

Determinants of Household Tuition Fee Expenditure in Somalia: Evidence from a Nationally Representative Household Survey

Abdinasir Nur Dahir

abdinasirnurdahir@gmail.com

SIMAD University

Abdirahman Kasim Mohamed Abdullahi

Ministry of Planning, Federal Republic of Somalia

Ayni Yusuf Gedi

SIMAD University

Abdimalik Omar Mustaf

SIMAD University

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Abstract

Access to education in Somalia remains constrained by substantial household financing requirements, reflecting decades of conflict, institutional weakness, and limited public provision. Empirical evidence on household tuition fee expenditure using recent, nationally representative data remains limited. This study examines the factors associated with household tuition fee expenditure in Somalia using cross-sectional data from the 2022 Somalia Integrated Household Budget Survey (SIHBS), covering 6,532 households. Because 55.6% of households reported zero tuition expenditure, a Tobit regression model with heteroskedasticity-robust standard errors was employed, with OLS and a probability-weighted Tobit specification used as sensitivity analyses. Results show that total household expenditure, remittance receipt, and household-head employment status are positively and significantly associated with tuition expenditure. Household-head education, gender, and household size are not statistically significant. Location is the strongest predictor: urban and rural households have substantially higher expected tuition expenditure than nomadic households, highlighting a settled-versus-nomadic divide beyond the conventional urban-rural distinction. Internal displacement and food insecurity are significantly associated with lower tuition expenditure. The findings highlight financial capacity, settlement type, and household vulnerability as important dimensions of education financing in Somalia and suggest the need for policies that improve educational access for nomadic communities and strengthen support for displaced and food-insecure households, with relevance to Sustainable Development Goal 4.

1 Introduction

Access to education remains one of the most persistent development challenges facing low-income and fragile states and sits at the core of Sustainable Development Goal 4, which calls for inclusive and equitable quality education for all. Globally, more than 258 million children and youth remain out of school, with the overwhelming majority concentrated in low-income and conflict-affected countries [1]. In many of these settings, the gap between the ambition of SDG 4 and the reality on the ground is driven not only by educational supply but also by the financial burden schooling places on households. Where public education systems are underfunded or largely absent, families may be required to finance tuition, uniforms, and learning materials directly, making household economic capacity an important factor in educational access [2].

This dynamic is particularly pronounced in Somalia. Decades of conflict and institutional collapse have contributed to one of the most privatized education systems in the world: public schools account for only about 3 percent of primary and 5 percent of secondary institutions nationally [3]. Household economic capacity, however, operates alongside other important socioeconomic and locational conditions. Somalia has substantial remittance flows, with roughly one-fifth of households receiving remittances [4], while households also differ markedly across urban, rural, and nomadic settlement types and face varying degrees of vulnerability related to internal displacement and food insecurity [5]. Understanding how these economic, demographic, locational, and vulnerability characteristics are

associated with household tuition expenditure is therefore important for understanding education financing in Somalia and the broader challenge of financing education in fragile states.

A substantial empirical literature has examined the determinants of household education expenditure in other developing-country contexts. Studies from Ghana, Sudan, Nigeria, Turkey, Vietnam, and Malaysia identify household income or expenditure, the education and employment status of the household head, household size, and location as important correlates of education spending [6–11]. Remittances, in particular, have been associated with higher household education expenditure: a cross-country meta-analysis finds that international remittances increase education spending by approximately 35 percent on average, and by as much as 53 percent in some regions [12], while evidence from Sub-Saharan Africa reports a comparable positive association [13]. Vulnerability has also been linked to lower educational investment: households affected by displacement have been found to reduce education spending by 20 to 35 percent even where school enrollment itself is unaffected [14], while food insecurity has been associated with reduced educational engagement in the Horn of Africa [15].

Despite this body of evidence, empirical research on household tuition fee expenditure in Somalia remains limited. Existing Somalia-focused studies have concentrated primarily on school non-attendance and structural barriers to educational attainment [16], with less attention to the household expenditure dimension of education financing. In particular, evidence based on recent nationally representative data examining how economic, demographic, locational, and vulnerability characteristics are jointly associated with household tuition expenditure remains limited. This gap is important in a system where households bear a substantial share of education costs, making tuition expenditure a directly measurable dimension of household educational investment.

This study addresses this gap by examining the factors associated with household tuition fee expenditure in Somalia using data from the 2022 Somalia Integrated Household Budget Survey (SIHBS), a nationally representative dataset covering urban, rural, and nomadic households across the country. Because a substantial share of sampled households report zero tuition expenditure, a Tobit regression model is employed to account for the lower-limit censoring of the dependent variable, with heteroskedasticity-robust standard errors. OLS and a probability-weighted Tobit specification are used as sensitivity analyses. By identifying the socioeconomic, locational, and vulnerability characteristics associated with differences in household tuition expenditure, the study contributes evidence to inform targeted education-financing policy in Somalia and to the broader discussion of equitable education financing in fragile and conflict-affected settings in support of SDG 4.

2 Literature Review

2.1 Theoretical framework

The theoretical basis for this study is Human Capital Theory, developed by Schultz [17] and formalized by Becker [18, 19], which views education as an investment that can generate future returns in earnings,

productivity, and welfare [20]. Applied to household tuition expenditure, the theory implies that spending on schooling represents a resource-allocation decision made under financial constraints. The extent of this expenditure may therefore vary with household economic capacity, demographic characteristics, location, and vulnerability. This framework motivates the study's classification of explanatory variables into economic, demographic, locational, and vulnerability factors, representing different dimensions through which household educational spending may be facilitated or constrained.

2.2 Empirical review

A substantial empirical literature examines household education expenditure across developing-country contexts. Using panel data from the China Family Panel Survey, Ye et al. [21] find that Hukou reform significantly increased education expenditure among migrant households, with the increase concentrated in in-school expenditure; their analysis identifies improved access to public education, changes in households' expectations, and income effects as potential mechanisms. In Ghana, Addai [22], using the sixth round of the Ghana Living Standards Survey and a Tobit model, finds that household-head education and family size are positively associated with annual household education expenditure, while rural residence and male household headship are negatively associated with expenditure; household income is negatively related to education expenditure but is not statistically significant. Using the seventh round of the Ghana Living Standards Survey, Addai [23] similarly examines variation in household formal education expenditure across schooling levels and geographic regions. These findings are broadly consistent with earlier evidence from Ghana [6], Nigeria [8], and Sudan [7], which identifies household economic resources, household-head characteristics, family size, and location as important correlates of household education expenditure.

Remittances represent another important source of resources for household educational spending. A meta-analysis of 73 studies covering 30 countries finds that international remittances increase household education expenditure by approximately 35% in most countries and by approximately 53% in Latin America after accounting for sample selection, reverse causality, and differences in research design [12]. Evidence from Sub-Saharan Africa similarly reports that international remittances affect household expenditure patterns, including spending on education and health [13]. This relationship is consistent with the New Economics of Labour Migration framework, which views remittances as a mechanism through which households diversify resources and support human-capital investment under conditions of economic uncertainty [24].

Locational differences in education expenditure have also been documented across developing countries. Ebaidalla [7], using Sudanese household survey data, finds that urban residence and other household characteristics are associated with differences in education expenditure. Evidence from Malaysia [11] and China [25] likewise documents differences in household educational spending across geographic and household characteristics. In Somalia, recent national evidence provides a particularly relevant perspective: Ali et al. [16], using 2022 SIHBS data on 10,511 children, find that residence type is among the strongest predictors of school attendance, with nomadic children facing approximately three times the non-attendance risk of their peers. This evidence suggests that settlement type may represent

an important dimension of educational disadvantage in Somalia beyond the conventional urban-rural distinction.

Household vulnerability is also associated with educational disadvantage. Using displacement during the Bosnian War as a natural experiment, Eder [14] finds that displacement reduced household investment in children's education, with displaced households spending 20–35% less than comparable non-displaced households while school enrollment remained unaffected. Evidence from Somaliland further shows that household food insecurity is strongly associated with poorer academic performance among primary-school adolescents, with food-insecure households having substantially higher odds of poor academic performance [15]. Together, these findings indicate that displacement and food insecurity represent important dimensions of educational vulnerability alongside household economic resources and location.

Despite the growing evidence, important gaps remain in understanding household tuition expenditure in Somalia. Recent Somalia-specific research using the 2022 SIHBS examines household educational investment by classifying households into low, medium, and high investment categories and estimating multinomial logistic models [29]. While this study provides important evidence on socioeconomic, demographic, and locational differences in educational investment, its broader investment measure does not specifically isolate annual tuition expenditure as a continuous monetary outcome. Other recent Somalia research has focused on school non-attendance and structural barriers to educational attainment [16]. Consequently, evidence remains limited on how household economic capacity, remittance receipt, employment, settlement type, internal displacement, and food insecurity are jointly associated with household tuition expenditure. This study addresses this gap by focusing specifically on annual household tuition expenditure using the nationally representative 2022 SIHBS and examining these economic, demographic, locational, and vulnerability dimensions within a Tobit framework that accounts for the substantial concentration of zero tuition expenditure observations.

3 Data and methods

3.1 Study area and data source

This study uses secondary, cross-sectional data from the 2022 Somalia Integrated Household Budget Survey (SIHBS), conducted by the Somali National Bureau of Statistics. The SIHBS is the most recent nationally representative household survey in Somalia, employing a stratified multi-stage sampling design to capture household-level information on demographic characteristics, income sources, expenditure patterns, and living conditions across urban, rural, and nomadic settlement types. Its coverage of Somalia's three principal settlement types is a particular strength for this study, given that access to formal schooling and to markets more broadly differs substantially across these populations. Following data cleaning, the final analytical sample comprises 6,532 households.

3.2 Variable description

The dependent variable is household tuition fee expenditure (*Tuition_Exp*), measured as the total annual amount, in United States dollars, paid by a household toward school tuition. Because Somalia's education system is overwhelmingly privately financed, with public schools accounting for only about 3 percent of primary and 5 percent of secondary institutions nationally [3], tuition expenditure provides a direct monetary measure of household spending on children's education.

Guided by the theoretical framework outlined in Section 2.1, the independent variables are grouped into four conceptual categories. Economic variables comprise the logarithm of total household expenditure (used as a proxy for household economic capacity), a dummy variable for remittance receipt, and a dummy variable for the employment status of the household head. Demographic variables comprise the household head's education level (represented by two dummy variables, Low and Middle, with Tertiary/High education as the reference category), the household head's gender, and household size. Locational variables comprise two dummy variables, Urban and Rural, with Nomadic residence as the reference category. Vulnerability variables comprise dummy variables for internally displaced (IDP) status and household food insecurity. Table 1 summarizes the measurement of all study variables.

Table 1
Description and measurement of study variables

Variable	Description	Measurement
Tuition_Exp	Household tuition fee expenditure (annual)	USD per household per year
Total_Exp	Total household expenditure	Log of USD per household per year
Remittance	Household receives remittances from abroad	1 = Yes, 0 = No
Employment_HH	Employment status of household head	1 = Employed, 0 = Not employed
Education_HH	Education level of household head	Dummies: Low, Middle (Reference: Tertiary/High)
Gender_HH	Gender of household head	1 = Male, 0 = Female (Reference)
HH_Size	Number of household members	Numeric count
Area_Type	Settlement type	Dummies: Urban, Rural (Reference: Nomadic)
IDP_Status	Internally displaced household	1 = Yes, 0 = No
Food_Insec	Household food insecurity	1 = Yes, 0 = No

3.3 Analytical technique

Preliminary inspection of the dependent variable shows that 3,634 households (55.6%) report zero tuition expenditure, while 2,898 households (44.4%) report positive expenditure. The substantial

concentration of observations at zero reflects different household circumstances, including households without school-age children, households with school-age children who are not enrolled, and households with enrolled children who report no tuition expenditure. Because the dependent variable is bounded at zero with a substantial mass of observations at the lower limit, the study employs the Tobit regression model, originally developed by Tobin [26], as the primary estimation technique [7, 11]. The Tobit framework models the observed outcome as arising from an underlying latent expenditure propensity while accounting for the lower-limit censoring. Although the available enrollment information provides an opportunity for future research to distinguish more explicitly between the decision to participate in schooling and the intensity of tuition expenditure, the present study focuses on household tuition expenditure within a single-equation framework.

The Tobit model assumes the existence of a latent, unobserved variable, T_i^* , which determines observed household tuition expenditure, T_i according to:

$$T_i^* = \beta_0 + \beta_1 \ln(\text{TotalExp}_i) + \beta_2 \text{Remittance}_i + \beta_3 \text{Employment}_i + \beta_4 \text{Low}_i \\ + \beta_5 \text{Middle}_i + \beta_6 \text{Male}_i + \beta_7 \text{HHSize}_i + \beta_8 \text{Urban}_i + \beta_9 \text{Rural}_i \\ + \beta_{10} \text{IDP}_i + \beta_{11} \text{FoodInsec}_i + \varepsilon_i$$

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

where ε_i is assumed to be independently and normally distributed with mean zero and constant variance σ^2 . The Tobit maximum-likelihood estimator therefore relies on the specified distributional assumptions for the latent error term. Heteroskedasticity-robust standard errors were used to provide inference that is robust to potential heteroskedasticity in the household-level cross-sectional data [27]. Prior to estimation, Variance Inflation Factors (VIFs) were computed to assess multicollinearity among the explanatory variables. As sensitivity analyses, the same specification was additionally estimated using OLS and using the household expansion weight provided in the SIHBS 2022 public-use microdata. Because the publicly available data do not provide the primary sampling unit and stratum identifiers required to reproduce the full complex survey design, the probability-weighted specification is treated as a sensitivity analysis rather than a complete survey-design adjustment.

4 Results

4.1 Descriptive statistics

Table 2 presents descriptive statistics for the study variables. Households spent an average of USD 104.43 annually on tuition (SD = 364.58), with expenditure ranging from USD 0 to USD 9,900, reflecting a heavily right-skewed distribution with a substantial concentration of zero observations, motivating the limited-dependent-variable approach adopted. Average total household expenditure was USD 5,838.50

(SD = 4,518.53), and the average household comprised 6.63 members. Approximately 21.6 percent of households received remittances, 42.3 percent were headed by an employed individual, and 46.9 percent were male-headed. Educational attainment among household heads was low overall, with 88.5 percent classified as having low education, 7.5 percent middle, and only 4.0 percent tertiary. Regarding vulnerability, 10.6 percent of households were internally displaced and 40.0 percent were food insecure. By settlement type, 60.2 percent of households resided in urban areas, 26.7 percent in rural areas, and 13.1 percent in nomadic communities.

Table 2
Descriptive statistics (N = 6,532)

Variable	Mean	SD	Min	Max
Tuition expenditure (USD)	104.43	364.58	0	9,900
Total household expenditure (USD)	5,838.50	4,518.53	279.11	75,391.50
Household size	6.63	2.75	1	23
Remittance (1 = Yes)	0.216	0.412	0	1
Employment status (1 = Employed)	0.423	0.494	0	1
Male household head	0.469	0.499	0	1
Low education	0.885	0.319	0	1
Middle education	0.075	0.264	0	1
IDP status	0.106	0.308	0	1
Food insecurity	0.400	0.490	0	1
Urban	0.602	0.489	0	1
Rural	0.267	0.442	0	1
Nomadic	0.131	0.337	0	1

4.2 Tobit regression results

Table 3 presents the Tobit regression results estimated with heteroskedasticity-robust standard errors. The model is statistically significant overall ($F(11, 6521) = 13.12, p < 0.001$), and multicollinearity does not appear to be a concern, with a mean VIF of 1.61 and a maximum VIF of 2.74. The model also provides a better fit than the intercept-only specification, with AIC = 48,736.79 and BIC = 48,824.99; the log likelihood improves from - 24,720.13 for the null specification to - 24,355.40 for the estimated model.

Table 3
Tobit regression results (robust standard errors)

Variable	Coefficient	Robust SE	t	p
ln(Total household expenditure)	56.774	14.155	4.01	< 0.001***
Remittance	173.416	26.812	6.47	< 0.001***
Employment status	106.885	18.197	5.87	< 0.001***
Low education	-51.420	42.193	-1.22	0.223
Middle education	-7.411	57.526	-0.13	0.898
Male household head	2.731	16.759	0.16	0.871
Household size	-5.384	3.403	-1.58	0.114
Urban	594.863	54.854	10.84	< 0.001***
Rural	428.997	45.225	9.49	< 0.001***
IDP	-224.214	31.576	-7.10	< 0.001***
Food insecurity	-141.730	18.741	-7.56	< 0.001***
Constant	-1,113.299	155.080	-7.18	< 0.001***

N = 6,532; 3,634 left-censored, 2,898 uncensored. Reference categories: Tertiary education, Nomadic residence, Female household head. *** $p < 0.01$.

Total household expenditure is positively and significantly associated with tuition expenditure ($\beta = 56.774$, $p < 0.001$), indicating that greater household economic capacity is associated with higher investment in schooling. This finding is consistent with Human Capital Theory and with previous evidence from Ghana, Nigeria, and Sudan [7, 8, 22]. Remittance receipt is also positively associated with tuition expenditure ($\beta = 173.416$, $p < 0.001$). The corresponding average marginal effect indicates that, conditional on positive tuition expenditure, households receiving remittances have approximately USD 61.9 higher expected tuition expenditure than non-recipient households. This finding is consistent with cross-country evidence showing that remittances increase household education expenditure [12] and with evidence from Sub-Saharan Africa [13]. Employment status of the household head is likewise positively associated with tuition expenditure ($\beta = 106.885$, $p < 0.001$). Its average marginal effect indicates an approximately USD 38.2 higher expected tuition expenditure among households with an employed household head, conditional on positive expenditure. Together, these findings suggest that household economic resources are multidimensional, with employment status and remittance receipt associated with tuition expenditure even after controlling for total household expenditure.

Household head education, gender, and household size are not statistically significant associations of tuition expenditure ($p > 0.10$ in all cases). The lack of a significant association for household head

education differs from findings in Ghana and Sudan, where higher household-head education was positively associated with education expenditure [7, 22]. This result suggests that, after accounting for household economic capacity, the measured demographic characteristics of the household head do not have an independent statistically detectable association with tuition expenditure in the present sample.

Settlement type exhibits the largest estimated differences in tuition expenditure. Relative to nomadic households, both urban residence ($\beta = 594.863$, $p < 0.001$) and rural residence ($\beta = 428.997$, $p < 0.001$) are positively and significantly associated with tuition expenditure. The substantially larger differences between settled and nomadic households than the difference between urban and rural households suggest that the principal geographic divide in tuition expenditure is between settled and mobile populations. This finding is consistent with recent evidence showing that nomadic children face substantially higher risks of school non-attendance in Somalia [16].

Vulnerability factors are negatively associated with tuition expenditure. IDP status is significantly associated with lower tuition expenditure ($\beta = -224.214$, $p < 0.001$), while food insecurity is likewise associated with significantly lower tuition expenditure ($\beta = -141.730$, $p < 0.001$). These findings are consistent with evidence that displacement can reduce household education expenditure in conflict-affected settings [14] and that food insecurity is associated with reduced educational engagement in the Horn of Africa [15]. The results suggest that displacement and food insecurity may constrain households' ability to allocate resources to schooling, although the cross-sectional design does not permit these associations to be interpreted as causal effects.

4.3 Marginal effects

To express these determinants in directly interpretable monetary terms, average marginal effects on expected household tuition expenditure were estimated (Table 4).

Table 4
Average marginal effects on expected tuition expenditure conditional on positive expenditure

Variable	dy/dx (USD)	Robust SE	z	p
ln(Total household expenditure)	20.268	4.958	4.09	< 0.001***
Remittance	61.908	8.983	6.89	< 0.001***
Employment status	38.157	6.375	5.99	< 0.001***
Low education	-18.357	15.042	-1.22	0.222
Middle education	-2.646	20.543	-0.13	0.898
Male household head	0.975	5.984	0.16	0.871
Household size	-1.922	1.207	-1.59	0.111
Urban	212.361	17.307	12.27	< 0.001***
Rural	153.148	14.668	10.44	< 0.001***
IDP	-80.043	10.743	-7.45	< 0.001***
Food insecurity	-50.596	6.326	-8.00	< 0.001***

Settlement type shows the largest estimated differences in expected tuition expenditure. Relative to nomadic households, urban residence is associated with an estimated USD 212.36 higher expected tuition expenditure, while rural residence is associated with an estimated USD 153.15 higher expected expenditure, conditional on positive tuition expenditure. Remittance receipt is associated with an estimated USD 61.91 higher expected tuition expenditure, while employment of the household head is associated with an increase of approximately USD 38.16. A one-unit increase in log total household expenditure is associated with an estimated USD 20.27 increase in expected tuition expenditure. In contrast, IDP status is associated with an estimated USD 80.04 lower expected tuition expenditure, and food insecurity with an estimated USD 50.60 lower expected expenditure. Overall, the marginal effects indicate substantial differences in expected tuition expenditure associated with settlement type and vulnerability status, while remittance receipt, employment status, and household economic capacity are also positively associated with expenditure.

4.4 Robustness check

Table 5 reports OLS estimates using the same specification as the Tobit model as a sensitivity analysis. Because the dependent variable contains a substantial proportion of zero observations and is bounded at zero, OLS is not the preferred estimator; rather, the comparison is used to assess whether the direction and statistical significance of the estimated associations are broadly consistent across estimation approaches.

Table 5
OLS regression results (robustness check)

Variable	Coefficient	SE	t	p
ln(Total household expenditure)	12.619	7.110	1.77	0.076*
Remittance	56.305	11.102	5.07	< 0.001***
Employment status	30.242	9.202	3.29	0.001***
Low education	-8.173	22.947	-0.36	0.722
Middle education	30.756	27.430	1.12	0.262
Male household head	3.070	9.054	0.34	0.735
Household size	-2.406	1.736	-1.39	0.166
Urban	122.653	13.760	8.91	< 0.001***
Rural	37.488	15.029	2.49	0.013**
IDP	-64.058	14.892	-4.30	< 0.001***
Food insecurity	-60.630	9.404	-6.45	< 0.001***
Constant	-60.528	62.813	-0.96	0.335

$R^2 = 0.0411$; $F(11, 6520) = 25.42$, $p < 0.001$.

The OLS results show that all variables retain the same signs as in the Tobit specification. Remittance receipt, employment status of the household head, urban residence, rural residence, IDP status, and food insecurity remain statistically significant at the 5 percent level or better. Total household expenditure remains positive but is statistically significant only at the 10 percent level ($\beta = 12.619$, $p = 0.076$), compared with the stronger statistical significance observed in the Tobit model. Household head education, gender, and household size remain statistically insignificant. The consistency in coefficient signs and the persistence of significance for the principal explanatory variables provide a sensitivity check supporting the stability of the main findings across the two estimation approaches.

4.5 Weighted robustness check

Because the SIHBS 2022 is based on a stratified, multi-stage household survey, the main specification was additionally re-estimated using the household-level probability weight provided in the public microdata to assess whether the estimated associations are sensitive to unequal selection probabilities across households and settlement types. The publicly released microdata do not include primary sampling unit or stratum identifiers. Accordingly, the available probability weight was incorporated into the estimation. This approach accounts for the available sampling weights but cannot account for intra-cluster correlation or other elements of the full survey design. Table 6 reports the resulting probability-weighted Tobit estimates.

Table 6
Weighted Tobit regression results (probability-weighted, linearized standard errors)

Variable	Coefficient	Linearized SE	t	p
ln(Total household expenditure)	54.745	19.161	2.86	0.004***
Remittance	175.608	33.910	5.18	< 0.001***
Employment status	93.802	24.464	3.83	< 0.001***
Low education	-105.384	83.442	-1.26	0.207
Middle education	-69.886	96.934	-0.72	0.471
Male household head	25.431	22.617	1.12	0.261
Household size	-5.860	4.291	-1.37	0.172
Urban	561.417	63.937	8.78	< 0.001***
Rural	351.897	54.272	6.48	< 0.001***
IDP	-254.121	40.283	-6.31	< 0.001***
Food insecurity	-182.333	26.687	-6.83	< 0.001***
Constant	-1,000.031	201.354	-4.97	< 0.001***

N = 6,532; population size = 2,086,335; Design *df* = 6,531; $F(11, 6521) = 10.57$, $p < 0.001$. Reference categories: Tertiary education, Nomadic residence, Female household head.

The probability-weighted estimates are consistent with the main Tobit results in terms of both coefficient signs and statistical significance. Total household expenditure, remittance receipt, employment status, urban residence, rural residence, IDP status, and food insecurity remain statistically significant at the 1 percent level, while household head education, gender, and household size remain statistically insignificant. The estimated coefficients for the principal location and vulnerability variables are somewhat larger in absolute value under weighting, particularly for IDP status (- 254.121 compared with - 224.214) and food insecurity (- 182.333 compared with - 141.730). These results indicate that the main findings are not sensitive to the incorporation of the available household-level probability weights. However, because the public-use data do not provide PSU and stratum identifiers, the weighted analysis should be interpreted as a partial survey-weighting sensitivity check rather than a complete correction for the complex survey design. The weighted standard errors therefore do not account for possible intra-cluster correlation among households sampled within the same enumeration area.

5 Discussion

This study examined the factors associated with household tuition fee expenditure in Somalia, where decades of conflict and institutional disruption have contributed to a highly privatized education system.

The findings identify a clear pattern of socioeconomic, locational, and vulnerability-related differences in household tuition expenditure. Settlement type and vulnerability status are associated with the largest differences in expected expenditure, while remittance receipt, employment status, and household economic capacity are also positively associated with tuition expenditure. In contrast, household head education, gender, and household size do not show statistically significant associations after controlling for the other characteristics in the model. These findings highlight the importance of examining educational financing through the combined lenses of economic resources, settlement conditions, and household vulnerability in fragile and conflict-affected settings.

The positive associations between remittance receipt, employment status, and tuition expenditure indicate that household economic resources are multidimensional. Remittance-receiving households have higher expected tuition expenditure, even after controlling for total household expenditure, while households with an employed head also report higher expected expenditure. This pattern is consistent with previous evidence that remittances can support household investment in education [12, 13]. It also extends the interpretation of household economic capacity beyond total expenditure alone: employment status and remittance receipt may capture additional dimensions of resource availability that are not fully reflected in aggregate household expenditure. However, because the data are cross-sectional and employment and remittance receipt are not direct measures of income stability, the results do not establish that income stability or precautionary saving mechanisms cause higher tuition expenditure. Rather, they indicate that different dimensions of household economic circumstances are independently associated with educational spending.

The location results represent the most pronounced geographic pattern in the analysis. Relative to nomadic households, urban and rural households have substantially higher expected tuition expenditure, while the difference between urban and rural households is considerably smaller than the differences between either settled group and nomadic households. This pattern differs from the urban-rural differences documented in previous studies from Sudan and Malaysia [7, 11] and suggests that, in Somalia, the distinction between settled and mobile populations may be particularly important for understanding household education financing. The finding is consistent with evidence that nomadic children face substantially higher risks of school non-attendance in Somalia [16]. Taken together, the evidence points to a potentially compounded educational disadvantage among pastoralist communities, involving both weaker access to schooling and substantially lower household tuition expenditure. Because the present study does not directly model school enrollment or the mechanisms underlying these locational differences, this interpretation should be understood as a plausible explanation rather than a causal conclusion.

The vulnerability results provide further evidence of substantial differences in household educational investment. IDP status is associated with an estimated USD 80.04 lower expected tuition expenditure, while food insecurity is associated with an estimated USD 50.60 lower expected expenditure, conditional on positive tuition expenditure. These findings are consistent with evidence that displacement can reduce household education expenditure in conflict-affected settings [14] and that food insecurity is

associated with poorer academic performance among school-age adolescents in Hargeisa, Somaliland [15]. The associations may reflect the competing resource demands and disruptions faced by vulnerable households, including losses of assets and livelihoods, displacement-related disruptions to social and financial networks, and the need to prioritize immediate food needs. However, these mechanisms are not directly observed in the present data and should therefore be interpreted as possible pathways rather than established causal mechanisms. The findings nevertheless indicate that educational financing policies focused only on general household economic capacity may not fully address the substantial expenditure gaps associated with displacement and food insecurity.

6 Policy implications

The findings suggest several policy priorities for improving equitable education financing in Somalia. The substantially lower tuition expenditure among nomadic households highlights the need for accessible public or subsidized education and flexible service-delivery approaches suited to mobile and pastoralist communities. The negative associations between IDP status and food insecurity and tuition expenditure further suggest the importance of targeted education assistance and complementary social-protection measures for vulnerable households. At the same time, the positive associations of remittance receipt and household-head employment with tuition expenditure indicate that strengthening secure remittance channels and employment opportunities may improve households' capacity to finance schooling. Together, these findings support a differentiated education-financing strategy that addresses geographic and socioeconomic vulnerability alongside household economic capacity, consistent with the equity and inclusion objectives of Sustainable Development Goal 4. Because this study identifies associations rather than evaluates specific interventions, the effectiveness of these policy measures requires further assessment.

7 Conclusion

This study finds that household economic capacity, remittance receipt, employment status, settlement type, and vulnerability are significantly associated with household tuition expenditure in Somalia, while household head education, gender, and household size are not. The pronounced difference between settled and nomadic households, together with the lower expected tuition expenditure associated with IDP status and food insecurity, highlights important geographic and socioeconomic inequalities in education financing. These findings contribute evidence on household education expenditure in a fragile and highly privatized education system and underscore the need for policies that improve equitable access to education, particularly among nomadic and vulnerable populations, in support of Sustainable Development Goal 4.

8 Limitations and future research

This study is subject to several limitations. First, the main Tobit analysis is unweighted, while the robustness analysis incorporates the household expansion weight provided in the SIHBS 2022 public-

use microdata. Although the weighted results are consistent in sign and statistical significance with the main model, the publicly available data do not provide enumeration-area or stratum identifiers required to reproduce the full complex survey design; therefore, the weighted analysis cannot account for intra-cluster correlation or other design features requiring these identifiers. Second, the zero observations in tuition expenditure may reflect different circumstances, including households without school-age children, households with unenrolled school-age children, and households with enrolled children unable to afford tuition, which the single-equation Tobit model does not distinguish. Future research could use two-part, double-hurdle, or selection models to examine these processes separately. Third, the cross-sectional design limits causal inference, and associations such as that between remittance receipt and tuition expenditure may be influenced by unobserved household characteristics, including migration history. Future research using longitudinal or richer household-level data could examine these relationships more rigorously.

Declarations

Contributions of Authors

Abdinasir Nur Dahir

Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Writing—original draft, Writing—review and editing, Project administration, and Supervision.

Abdirahman Kasim Mohamed Abdullahi

Data validation, Formal analysis, and Writing—review and editing.

Ayni Yusuf Gedi

Literature review, Investigation, Formal analysis, and Writing—review and editing.

Abdimalik Omar Mustaf

Methodology, Data validation, and Management.

All authors read and approved the final manuscript.

ORCID

Abdinasir Nur Dahir: <https://orcid.org/0009-0005-7537-2743>

Abdirahman Kasim Mohamed Abdullahi: <https://orcid.org/0009-0001-1129-6295>

Ayni Yusuf Gedi: <https://orcid.org/0009-0004-9752-1589>

Abdimalik Omar Mustaf: <https://orcid.org/0009-0003-0207-234X>

Clinical Trial Number

Not applicable.

Ethical approval

Not applicable. This study uses secondary, de-identified household survey data publicly released by the Somali National Bureau of Statistics. The authors did not collect primary data from human participants; therefore, additional institutional ethics approval was not required.

Consent to participate

Not applicable. The authors did not directly recruit or interact with human subjects; all data used were collected by the Somali National Bureau of Statistics under its own survey protocols prior to this study.

Consent to publish

Not applicable. The manuscript contains no individually identifiable data, images, or videos; all analysis is based on anonymized, household-level survey records.

Human or animal rights

Not applicable. This study uses secondary, de-identified, publicly available household survey data and does not involve direct research on human or animal participants by the authors.

Competing interests

The authors declare no competing interests.

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Author Contribution

Abdinasir Nur Dahir: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Writing—original draft, Writing—review and editing, Project administration, and Supervision. Abdirahman Kasim Mohamed Abdullahi: Data validation, Formal analysis, and Writing—review and editing. Ayni Yusuf Gedi: Literature review, Investigation, Formal analysis, and Writing—review and editing. Abdimalik Omar Mustaf: Methodology, Data validation, and Management.

Data Availability

The data used in this study were obtained from the Somalia Integrated Household Budget Survey (SIHBS 2022), conducted by the Somali National Bureau of Statistics, which is publicly available at <https://microdata.nbs.gov.so/index.php/catalog/59>. The cleaned and processed datasets that support the results can be provided by the corresponding author, Abdinasir Nur Dahir (abdnasirnurdahir@gmail.com), upon reasonable request.

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