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**DETERMINANTS OF HOUSEHOLD
EDUCATION EXPENDITURE IN SUDAN**

Ebaidalla Mahjoub Ebaidalla

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Send correspondence to:

Ebaidalla Mahjoub Ebaidalla
University of Khartoum and ERF
ebaidalla@gmail.com

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Abstract

This paper examines the factors that influence households' expenditure on education in Sudan using the National Baseline Household Survey data (NBHS, 2009) for national, urban and rural levels. The results of the tobit model indicate that household's income, head education, head age, household size, number of school-age children and residence in urban areas are the most significant factors affecting education expenditure. Interestingly, the results show that the income elasticity of education in the urban sample model is greater than that of the rural model, implying that households residing in urban areas are likely to spend more on education. In addition, the effect of household income is found to be positive and significant in the highest income quintile. Overall, the results revealed that households with higher income, whose heads are educated and reside in urban areas tend to spend more on education compared to poor and rural households. These results signify the lack of inter-generational educational and income mobility in Sudan, implying that children from poor households are caught permanently in low income and educational levels, and are not able to "catch up" with their peers in high-income families.

JEL Classification: I21, I22, I24, C24

Keywords: Education Expenditure, Tobit models, Sudan

ملخص

تبحث هذه الورقة العوامل التي تؤثر على إنفاق الأسر على التعليم في السودان باستخدام بيانات المسح الأساسي الوطني، 2009 على المستويات الوطنية والحضرية والريفية. وتشير نتائج نموذج المدار إلى أن دخل الأسرة، وتعليم رأس الأسرة، وعمر رأس الأسرة وحجم الأسرة المعيشية، وعدد الأطفال في سن الدراسة، والإقامة في المناطق الحضرية هي أهم العوامل التي تؤثر على الإنفاق على التعليم. ومن المثير للاهتمام أن النتائج تشير إلى أن مرونة الدخل في نموذج العينة الحضرية أكبر من النموذج الريفي، مما يعني أن الأسر المقيمة في المناطق الحضرية من المرجح أن تنفق المزيد على التعليم. وبالإضافة إلى ذلك، وجد أن أثر دخل الأسرة إيجابي ومهم في الخمس الأعلى للدخل. وبصفة عامة، كشفت النتائج أن الأسر ذات الدخل المرتفع، الذي يتعلم رعاياه ويقيمون في المناطق الحضرية يميلون إلى إنفاق المزيد على التعليم مقارنة بالأسر الفقيرة والريفية. وتدل هذه النتائج على عدم وجود حراك تعليمي ودخل بين الأجيال في السودان، مما يعني أن الأطفال من الأسر الفقيرة يعيشون بشكل دائم في مستويات منخفضة من الدخل والتعليم، وهم غير قادرين على "اللاحق" بأقرانهم في الأسر ذات الدخل المرتفع.

1. Introduction

Education has been considered as a key factor for supporting economic growth and development and alleviating poverty in developing countries. According to Human Capital Theory, education allows individuals to gain better skills and knowledge needed to access jobs, hence enhancing productivity and economic growth; which in turn help in eradicating extreme poverty and hunger (Bryant, 1990; Becker, 2009; Mincer, 1970; Schultz, 1961). Therefore, the issue of education expenditure by both government and households has gained sizable attention from researchers and international development organizations.

In Sudan, the education system has been affected by many economic transformations that the country has undergone in the last three decades. Specifically, the adoption of liberalization and free market policies in the early 1990s has resulted in reducing public spending on education. Since then, the size of private investment in education has expanded remarkably. Accordingly, households' expenditure on education has gone up, despite the fact that basic education, such as primary and secondary education, is still delivered through the public sector. Moreover, the reduction of government expenditure on education has contributed greatly to lessening the quality of public education; pushing a large segment of the population into private education. This leads to a significant increase in household education expenditure, particularly in urban areas and among high-income households.

Against this backdrop, many questions can be raised in accordance with the aims of this study, including: What are the key determinants of households' education expenditure in Sudan? Does the poor and rural household spend less than the rich, urban household? To what extent could the factors affecting education expenditure vary across rural and urban areas and among different categories of income groups?

Regarding the importance and policy relevance, the empirical investigation to be undertaken by this study is useful for several reasons. First, investigating household education expenditure is crucial to providing evidence that can be used to formulate relevant policies targeting planning and reforming the educational system in Sudan. Second, understanding the factors affecting educational spending in Sudan may help policymakers and key stakeholders (i.e. national and international NGOs) design effective strategies that ensure better access to education so as to create more jobs and reduce poverty. Finally, by identifying the factors affecting education expenditure among different areas (i.e. urban and rural) and income quintiles, the study would provide a strong foundation in designing effective education programs for disadvantaged groups of population.

This paper is organized into six sections as follows. The next section outlines some stylized facts about the educational system and its finance in Sudan. Section three discusses the theoretical and empirical literature on the determinants of household educational spending. Section four outlines data and research methodology, while section five presents the empirical results and discussions. Section six ends with a conclusion and possible ways forward.

2. Education in Sudan: An Overview

Gaining its independence in January 1956 from the British colony, Sudan inherited an education system designed to provide civil servants and professionals to serve the colonial administration. The distribution of educational facilities such as teachers and enrollment was biased in favor of the needs of the British administration and Western curriculum. Thus, the educational services were clustered in urban cities, although about 70% of population resides in rural areas. However, at that time, education was fully sponsored by the government and public expenditure on education was about 20% (Nour, 2012). Most education during the colonial era was focused on the basic education (i.e. primary, intermediate and secondary), while tertiary education was limited to the University of Khartoum. In addition, a number of students with wealthier parents received secondary and university educations abroad.

After the independence, the educational system in Sudan received considerable attention from national governments. The national education policies concentrated on the target of achieving universal and compulsory education with the aim of equitable distribution of facilities among urban and rural areas. Therefore, the educational system experienced a significant change in terms of years of schooling and distribution of schools. For instance, the Nimeiri regime (1969) considered the educational system as inadequate for the needs of social and economic development, reorganizing the educational system in the 1970s as a result (Elmagboul, 2014). The basic educational system was changed from 4-4-4 to 6-3-3 (six compulsory primary years, three intermediate and three secondary). Technical and vocational education also gained more attention during Nimeiri government. Moreover, during the era of the 1970s, tertiary education expanded with the establishment of two new universities, in addition to oldest one: the University of Khartoum.

During the 1980s, Sudan underwent a remarkable expansion in basic education with the opening of hundreds of primary and secondary schools, despite economic and political instability. The technical and vocational education also increased remarkably. All these efforts led to a significant increase in the rate of enrollment from 1980.

In the early 1990s, the educational system in Sudan witnessed a great transformation. First, it was further reorganized into eight years of primary education followed by three years of secondary schooling. In addition, the Arabic language was adopted as the instruction language in all universities. Moreover, tertiary education expanded and more than 30 universities were established. The number of private schools grew rapidly following economic policies lifting government subsidies to service sectors, including education.

Regarding financing education in Sudan, the country inherited a tax-based education system from the British colony, in which the state provides free educational services for the entire population. Thus, successive national governments adopted free education and this continued until the adoption of free market policies in the decade of the early 1990s. However, after the implementation of the Structural Adjustment Program (SAP), the government began its sudden withdrawal from the provision of educational services. The austerity measures adopted in 1992 resulted in a great reduction in public spending on education. To fill the gap in financing education resulting from these policies, the government provided licenses to private schools. In line with this system, parents were requested to pay some fees for public schools in order to utilize education.

To understand the contribution of government in education, table 1 below presents the public spending on education in Sudan and a sample of Sub-Saharan African countries. The table shows that public spending in Sudan is accounted for in a small portion of the country's GDP compared to other countries in the sample.

Table 1 shows that Sudan has the smallest public education spending ratio to its GDP compared to other SSA countries in our sample. Specifically, the government expenditure on education (% of GDP) remained rotating around 1 percent during 1990-1999. During 2000-2009, it increased positively to the rate of 1.8 percent, indicating the expansion in education expenditure, which may be due to oil revenue at such a period. Moreover, during the last period (2010-2014) the spending on average progressed to 2.1 percent. However, in all periods, the public spending on education in Sudan lags far behind the levels of public expenditure in SSA countries.

Regarding the contribution of government education spending to the total public spending, table 2 below presents data on public spending on education as a percentage of total government expenditures for Sudan and a sample of SSA.

Table 2 indicates that Sudan has the second lowest percentage of public education spending (percentage of total government spending) after Angola. For instance, during the period (1990-1999), Kenya holds the highest rate of public spending on education, which is about a threefold of that of Sudan. The low rate of public educational spending as a percentage of GDP and total government expenditure implies low public investment in education in Sudan. This also indicates that public education spending falls below the standardized international adequacy criterion, which was earlier adopted in the 1960s and related to the supply side and implies the allocation of either 8 percent of GDP on education or 20 percent of total government or public spending on education (Nour, 2013). The reduction in government spending on education resulted in a significant deterioration in efficiency indicators like education attainment and enrollment.

Regarding the demand for education, table 3 presents the gross enrollment ratio for the three educational levels: primary, secondary and tertiary, respectively¹.

The table shows that the enrollment ratio for primary education in Sudan was close to some African countries belonging to poor income group, such as Angola. However, the primary enrollment ratio falls below some of the SSA countries, such as Kenya and Ghana. Regarding the secondary enrollment ratio, Sudan also has a lower rate compared to some SSA countries, such as Botswana, Ghana and Kenya. The low enrollment ratio in primary and secondary education in Sudan may be attributed to poverty and economic instability. During the period under consideration, the tertiary enrollment ratio in Sudan has the second highest ratio during all periods after South Africa. This high tertiary enrollment ratio may be due to the expansion in tertiary education over the last three decades.

Regarding the educational attainment, figure 1 below shows the average years of total schooling in Sudan and a sample of SSA countries². As indicated in the figure, Sudan has the lowest rate of educational attainment among other SSA countries in comparison. The low level of educational attainment confirms the relatively low level of school enrollment. This also supports the high rate of illiteracy in Sudan, which is about 26 percent in 2013 (World Bank, 2013). However, there are many factors that may be held responsible for low educational attainment, including the high cost of education, poverty and unemployment. In general, the low rate of educational attainment and enrollment indicates low commitment to the standardized international adequacy and equity criteria in the demand side as measured by the lack of adequacy in enrollment rate in primary, secondary and tertiary education and literacy rate of population (Nour, 2013).

3. Literature Review

Given the importance of education in economic growth and development, the determinants of household educational expenditure gained considerable attention from both researchers and policy makers in the last decades. However, most of the exiting literature has focused on the macroeconomic perspective and government expenditure on education. On the other hand, the issue of household expenditure on education gained less attention, particularly in developing countries. In this section we briefly review some empirical studies on this issue.

The empirical literature indicates that household education expenditure is influenced by many variables, including household characteristics, parents' educational level and household income, among others. However, the main consensus among most empirical studies is that

¹ Gross primary or secondary school enrollment ratio - The number of children enrolled in a level (primary or secondary), regardless of age, divided by the population of the age group that officially corresponds to the same level (World Bank, 2016).

² Educational attainment refers to the highest level of schooling that a person has reached. Here we use average years of total schooling as calculated by Baroo and Lee (2010).

household income is the most significant factor affecting education expenditures (e.g. Hashimoto and Heath, 1995; Panchamukhi, 1965; Kothari, 1966; Tilak, 2002).

Huston (1995) analyzed the impact of income and household characteristics on education expenditure in the US. Using a sample from the 1990-1991 Consumer Expenditure Survey, he found that head age, education level, income, region, race, and family size are the most significant factors affecting household education expenditure.

Kanellopoulos and Psacharopoulos (1997) investigated the factors that affect private expenditure on education in Greece using the Household Expenditure Survey of 1988. They found that household size and the number of children under six years of age have a negative effect on private spending on education, while the head's years of education and income have a positive impact on education expenditure. Similarly, Psacharopoulos and Papakonstantinou (2005) examined household expenditure on university education in Greece, using a sample of 3,000 university freshmen. They argued that private education is highly inelastic, indicating its importance in the Greek household budget. They also found that private out-of-pocket spending to prepare for entrance exams and study at college exceeds that of public spending. In addition, they found that poorer families spend a higher share of their income on the education of their children. Moreover, using data from the household surveys for 1990 and 1992, Psacharopoulos et al. (1997) examine the extent of private expenditure on education in Bolivia and calculate an income elasticity of 0.23. They conclude that educational expenditure is not a luxury good for Bolivian families.

Tilak (2002) studied household education expenditure in rural India using the national survey on Human Development in Rural India (HDI) (1994). The paper also examines the household expenditure on education by different groups of population. He found that there is nothing like free education in India and household expenditure on education represents a considerable portion of the household budget. In addition, households from lower socio-economic backgrounds and low-income groups spend considerable amounts on acquiring education, specifically including elementary education, which is expected to be provided free to all by the state. His results also indicate that household income, educational level of the head of household and household size are among the most significant factors affecting educational expenditure. Interestingly, he found that education is income inelastic in India by compiling time series of household expenditure estimates over the period 1960-1961 and 1984-1985.

Glewwe and Jacoby (2004) examined the relation between household resources and demand for education in Vietnam using household panel survey data covering the period 1993-1998. They found a positive relationship between household income and demand for education, even after controlling for locality-specific factors such as change in education returns, supply and quality of schools, and opportunity costs of schooling.

Tansel and Bircan (2006) studied the demand for private tutoring in Turkey, using the 1994 household expenditure survey. Adopting the tobit model, the authors showed that private tutoring is neither a luxury nor a necessity item in a household's budget. They also found that parents' educational level, especially that of mothers, has a positive and significant effect on private tutoring expenditures, which means inequity in the intergenerational distribution of education. Moreover, the results indicate that private tutoring expenditures increase at a decreasing rate with the age of the household head, hence implying lifecycle considerations. Their results also indicate that urban families spend more than rural household residents. Finally, household private tutoring expenditures are found to decline with the number of children in the household.

Qian et al. (2011) examined parents' expenditure on their children's education, using household survey data from 32 selected cities across China in 2003. Their results show that household

income has significant effects on both domestic and overseas educational expenditures. The results also indicate that households whose mothers have secondary school or college education and fathers who are working in professional occupations are likely to spend more on education. Moreover, this study found that households belonging to the highest income group, with a college-educated father, a mother who is a cadre or middle professional and living in coastal areas, are more probable to spend on children's education abroad.

Sulaiman et al (2012) examined the determinants of household expenditure on education in Malaysia. Using household survey data, they found that household characteristics, such as parents' income and educational level, mothers' work status, job category of head of household and parents' awareness of globalization in respect to their children's education are the most significant factors affecting education expenditure. Specifically, their results show that the elasticity of income is very high (approximately 1 percent) indicating the importance of household income in education expenditure.

Vu Quang (2012) investigated the factors affecting household expenditure on children's education in Vietnam. Using the Vietnamese Household Living Standards Survey (VHLSS 2006) and adopting the tobit model, he found that household income has a positive and significant effect on household educational expenditure. Meaning, increase in the income of the household is always associated with an increase in educational expenditure. His result also revealed that households whose heads have a higher level of education or have professional jobs are more likely to spend more on education. Moreover, households with more primary-school-age or secondary-school-age children are likely to spend more on education compared to households with pre-school-age or college-age children. Vu Quang shows that families with more resources and better human capital are those who are able to spend more income on their children's education.

Andreou (2012) investigated the determinants of household education expenditure in Cyprus, using the expenditure surveys of 1996-1997, 2002-2003 and 2008-2009. He found that the level of educational expenditure increases with income across the years. In addition, his results pointed out that household income, number of children in the household, region of residence and heads' age and educational level are the most important factors affecting the level of household expenditure on education.

Recently, Acar et al (2016), using Turkish household budget surveys from 2003, 2007 and 2012, investigated the determinants of household education expenditures while adopting an Engel curve framework. In particular, they estimate tobit regressions of real educational expenditures by income groups to examine if and to what extent the determinants of educational expenditures differ by income groups. Their results indicate that the estimated expenditure elasticity is low for the top- and bottom-income quartiles, but is high for the middle-income quartiles. The results also show that for all income groups, the expenditure elasticity of education increases over time, indicating that Turkish households allocate a greater share of their budgets to education expenditures.

The above discussion has made it clear that there is a dearth of empirical studies on household educational expenditure in Africa in general and Sudan in particular. Therefore, this study would contribute to the existing literature by examining the factors affecting household health expenditure across national, urban and rural areas. Moreover, unlike previous studies, this paper emphasizes the role of income and regional disparities in household educational expenditure.

4. Data and Methodology

4.1 Data and variables

The data used in this study is sourced from the National Baseline Households Survey (NBHS) conducted by the Central Bureau of Statistics in 2009. The survey contains data on all household expenditures (e.g. food, education, health, utilities... etc.) as well as demographic and socio-economic characteristics of households and individuals. The survey comprises 48,825 individuals of 7,913 households and covers 15 states. However, information on educational expenditure for each individual in the household does not exist, so we use the household as a unit of the analysis. The data include expenditure of the household in past 12 months (one year). Following previous studies (e.g. Qian and Smyth, 2010; Quang, 2012) we focus on households with dependent children whose ages are not older than 22; as most household members are graduated from university by that age. Accordingly, there were 7,257 valid households who hold such criteria³. Therefore, we ensure that there is no sample selection problem because most of the households with children have positive education expenditure.

Based on the literature review discussed in the previous section, the dependent variable in our analysis is household education expenditure on education. The dependent variable is explained by a vector of explanatory variables, including household income and socio-economic characteristics. The socio-economic characteristics include a set of variables that are hypothesized to influence household education expenditure, such as household size, educational level of the head of the household, gender, age of the head of household, marital status and dummy variables indicating region of residence and occupation. Regional and seasonal factors are also considered. The definition and descriptive statistics of the variables used in the analysis are presented in table 5.

4.2 Estimation technique

To analyze the factors affecting household education expenditure, this paper uses the tobit model, which is an appropriate technique to estimate household expenditure with zero observations (Tobin, 1958). That is, because not all households spend on education services; numerous zero observations will exist in the data, making us face the so-called censored sample problem (Barslund, 2007; Czarnitzki and Stadtmann, 2002; Dardis et al., 1994). The tobit model was originally developed by Tobin in 1958 to accommodate censoring in the dependent variable. This model also overcomes the bias associated with assuming a linear functional form in the presence of such censoring. The tobit model considers that all zeros are attributable to standard corner solutions. Negative values of the dependent variable are assumed to exist but are considered to be unobservable and bunched at zero. Based on Tobin's model, it is assumed that a latent variable that measures the consumer's propensity to spend money on education (y_h^*) is related to the vector of explanatory variables (X_h) and undetectable influences, as specified in the following:

$$y_h^* = \beta X_h + \varepsilon_h \quad (1)$$

It is assumed that a household h spends (y_h^*) on education if the latent variable (y_h^*) is positive. In contrast to the observed expenditure of household h (y_h), the value of the unobservable value (y_h^*) can be negative. Negative values of the latent variable imply that the household will not spend any money on education:

$$y_h = \begin{cases} y_h^* & \text{if } y_h^* > 0 \\ 0 & \text{if } y_h^* \leq 0 \end{cases}$$

³ The study does not discriminate between private and public education expenditure because there is no information on the type of schooling and/or education expenditure in the NBHS' data.

The conventional estimators for these types of models are based on Maximum Likelihood Estimation (MLE). The MLE produces consistent estimates of the parameters of the tobit model, under appropriate assumptions, such as homoscedasticity and normality of the error terms. The likelihood function consists of two parts: the product of the probabilities that households do not spend any money on education [$Pr(y_h = 0)$], and the product of the probabilities that households spend y_h^* on education [$Pr(y_h = y_h^*)$]:

$$L(\beta, \sigma_e) = \prod_{censored} Pr(y_h = 0) \prod_{uncensored} Pr(y_h = y_h^*) \quad (2)$$

Assuming standard normal distributed errors (ε_h), the likelihood function of censored model can be rewritten using a probability density function (ϕ) and cumulative distribution function (Φ) of the standard normal distribution as (Tobin, 1958):

$$L(\beta, \sigma_e) = \prod_{censored} \Phi\left(\frac{0 - X_h\beta}{\sigma_e}\right) \prod_{uncensored} \frac{1}{\sigma_e} \phi\left(\frac{X_h - X_h\beta}{\sigma_e}\right) \quad (3)$$

Equation (3) will be estimated via the Maximum Likelihood (ML). The estimation is run for different samples, namely full, urban and rural household samples, as well as for different household income groups.

5. Empirical Results and Discussion

This section presents the empirical results and discussions. First, we present some descriptive statistics about the variables used in the analysis and then report the econometric results.

5.1 Descriptive statistics

Before analyzing the factors influencing household educational expenditure in Sudan, it is useful to present some descriptive statistics. Thus, table 4 below describes the definition and mean as well as the standard deviation of variables employed in the analysis. As can be read from the table, the reported statistics indicate that the mean of total household income is SDG 6,846 per annum. This is somewhat consistent with the national statistics as reported by NBHS (2009). However, the higher standard deviation of the total income point to the prevalence of income inequality in Sudan. The mean of health expenditure is about SDG 472 per month, representing about 17 percent out of non-food expenditure. This suggests that a considerable portion of Sudanese households' income is spent on education. The standard deviation of household education expenditure is also high, indicating a great disparity among households in terms of educational expenditure.

The table indicates that the average of the gender variable is very high (about 90 percent), indicating the dominance of males in heading households. Regarding the mean and standard deviation of education variables, the table shows that most heads of households and spouses have low levels of educational attainment, confirming the widespread illiteracy in Sudan.

Moreover, as can be read from the table, the mean of number of heads engaging in agriculture and industry is very small, while the mean for service activity is very high. This implies that a considerable portion of household income is generated from service activities, confirming the dominance of the service sector in Sudan's economy. Moreover, as can be fairly read from the table, the average household size is about six persons, which is consistent with the 2009 NBHS. Interestingly, the mean of dummy variable (married) is high, implying that most household heads are married. Finally, the mean of electricity is found to be relatively small, demonstrating the weakness of infrastructure in Sudan, particularly in rural areas.

5.2 Econometrics results

5.2.1 A. Determinants of Household Health Expenditure

First, the results of the tobit estimation of equation (1) for the full, urban and rural sample are presented in table 1 in Appendices. As can be observed from the table, most of the variables

carry their expected signs and are in line with the theory. The result reveals that the coefficient of total household income is positive and significant in all estimated models. However, the results show some differences in income coefficients across models, indicating variations in terms of income impact on education between regions. For instance, the elasticity of income is higher in the urban sample compared to the rural sample. This result indicates that households residing in urban areas spend about 6 percent more on children's education than those living in rural areas. This result suggests that urban households devote a considerable portion of their budget to children's education. This can be explained by the fact that the extremely poor quality of education in Sudan led most urban households to switch their children to private institutions, which supply better educational services than their public counterparts. On a national level, an increase in household income by 1 percent elevates its educational spending by 8.4 percent. This strong association between household income and educational expenditure indicates the absence of free provision of education in Sudan. Alternatively stated, due to the withdrawal of the government from financing education, the households are pressed to cover educational spending, relying on their own resources. Furthermore, quality deterioration of public schools pushes a considerable part of the population to private institutions.

Regarding the household head characteristics, the results show that the age of head has a positive and significant impact of education expenditure. This result confirms many previous empirical studies (e.g. Sulieman, 2012; Andreos, 2012). Also, the coefficients of the educational level of the head and spouse are found to be positive and significant in full, urban and rural sample models. This means that a household whose head received a university degree or diploma is likely to spend more on their children's education, indicating that educated heads and mothers are likely to spend more in education. This finding is in line with the previous studies of Acar (2016) and Vu Quang (2012).

The number of secondary school and university age children has a positive and significant impact on education expenditure. This implies that households with children in high education institutions tend to spend more on education compared to those with more children in low education levels. In addition, household heads who engage in service activities tend to spend more on education compared to those participating in agricultural activities. This is because most service activities are located in urban areas, where households have a better opportunity to spend more on education compared to rural households that engage in the agricultural sector.

Moreover, the results show that the coefficients of household size, number of rooms and access to electricity have a positive and significant impact on household education expenditure in Sudan. This can be justified by the fact that larger households with urbanized facilities tend to spend more on education. This finding also confirms the positive and significant coefficient of the urban dummy variable, which indicates that households residing in urban areas tend to spend more on education than those living in rural areas.

In terms of geography, households residing in the northern, eastern, central and Kurdoan regions are likely to spend less on their children's education than households residing in the capital city of Khartoum. This confirms the fact that households in Khartoum dedicate a large investment for their children's education. Expectedly, the coefficient of the Darfur region is found to be negative but not significant. This finding can be justified by the fact that people of Darfur suffer from a civil war and a large portion of them live in IDP camps and spend nothing on education, as most of education services are provided by the government and non-governmental organizations.

Overall, households with higher incomes and residing in urban areas tend to spend more on the education of their children. This finding confirms our hypothesis that rural and poor household spend less on education in Sudan. In addition, households whose head and mother have a higher educational level are likely to invest more on education.

Regarding the factors affecting educational expenditure by income quintile, table 2 in Appendices reports the marginal effects for the tobit estimates. As can be read from the table, the coefficient of household income in the bottom four income quintiles is insignificant. On the other hand, the effect of household income on the highest (fifth) income quintile is found to be positive and statistically significant. This indicates that households belonging to the high-income quintile are likely to spend more on children education. This result confirms the previous results of full, urban and rural models. This also implies that children's education is an important investment for the rich population. However, the result suggests that an increase in the income of households belonging to low income quintiles does not raise the education expenditure, as poor households devote a greater part of their budget to food and health expenses.

Similar to the results obtained from the full, urban and rural samples, the education level of household head is found to be very significant in influencing household expenditure, particularly for the highest income group. This finding supports the previous analysis that households with higher incomes and educated heads tend to spend more on education than poor and less educated heads. In addition, the number of secondary- and university-age children increases household education expenditure in both fourth and fifth quintiles. In addition, households whose head is working in service sector and belonging to the third and fourth income quintiles spend more on education compared to other income quintiles. Moreover, the results show that households residing in regions other than Khartoum spend less. Finally, the coefficient of Darfur is not significant, confirming the pervious analysis.

6. Conclusion and Policy Implications

This paper examines the factors influencing household educational expenditure, with emphasis on the role of household income. The study used the NBHS data (2009) for national, urban and rural levels and employed a tobit model. For further understanding of the impact of income on children's education, the analysis is executed for different income groups.

The results of the tobit estimation reveal that household income, heads' educational level, heads' age, household size, number of school-age children and residing in urban areas are the most significant factors affecting educational expenditure in full, urban and rural samples of the surveyed households. Interestingly, the empirical results show some variations between the effects of household income on educational expenditure across urban and rural areas. Specifically, the income elasticity of education in the urban sample model is greater than that of the rural model, implying that households residing in urban areas tend to spend more on education than rural households. In addition, the effect of household income is found to be positive and significant in the highest income quintile, implying that rich households tend to spend more than poor households.

Overall, our results indicate that households with higher incomes residing in urban areas tend to spend more on education in Sudan. In addition, households whose head and mother have higher educational levels are likely to spend more on education than the others. These results signify the weakness of intergenerational educational and income mobility in Sudan. This also suggests that children from poor households are caught permanently in low income and low education levels and are not able to "catch up" with their peers of high-income families. Accordingly, educational policies in Sudan need to take into account the equality of opportunity in education to ensure that children from low education families have as much access to education as their richer counterparts; thus leading to higher intergenerational mobility in Sudan. Accordingly, the liberalization of education adopted in 1992 should be revised with caution to achieve income and educational equality.

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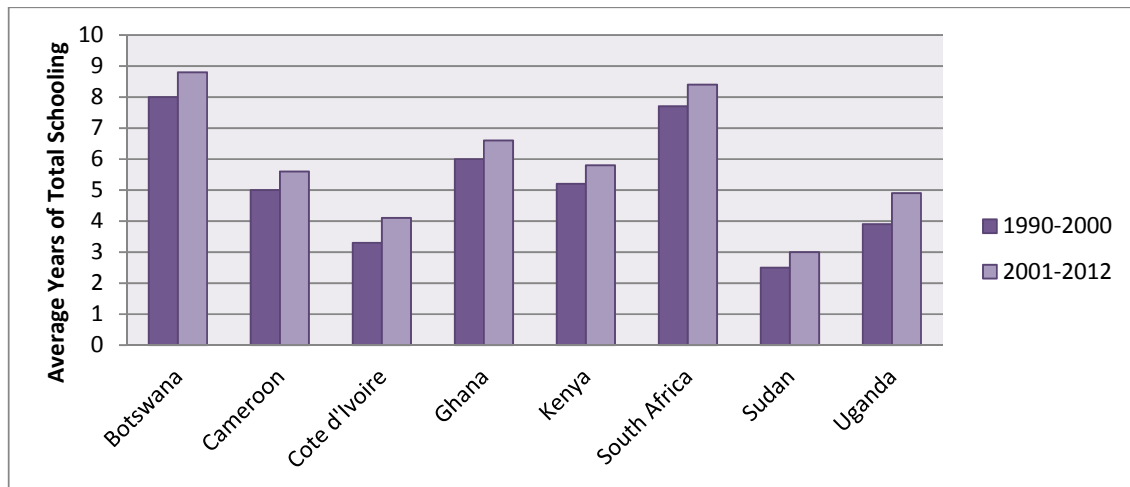
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Figure 1: Educational Attainment of Population Aged 15 and Older in Sudan and A Sample of SSA Countries (Average of Years of Total Schooling)



Source: World Bank, World Bank Indicator (2016)

Table 1: Public Education Expenditure (% of GDP) in Sudan and a Sample of SSA Countries

Country	1990-1999	2000-2009	2010-2014
Angola	2.6	2.7	3.5
Botswana	6.3	9.7	9.6
Cameroon	3.1	3.0	3.1
Cote d'Ivoire	4.8	4.1	4.7
Ethiopia	2.6	4.6	4.5
Ghana	4.1	6.0	6.9
Kenya	6.0	6.3	5.5
South Africa	5.8	5.0	6.0
Sudan	1.0	1.8	2.1
Uganda	2.5	3.6	2.5

Source: World Bank, World Bank Indicator (2016)

Table 2: Public Education Expenditure (% of Total Government Expenditure) in Sudan and a Sample of SSA Countries

Public Education expenditure (% of Total Government Spending)			
Country	1990-1999	2000-2009	2010-2014
Angola	6.1	6.9	8.7
Botswana	20.0	24.3	21.0
Cameroon	11.6	18.7	15.7
Cote d'Ivoire	19.0	21.9	20.7
Ethiopia	14.0	20.6	26.7
Ghana	15.0	22.3	27.9
Kenya	24.0	25.0	20.6
South Africa	20.0	19.4	19.2
Sudan	9.1	8.9	11.0
Uganda	10.0	14.8	11.5

Source: World Bank, World Bank Indicator (2016)

Table 3: Gross Enrollment Ratio by Educational Level in Sudan and a Sample of SSA Countries (%)

	Primary level			Secondary Level			Tertiary Level		
	1990-1999	2000-2009	2010-2014	1990-1999	2000-2009	2010-2014	1990-1999	2000-2009	2010-2014
Angola	18.4	115.4	85.7	11.6	18.9	28.8	0.6	2.3	8.4
Botswana	15.2	17.0	16.9	55.0	77.5	83.3	5.3	10.6	21.4
Cameroon	10.5	16.6	29.1	25.9	30.0	51.6	3.6	6.1	11.5
Cote d'Ivoire	1.7	2.9	5.3	24.3	25.6	40.1	4.6	9.1	8.5
Ethiopia	1.4	2.3	14.2	11.5	24.2	35.7	0.8	2.6	7.4
Ghana	83.7	75.0	113.7	37.5	47.3	60.9	1.2	6.9	13.5
Kenya	36.9	48.1	67.4	38.5	48.1	67.6		3.1	
South Africa	26.1	42.1	75.8	79.6	88.9	92.9	13.1	16.3	19.3
Sudan	16.2	23.6	34.3	33.2	36.2	39.3	6.3	11.0	15.4
Uganda	9.1	11.4	12.4	10.4	21.0	80.8	1.5	3.5	4.2

Source: World Bank, World Bank Indicator (2016)

Table 4: Summary Statistics of Variables used in the Analysis

Variable	Definition	Mean	Std. Dev.
Educational Expenditure	Household expenditure on education	472.501	4644.57
Income	Household total disposable income in SDG	6846.134	24416.66
Household's Head Characteristics			
Age	Age of head of household in years	45.811	14.81
Gender of Head	Gender of the head of household (1 = male; 0 = female)	0.896	0.305
Educational Level of Household Head			
Primary	Primary school, dummy	0.192	0.394
Secondary	Secondary school, dummy	0.078	0.268
University	University, dummy	0.042	0.201
Educational Level of Spouse			
Spouse Primary	Primary school, dummy	0.191	0.393
Spouse Secondary	Secondary school, dummy	0.07	0.255
Spouse University	University, dummy	0.032	0.176
Number of Children in Household			
Pre-school	The number of children aged 1 to 6 living in the household.	0.967	1.046
Primary School	The number of children aged 6 to 14 living in the household	1.5	1.512
Secondary School	The number of children aged 15 to 17 living in the household	0.404	0.628
University Level	The number of children aged 18 to 22 living in the household	0.971	1.099
Profession of Household Head			
Agriculture	A dummy variable where 1 = household head being engaged in agricultural activities, 0 otherwise.	0.072	0.258
Industry	A dummy variable where 1 = household head being engaged in industrial activities, 0 otherwise.	0.003	0.053
Service	A dummy variable where 1 = household head being engaged in industrial activities, 0 otherwise.	0.925	0.262
Household Type of Dwelling			
House	A dummy variable where 1 = being a resident in house, 0 otherwise.	0.995	0.068
Apartment	A dummy variable where 1 = being a resident in apartment, 0 otherwise.	0.006	0.108
Villa	A dummy variable where 1 = being a resident in villa, 0 otherwise.	0.005	0.126
Household Characteristics			
Household Size	Number of household members	6.173	2.806
Room	Number of rooms	3.265	1.869
Married Head	A dummy variable, (1= married; 0= unmarried)	0.895	0.306
Electricity	A Dummy variable, (1= electrified; 0= un-electrified)	0.391	0.488

Appendix

Table A1: Tobit Estimation Results for Household Education Expenditure in Sudan (Full, Urban and Rural Samples)

Variable	Full Sample	Urban	Rural
Income	0.084*** 0	0.130*** -0.001	0.067*** -0.003
Household Head Characteristics			
Age	0.007*** 0	0.006** -0.043	0.008*** 0
Gender of Head	-0.106 -0.177	-0.138 -0.332	-0.071 -0.445
Married	-0.056 -0.471	-0.09 -0.516	-0.046 -0.625
Educational Level of Household Head			
Primary	0.153*** -0.002	0.156* -0.062	0.151** -0.011
Secondary	0.337*** 0	0.390*** 0	0.238** -0.016
University	0.654*** 0	0.526*** 0	0.864*** 0
Educational Level of the Spouse			
Spouse Primary	0.136*** -0.006	0.045 -0.578	0.202*** -0.001
Spouse Secondary	0.371*** 0	0.311*** -0.004	0.360*** -0.002
Spouse University	0.439*** 0	0.374*** -0.009	0.408** -0.038
Number of Children in Household			
Pre-school	-0.155*** 0	-0.153*** -0.001	-0.149*** 0
Primary School	-0.006 -0.79	-0.063* -0.075	0.034 -0.19
Secondary School	0.151*** 0	0.118** -0.027	0.177*** 0
University Level	0.181*** 0	0.159*** 0	0.196*** 0
Profession of Household Head (agriculture as reference)			
Service	0.338*** -0.001	0.375 -0.498	0.350*** 0
Industry	-0.186 -0.745	-0.412 -0.636	0.107 -0.889
Household Type of Dwelling (house as reference)			
Apartment	0.375** -0.024	0.479** -0.015	-0.157 -0.682
Villa	-0.152 -0.233	-0.335 -0.249	-0.078 -567
Other Household Characteristics			
Household Size	0.079*** 0	0.093*** -0.001	0.065*** -0.002
Room	0.037*** -0.001	0.062*** -0.002	0.021 -0.128
Electricity	0.353*** 0	0.425*** 0	0.306*** 0
Urban	0.273*** 0		
Region (Khartoum as reference)			
Northern	-0.555*** 0	-0.720*** 0	-0.26 -0.109
Eastern	-0.444*** 0	-0.524*** 0	-0.183 -0.274
Central	-0.660*** 0	-0.481*** 0	-0.538*** -0.001
Kordufan	-0.534*** 0	-0.625*** 0	-0.319* -0.053
Darfur	-0.081 -308	-0.103 -0.347	0.11 -0.497
Constant	0.962*** 0	0.997*** 0	0.827*** 0
Observations	7257	2230	5027
Pseudo R2	0.113	0.093	0.092
LR chi2	1589.20 (0.000)	491.25 (0.000)	767.91 (0.000)
Log likelihood	-6198.213	-2378.344	-3784.186

Note: p-values in parentheses. ***p<0.001, **p<0.01, *p<0.05.

Table A2: Tobit Estimation Results for Household Education Expenditure by Income Quintile

Variable	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile
Income	0.03 -0.431	-0.05 -0.224	-0.026 -0.551	0.007 -0.875	0.152*** -0.001
Household Head Characteristics					
Age	0.004 -0.185	0.005 -0.13	0.007* -0.052	0.004 -0.193	0.008** -0.021
Gender of Head	0.209 -0.161	-0.088 -0.569	-0.23 -0.187	-0.174 -0.322	-0.064 -0.721
Married	-0.14 -0.352	-0.105 -0.502	-0.382** -0.027	0.07 -0.681	0.006 -0.97
Educational Level of Household Head (illiterate as reference)					
Primary	0.025 -0.846	0.084 -0.42	0.241** -0.015	-0.046 -0.633	0.343*** -0.001
Secondary	-0.181 -0.476	0.07 -0.705	0.370** -0.013	0.059 -0.679	0.545*** 0
University	1.107 -0.207	1.381*** -0.005	0.313 -0.277	0.094 -0.623	0.696*** 0
Educational Level of Spouse (illiterate as reference)					
Spouse Primary	0.244* -0.06	0.026 -0.815	-0.055 -0.579	0.115 -0.235	0.206** -0.043
Spouse Secondary	0.904*** -0.009	-0.101 -0.631	0.202 -0.245	0.330** -0.041	0.378*** -0.003
Spouse University	1.519*** -0.004	0.821** -0.015	-0.089 -0.812	0.509** -0.017	0.285* -0.094
Number of Children in Household					
Pre-school	-0.157** -0.015	-0.211*** -0.001	-0.181*** -0.002	-0.126** -0.015	-0.153*** -0.003
Primary School	0.109** -0.043	-0.164*** -0.003	0.002 -0.966	0.007 -0.874	-0.01 -0.799
Secondary School	0.224*** -0.005	0.037 -0.619	0.158** -0.018	0.228*** 0	0.098 -0.115
University Level	0.136** -0.026	0.006 -0.917	0.144*** -0.008	0.209*** 0	0.209*** 0
Profession of Household Head (agriculture as reference)					
Service	0.201 -0.123	0.25 -0.149	0.455** -0.041	0.808*** -0.006	0.241 -0.485
Industry	-0.991 -0.255	-0.241 -0.801	0.116 -0.915	1.137 -0.32	
Household Type of Dwelling (house as reference)					
Apartment	-0.416 -0.179	-0.228 -0.503			0.624*** -0.006
Villa		-0.348 -0.283	-0.149 -0.316	-0.027 -0.921	
Other Household Characteristics					
Household size	0.004 -0.925	0.212*** 0	0.107*** -0.009	0.037 -0.279	0.033 -0.266
Room	0.062* -0.061	0.005 -0.871	-0.003 -0.916	0.015 -0.531	0.006 -0.774
Electricity	0.092 -0.585	0.228*** -0.002	0.212** -0.018	0.258*** -0.005	0.542*** 0
Region (Khartoum and reference)					
Northern	-1.096*** -0.005	-0.809*** 0	-0.459** -0.01	-0.564*** 0	-0.768*** 0
Eastern	-0.971*** -0.009	-0.645*** -0.001	-0.349* -0.05	-0.387** -0.021	-0.614*** 0
Central	-1.246*** -0.001	-0.947*** 0	-0.689*** 0	-0.692*** 0	-0.660*** 0
Kordufan	-0.818** -0.028	-0.625*** -0.001	-0.521*** -0.005	-0.599*** -0.001	-0.714*** 0
Darfur	-0.573 -0.113	-0.299 -0.113	0.074 -0.681	-0.095 -0.562	-0.09 -0.54
Constant	1.577*** -0.001	1.844*** 0	2.080*** 0	1.565*** 0	1.173*** -0.001
Observations	1419	1507	1671	1211	1440
Pseudo R2	0.11	0.087	0.079	0.066	0.103
LR chi2	155.61	182.7	214.17	205.94	402.61
Log Likelihood	0	0	0	0	0
	-625.912	-952.165	-1244.937	-1442.129	-1740.427

Note: p-values in parentheses. ***p<0.001, **p<0.01, *p<0.05.