AN ANALYSIS OF RURAL POVERTY IN OYO STATE: A PRINCIPAL COMPONENT APPROACH

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Abstract

The 2003/2004 NLSS data was used in this paper to consider the status of rural household poverty in Oyo State, Nigeria and to identify the relevant determinants using the. Principal component analysis (PCA) was employed to determine the important factors associated with rural household poverty. Household size, mother's educational level, age of the household head, father's work and mother's work were the key factors found to be major determinants of rural poverty incidence in the state. The choice of expenditure as a proxy for measuring poverty was further corroborated. These findings indicated that factor analysis is very helpful in poverty -targeting and alleviation.

Keywords: Fundamental Freedoms of Action, Unacceptable Deprivation, Economic Growth, Rural household poverty, Principal Component Analysis, Proxy

Introduction

Poor people live without fundamental freedoms of action and choice that the better off take for granted (Sen, 1999). They often lack adequate food and shelter, education and health, deprivations that keep then from leading the kind of life that every one values. They also face extreme vulnerability to ill health, economic dislocation, and natural disasters. And they are often exposed to ill treatment by institutions of the state and society and are powerless to influence key decisions affecting their lives. These are several dimensions of poverty (World Bank, 2001).

Poverty is an unacceptable deprivation in well-being (World Bank, 2001). It exists when there is lack of the means to satisfy critical needs. Poverty can be regarded as the status, objective or subjective, of an individual or a population. Poverty will have an objective definition once observable and measurable indicators exist that are used to approach the material or other aspects of the lives of individuals. On the other hand, the subjective definition of poverty is when judgment (including value judgment) of individuals is taken into consideration in order to investigate their welfare (Boccanfuso, 2004).

Reducing poverty is an important development policy issue because economic growth is obviously associated with poverty reduction. Nigeria has experienced a high incidence of poverty and has not been very successful in poverty alleviation (Okojie et al., 2001; Canagarajah et al., 1997). The worrisome aspect of this phenomenon is the spatial differences in the incidence of poverty in Nigeria. The spatial distribution of poverty in Nigeria in 1996 as presented by FOS (1999) now NBS shows that the North West region had the highest incidence of poverty, with about 68% of the population in poverty while the South East region had the lowest incidence.

The United Nations Human Development Report (1998) declares that Nigerian poverty level is getting worse by the day and more than four in ten Nigerians live in conditions of extreme poverty of less than N320 per capita per month, which could hardly provide for a quarter of the nutritional requirements of healthy living. This is approximately $8.2 per month. The report ranked Nigeria 146 out of a total of 174 countries in its Human Development Index (HDI), which measures achievement in terms of life expectancy, education and real income per capita. Poverty has been identified as a rural phenomenon and its interventions will be effective only if the correct poverty causing factors are identified. This paper differs from the traditional use of regression methods to identify key determinants of rural poverty in Oyo State, Nigeria. It uses a principal component analysis method-a relatively new technique.

Methodology

The data used for this study were from the 2003/04 Nigeria Living Standard Survey (NLSS) data from the National Bureau of Statistics (formerly known as the Federal Office of Statistics). The sample design was a two-stage stratified sampling. The first stage involved the selection of 120 Enumeration areas (EAs) in each of the 36 states and 60 EAs at the Federal Capital Territory (FCT). The second stage was the random selection of five housing units from each of the selected EAs. A total of 21,900 households were randomly interviewed across the country with 19,158 households having consistent information (NBS, 2005). For the purpose of this study, the secondary data was first stratified into rural and urban sectors. The second stage was the stratification of the rural area based on the six geo-political zones of Nigeria namely South West, South East, South South, North Central, North East and North West. The next stage involved the selection of all the sampled rural households in each of the geo-political zones. The data set provides detailed records on household expenditure (which was used as a proxy for household income) and household characteristics. For the data analysis, Principal Components Analysis (PCA) was used. PCA is a useful statistical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension.

PCA summarizes the variation in correlated multivariate attributes to a set of non-correlated components, each of which is a particular linear combination of the original variables. The extracted non-correlated components are called Principal Components (PC) and are estimated from the eigenvectors of the covariance matrix of the original variables. Therefore, the objective of PCA is to achieve parsimony and reduce dimensionality by extracting the smallest number components that account for most of the variation in the original multivariate data and to summarize the data with little loss of information. It is useful when data have been obtained data on a number of variables (possibly a large number of variables), and there is some redundancy in those variables. In this case, redundancy means that some of the variables are correlated with one another, possibly because they are measuring the same construct. Because of this redundancy, there is the need to reduce the observed variables into a smaller number of principal components (artificial variables) that will account for most of the variance in the observed variables.

In principal component analysis, one of the most commonly used criteria for solving the number-of-components problem is the eigenvalue-one criterion, also known as the Kaiser criterion (Kaiser, 1960). With this approach, you retain and interpret any component with an eigenvalue greater than 1.00. The rationale for this criterion is straightforward. Each observed variable contributes one unit of variance to the total variance in the data set. Any component that displays an eigenvalue greater than 1.00 is accounting for a greater amount of variance than had been contributed by one variable.

Such a component is therefore accounting for a meaningful amount of variance, and is worthy of being retained. On the other hand, a component with an eigenvalue less than 1.00 is accounting for less variance than had been contributed by one variable. For this reason, components with eigenvalues less than 1.00 are viewed as trivial, and are not retained. Stevens (1986) reviews studies that have investigated the accuracy of the eigenvalue-one criterion, and recommends its use when less than 30 variables are being analyzed and communalities are greater than 0.70, or when the analysis is based on over 250 observations and the mean communality is greater than or equal to 0.60.

The Scree test (Cattell, 1966) could also be used to decide on the number of components to retain. Here the eigenvalues associated with each component are plotted and a "break" between the components with relatively large eigenvalues and those with small eigenvalues is looked for. The components that appear before the break are assumed to be meaningful and are retained for rotation; those appearing after the break are assumed to be unimportant and are not retained. A more detailed discussion of PCA can be found in textbooks in Duda *et. al*.(2001) and Haykin S.(1999). In this study, principal component analysis (PCA) was utilized to determine the important factors explaining household poverty. This deviates from the traditional approach of regressing poverty status of households on some selected poverty correlates.

Empirical results

The quantitative data analysis is presented here. It firstly refers to the PCA and secondly the indicators affecting household poverty.

Result of principal component analysis

Principal component analysis (PCA) retained 16 out of a possible 76 poverty determining variables. Some of the variables included sex, age (years), household size, literacy level, per capita expenditure, e.t.c. Household expenditure showed a high correlation to poverty. This justified the use of expenditure as a proxy for poverty. The Kaiser-Meyer-Olkin Measure (KMO) of sampling adequacy is a measure for comparing the magnitudes of observed correlation coefficients with the magnitudes of partial correlation coefficients. The value of the KMO was 0.507 and this showed the appropriateness of the model which is within an acceptable range for a well-specified model (Table 1). The Eigenvalues are calculated for each component. The Eigenvalues and Scree test were used to determine the number of extracted components from the observed data. The size of an eigenvalue indicates the amount of variance in the principal component explained by each component.

Table 1 : KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.507
Bartlett's Test of Sphericity	Approx. Chi-Square	7183.693
	Df	120
	Sig.	.000

The orthogonal rotated solution was chosen to obtain uncorrelated components using varimax rotation method. The rotated component matrix of PCA led to the selection of six components explaining poverty. These components reflect poverty thorough different indicators. The components are extracted from a set of indicators by the application of the PCA. The first principal component makes up the largest proportion of the total variability in the set of indicators used. The second component accounts for the next largest amount of variability not accounted by the first component, and, so on for the higher order components. The poverty components can be easily interpreted by analyzing the signs and size of the indicators in relation to the new component variable (Table 2).

Table 2: Rotated Component Matrix [a]

	Component					
	1	2	3	4	5	6
Total annual household expenditure in local current prices	.815	.516	.065	-.084	-.070	.075
Total annual household expenditure in regionally deflated current prices	.815	.505	.056	-.099	-.073	.074
Per capita expenditure in regionally deflated current prices	.940	-.258	-.119	-.032	-.030	.031
Per capita expenditure in local current prices	.933	-.275	-.108	-.013	-.028	.025
Sex	-.091	-.545	.551	-.090	-.156	.031
Age years	-.007	.023	.775	.099	-.026	-.065
Marital status	.053	-.776	.288	-.099	-.071	.086
Religion	-.077	-.018	.188	-.168	.775	-.218
Father's education level	.170	-.059	-.334	-.322	-.088	.579
Father's work	.035	-.014	.101	.751	-.128	-.116
Mother's education	.013	.047	.060	-.005	.059	.889
Mother's work	-.095	-.012	.132	.670	-.011	-.028
Household Size	-.055	.881	.116	-.115	.015	.097
Occupation group	-.065	.042	-.338	.552	.417	.024
Educational groups for highest level attained	.146	.289	-.605	-.358	-.360	.044
Literacy	-.013	.090	-.090	.046	.550	.150

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization
a Rotation converged in 6 iterations.

Conclusion and recommendation

In conclusion, selecting appropriate poverty indicators is most important, particularly as they reflect a country's local conditions. As for Oyo State, poverty is mostly determined by household size, mother's educational level, age of the household head, father's work and mother's work. The link between poverty and expenditure has been further illustrated by the high correlations of expenditure for component one. Thus, poor households have larger families, and lower educational attainments.

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