

A Wealth Index of Households Living Conditions in Mauritania

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Abstract

Evaluating poverty reduction requires repeated measures of the living standards of the poor. In this paper, the possibility of constructing the asset index by using data of Mauritanian Survey on Household Living Conditions (SHLC, 2008) will be investigated and the relation between household socio-economic positions classified by using asset index and traditional money-metric measures. Household expenditure will also be considered.

Keywords: classification, correlations, expenditure, living standards, principal component analysis, socio-economic status and wealth index.

1-Introduction

Measuring standard of living has historically been problematic because of the difficulty of defining an aggregate measure that captures the notion of well-being (Mazumdar, 1999).

Methods for assessing household socio-economic status can be categorized into two major groups: money-metric measures and alternative approaches. The first category is traditionally used by the economists because it is easy to measure in a monetary definition and is widely well understood by the public. Its concept relies on the assumption that a person's material standard of living largely determines their well-being. Thus, the poor are defined as those who engage in a material standard of living measured by income and expenditure below a certain level – the poverty line (Falkingham, and Nmziel, 2001).

Economists traditionally prefer to use an indicator in money term – income or consumption – to assess household's poverty and living standards. Although the best indicator of household welfare is the actual consumption of individual on food or other goods and services such as health and education, those individual's consumption is difficult to be disaggregated. In practice, income and expenditure data are therefore commonly used to proxy for the level of consumption utilized (Atkinson, 1989).

Income refers to the earnings of individuals or households from productive activities and current transfers. It can be seen as comprising claims on goods or services produced by individuals or households. In contrast, consumption refers to resources actually consumed by household members. Generally, economists prefer consumption or expenditure to income. This is because income tends to vary over a course of a year, especially in developing countries where income highly depends on seasonal agriculture. Moreover, large proportion of household's income in developing countries is shared by the informal sector and self employment both inside and outside agriculture. This makes the accuracy of income be problematic.

Criticisms have been made over using monetary measures, either income or expenditure, to assess household's living status and socio-economic status in developing countries. One criticism is that using a monetary indicator does not take into account how money is earned and how much time is spent working. The quality of income and expenditure data is most likely to be poor, particularly in middle- and low-income countries. Thus, other non-monetary indicators of household welfare such as the asset-based index have been introduced and developed as an alternative tool for classifying household socio-economic status (Filmer and Pritchett, 2001).

The asset index has been introduced by researchers since 1999 (Filmer and Pritchett, 1999). This method employs data of household's assets such as durable and semi-durable goods to describe household welfare instead of using

household's income or expenditure data. The concept of the asset index relies on evidence that money metric measure is too narrow for defining household welfare and this index is most likely to be consistent with the financial means. In addition, the index requires less data intensive which possibly result in smaller measurement error. This data assumedly is easy, quick to collect and reliable because it necessitates few questions; and these elicit yes-no answers ("Do you have a radio?") or a choice from among very few commonly known options ("What kind of toilet does your family use?"). This would be a very useful tool for a national household survey which income and expenditure data are unreliable (Rutstein and Kiersten, 2004).

The original list of assets and services used to calculate the Wealth Index was based on questions already in the household questionnaire for purposes other than determining economic status. For example, type of flooring, type of toilet and type of water supply were asked because of their relationship with diarrhea.

Wagstaff, and Watanabe (2003) discussed the choice of socio-economic status in the measurement of health inequality, concluding that an index based on assets performs as well as one based on consumption. Rutstein et al. (2004) compared the DHS Wealth Index with more traditional indexes of consumer expenditures, concluding that the Wealth Index better represents long-term (permanent) economic status and also is much easier to implement.

Asset information was collected with the SHLC, which collected data on 13,705 households. Household Questionnaire and covered information on household ownership of a number of consumer items, such as electricity, radio, television, refrigerator, ownership of agricultural land and size, ownership of farm animals by type and number, telephone (fixed and mobile) and cooking fuel, as well as dwelling characteristics, such as source of drinking water, sanitation facilities and type of material used for flooring.

Principal Components Analysis (PCA) was used to assign the indicator weights. Also, factor analysis process has been used as follows:

First standardized (normalized) the indicator variables; then the factor loadings are calculated; and finally, for each household, the indicator values are multiplied by the loadings and summed to produce the household's index value. In this process, only the first of the factors produced is used to represent the wealth index.

The cut points in the wealth index at which to form the quintiles are calculated by obtaining a weighted frequency distribution of households. Thus, the distribution represents the national household population, where each member is given the wealth index score of his or her household. The persons are then ordered by the score (ranked), and the distribution is divided into five sections (20%- for each). Then the household score is recoded into the quintile

variable so that each member of a household also received that household's quintile category.

To evaluate the performance of such indicators, the data sets which include indicators and economic variables that are meant to represent, that is, household consumption expenditures or incomes have been required.

2- Data sources

The SHLC, 2008 were used as the main data sources for computing the asset index. Data of housing characteristics, ownership of household assets, and water supply were used to construct the wealth index. Household expenditure per individual was also used for classifying individual socio-economic positions compared with using the asset index. In this paper the terms "wealth index" and "asset index" were used interchangeably

This paper adopted an approach of constructing the asset index by using PCA. Household survey data which included housing characteristics, household durable and semi-durable assets were used for constructing the asset index of Mauritanian' households. Then, a comparison between using household expenditure and the asset index to classify household socioeconomic positions were carried out.

Since, the proportion of population in Mauritania below the national poverty line in 2008 was 42.1 % (National Office of Statistics (NOS), 2008), then, households in the first and second quintiles of the Wealth score can be assumed as those having living standards below the poverty line. A comparison between poor households classified by the asset index and national poverty line can show a correlation and consistency between the asset index and household expenditure.

3- Method of Analysis

In Principal Component Analysis a new set of variables is created as linear combinations of the original set. If X_1, X_2, \dots, X_p are the original set of p variables, then a variable Y formed from a linear combination of these takes the form:

$$Y = a_1X_1 + a_2X_2 + \dots + a_pX_p, \quad (1)$$

Where the a_i 's ($i = 1, 2, \dots, p$) are the principal component coefficients.

The linear combination that explains the maximum amount of variation is called the first principal component. A second principal component (another linear combination) is then found, independent of the first, so that it explains as

much as possible of the remaining variability. Further components are then created sequentially, each new component being independent of the previous ones. If most (for instance, 80% to 90%) of the total population variance, for large p , can be attributed to the first one, two or three components, then these components can replace the original p variables without much loss of information, then essentially, the number of variables to be analyzed has been reduced from the original set of variables to the new variables (components) (Richard and Dean, 1988).

The magnitude of e_{ki} of each component of the coefficient vector $e'_i = [e_{1i}, e_{2i}, \dots, e_{pi}]$ measures the importance of the k^{th} variable to the i^{th} principal component, irrespective of the other variables. In particular e_{ki} is proportional to the correlation coefficient between Y_i and X_k

$$\rho_{Y_i, X_k} = \frac{e_{ki} \sqrt{\lambda_i}}{\sqrt{\sigma_{kk}}}, \quad i, k = 1, 2, \dots, p. \quad (2)$$

The results are presented into two sections: first, details of the asset index calculated by PCA and; second, the relation between the asset index and household expenditure to classify households into different quintiles or deciles. Finally, a comparison between using the asset index and household expenditure to classified households being above or below the poverty line is also explored.

3.1 Asset Index

Table (1) below presented the list of assets and services currently asked in the SHLC questionnaires that used for calculating the Wealth Index.

Table 1: Items of Mauritanian SHLC, 2008

Items
1- Type of flooring: cement
2- Type of flooring: earth/ sand
3- Type of roof: cement
4- Type of roof: wood
5- Household having a Television
6- Household having a Telephone
7- Type of Dwelling: M'bar
8- Type of Dwelling: Maison

It can be noticed that, the water source variable was removed from the set of indicators since it was not statistically significant.

PCA method was used in order to extract the first principal component of 8 assets variables among SHLC, 2008 data sets. This model produces two components with Eigenvalues greater than one, but the first is so much stronger that it alone needs to concern us. It explains 41.4 % of the variance (Table 2).

Table (2): Total Variance Explained

Component	Initial Eigen-values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.309	41.361	41.361	3.309	41.361	41.361	2.855	35.693	35.693
2	1.739	21.739	63.100	1.739	21.739	63.100	2.193	27.407	63.100
3	.784	9.798	72.898						
4	.709	8.864	81.762						
5	.555	6.942	88.704						
6	.501	6.264	94.968						
7	.223	2.791	97.759						
8	.179	2.241	100.00						

From the first principal component having a cement floor was the variable that got the highest factor scores. Having a cement roof, a television and a mobile phone were other three variables that had high factor scores (Table 3).

Table (3): Factor scores of the variables in the first PCA

Factor	Component	
	1	2
Has cement/bamboo floor	.834	.210
Has earth/sand floor	-.825	.355
Has cement roof	.671	.218
Household has: Television	.661	.204
Household has: mobile phone	.600	.192
Has Dwelling: M'bar	-.063	-.930
Has Dwelling: Maison	.171	.885
Has roof of the wood	-.447	-.499

After categorizing the population households into 5 quintiles, from the poorest to the richest by using the asset index, the PCA can be used to measure household socio-economic status because the index produces significant differences among different socio-economic groups, especially in the assets with high factor scores. Households in the fourth and the fifth quintiles usually have the assets with high factor score such as having a cement floor, a cement roof and a television, while none or small percentage of households in the first and second quintiles would have such assets. In contrast, higher percentage of households in the first and the second quintiles would own assets with low factor scores such as having an earth/sand floor and a roof of the wood (table 4 to table 8).

Table (4): Having a cement floor by wealth index quintiles, Mauritanian'
SHLC, 2008

Wealth Index Quintiles	Has cement/bamboo floor		Total
	No	Yes	
1	100.0%	-	100.0%
2	99.9%	.1%	100.0%
3	65.0%	35.0%	100.0%
4	5.7%	94.3%	100.0%
5	0.1%	99.9%	100.0%

Table (5): Having a cement roof by Wealth Index Quintiles, Mauritanian'
SHLC, 2008

Wealth Index Quintiles	Having a cement roof or not		Total
	No	Yes	
1	100.0%	-	100.0%
2	99.6%	.4%	100.0%
3	96.7%	3.3%	100.0%
4	90.6%	9.4%	100.0%
5	1.0%	99.0%	100.0%

Table (6): Having a Television by Wealth Index Quintiles, Mauritanian'
SHLC, 2008

Wealth Index Quintiles	Household Having a Television		Total
	No	Yes	
1	100.0%	-	100.0%
2	91.4%	8.6%	100.0%
3	90.0%	10.0%	100.0%
4	57.9%	42.1%	100.0%
5	27.6%	72.4%	100.0%

Table (7): Having a roof of the wood by Wealth Index Quintiles, Mauritanian'
SHLC, 2008

Wealth Index Quintiles	Having a bois roof		Total
	No	Yes	
1	49.6%	50.4%	100.0%
2	62.2%	37.8%	100.0%
3	74.7%	25.3%	100.0%
4	95.7%	4.3%	100.0%
5	99.8%	0.2%	100.0%

Table (8): Having an earth floor by Wealth Index Quintiles, Mauritanian' SHLC, 2008

Wealth Index Quintiles	Having an earth/sand floor		Total
	No	Yes	
1	-	100.0%	100.0%
2	45.0%	55.0%	100.0%
3	99.9%	0.1%	100.0%
4	100.0%	0%	100.0%
5	100.0%	-	100.0%

3.2 Classification Differences by Asset Index and Expenditure

Table (9) showed the households cross-classified by quintiles based on per member expenditures and based on wealth index quintiles. If all households were classified in the same quintiles for each measure, only the diagonal cells would be filled.

Table (9): A Comparison between Individuals Classified by Expenditure and Wealth Index Quintiles, Mauritania, SHLC 2008

Wealth Index Quintiles	Expenditure					Total
	1	2	3	4	5	
1	42.1%	26.8%	17.3%	9.0%	4.8%	100.0%
2	28.6%	26.7%	21.9%	14.8%	8.0%	100.0%
3	19.0%	22.9%	22.6%	18.9%	16.5%	100.0%
4	7.2%	15.0%	22.7%	29.0%	26.1%	100.0%
5	3.1%	8.5%	12.7%	27.3%	48.3%	100.0%

The comparison between households classified by the asset index and per member expenditures reveals that 42.1% of the first quintile households classified by the asset index exactly matched with those classified by household expenditure, while 48.3% of the households in the fifth quintile matched between these two classifications. The lower matching was found in the second, the third and the fourth quintiles.

A comparison between using the asset index and Household/ individual expenditure to identify peoples above or below the poverty line is also explored. Since, the poverty incidence in Mauritania' households was 35% percent (NOS, 2008), therefore, households in the first and second quintiles of the Asset score can be assumed as those having living standards below the poverty line. A comparison between poor households classified by the asset index and national poverty line can show a correlation and consistency between the asset index and household expenditure a frequency for the Z-scores has been made and the value corresponding to this percentage has been

used as the value of cutoff, which is based on the household population not the households themselves, therefore, households below this value classified as poor.

Based on this assumption households classified by the wealth index as the poor and those classified by per member expenditure (the expenditures divided by the number of household members and then divided in fifths of the household population) were compared (Table 10). The results showed that 62.6% of households classified by the wealth index as poor exactly matched with those classified by expenditure, while 76.4% of households classified by the wealth index as non-poor correctly matched with those classified by expenditure.

Table (10): A Comparison of Poor Household

Poor by the Wealth Index	Poor by Household Expenditure	
	Non Poor	Poor
Non Poor	76.4%	37.4%
Poor	23.6%	62.6%
Total	100.0%	100.0%

Also, the results showed that, the correlation between household quintiles determined by the wealth index and expenditure was 0.513 (significant at the 0.01 level).

4-Conclusions

Based on these results, it appears that the asset index have the potential for providing alternative living standard rankings of the Mauritanian households. The index is internally coherence and can produce clear differentiation of living standards among different household quintiles. Households with high economical status tended to occupy assets with a high factor score, and vice versa. So, a future study by including other items will be needed.

Also, it is quite clear that the asset index is appropriate to classify the richest and the poorest quintiles (or deciles) than middle quintiles (or deciles). the rate of classification between using the index and household expenditure to identifying the poor is relatively high (62.6 %). These findings support the relatively strong correlation between the asset index and the money metric measure (household expenditure).

It is important to recognize that utilization of the index is strictly limited to providing relative analysis of household welfare; for example, the characteristics of those household in the first quintile (the poorest) versus those in the fifth quintile (the richest) of the distribution. Moreover, the index are limited to be used for monitoring changes in poverty over time because there may be significant changes in household ownership of the index components, which may not necessarily translate into a reduction in material poverty.

References

1. Atkinson, B. 1989. Poverty and Social Security. Hemel Hempstead.
2. Falkingham, J. and C. Nmziel, 2001. Identifying the poor: A critical review of Alternative approaches. London, London School of Economics.
3. Filmer, D. and L. Pritchett, 1999. "The Effect of Household Wealth on Educational Attainment: Evidence from 35 Countries." Population and Development Review 25(1):85-120.
4. Filmer, D. and L. Pritchett, 2001. Estimating wealth effects without income or expenditure data-or tears: an Application of education enrolment in States of India. Demography 38(1):115-132.
5. Mazumdar, K.1999, Measuring the well-being of the developing countries: Achievement and Improvement indices, Social Indicators Research.
6. Richard A., and Dean W., 1988. Applied Multivariate Statistical Analysis, Prentice-Hall, Inc.
7. Rutstein S. O. and Kiersten J., 2004. The DHS wealth index [DHS Comparative Reports No. 6]. Calverton, Maryland, USA, ORC Macro.
8. Sahn, D. E. and D. Stifel, 2001. Exploring Alternative Measures of Welfare in the Absence of Expenditure Data, Cornell University.
9. Wagstaff, A. and N. Watanabe, 2003. What difference does the choice of SES make in health inequality measurement? Health Econ.