The Use of Sudan 2008 Population Census Data in Estimating Human Poverty Index

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ABSTRACT

This study estimated the human poverty index for the States of the whole Sudan (before th independence of the Southern Sudan) and examined the policy interventions that could have significant impact on human poverty reduction. The study employed data obtained from the fifth population census for the Sudan 2008 and the Statistical Year Book of the Sudan. For the purpose of calculating the human poverty index at the state and national levels, standard methods are used to calculate the values of the three sub-indices related to poverty in longevity (P_1), poverty in knowledge (P_2), and poverty in the decent standard of living (P_3). These were then used to compute the human poverty index at the national level as well as at the states level. The results reveal that some states, namely Khartoum, Gezira, and Northern state have the lowest HPIs. This is reflecting the concentration of human development programs in these states. On the other hand, Warab, Unity and West Bahr-Elgazal are found to have the highest HPIs. This is attributed to the higher values of all HPI sub-indices in these states which is the direct result of the prolonged war in southern Sudan ended by Comprehensive Peace Agreement (CPA) in 2005. The analysis focused on the impact of education and health policies that will more likely enhance longevity, knowledge and the standard of living, and thereby reduce human poverty in Sudan. Simple regression method is applied to sets of data to examine the impact of health and education policies on human poverty index. Based on this analysis, the results shows that with the exception of number of doctors, all health variables considered in the analysis have no significant effect on the human poverty index, while number of teachers in basic schools is found to be the only one education variable that has a significant effect on human poverty index. Based on these results, an increase in the number of teachers in basic schools and number of doctors tends to be the most important variables in reducing the human poverty index especially in least developed states. In parallel with economic growth, and attention to these measures can enhance the main objective of development is to improve people's lives.

KEYWORDS: *Human Poverty, Health policy, Education policy, Sudan*

INTRODUCTION:

Sudan is multi-cultural, multi-ethnic, multi-lingual and multi-religious. Sudan is also sparsely populated because of its size (2.51 million square kilometers) compared to its total population of 38 million according to the 2008 census. Because of its sheer size, the country is covered by pervasive climatic and ecological zones. It is mostly characterized by arid and unpredictable weather conditions affecting vast stretches of the country that are subjected to

bouts of extreme drought and/or substantial flooding. This diversity of geography is also reflected in its people.

There is a general concensus that poverty in Sudan is associated largely with regional inequality and urban biased development strategies. The large regional disparities have given rise to social conflicts and civil unrest in many parts of the Sudan, including Southern Sudan, Darfur, Kordufan, and Eastern states. These regions are characterized by high death rates at all ages, malnutrition among children, low literacy rates, high levels of morbidity, scarcity in safe drinking water and many other shortages in basic human needs. The objective of this paper is to estimate the human poverty in the Sudan and then examine the differentials, if any, in human poverty indices between Sudan States, as well as the factors that may explain such differentials and to come up with policy recommendations regarding the eradication or elimination of human poverty in the Sudan.

THE STATISTICAL METHODOLOGY AND DATA:

Human poverty as introduced by the United Nations Development Program (UNDP) in 1997 is a multidimensional concept that extends beyond the lack of what is necessary for material well-being. It encompasses the denial of opportunities and choices most basic to human development and it does not focus on what people do or do not have, but also on what they can or cannot do. In this sense, human poverty means "… *deprivation in the most essential capabilities of life, including leading a long and healthy life, being knowledgeable, having adequate economic provisioning, and participating fully in the life of the community*" (United Nations Development Program (UNDP), 1997).

According to the UNDP (1997), the Human Poverty Index (HPI) is measured on the basis of deprivation from three aspects of human development, namely: longevity, knowledge, and a decent standard of living. Deprivation in longevity, denoted (P_1) is measured by the percentage of newborns not expected to survive to age 40, deprivation in knowledge, denoted (P_2) is measured by the percentage of adults who are illiterate and deprivation in a decent standard of living denoted (P_3) is measured by the arithmetic average of three variables; the percentage of people not using improved drinking water $(P_{3.1})$, the percentage of children below the age of five who are underweight $(P_{3.2})$ andpercentage population with no sanitation $(P_{3.3})$.

Accordingly the HPI may be calculated as:

$$HPI = [(P_1^3 + P_2^3 + P_3^3)/3]^{(1/3)} \qquad (1)$$

The analysis is based on primary data from the tabulations of fifth census for the Sudan in 2008and some secondary data obtained from the Statistical Year Book of the Sudan. The empirical model is applied to the data and some regression methods are also adopted to identify the most important variables that impact on human poverty in Sudan.

The elasticity (e_{HPI}) of human poverty index with respect to the policy variable (V) may be calculated according to the formula:

$$e_{HPI} = \frac{\partial HPI}{\partial V} \frac{\overline{V}}{\overline{HPI}} \qquad (2)$$

For clarity, this elasticity measures the percentage change in the human poverty index resulting from a change in the policy variable by one percentage point.

THE EMPIRICAL RESULTS:

This section reports the empirical results on human poverty in Sudan and the results of the regression methods applied to examine the most important determinants of human poverty, together with the impact of public policy on the human poverty index.

The human poverty index is calculated using equation (1) above. The results are reported in table (1) below, together with the rank for each state where the rank of one indicates the highest value of the HPI. Table (2) reports summary statistics of the results, while table (3) reports human poverty index by regions.

Table 1. Human Poverty Index (%) by States, Sudan, 2008

State	P_1	P_2	P_3	HPI	Rank
Warap	12.98	64.10	60.96	54.74	1
Unity	12.24	53.20	63.10	51.24	2
W.B. Gazal	12.00	57.90	55.53	49.64	3
N.B. Gazal	12.00	50.60	60.40	48.94	4
Upper Nile	10.96	42.80	64.21	48.60	5
E. Equatoria	18.04	50.80	57.78	47.91	6
Lakes	12.98	60.30	41.43	46.03	7
Jonglei	12.00	48.70	50.37	43.39	8
C. Equatoria	17.13	54.40	41.12	42.82	9
Red Sea	10.40	28.50	58.74	42.29	10
W. Darfur	12.00	42.80	52.32	42.07	11
W. Equatoria	10.88	52.70	37.16	40.48	12
Kassala	10.64	29.90	55.20	40.28	13
S. Darfur	11.52	40.90	49.82	40.11	14
N. Darfur	11.52	40.00	49.73	39.76	15
Gadarif	9.78	39.50	48.94	39.13	16
Blue Nile	11.84	37.10	47.11	37.43	17
N. Kordofan	9.78	33.50	46.28	35.80	18
White Nile	8.87	33.40	45.68	35.42	19
S. Kordofan	11.27	36.70	42.71	35.01	20
Sinnar	10.40	26.00	34.65	27.19	21
Nahr El Nil	8.87	23.50	28.79	23.22	22
Northern	7.24	29.80	20.18	22.69	23
Gezira	5.89	18.30	29.55	22.04	24
Khartoum	5.66	14.40	15.20	13.06	25

Source: Own calculation based on data from the final tabulations of the 2008 population census and Sudan Household Health Survey (SHHS), 2006.

Table 2. Descriptive Statistics for HPI and the Sub-Indices

	Number	Minimum	Maximum	Mean	Std. Deviation	Coefficient of Variation
P_1	25	5.66	18.04	11.08	2.76	0.25
P_2	25	14.40	64.10	40.39	13.25	0.33
P_3	25	15.20	64.21	46.28	13.03	0.28
HPI	**25**	**13.06**	**54.74**	**38.77**	**10.30**	**0.27**

Source: Own calculations based on data from table (1).

The values of the percentages of new-born not expected to survive to age 40 ranged between 5.66 and 18.04 with an average of 11.08 percent (2), compared to ranges of 14.40-64.10 and 15.20-64.21 for percentages of adults who are illiterate and people not having a decent standard of living, with averages of 40.39 and 46.28 percent, respectively. These results may suggest that P_2 and P_3 are the major cause of the high human poverty index in Sudan. The estimated values of the human poverty index and its three components suggest larger disparities between states in poverty in knowledge measured by (P_2) with a coefficient of variation of 0.33 compared to 0.25 and 0.28 for (P_1) and (P_3), respectively (2); the coefficient of variation of the HPI is estimated at 0.21.

In line with common beliefs, the concentration of services, particularly those related to health and education, in the capital city ranks Khartoum state at the bottom of the list of the States with the lowest HPI of 13.06 percent (1). Gezira and Northern State rank second and third, with values of HPI estimated at 22.04 and 22.69, respectively (1). The relatively low HPI values in Khartoum and Gezira states correspond to the low values of P_1 and P_2 while that for Northern state is due to the low values of P_1 and P_3. In line with commonly held views, the states with highest HPI are Warap (54.74%), Unity (51.24%), West Bahr Al-Gazal (49.64%), North Bahr Al-Gazal (48.94%), Upper Nile (48.60%) and East Equatoria (47.91%).

Although poverty in standard of living as measured by P_3 exhibits relatively higher variation among states, its high mean may suggest that itis one of the important causes of human poverty in the northern states of Sudan, with an index estimated at an average of 43.7 percent. Table (3)shows the values of human poverty index by regions, we observe from these results that, there is highly significant difference in all HPI components between North and South Sudan. For Southern Sudan, the values for P_1, P_2 and P_3 are estimated at 12.82, 51.10 and 63.23, respectively, compared to 9.47, 33.70 and 43.76 respectively for Northern Sudan. These significant difference have given rise to difference in HPI for Southern and Northern Sudan, estimated at 50.59 and 34.47 respectively.

Table 3. Human Poverty Index by Regions, Sudan, 2008

Region	P_1	P_2	P_3	HPI
Sudan	11.19	41.00	42.12	36.43
North	9.47	33.70	43.76	34.47
South	12.82	51.10	63.23	50.59

Source: Own calculation based on data from final tabulations of the 2008 population census and Sudan Household Health Survey (SHHS), 2006.

Having calculated and discussed the human poverty index, it is very important to examine the variables that can affect the human poverty index.In this respect some education and health

variables are chosen as policy variables, namely: doctors per 100,000 population (D), hospital beds per 100,000 population (B), hospitals per 1,000,000 population (H), primary schools teachers per 100,000 population (T), and schools per 100,000 population (S). Thus in the next step we are going to identify the education and health variables (policy variables) that have impact on human poverty.

Table (4) below reports the best regression results of the relationship between human poverty index (HPI) and the education and health policy related variables, where the figures in parentheses are the t-ratios of the estimated parameters, and those inside the square brackets are the significance levels of the parameters. It is clear from these results that with the exception of the constant term, all the variables that appeared in the first three equations are statistically insignificant in explaining HPI.Furthermore, schools per 100000 population (S) in equation (1) turned to have unexpected sign. Finally it is clear that equations (4) is the best fitted equation, with the coefficients of primary schools teachers per 100000 population (T) and doctors per 100000 population (D) estimated at (-0.021) and (-0.396), respectively.

Table 4. Regression of Education and Health Variables on Human Development Index (HPI) for Sudan, 2008

Eq. No.	Constant	Estimated Coefficient of					R^2	Adj. R^2	F	Sig. Level
		S	T	H	B	D				
1	48.301	0.023	-0.019	-0.473	-0.010	-0.382				
	(7.364)	(-0.133)	(-0.933)	(0.065)	(-0.087)	(-1.809)	0.835	0.743	9.081	0.003
	[0.000]	[0.897]	[0.375]	[0.950]	[0.933]	[0.104]				
2	49.019		-0.017	-0.983	-0.004	-0.400				
	(13.811)		(-1.323)	(-0.167)	(-0.035)	(-2.558)	0.834	0.768	12.583	0.001
	[0.000]		[0.215]	[0.871]	[0.972]	[0.028]				
3	49.231		-0.018		-0.019	-0.378				
	(15.551)		(-1.805)		(-0.447)	(-4.335)	0.835	0.788	18.394	0.000
	[0.000]		[0.001]		[0.664]	[0.001]				
4	49.575		-0.021			-0.396				
	(16.713)		(-3.604)			(-5.265)	0.831	0.803	29.456	0.000
	[0.000]		[0.004]			[0.000]				

Source: Own calculation.

So far we have calculated the descriptive statistics of HPI and its sub-indices, and also estimated the regressions of education and health variables on human development index, we are now in a position to use these estimated equations to calculate the elasticities of policy variables with respect to human poverty index. The ultimate objective of such an exercise is to gain some insight into the ease or otherwise with which these indices respond to public policy with a view to reduce human poverty. Needless to mention, these elasticities are calculated at the mean values of the relevant variables. It is also important to note that only the most significant coefficients in the most significant regression equations are used in calculating these elasticities.

Using equation (1) in table (4), together with the mean values of the variables involved into the formula in (2) above we obtain the elasticities of the human poverty index with respect to the policy variables. These results are reported in table (5) below.

Table 5. Estimated Elasticities of HPI with respect to Policy Variables

	Education Variable	HealthVariable
	T	**D**
HPI	-0.024	-0.157

Source: Own calculations based on regression results of tables (4)above.

Table (5) shows the results of the elasticities of the human poverty index with respect to the most important policy variables that have a significant effect on HPI, we observe from the table that the elasticity of (HPI) with respect to the doctors, estimated at -0.157, is highest than that one respect to basic school teachers. Once more, this suggests that an increase in the number of doctors could contribute significantly to efforts made toward eradicating human poverty. In particular, an increase in the number of doctors per 100,000 people by one percentage point decreases human poverty index by 0.157 percent. The elasticity of (HPI) with respect to the basic school teachers estimated at (-0.024), suggests that an increase in the number of teachers per 1,000,000 people by one percentage point decreases the Human poverty index by 0.024 percent.

CONCLUSION:

This study calculated the human poverty index for the Sudan and examined its most important determinants with a view of examining the policy interventions that could have significant impact on human poverty reduction. The study employed data obtained from the Sudan fifth census tabulations for the year 2008 and the Statistical Year Book for the Sudan. For the purpose of calculating the human poverty index for the states, standard methods are used to calculate the values of the sub-indices (P_1, P_2, and P_3), which were then used to compute the human poverty index for each state as well as for the Sudan.

The results reveal that some states, namely, Khartoum, Gezira, and Northern state have the lowest HPIs. On the other hand, Warap, Unity and West Bahr Algazal are found to have the highest HPIs. This is the direct result of the prolonged war in southern Sudan ended by Comprehensive Peace Agreement (CPA) in 2005.

The analysis focused on the impact of education and health policies that will more likely reduce human poverty in Sudan. Because of data limitations, simple regression method is adopted to examine the impact of health and education policies on human poverty index. Based on this analysis, inferences were made about the most effective policies for human poverty reduction. The results suggests that, among education policy indicators number of teachers in basic education is the only one policy variable that has a significant effect on human poverty index, while number of doctors is the only one variable among the health policy variables that has significant effect on human poverty index. Based on these results, peace achievement in all over the country is the more important step that enhances promoting human development programs. Increasing the number of doctors and basic school teachers could play a major role in decreasing the human poverty index especially in rural areas. All

of this can be achieved only through concerted effort by the government, private sector and citizens of the areas. Together with economic growth, good health and education can make an enormous difference in the lives of poor people, which are the main goals of development.

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