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Does Inequality in Landownership Contribute To Inequality in Education Attainment? Empirical Evidence From Kenya

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Abstract

An inverse relationship is found across countries between unequal landownership and education attainment. Since Kenya exhibits inequalities in landownership and education attainment across and within counties, households and gender, is there any relationship between the observed inequalities? Using data from the Kenya Integrated Household Budget Survey and the Kenya Population and Housing Census, the study applies fractional IV and IV-Two Stage Least Squares (2SLS) regression methods to examine whether the Gini of landownership influences the Gini of education attainment across counties, and the determinants of education attainment in Kenya. The evidence generated does not support the strong relationship between landownership inequality and inequality in education previously documented. Government financing of free education, coupled with bursaries, muffle the relationship. Inequality in education attainment across counties is likely due to county disparities in household size, income, urbanization rate, and participation in high-level public employment. An increase in average per capita household expenditure, or urban population, also reduce the probability of inequality in primary as well as secondary education attainment in a county. Government financing of education and policies that promote urbanization, enhance quality of families, and increase high-level participation in government reduce any effect that landownership inequality could have on education attainment.

Keywords*: landownership, education attainment, inequality, county, household.*

JEL Classification*: I24; C21; C26; D13; Q15; R20.*

1. Introduction

In sub-Saharan Africa, empirical evidence shows that landownership is highly concentrated (Jayne et al., 2014; Burke & Jayne, 2014). Large farms of former colonial settlers stand out conspicuously in contrast to smallholder farms. Within the smallholder farms, there are also wide disparities in land sizes. In Kenya, land inequalities began in the 1950s when the British colonialists displaced people from fertile highlands, and either resettled them elsewhere or left them landless. The introduction of private landownership and registration laws in 1956 formalized the inequalities. Later-day land sales, illegal allocation of state and communal lands (land grabs) (Waiganjo and Ngugi 2001), population growth and subsequent subdivisions of land have aggravated landownership inequalities in Kenya. Group ranches in communal lands create landownership inequalities in otherwise

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egalitarian societies that occupy agriculturally low potential zones. Customary practices of bequeathing land to male children exacerbate the inequalities on gender lines, even though the Constitution enacted in 2010 gives equal rights to both gender in matters of inheritance.

Land reforms in Kenya have been half-hearted, and have neither eliminate landlessness nor reduce land inequality. In some cases, they have exacerbated inequalities. For instance, in the transfer of ownership of former European farms to Africans at independence, the government organized two types of settlement schemes: low-density schemes occupying 70,000ha for people with farming experience and capital; and high-density schemes occupying 430,000ha for the landless and unemployed (Republic of Kenya, 1964). This policy unequalised landownership by design. A few people came to own relatively big portions of land, while a large majority of the peasantry settled on small portions. Courtesy of the reforms, the high potential areas have been adjudicated and registered; while the marginal areas have largely been left to customary laws and practices. The overall effect of the reforms is a structure of landownership distribution characterized by wide inequalities as shown in Table 1.

Table 1: Percentage of Landowners of Different Sizes in Kenya by Province, 2003

Province	Landless 0.0ha.	0.01-0.99ha.	1.0-2.99ha.	3.0-4.99ha.	5+ ha.
Kenya	28.9	32.0	27.5	6.1	5.3
Nairobi	96.2	2.4	0.7	0.3	0.3
Central	12.6	52.7	17.3	1.8	0.9
Coast	49.4	17.6	22.5	7.6	2.8
Eastern	11.5	35.0	33.6	11.1	8.8
North Eastern	73.9	9.9	11.7	2.3	2.0
Nyanza	10.6	33.3	43.5	5.7	7.0
Rift Valley	26.8	30.1	27.1	7.8	8.1
Western	7.5	45.0	37.1	5.9	4.3

Source*:* Republic of Kenya, 2003.

In a study of farm sizes in Njoro area of the Nakuru County, in Kenya, Carter, Wiebe and Blarel (1994) captures the phenomenon of landownership inequality in Kenya when they observe that farms of 50 acres (20ha) and above comprise 1 percent of farm ownership, but take up almost 40 percent of the total agricultural area in Njoro. The farms occupy better quality land characterized by flatter terrain, and they are better served by infrastructure such as feeder roads, water and electricity. In contrast, smaller farms of poorer farmers occupy hilly areas with low-nutrient soils, and are in most cases thinly connected to main roads and water supplies.

A majority of smallholder farms in Kenya measure less than 1ha in high potential zones, and between 1–10ha in low potential zones. Medium-sized farms measure over 5ha in high potential zones, and over 10ha in low potential zones (Republic of

Kenya, 2003). Estates measure hundreds to thousands of hectares. Muyanga (2013) observes that, on average, medium-sized farms utilize only less than half of the land for agriculture. The rest of the land is idle.

In agrarian societies such as Kenya, land is a major resource for income generation, and its unequal ownership distribution could influence disparities in other fields, including education attainment. There are notable disparities in primary as well as secondary education attainment across regions, counties and households in Kenya; in spite of free primary education and subsidized secondary education. There is need to interrogate the association between unequal landownership and unequal education attainment. Table 2 shows the disparities in primary and secondary education attainment between and within regions; and between primary and secondary levels in Kenya for the 15–49 years age group.

Table 2: Percentage of Population in Kenya Aged 15-49 Years With Complete Primary, and Complete Secondary School Education by Province and County, 2014.

Region and its Counties	Completed Primary	Completed Secondary
Coast	**24.4**	**14.5**
Mombasa	29.1	24.75
Kwale	21.55	11.3
Kilifi	22.1	12.45
Tana River	19.35	8.85
Lamu	19.7	7.9
Taita Taveta	34.3	21.9
North Eastern	**9.0**	**6.4**
Garissa	11.7	7.85
Wajir	7.55	6.05
Mandera	7.75	5.4
Eastern	**25.3**	**13.3**
Marsabit	10.15	9.85
Isiolo	19.6	15.3
Meru	26.4	12.95
Tharaka-Nithi	23.2	12.4
Embu	28.3	12.95
Kitui	28.85	8.95
Machakos	34.25	20.4
Makueni	31.55	13.75
Central	**29.3**	**21.9**
Nyandarua	35.4	20
Nyeri	29.25	24.15
Kirinyaga	29.3	20.8
Murang'a	28.8	18.75
Kiambu	23.6	25.85

Rift Valley	**20.3**	**14.3**
Turkana	5.4	5.35
West Pokot	13.35	4.85
Samburu	10.35	8.95
Trans-Nzoia	23.6	12.7
Uasin Gishu	23.25	21.65
Elgeyo Marakwet	27.6	18.2
Nandi	25.1	15.75
Baringo	20.6	16.1
Laikipia	20.1	17.15
Nakuru	28.15	19.3
Narok	19.4	12.2
Kajiado	16.9	17.15
Kericho	23.55	16.25
Bomet	26.45	14.8
Western	**19.4**	**9.7**
Kakamega	17.15	10.2
Vihiga	25.5	8.55
Bungoma	18.35	10.9
Busia	16.5	9.2
Nyanza	**24.2**	**15.2**
Siaya	25.8	11.95
Kisumu	24.25	14.5
Homa Bay	27.6	10.45
Migori	24.15	9.8
Kisii	19.85	20.65
Nyamira	23.4	23.75
Nairobi	**20.55**	**28.5**
Kenya	**23.65**	**17.4**

Source: KNBS, 2014

According to the Kenya National Bureau of Statistics (KNBS) and the Society for International Development (SID) (2013), one-quarter of Kenya's population has no education. Slightly over half of the population has primary education only, and only 23% of the population has secondary education and above. In rural areas, one-third of the population has no education, and slightly over half have primary education only. Only four (4) out of every 25 people in rural areas have secondary education. About 38% of the people with secondary education and above live in urban areas.

From the Kenya National Population and Housing Census (KNBS, 2009), different counties have different populations of people with complete primary or secondary education. According to the Basic Report of KNBS (2005), the North Eastern Province has the lowest literacy levels, with only 28.2 per cent of population being able to read and write; but the region has the highest completion rate of Madrassa/Duksi education at over 77 per cent. The situation in other Muslim-dominated regions closely follows this pattern. This gives a negative correlation between county education attainment and completion of Madrassa. Nevertheless, low county or household education attainment could also be explained by other factors beyond religion.

In this study we analyse whether inequalities in landownership across counties explain disparities in education attainment across counties and households. This understanding will particularly be important in explaining the extent to which, if at all, land inequality explains the asymmetry in education attainment across counties; and help in designing policies to remedy the situation. The observation by the Society for International Development, (SID, 2010) that the nature of politics in Kenya could somehow be a cause of the many inequalities observed in society today lead us into also examining the role of employment of people from a county in high government offices on inequalities in education attainment. The issue is scantily given attention in literature.

2. Literature Review

Inequality in landownership reflects unequal opportunities and power relations. It suggests uneven playing field and variations in local institutions (Cinnirella & Hornung, 2011); and social relations not favourable to investments in, for instance, public goods such as education (Binswanger et al., 1995). It could also reflect distorted property markets, weak statutes and laws; or a combination thereof. Galor et al. (2009) theorize that landownership concentration is associated with less investment in education and lower attainment in education; and prevents the emergence of human-capital-promoting institutions. Deininger and Squire (1998) and Easterly (2007) find an inverse relationship across countries between land inequality and human capital formation, and income growth. However, the causal link between land inequality and human capital is not outright. The pathway from land inequality to inequality in education attainment and underdevelopment of human capital needs a deeper analysis. Again, much of the evidence gathered in support of this theory compares inter-country and regional development; hence it would be useful to investigate whether the theory also applies to intra-country comparative development.

In understanding the pathway from land inequality to inequality in education attainment, it would be good to first understand factors that determine the latter. According to UNESCO (2005), educational experience is shaped by factors that are school-based, child's family and community, and the social and cultural environment of the child. Sackey (2007) particularly identifies school infrastructure, parental education, household resources and religion, urban residency and age of the child to be significant determinants of schooling. Thus, education attainment is an outcome of social, political, cultural and economic contexts within which schooling takes place.

Educational attainment is a component of human capital stock acquired at school. The highest educational level achieved converted to years of schooling is an indicator of education attainment. The variable is influenced by three groups of factors: individual characteristics (e.g., gender, age and age rank among siblings); household characteristics (e.g., household size, household income, assets, parents' education, gender of the household head, parental gender preference in children's education and household composition); and community characteristics (e.g., school quality) (Sackey, 2007; Kabubo-Mariara & Mwabu, 2007). Parental education could be associated with

household resources (Kabubo-Mariara & Mwabu, 2007). Educated parents could also be expected to have positive attitudes towards education and human capital development of their children (Al-Samarrai & Reilly, 2000).

The extent to which rational educated parents sponsor schooling engagements of their children depends on family assets, number of resource claimants in the family, parents' social class, and attitude towards formal education (Al-Samarrai & Reilly, 2000). Large poor families derive lower utility from sending an additional child to school if some children are already enrolled (Gertler & Glewwe, 1990; Al-Samarrai & Peasgood, 1998). This might see some children not attending school. Other studies argue that, in a large household with many older sisters and adult women, the time required to attend to each child is shared out, and this increases the likelihood of enrolment (Al-Samarrai & Reilly, 2000). Deolalikar (1997) introduces a gender dimension to this argument when he posits that the presence of more adult females in a household raises the probability of boys' enrolment, but not for girls.

Community characteristics that bear on education attainment include the quality of schooling as measured by pupil- or student-teacher ratio, availability of text books, teacher skills and experience, library stock, classrooms, desk and blackboards, and distance to school (Glewwe & Jacoby, 1994; Case & Deaton, 1999). Sackey (2007), in a study of Ghana, finds that residing in urban areas as opposed to rural areas increases chances of children going to school and completing various school levels. Kabubo-Mariara and Mwabu (2007), using household survey data, find that only less than half of all the rural children that enrol in primary school in Kenya proceed to class eight. Of those who enter secondary school, again only less than half reach the final grade. The study also finds that the larger the number of children and working-age adults in a household, the higher is the competition for resources, and the lower is the probability of a child enrolling in school. In contrast, Gomes (1984) finds that children from a larger family in Kenya have a higher likelihood to complete grades. He reasons that parents in Kenya control the earnings of eldest children to the benefit of education of younger children. Bahr and Leigh (1978) find a weak association between family size and expected education or intelligence. Galor et al. (2009) observe that urbanization attracts migrant workers and residents with education.

According to the KNBS and SID (2013), the education level and gender of a household head influence the attainment of secondary education in a household. The report indicates that, in male-headed households in Kenya, the proportion of individuals with secondary education is higher than in female-headed households across all counties. In other cases, disparities are evident across regions, rural-urban areas, and per capita public expenditure in different levels of education. Against this background of determinants of education attainment at individual, household and regional level, and the situation of landownership inequalities in Kenya, section three endeavours to analyse whether there is a relationship between landownership inequalities and inequalities in education attainment across counties in Kenya. It goes further to try and answer the question whether education attainment in a household has any relationship with its land holding.

3. Model Specification

This section analyses whether inequalities in primary/secondary education attainment in a county relate to inequalities in the Gini of land ownership in that county. The data on the share of land holding by the minimal number of farms, and county population were sourced from the Kenya Integrated Household Budget Survey (KIHBS) 2005/06. From the data, we calculated landownership Gini coefficients for each of the 47 counties. The Gini coefficient is a measure of inequality, which we computed using equation 1 (World Bank, 2002).

$$\text{Gini} = 1 - \sum_{i=1}^{N}((x_i + x_{i-1})(y_i - y_{i-1})) \qquad (1)$$

where, x is a point on the x-axis (cumulated proportion of population in a county, starting with the smallest proportion in percent); and y is a point on the y-axis (cumulated proportion of population with a given land size from the smallest in percent).

The summed area represents twice the area under the Lorenz curve. Subtracting half this area from the maximum concentration area (=1/2) gives the concentration area. The Gini coefficient is the concentration area as a ratio of maximum concentration area, which works out to equation (1). The Gini coefficient is bounded between 0 and 1. In the study, large farms were defined as individual land holdings of 5ha and above in medium to high agricultural potential zones, and 10ha and above in low potential zones (see Jayne et al., 2003; William et al., 2014).

From the KIHBS (2005/06) dataset, we also calculated the Gini of education attainment (primary and secondary) in each of the counties in a similar manner. The x-axis showed the cumulated proportion of population in a county starting with the smallest proportion in percent, while y was the cumulated proportion of population with a given level of education (primary/secondary) from the lowest in percent. Further, the study used data from the Kenya Population and Housing Census, 2009 (KNBS, 2009) on education attainment and population at the county level, to calculate the proportion of people with a given level of complete education (primary and secondary). Following Galor et al. (2009), Cinnirella and Hornung (2011), and Faguet et al. (2016), the relationship between inequality in landownership (Gini coefficient) and inequality in education attainment (Gini coefficient of primary/ secondary education attainment) in 2006 was specified as:

$$\text{EduGini}_i = \beta_0 + \beta_1\text{landGini}_i + +\beta_2\text{lnpchhcexp}_i + \beta_3\text{Urban}_i + \beta_4\text{HHsize}_i + \beta_5\text{Muslim}_i + \beta_6\text{Pinf}_i + \beta_7\text{pcland}_i + \upsilon_i \qquad (2)$$

Where,

EduGini_i is the Gini of education attainment (primary/secondary) in county i,
landGini_i is Gini coefficient of landownership in county i,
lnpchhcexp_i is the log of mean per capita household consumption expenditure in county i,

Urban_i is the share of urban population in county i,
HHsize_i is the average household size in county i,
Muslim_i is the share (proportion) of Muslims in county i,
Pinf_i is county i's regional political influence,
pcland_i is per capita land holding in county i, and
υ_i is the error term
i = 1, 2…47 counties; j = 1, 2 for primary and secondary education attainment, respectively.

Equation 2 was estimated using fractional IV probit regression method. To control for potential endogeneity, the land Gini was instrumented with the average annual precipitation of a county. The data on precipitation was sourced from the Climate Data Organization (https://en.climate-data.org/africa/kenya-124/). Given that precipitation is randomly distributed in a county, areas with fertile land are likely to have higher farm income and acquire more land, worsening the distribution of land ownership. Rainfall is assumed to have no direct effect on the education Gini, but on the land Gini. Since the dependent variable is bounded between 0 and 1, a fractional logit or probit estimator—as proposed by Papke and Wooldridge (1996)—gives better estimates. According to Papke and Wooldridge (ibid.), when a dependent variable is bounded between 0 and 1, the effect of any particular explanatory variable cannot be constant over the entire range of the variable, unless the range is very limited. From the Stata.com guide, fractional regression fits response models where the dependent variable is greater than or equal to 0; and less than, or equal to, 1. The beta regression method is an alternative that fits response models when the dependent variable takes values between 0 and 1.

The study also examined whether the proportion of education attainment (primary/secondary) in a county in 2009 had any relationship with the Gini of landownership in a county in 2005/2006. Equation 3 tried to establish whether the relationship exists.

$$\text{Eduprop}_{ijt} = \beta_0 + \beta_1 \text{landGini}_{i,t-1} + \beta_2 \text{lnpchhcexp}_{i,t-1} + \beta_3 \text{Urban}_{i,t-1} + \beta_4 \text{HHsize}_{i,t-1} + \beta_5 \text{Muslim}_{i,t-1} + \beta_6 \text{Pinf}_{i,t-1} + \beta_7 \text{pcland}_{i,t-1} + \upsilon_2 \quad (3)$$

Where,

Eduprop_{ijt} is the proportion of people in county i who had attained a given level of education (j = 1 for primary, and j = 2 for secondary) in 2009. Other variables are as earlier defined for equation 2, and υ_2 is the error term. Equation 3 was estimated using the fractional IV probit regression method.

The study went further to examine whether education attainment in a household has any relationship with its land holding. The study used KIHBS 2005/06 data, and the instrumental variable Two Stage Least Squares (IV-2SLS) regression method to estimate equation 5. Household education stock was measured by the average years of education completed by household members. Without class repetition, complete pre-primary school in Kenya was equivalent to three years;

complete primary school 8 years; complete secondary school 12 years; complete college 14 years; complete bachelor's degree 18 years; complete master's degree 20 years; and complete doctorate 24 years. Any incomplete education level was represented by the mean years of that level.

Following Glewwe and Kremer (2006), the education production function could be specified as:

$$\text{Edu} = f(S, X, F, T) \qquad (4)$$

Where,

Edu is education attainment as measured by the average number of years of schooling in a household; S is a vector of school characteristics; X is a vector of learner's characteristics; F is a vector of household characteristics; and T is a vector of other inputs under the control of a household.

According to Glewwe and Kremer (2006), education attainment or the years of schooling vary with school characteristics, learner's characteristics, household characteristics, and the cost of schooling (P). Thus, the household education production function was specified as:

$$\text{hhedu}_i = g_0 + g_1\text{hhage} + g_2\text{hhagesq} + g_3\text{hhsex} + g_4\text{hhsize} + g_5\text{muslim} + g_6\text{lnpcexp} + g_7\text{adultfemale} + g_8\text{rural} + g_9\text{land} + g_{10}\text{credit} + \mu \qquad (5)$$

where, μ is the error term with the usual assumptions.

Table 3 provides definition, measurement and descriptive statistics of the variables used in estimating equations (2), (3) and (5).

4. Data and Sources

The data for this study is sourced from the Kenya Integrated Household Budget Survey (KIHBS 20052006), and the Kenya National Population Census 2009. Both datasets were generated by the Kenya National Bureau of Statistics (KNBS). While the KIHBS 20052006 provides data on the variables of interest at the household level, the Kenya National Population Census 2009 provides data on education attainment (primary and secondary) at the county or district level. The data on climate is from the Climate Data Organization (https://en.climate-data.org/ africa/ kenya-124/).

According to the KNBS (2005), the KIHBS 2005/06 data was collected over a 12-month period from 1,343 (861 rural and 482 urban) randomly selected clusters across all districts (now counties) in Kenya. To collect the data, the KNBS relied on the National Sample Survey and Evaluation Program (NASSEP IV) master sampling frame that the Bureau developed during the 1999 Population and Housing Census for obtaining nationally and sub-nationally representative household data. In this framework, a country is divided into a set of enumeration areas that are further sub-divided into clusters. A cluster is the primary sampling unit; and comprises of about 100 households.

Table 3: Variable Definition, Measurement and Descriptive Statistics

Variable	Definition and measurement	Obs.	Mean	Std Dev	Min	Max
Dependent variables						
$EduGini_1$	Gini of primary education attainment in a county	47	0.563	0.797	0.282	0.797
$EduGini_2$	Gini of secondary education attainment in a county	47	0.817	0.944	0.517	0.944
$Eduprop_1$	Proportion of people in a county with complete primary education	47	0.116	0.180	0.020	0.180
$Eduprop_2$	Proportion of people in a county with complete secondary education	47	0.083	0.222	0.014	0.222
$Hhedu_i$	Average number of education years completed by household members	7146	5.386	3.819	0	23
Independent variables						
hhage	Age of HH head in years	7146	45.803	36.729	12	99
hhagesq	Square of years of HH head	7146	34.468	433.595	1.44	9980.0
hhsex	=1 if HH head is female, =0 if otherwise	7146	0.660	0.474	0	1
hhsize	Household size in numbers	7146	4.258	2.524	1	28
Muslim	= 1 if HH is Muslim, =0 otherwise	7146	0.128	0.334	0	1
lnpchhcexp	Log of per capita HH consumption expenditure	7146	8.534	0.714	2.240	13.222
adultfemale	No. of adult females in HH	7146	1.093	0.711	0	6
Urban	=0 if rural, =1 if urban	7146	0.308	0.462	0	1
credit	=1 if HH head asked and got credit within the year, =0 if got no credit	7146	1.399	0.489	0	1
land	Owned family land size in acres	7146	0.763	4.119	0	201
landGini	Gini coefficient of landownership in a county	47	0.514	0.138	0.129	0.818
pcland	per capita land holding in a county	47	0.575	0.285	0.211	2.013
Precipit	Average precipitation in a county	47	1056.83	459.618	244	1971

Source: Author calculations are from KIHBS, 2005/06 and National Population Census, 2009 data.

There was a total of 1,800 clusters in this framework, which were selected with probability proportional to size. They were further stratified to reflect the unequal distribution of population across districts. From each cluster, and following a source list, 10 households were randomly selected with equal probability, resulting in a total sample size of 13,430 (8,610 rural and 4,820 urban) households. This sampling procedure produced an approximately self-weighted sample of households in each stratum, thus ensuring that the collected data give unbiased estimates and statistics. From the sampled households, and using face-to-face interviews guided by a questionnaire, the KIHBS collected information on household characteristics, education, agricultural holdings, land parcel sizes, and land ownership; among other household data. The data is in modules, and we selected and merged the relevant ones for use in this study. The analysis was done using STATA, version 14.

5. Estimation Results and Discussion

Table 4 presents the regression results of the influence of landownership Gini on the Gini of inequality in primary education attainment across counties in Kenya controlling for other covariates.

Table 4: Fractional IV Probit Regression Results of the Influence of Landownership Gini on the Gini Of Inequalities in Primary Education Attainment Across Counties in Kenya

Variable	Probit coefficients	Marginal effects, dy/dx
LandGini	-.2783(.4917)	-.1070(.1885)
Lnpchhcexp	-.2631*(.1492)	-.1011*(.0570)
Pcland	-.0671 (.0668)	-.0258 (.0257)
Urbanization	-.0042*(.0020)	-.0016*(.0007)
HHsize	.1826***(.0392)	.0702***(.0148)
Muslim	-.0011(.0013)	-.0004(.0004)
Political influence	-.0319(.0229)	-.0122 (.0088)
Constant	1.8123(1.411)	
First stage regression results		
Lnpchhcexp	.1153(.1734)	
Pcland	.0018(.0573)	
Urban	-.0036(.0025)	
HHsize	.0363(.0338)	
Muslim	.0028(.0017)	
Politicalinf	.0218(.0210)	
Preciptation	.0001(.0000)	
Constant	-1.1439(1.6448)	
No. of obs= 45	Wald Chi2(7)= 191.66	
Prob > Chi2 = 0.0000		
Log pseudolikelihood = 176.739		
Instrumented: land Gini		
Instruments: lnhhcexp, pcland, Urban, HHsize, Muslim, politicalinf, precipitation		
Wald test of exogeneity (/athrho = 0): chi2 = 0.05 Prob> chi2= 0.8320		

Notes: Quantities in (.)are robust standard errors of the probit coefficients, and standard errors of the marginal effects, respectively. ***1% significance level, **5% significance level, *10% significance level.

Source: Author's estimations using KIHBS 2005/06 data.

Table 4 shows that inequality in primary education is negatively associated with the land inequality Gini but the relationship is statistically insignificant. A percentage increase in household expenditure is associated with a 0.1011 decline in the primary education Gini, which falls by 1.1 ($e^{.1063}$). Improvements in household income status across counties would be expected to raise education standards and pursuits, thus reducing the Gini of inequalities in primary education attainment.

One percentage increase in urban population in counties was expected to reduce the probability of inequalities in primary education attainment across counties by 0.16%. Urbanization is associated with better infrastructural facilities with positive impacts on education provisioning. In addition, literature notes that urbanization brings into an area people with education. It is for this reason that progress towards urbanization in counties was expected to reduce the Gini of inequalities in primary education attainment among them.

A 1% increase in average household size in counties increased the Gini of inequalities in primary education attainment across counties by as much as 7%. In poor households, competition for common resources increases with household size. The competition is known to stifle the education of some household members based on sex and birth order. Since the trend is usually regional, inequalities in primary education attainment across counties were expected to rise with average household size.

Land concentration did not have any statistically significant effect on the probability of inequalities in primary education attainment across counties. Since primary education had become compulsory and free of tuition fee by 2003, land inequalities could not be expected to explain inequalities in primary education attainment across counties in 2005 because of government intervention that made primary education free.

Table 5 presents the fractional IV probit regression results of the influence of the landownership Gini on inequalities in secondary education attainment across counties in Kenya, controlling for other covariates.

Table 5: Fractional IV Probit Regression Results of the Influence of Landownership Gini on Gini for Inequality in Secondary Education Attainment Across Counties in Kenya

Variable	Probit coefficients	Marginal effects, dy/dx
LandGini	.1086(.4416)	.0295(.1200)
Lnpchhcexp	-.4361***(.1326)	-.1184***(.0357)
Pcland	.0399 (.0648)	.0108 (.0177)
Urbanization	-.0039*(.0020)	-.0010*(.0005)
HHsize	.1851**(.0372)	.0231**(.0101)
Muslim	-.0015(.0014)	-.0004(.0003)
Political influence	-.0626***(.0243)	-.0170** (.0067)
Constant	4.4073***(1.2185)	
First stage regression results		
Lnpchhcexp	.1531(.1734)	
Pcland	.0018(.0573)	
Urban	-.0036(.0025)	
HHsize	.0363(.0338)	
Muslim	.0028(.0017)	
Politicalinf	.0218(.0210)	
Precipitation	.0001**(.0000)	
Constant	-1.1439(1.6448)	
No. of obs= 45	Wald Chi2(7) = 191.66	
Prob > Chi2 = 0.0000		
Log pseudolikelihood = 176.739		
Instrumented: land Gini		
Instruments: lnhhcexp, pcland, Urban, HHsize, Muslim, politicalinf, precipitation		
Wald test of exogeneity (/athrho = 0): chi2 = 0.05 Prob> chi2= 0.8320		

Notes: Quantities in (.) are robust standard errors of the probit coefficients, and standard errors of marginal effects, respectively. ***1% significance level, **5% significance level, *10% significance level.

Source: Author's estimations using KIHBS 2005/06 data.

The main finding from Table 5 is that the land inequality Gini was positively correlated with the inequality Gini for secondary education, but the correlation was insignificant. According to the regression results in Table 3, inequalities in secondary school attainment across counties in Kenya were explained by average per capita household expenditure, urbanization, average household size and political influence in counties. An improvement in these variables reduced the probability of inequalities in secondary education attainment across the counties. A percentage increase in household expenditure was associated with a 0.1184 decline in the secondary education Gini, which fell by $1.6(e^{-.1184})$. Considering per capita household expenditure to be a proxy for household permanent income, if more households in a county could have experienced a rise in their permanent income, their ability to finance secondary education could have risen, and this could have brought down inequalities in secondary education attainment. The benefit could, however, be eroded by a big household size. In a big household, more people lay claim to its income. If the income is constrained, some of the claimants could miss out in their demands. This explains the outcome that growth in household size increased the probability of inequality in secondary education attainment across counties. A 1% increase in household size increased the probability of increasing the Gini of inequality in secondary education across counties by 2.3%.

Inequalities in secondary school attainment across counties in Kenya were most likely reduced by urbanization. As noted in the literature, urbanization brings into an area people with more education. Thus, a percentage increase in urban population brought down the probability of inequality in secondary education attainment across counties by 0.1%.

Increasing political influence across counties probably reduced inequality in secondary education attainment across the counties in Kenya. As noted elsewhere, increasing political influence attracted more resources into the counties to the benefit of learners. A percentage increase in the level of participation in high level governance reduced the probability of inequalities in secondary education attainment across counties by 1.7%. The devolution process that was ushered in 2010 in Kenya, where some government functions and funds were delegated to the counties, is an example of increasing county participation in high level governance. If the process was sustained, inequalities in education attainment across counties would likely reduce.

Inequalities in landownership as shown by the Gini did not have any statistically significant probability of affecting inequalities in secondary education attainment across counties in Kenya in 2005. Following the Free Primary Education (FPE) programme in 2003, the government rolled out a bursary programme to enable more students pursue secondary education. In the 2004/05 financial year, the budget allocation for secondary school bursary fund increased from US$11.5m in 2003/04 to US$13.8m (Republic of Kenya, 2006). The funds, together with other bursaries from non-governmental organizations, probably dampened the effect that land inequalities could have had on inequalities in secondary education attainment across

counties. In 2008, the government introduced 'affordable secondary education' programme, and this could have further dampened any effect that land inequality could have had on secondary education attainment. It is probably because of government financial support in education that the study findings did not confirm the existence of any relationship between land inequalities and inequalities in education attainment at either primary or secondary levels across counties in Kenya.

The theory by Galor et al. (2009), or the findings by Cinnirella and Hornung (2011), that landownership concentration is associated with inequality in education attainment did not appear to hold in an intra-county examination of the Kenyan context. The finding was, however, in agreement with the findings of Erickson and Vollrath (2004): that land inequality has no apparent relationship with inequalities in education attainment. Robustness check using beta regression did not give any better results.

The study also investigated whether the effects of inequalities in landownership across counties could have long-term effects even when short-term effects are not felt. To do this, the study examined whether the proportion of education attained in a county (primary/secondary) in 2009 had any relationship with the Gini of landownership in the county in 2006. Table 6 shows the estimation results for the primary education equation, and Table 5 for the secondary education equation.

Table 6: Fractional Logit Estimation Results of the Relationship Between the Proportion of Primary Education Attainment and the Gini of Landownership in a County

Variable	Logit coefficient	Marginal effect, dy/dx
LandGini	1.0443(.6156)	.1159*(.0661)
Pcland	.1538 (.0945)	.0170*(.0102)
Lnpchhcexp	.5081(.3766)	.0564(.0408)
Urbanization	.0043*(.0025)	.0004*(.0002)
HHsize	-.1654**(.0660)	-.0183**(.0073)
Muslim	-.0059*(.0030)	-.0006*(.0003)
Political influence	.0254(.0305)	.0028 (.0033)
Constant	-6.1174*(3.600)	
No. of obs= 45	Wald Chi2(7) = 66.39	
Prob > Chi2 = 0.0000	Log pseudolikelihood = -9026.8931 Pseudo R2=0.0148	

Notes: Quantities in (.) are robust standard errors for logit coefficients, and standard errors of marginal effects, respectively. ***1% significance level, **5% significance level, *10% significance level.

Source: Author's estimations using KIHBS 2005/06 and National Housing and Census 2009 data.

Table 6 shows a strong positive correlation between the land Gini and proportion of the population with primary education. According to the estimates in Table 6, the Gini of land inequality, per capita land holding, urbanization, household size and the dominant religion in a county most probably explain the proportions of primary education attainment across counties over time. For a percentage increase in the landownership Gini, the probability of improving the proportion of primary

education attainment in a county increased by 0.1159. The relationship could be more of an association than causal, and reflective of the rural-urban divide. While inequalities in landownership could be increasing, the proportion of people in a county with an education rises over time, thanks to government efforts in education financing as alluded to earlier. The same argument holds for per capita land holding.

Consistent with Al-Samarrai and Reilly (2000), urbanization increases the population of people with a given level of education. Thus, a percentage increase in urbanization is expected to increase the proportion of people with primary education in a county by .0004. Political influence pulls resources to a county, and a percentage increase in participation in high-level governance could be expected to increase the proportion of people in a county with primary education by .0028.

As found earlier, a growing household size is associated with a reduction in education attainment. A percentage increase in average household size is expected to reduce the proportion of people in a county with complete primary education by 0.0183. Likewise, a county with more Muslims is likely to have a lower attainment in education. One percentage increase in Muslim faithful is expected to reduce the proportion of people with complete primary education in a county by .0006. The possible reasons for this were offered earlier in the paper. Table 7 presents the estimates in relation to the proportion of secondary education attainment in a county in 2009.

Table 7: Fractional Logit Estimation Results of the Relationship Between the Proportion of Secondary Education Attainment and the Gini of Landownership in a County

Variable	Logit Coefficient	Marginal Effect, dy/dx
LandGini	.9207(.5923)	.0774(.0489)
Pcland	.0278 (.0877)	.0023(.0073)
Lnpchhcexp	.7491*(.4018)	.0630*(.0332)
Urbanization	.0105***(.0032)	.0008*** (0002)
HHsize	-.2521***(0797)	-.0212***(.0065)
Muslim	-.0047(.0032)	-.0003(.0002)
Political influence	.0988***(.0281)	.0083***(.0024)
Constant	-8.5470**(3.8190)	
No. of obs= 45	Wald Chi2(7) = 382.33	
Prob > Chi2 = 0.0000	Log pseudolikelihood = -7228.2912 Pseudo R2=0.0355	

Notes: Quantities in (.) are robust standard errors for logit coefficients, and standard errors of marginal effects, respectively. ***1% significance level, **5% significance level, *10% significance level.

Source: Author's estimations using KIHBS 2005/06 and National Housing and Census 2009 data.

From Table 7, the proportion of education attainment in a county was most probably explained by per capita household expenditure, urbanization, household size and political influence. The possible effect of these variables on education attainment has been explained at length in the paper. Inequalities in a land Gini do not appear to have any significant probability of influencing the proportion of

people with secondary education in a county. By 2009, the Affordable Secondary Education (ASE) had muted any effect that a land Gini would have had on secondary education attainment across counties in Kenya.

Lastly, the study sought to find out whether landownership has any relationship with education attainment in a household. This was achieved through instrumental variables Two-Stage Least Squares (IV-2SLS) estimation method of landholding on education attainment in a household. The results are shown in Table 8.

Table 8: IV-2SLS Regression Results of Landholding on Education Attainment in a Household in Kenya, 2006

Variable	Coefficient
Land	-1.1301(0.753)
Hhage	0.0061(0.006)
Hhagesq	-.0007 (0.0065)
Hhsex	1.154***(0.171)
Hhsize	-.3730***(0.040)
Muslim	-2.497*** (0.293)
Lnpchhcexp	1.781*** (0.153)
Adultfemale	0.817 ***(0.125)
Credit	-0.150 (0.424)
Rural	0.709***(0.187)
Constant	-8.963*** (2.354)
First stage results	
Hhage	.0026(0.004)
Hhagesq	-.0031 (0.004)
Hhsex	-.0828 (0.125)
Hhsize	-.0023 (0.031)
Muslim	-.3274*** (0.219)
Lnpchhcexp	-.1315 (0.098)
Adultfemale	-.0165 (0.098)
Credit	-.2888 (0.287)
Rural	-.1432(0.121)
Precipitation	-.0002*(1.088)
Constant	2.925 (1.088)
Wald chi2(10) = 936.11	Prob>chi2= 0.000
No. of observations= 7,146	Root MSE=5.891
Instrumented: Land	
Instruments: hhage, hhagesq, hhsex, hhsize, muslim, lnpcexp, adultfemale, credit, rural, precipitation	

Notes: Quantities in (.) are robust standard errors. ***1% significance level, **5% significance level, *10% significance level.

Source: Author's estimations using KNBS 2005/06 data.

From Table 8, per capita household expenditure, having a male household head, having more females in a household, and being in an urban area positively influenced the probability of education attainment in a household. It emerged that resource-rich households are not necessarily the most educated in Kenya. Probably

this is because of what Nkedianye et al. (2020) has observed: that household heads are more educated closer to urban centres where land sizes are small. Their paper also observes that more children enrol for schools closer to urban centres than further away, where landholdings are bigger.

A big household size and adherence to Muslim faith negatively influenced the probability of education attainment in a household. In 2014, the Muslim-dominated regions of North Eastern and Coast led in the proportion of people without an education in Kenya. According to the 2014 Demographic Health Survey (DHS), 69 percent of women and 49.2 percent of men in North Eastern region had never been to school (DHS 2014). At the Coast region, 15.9 percent of the male household population aged six and above had never been to school by 2014 (DHS, 2014). The two regions had the highest number of people who had never been to school. Muslim households were known to pursue religious teachings called Madrassa/ Duksi, sometimes at the expense of formal education. Additionally, a sizeable proportion of Muslims are in pastoral areas where livelihood activities and scant infrastructure undermine schooling. In a study of Tanzania, Al-Samarrai and Peasgood (1998) also note that household characteristics affect education attainment.

Land holding does not have any statistically significant influence on the probability of attaining education in a household. The findings give weight to the suggestion that inequalities in education attainment across counties could be expected to be explained by per capita household expenditure, urbanization, household size and whether a household is Muslim. The effect of inequalities in landownership is muted by government financing of education.

6. Conclusion and Policy Implications

The study examined whether inequalities in landownership were associated with inequalities in education attainment at primary and secondary school levels. Using data from the KIHBS 2005/06 and the National Population and Housing census 2009, and fractional IV probit regression models, the study failed to find any significant relationship between landownership inequality and inequality in education attainment across counties in Kenya. Inequalities in primary, as well as secondary, education attainment across counties are correlated with household size, average per capita household expenditure, urbanization, participation in high-level government (political influence) and the dominant faith. The influence of average household size and Muslim faith was probably to increase inequalities in education attainment across counties. Public policies that ensure quality over quantity of a family could have important bearings on reducing inequalities in education attainment. An affirmative action on Muslim education attainment could be necessary so that they, too, can increase their education attainment. Inequalities in education attainment were expected to reduce with improvements in urbanization, average household income and political influence in counties. The results suggest that public policies that promote shared growth and urbanization, as well as political power balancing, could have important bearings on the reduction of inequalities in education attainment across counties.

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