28%. The deprivation of households in rural areas paints a completely different picture. In DC 10 and the Metro, average deprivation in rural areas is

**Figure 9 The average deprivation in each district according to the living area - Cheli & Lemmi**



roughly 10% higher than average deprivation in urban areas. In DC 12 and the districts further east, there is a significant difference between urban and rural deprivation, ranging between 27% and 42%, with the average deprivation in rural areas between 65% and 75%. This big difference in deprivation between rural and urban areas is due to the influence of high deprivation, approximately 70%, in traditional authority areas, as indicated in Figure 9. There are no traditional authority areas situated in DC 10 and the Metro. In DC 12, 48% of households live in traditional authority areas, while in DC 13, DC 14, DC 15 and DC 44 this figure rises to 64%, 65%, 89% and 95% respectively. This, coupled with the high deprivation in traditional authority areas, results in the high levels of deprivation in rural areas.

**Figure 10 The average deprivation in each district according to gender of household head - Cheli & Lemmi**




The deprivation of female-headed households is higher than the deprivation experienced by male-headed households, as shown in Figure 10. Deprivation for male-headed households is nearly 13% lower than for female-headed households, at 46.6%. The biggest difference occurs in DC 12, DC 13 and DC 14. Figure 11 shows that African-headed households are more deprived than any other race, with white-headed households being the least deprived.[23] In DC 15 the deprivation of white-headed households is 25%, while in the rest of the districts, except for DC 44, the deprivation of white-headed households is 10% or less. The average deprivation for African-headed households is 32% in the Metro rising to 70% and 69% in DC 15 and DC 44 respectively. The average deprivation for an African-headed household in the Eastern Cape is 59%, while for white-, Asian- and Coloured-headed households the average

[23] The Asian population in the Eastern Cape is too small, relative to the other groups, to draw concrete conclusions about them. The same applies to the white-headed population in DC 44.

deprivation is 8.8%, 12% and 26.6% respectively. Furthermore, from Figure 12 we see that 99% of white-headed households are less than 30% deprived, while 75% of African-headed households are more than 40% deprived.

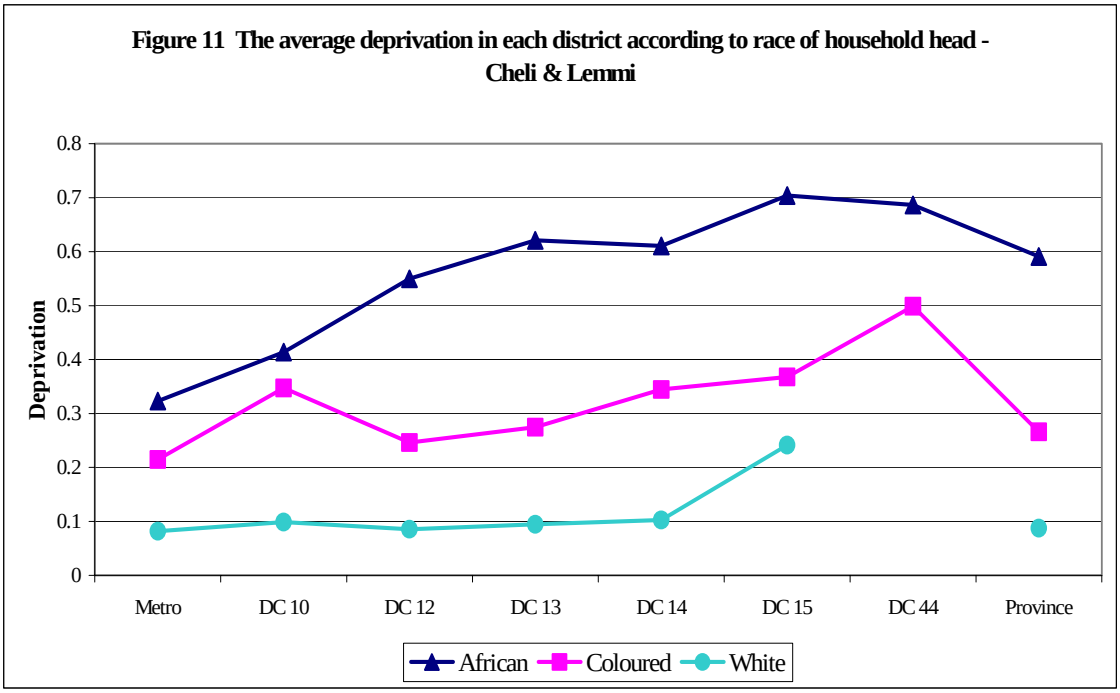
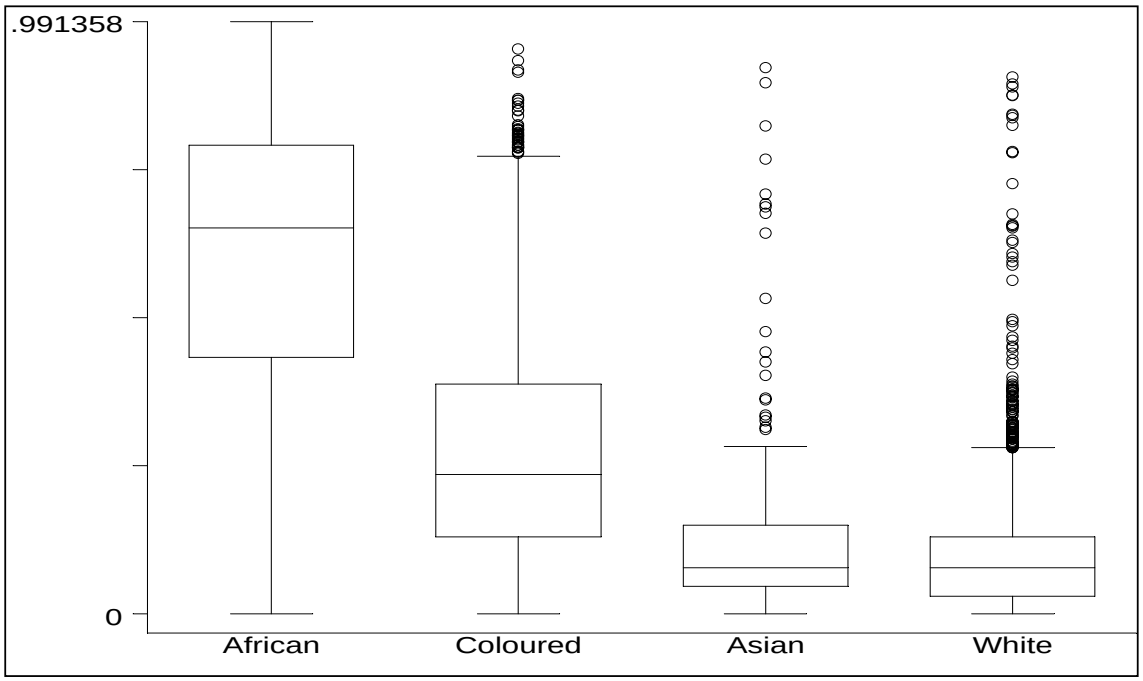



**Figure 12. The distribution of deprivation within each race - Cheli & Lemmi**




How does the deprivation measured here differ from the poverty measured according to the traditional approach? Table 6 gives the average deprivation of households if we were to draw

the household poverty line at R1000 p.m. and R500 p.m. Households in the Eastern Cape where the monthly income is less than R1000 are on average 63.4% deprived, while households earning more than R1000 p.m. are 28.2% deprived. In DC 15 and DC 44, the deprivation of households earning more than R1000 p.m. is 48.4% and 54.5% respectively. If the poverty line is R500 p.m., the average deprivation of households in the Eastern Cape earning less than this is 66%, and those earning more than R500 p.m. is 37%. The deprivation in DC 15 and DC 44 then rises to 58% and 61% respectively for those households earning more than R500 p.m. This measure clearly illustrates that the traditional poverty measure excludes a lot of households, who are actually deprived.

**Table 6 Comparing deprivation (Cheli & Lemmi method) and traditional poverty**

| | Less than R1000 | R1000 or more | Less than R500 | R500 or more |
|---|---|---|---|---|
| **Metro** | 0.3657 | 0.1456 | 0.3943 | 0.1749 |
| **DC 10** | 0.4196 | 0.2082 | 0.4397 | 0.2719 |
| **DC 12** | 0.6167 | 0.2764 | 0.6451 | 0.3667 |
| **DC 13** | 0.6548 | 0.3592 | 0.6769 | 0.4545 |
| **DC 14** | 0.6290 | 0.3797 | 0.6455 | 0.4701 |
| **DC 15** | 0.7469 | 0.4836 | 0.7597 | 0.5794 |
| **DC 44** | 0.7094 | 0.5450 | 0.7199 | 0.6059 |
| **Province** | **0.6337** | **0.2815** | **0.6607** | **0.3746** |

We now want to determine the deprivation level that yields the same poverty rate as a poverty line. A household poverty line of R1000 p.m. yields the same poverty rate, 71%, as a minimum deprivation level of 0.36062. In Table 7 we see that 86% of those households classified as poor according to a R1000 p.m. poverty line are also deprived, while 14% are poor but not deprived. We can also see that 33.5% of the non-poor are actually deprived. A household poverty line of R500 p.m. and a minimum deprivation level of 0.54361 would yield the same poverty rate of 55%. Of those considered poor according to the R500 poverty line, 74% are deprived, while 26% are not deprived. Table 7 also shows that 31% of those households not classified as poor are actually deprived. A poverty line of R200 p.m. and a minimum deprivation level of 0.7197 yield a poverty rate of 32%. 54% of the poor are also deprived, while 46% of the poor are not deprived. Table 7 also show that 22% of the non-poor are actually deprived. It is also interesting to note that the lower the poverty line, the less accurate it becomes in capturing actual deprivation. If the household poverty line is R1000 p.m., 14% of the deprived are non-poor, while a household poverty line of R500 p.m., results in 26% of the deprived not classified as poor. When using a household poverty line of R200 p.m., 46% of the deprived households are not considered poor. This corresponds with

Klasen's (2000:54) finding that "… at the most deprived end of the distribution, expenditure [or income] poverty is no longer a very good proxy for broader levels of deprivation."

**Table 7 Poverty and Deprivation - Cheli & Lemmi**

| Deprivation | | | | |
|---|---|---|---|---|
| | | **Less than 0.36062** | **0.36062 and higher** | **Total** |
| **Household Income** | **More than R1000** | 66.53% | 33.47% | **100.00%** |
| | **R1000 or less** | 13.72% | 86.28% | **100.00%** |
| | **Total** | 29.08% | 70.92% | **100.00%** |
| | | **Less than 0.5434** | **0.5434 and higher** | **Total** |
| | **More than R500** | 69.08% | 30.92% | **100.00%** |
| | **R500 or less** | 25.53% | 74.47% | **100.00%** |
| | **Total** | 45.23% | 54.77% | **100.00%** |
| | | **Less than 0.7197** | **0.7197 and higher** | **Total** |
| | **More than R200** | 77.82% | 22.18% | **100.00%** |
| | **R200 or less** | 46.16% | 53.84% | **100.00%** |
| | **Total** | 67.55% | 32.45% | **100.00%** |

**Table 8 Frequency of those households with no deprivation - Cheli & Lemmi method**

| | | **Metro** | **DC 10** | **DC 12** | **DC 13** | **DC 15** | **DC 44** | **Province** |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | | 547 | 86 | 262 | 55 | 44 | 11 | **1 005** |
| **Race** | **African** | 44 | | 11 | | 33 | | **88** |
| | **Coloured** | 22 | | 11 | | | 11 | **44** |
| | **Asian** | 22 | | | | | | **22** |
| | **White** | 459 | 86 | 240 | 55 | 11 | | **852** |
| **Gender** | **Male** | 427 | 75 | 229 | 55 | 33 | 11 | **830** |
| | **Female** | 121 | 11 | 33 | | 11 | | **175** |
| **Area** | **Urban** | 547 | 86 | 251 | 55 | 44 | 11 | **994** |
| | **Commercial farms** | | | 11 | | | | **11** |

Up to now, we have looked at those households that are deprived. Let us quickly look at those households that have no deprivation in the dimensions studied here, i.e. they have a membership function equal to 0. We can see in Table 8 that there are just over 1000, or 0.87%, of those households in the Eastern Cape, of whom 54.5% are in the Metro and 26.1% are in DC 12. Of those households that have a membership function of zero and living in the Metro, 84% are White-headed households, 8% African headed households, 4% Coloured headed households and 4% Asian-headed households. The 86 households in DC 10 that have no deprivation are all White-headed households, as are the households in DC 13 that have no

deprivation. 74.9% of households with no deprivation in DC 15 are African-headed households. The next two rows indicate that in the province, 82.6% of these are male-headed households, with only 17.4% headed by females, mostly situated in the Metro and DC 12. Nearly 99% of the households with no deprivation are situated in urban areas, with the rest situated on commercial farms in DC 12.

We can even incorporate the traditional approach here by applying a deprivation line.[24] Let the deprivation line be equal to 0.65 or 65%. This means we want to identify those households that are more than 65% deprived. We can construct a poverty index using the FGT method discussed earlier.[25] The results of this are given in Table 9. We can see here that in the Eastern Cape, 42.5% of households are more than 65% deprived, with the average deprivation gap being 0.1355 or 20.8% of the deprivation line. 1.7% of households in the Metro are more than 65% deprived, while in DC 15 and DC 44, 72.2% and 69.6% of the households are more than 65% deprived. In DC 15, the average deprivation gap is 0.153 or 23.8% of the deprivation line. In DC 12, where 36.8% of households are more than 65% deprived, the average poverty gap is 20.2% of the deprivation line. Looking at the $P_2$ measure, which measures the severity or depth of deprivation, we see that deprivation is the most severe in DC 15, followed by DC 13, then DC 44, DC 12, DC 14, DC 10 and lastly the Metro.

Table 9 also shows that 49.3% of African-headed households are more than 65% deprived, with an average deprivation gap of 20.8% of the deprivation line or 0.1357. Only 0.16% of white-headed households are more than 65% deprived, with a deprivation gap of 0.157 or 22.5% of the deprivation line. The interesting result we see here is that the depth of deprivation is the highest for white-headed households, followed by African-headed households, then Coloured-headed households and lastly Asian-headed households. There are more female-headed households where deprivation is higher than 65% than male-headed households. The deprivation gap is nearly the same for male and female-headed households, as is the depth of deprivation. In the last section of Table 9, we see that 72.4% of households living in tribal authority areas are more than 65% deprived, as well as 12% of households in informal dwellings in urban areas and 15.5% of households living on commercial farms.

[24] The deprivation line serves the same function as the poverty line, as it allows us to study the characteristics of the most deprived households in the population.

[25] See note 7 for the FGT method.

Households in tribal authority areas also have the biggest average deprivation gap, 0.1395, followed by households in other rural areas with a gap of 0.0976. Deprivation is also the most severe in tribal authority areas, but least severe in the formal urban areas.

**Table 9 The deprivation profile when deprivation line is 0.65 - Cheli & Lemmi method**

| | | Population size | No. of Hhs with deprivation <0.65 | $P_0$ | Average deprivation gap | $P_1$ | $P_2$ |
|---|---|---|---|---|---|---|---|
| District | **Metro** | 18 940 | 314 | 0.01658 | 0.05906 | 0.09235 | 0.00009 |
| | **DC 10** | 6 714 | 239 | 0.03560 | 0.04412 | 0.07468 | 0.00013 |
| | **DC 12** | 31 205 | 11 477 | 0.36779 | 0.13189 | 0.20232 | 0.00863 |
| | **DC 13** | 15 346 | 7 762 | 0.50580 | 0.13631 | 0.19855 | 0.01233 |
| | **DC 14** | 5 989 | 2 577 | 0.43029 | 0.11258 | 0.16889 | 0.00768 |
| | **DC 15** | 27 238 | 19 660 | 0.72179 | 0.15307 | 0.23773 | 0.02079 |
| | **DC 44** | 10 264 | 7 146 | 0.69622 | 0.10678 | 0.16674 | 0.01074 |
| Race | **African** | 99 161 | 48 899 | 0.49313 | 0.13570 | 0.20794 | 0.02412 |
| | **Coloured** | 7 357 | 162 | 0.02202 | 0.07537 | 0.12095 | 0.00962 |
| | **Asian** | 328 | 8 | 0.02439 | 0.11463 | 0.16444 | 0.02145 |
| | **White** | 8 545 | 14 | 0.00164 | 0.15735 | 0.22542 | 0.03069 |
| Gender | **Male** | 56 636 | 18 309 | 0.32327 | 0.13333 | 0.20463 | 0.02383 |
| | **Female** | 59 060 | 30 866 | 0.52262 | 0.13679 | 0.20942 | 0.02421 |
| Urban | **Urban - formal** | 34 885 | 508 | 0.01456 | 0.07235 | 0.11184 | 0.00864 |
| | **Urban - informal** | 10 802 | 1 302 | 0.12053 | 0.07482 | 0.11613 | 0.00944 |
| Rural | **Commercial farms** | 4 732 | 731 | 0.15448 | 0.09135 | 0.14844 | 0.01320 |
| | **Tribal authority areas** | 62 971 | 45 586 | 0.72392 | 0.13952 | 0.21347 | 0.02506 |
| | **Other non-urban areas** | 2 306 | 1 048 | 0.45447 | 0.09764 | 0.15524 | 0.01416 |
| **Province** | | **115 696** | **49175** | **0.42504** | **0.13550** | **0.20764** | **0.01023** |

## 7. SUMMARY

This paper started with a definition of poverty that characterises it as multidimensional and vague, exhibiting both horizontal and vertical vagueness. Critique against the traditional approach, with its uni-dimensional and dichotomous approach to poverty measurement, is that it does not properly address the horizontal vagueness or the vertical vagueness of poverty. Many methods were developed over time to address the multidimensional aspect to poverty - collectively called the multidimensional approach to poverty measurement - but failed to address the vertical vagueness of poverty. The fuzzy approach was presented as a measurement tool that overcomes the limitations of previous methods by taking both the

horizontal and the vertical vagueness of poverty into account when measuring poverty or well being in a population.

The fuzzy approach does offer certain advantages over the other available methods, but also contains some limitations. The vertical vagueness of poverty is addressed by allowing individuals or households some degree of poverty between two critical levels. The problem here is to decide where these critical levels should be and on what basis or formula poverty will decrease within these two levels, i.e. the issue of a membership function. In this paper, the issue of critical levels was avoided by choosing the minimum and maximum (allowable) categories in each poverty dimension. There are two definitions in the literature for the membership function: viz. the definition by Cerioli & Zani (1990) and the definition by Cheli & Lemmi (1995, as in Miceli, 1998). Both were used to test whether it made a difference to the results, but we found there to be no significant difference. Addressing the issue of horizontal vagueness is a delicate subject since different people rank the importance of the various dimensions of poverty differently. In the absence of an aggregate set of weights based on the individuals' rankings, the fuzzy approach proposes a weight system that is an inverse function of the actual poverty in each dimension. This gives more importance to those dimensions where poverty is lower, based on the notion that these individuals will feel more deprived. The analysis found that weights differ between districts. In the Metro refuse ranked the highest, but in the other districts crowding and type of dwelling ranked highest.

The analysis was based on the average provincial weights to make comparison possible. It was found that there are sharp differences between the various districts of the Eastern Cape. The Western district and Nelson Mandela Metro were found to contain the lowest deprivation levels, while the more eastern districts of OR Tambo and Alfred Nzo were found to contain the highest levels of deprivation. We also showed that households' deprivation levels differed according to race, gender and location. African-headed households have the highest levels of deprivation of the four races and whites-headed households the lowest. Male-headed households are also less deprived than female headed households. Households living in traditional authority areas have generally high levels of deprivation, while their urban counterparts living in formal housing have low deprivation levels.

Our analysis also looked at a comparison between the traditional approach and the fuzzy approach to poverty measurement by comparing poverty rates calculated by the two methods. It was found that a large percentage of deprived households from the fuzzy approach were

excluded from the set of poor households based on the traditional approach. This misspecification increased the lower the poverty line was set, indicating that the poorest of the poor are often missed by the traditional approach. In the last analysis a deprivation line of 0.65 or 65% was drawn to see where deprivation is the most severe. This indicated that household deprivation was the most severe in OR Tambo district, followed by Alfred Nzo district.

Despite poverty being "… a composite phenomenon with multidimensional causes and effects, and varying according to current ethical/social evaluations, [making it] all the more complex" (Carbonaro, 1990:264-265), the fuzzy approach gives us a tool to identify the poor in the population and also to construct an aggregate index of poverty. To answer the question posed in the introduction: does this method add value to other, more conventional methods of poverty? Yes, it does: for by looking at many simultaneous dimensions or indicators of poverty at the same time we get a clearer picture of an individual's or household's overall well being or poverty status.

> *"After all, the main purpose of poverty studies should be … overcoming poverty" (Boltvinik, 1998:7).*

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