Land Ownership Inequality and Inequality in Education Attainment in Kenya

John Kamau Gathiaka

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By

John Kamau Gathiaka
School of Economics, University of Nairobi

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List of abbreviations and acronyms

ASE	Affordable Secondary Education
EWC	Electricity, Water and Conservancy
FPE	Free Primary Education
FSE	Free Secondary Education
ICT	Information Communications and Technology
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
NASSEP	National Sample Survey and Evaluation Programme
NEPAD	New Partnership for Africa's Development
OLS	Ordinary Least Squares
RMI	Repair, Maintenance and Improvement
SID	Society for International Development – East Africa
UNESCO	United Nations Education Scientific and Cultural Organization

Abstract

Unequal asset ownership accompanies other socioeconomic inequalities so that the disparity in physical possessions, particularly land, is worth a rigorous analysis. The case in point is the inverse relationship that has been reported across countries between unequal landownership and education attainment. In Kenya, inequalities in landownership vary across and within counties, households included. Using data from the Kenya Integrated Household Budget Survey and the Kenya Population and Housing Census, the study applies a fractional IV probit regression model to examine the relationship between the Gini of land ownership and education inequality across counties in Kenya. The evidence generated does not confirm the strong relationship between land inequality and inequality in education previously documented in other countries.

Inequality in primary education attainment across counties is likely due to county disparities in household size, income, urbanization rate, and participation in high level public employment, rather than to a landownership disparity. A 1% increase in county average per capita household expenditure reduces the Gini of inequality in primary education attainment by 0.1011. A one percentage increase in urban population reduces the inequality in primary education attainment by 0.16%. A similar pattern is generally uncovered for secondary education. Land inequality does not influence inequalities in education attainment. Government financing of education through bursaries and free education muffle any such influence. The findings suggest that government financing of education and policies that promote urbanization, enhance quality of families and increase high level participation in government affairs lower inequalities in schooling. Further, an affirmative action on education for Muslims is required to reduce inequalities in schooling.

Key words: Land ownership; Education attainment; Inequality; Kenya.

JEL classification: I24; C21; C26; D13; Q15; R20.

1. Introduction

Empirical evidence shows that land ownership across sub-Saharan Africa is highly concentrated (Jayne et al, 2014; Burke and Jayne, 2014). The large farms of the former colonial settlers especially stand out conspicuously in contrast to smallholder farms in Kenya. Within the smallholder farms there are also wide disparities in land sizes. Burke and Jayne (2014) note that the land ownership Gini within African smallholder farms compares favourably with Gini coefficients for Latin America. Inequitable asset ownership gives rise to disparities in income growth which could slow down overall growth and poverty reduction. Income disparities create disparities in other areas such as education attainment.

In rural areas, land size is an important consideration in income generation. Rapsomanikis (2015) estimates that about two-thirds of the developing world's three billion rural population live in about 475 million small farm households drawing livelihoods from working on land plots smaller than two hectares. In Africa, smallholder farms account for 80% of all farms and support 33 million households (NEPAD, 2013). The farms measure less than two hectares each and account for about 75% of total agricultural production and employment (Salami et al, 2010). Smallholder farms in drier areas may extend beyond two hectares, but NEPAD (2013) estimates that not more than 3% of farms in the continent measure 10 hectares and above.

Self-employment in plots of less than two hectares using traditional methods may not provide financial returns capable of supporting decent livelihood. Since income is an input in education production function, low incomes associated with working on small plots may be a limitation to education attainment in rural areas. Additionally, poor rural areas are often neglected in terms of roads, access to piped water and electricity. These constraints further undermine education attainment in rural areas.

Land inequality is an ethical as well as a policy issue. In ethical terms, the way land and other assets are shared in a society is a reflection of fairness or otherwise in societal institutions and culture. If a section of the society is systematically favoured and holds big land sizes while the rest of the society holds only small land sizes, this land unfairness may spill over to other sectors of the economy.

The remainder of the paper is organized as follows: The rest of Section 1 briefly examines land ownership inequalities as well as inequalities in education attainment across Kenyan regions, gives a preview of education financing, the research problem and the objectives of the study. Section 2 presents a review of relevant literature, while Section 3 shows the methodology followed in the study and the sources of the data used. Section 4 presents and discusses the estimation results, while Section 5 summarizes the paper and offers policy direction.

Regional land ownership distribution

Nearly one-third of the Kenyan households (28.9%) are landless (Republic of Kenya, 2004). Rural landlessness is highest in North Eastern region which houses the counties of Garissa, Wajir and Mandera. The counties are semi-arid with low population density of less than 30 persons per square kilometre. Communal land tenure is dominant in these regions. Rural landlessness is also high at the Coast and Rift Valley, where communal land tenure is also prevalent. In communal lands, population distribution is sparse except in towns. Households in communal land systems feel landless despite land abundance. The paradox is explained by the absence of individual land titles. In contrast, landlessness in the densely populated regions, e.g., the Central region, is only 12.6%, where most households have a title deed. Table 1 shows land ownership distribution within and across regions in Kenya.

Table 1: Land ownership distribution within and across regions in Kenya (%)

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

Source: Republic of Kenya, 2003.

Land inequalities began in Kenya in the 1950s when the British colonialists displaced people from Kenya's fertile highlands and either resettled them elsewhere or left them landless. Introduction of private land ownership and registration laws in 1956 entrenched the inequalities. Later day land sales, illegal allocations of state and communal lands (land grabs) (Waiganjo and Ngugi, 2001), population growth and subsequent subdivisions of land have aggravated land inequality in Kenya. Group ranches create land inequality in low potential zones. Customary practices of bequeathing land to male children further exacerbate inequalities on gender lines. The Constitution enacted in 2010 gives equal rights to both gender on inheritance.

The land reforms instituted in Kenya before and after independence in 1963 to address landlessness and land inequalities include the following:

- Adjudication and registration of land outside the former 'white highlands'.
- Subsidized sale of some of the former 'white highlands' to natives.
- Transfer of some publicly held land to the landless.

The reforms have been half-hearted and have neither eliminated landlessness nor reduced land inequality. In some cases, the reforms have perpetuated inequalities deliberately. For example, in the transfer of ownership of former European farms to Africans at independence, the government organized two types of settlement schemes, namely, low-density schemes occupying 70,000 hectares for people with farming experience and capital, and high density schemes occupying 430,000 hectares for the landless and unemployed (Republic of Kenya, 1964). This policy made land ownership unequal 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 law. People accommodated by others under customary arrangements lost their right to land once the hosts got title deeds. The overall effect of the reforms is a structure of land distribution characterized by wide inequalities.

Carter et al (1994), in a study of farm sizes in Njoro area of Nakuru County in Kenya, captures the phenomenon of land inequality in Kenya when they observe that farms of 50 acres (20 hectares) and above comprise 1% of farm ownership but take up almost 40% 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 poor soils, and are in most cases poorly connected to roads and water supplies.

A majority of the smallholder farms measure less than one hectare in the high potential zones, and 1-10 hectares in low potential zones. Medium-sized farms measure over five hectares in high potential zones, and over 10 hectares in low potential zones (Republic of Kenya, 2003). Big farms or estates measure hundreds and thousands of hectares. Muyanga (2013) observes that medium-sized farms utilize, on average, only less than half of the land for agriculture. The rest of the land is idle.

Inequality in land ownership suggests inequalities in other areas. In this study we analyse whether inequalities in land ownership across individuals and counties explain disparities in education attainment across households and counties. In an attempt to gain a better understanding of the issue, we examine the state of inequality in education attainment at primary and secondary levels across regions in Kenya.

Inequalities in primary and secondary education attainment across regions in Kenya

According to KNBS and SID (2013), one-quarter of Kenya's population has no education. Slightly over half 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 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.

The regions with the highest percentage of population with some primary school education are Western (61%), Nyanza (60%) and Central (57%). Eastern (53%), Coast (50%) and Rift Valley (49%) follow in that order. The counties with the highest proportion of the population with complete primary education are Nyandarua (18%), Nyeri (17.4%), Kirinyaga (16.7%), Murang'a (16.4%) and Taita Taveta (16.7%). The counties with the least proportion of individuals with complete primary education are Turkana (1.2%), Wajir (2.2%), Mandera (2.9%) and Garissa (3.1%). At the secondary education level, counties with the highest proportion of population with complete secondary education are Nairobi (22.2%), Kiambu (17.7%), Mombasa (17.6%) and Nyeri (16%). Counties with the least proportion of population with complete secondary education are in pastoral communities of Turkana (1.4%), Wajir and Mandera (1.5% each), Garissa (2.2%), West Pokot (2.3%), Marsabit (2.4%) and Samburu (2.6%). (see Table A2 in the Appendix).

North Eastern region has the lowest attainment of primary school education (22%), and the highest population of people without an education (73%). The counties with the highest proportion of the population with no education are Turkana (82.1%), Wajir (76.4%) and Garissa (74.4%) (KNBS and SID, 2013).

The Central region has the highest population of people with secondary education (30%) followed by Nyanza (22%) and Western (19%). Eastern and Rift Valley regions tie in secondary school attainment at 18% closely followed by the Coast at 17%. North Eastern region trails in secondary school attainment with only 5% of the population having secondary level of education (KNBS and SID, 2013).

According to UNESCO (2005), educational experience is shaped by factors that are school based, child's family, as well as community, social and cultural environment of the child. Thus, education attainment is an outcome of social, political, cultural and economic context within which schooling takes place. In the following subsection, we examine education financing in Kenya with a view to understand the economic and political context within which schooling takes place in the country.

Education financing

The burden of financing education in Kenya has over time oscillated between government and parents. Immediately after independence in 1963, the burden of providing primary education was with the government (Otieno and Colclough, undated). In 1988, government financing of education took an about-turn following World Bank's recommendations of user fees in the social sector, including education (World Bank, 1988). From 1988, the burden of tuition, activity and examination fees, as well as provision of textbooks, was transferred to parents. In addition, parents met uniform, transport and boarding costs.

In 2003, the government, once again, took much of the burden of primary school

education financing (Republic of Kenya, 1988, 2004, 2006). Ideally, parents could only meet the cost of uniform, transport and lunch, but schools charge additional levies to date.

At the secondary school level, parents bore the financial burden of providing education until 2008. By 2005/2006, tuition fee in day secondary schools was Ksh 10,265 per year (Otieno and Colclough, undated). Schools also charged extra money for insurance, medical, ICT, electricity, water and conservancy (EWC), sporting activities, administration, repair, maintenance and improvement (RMI), local travels and trips, complementary learning materials, motivation, caution, identity card and personal emoluments. Boarding schools charged extra for the service. The cost of secondary education was almost out of reach for children from poor households by 2008. In 2008, the government introduced substantial subsidies under the "affordable secondary education" (ASE) programme, and in 2017 tuition and development fees were abolished under the "free secondary education" (FSE) programme (Otieno and Colclough, undated). The interest in this study is the period before FSE.

Another relevant parameter in education financing in Kenya is political influence. Until 2010, when a new constitution ushered major changes in the country's governance structure, pro-government regions received preferential allocation of state resources in form of school infrastructure, teachers and learning materials. This was most pronounced during the "Nyayo" era of 1978-2002. Political influence could be proxied by the extent of high-level participation in governance by personalities from a region. Of special importance in this regard is the Office of President, Prime Minister, Vice President and Minister for Education. Table 2 shows the situation over the period 1963-2006.

Table 2: Regional participation in high level governance and the associated political influence, 1963-2006

Region	President	Vice president	Prime minister	Education minister	Participants in top governance	Intensity of participation (%)	Implied political influence[1]
Nairobi (1)							
Central (2)	2	2	1	3	8	36.3	Very high (4)
Coast (3)						0	Low (1)
Eastern (4)				1	1	4.6	Low (1)
North Eastern (5)						0	Low (1)
Nyanza (6)		1		2	3	13.6	Moderate (2)
Rift Valley (7)	1	3		2	6	27.3	High (3)
Western (8)		3		1	4	18.2	Moderate (2)
Total	**3**	**9**	**1**	**9**	**22**	**100**	

Source: Compiled from https://en.wikipedia.org>wiki and www.education.go.ke

Research problem

Inequality in land ownership reflects differences in opportunities. Galor et al (2009) theorize that land ownership concentration is associated with less investment in education, 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.

Much of the evidence gathered in support of this theory is used to compare inter-county and regional development. It would be useful to investigate whether the theory also applies to intra-country comparative development, especially in a country with unequal land ownership as Kenya. Do inequalities in land ownership matter in education attainment? In answering this question, it is also important to check whether inequalities in land ownership have any relationship with inequalities in education attainment at the distribution, and county attainment level. This understanding would particularly be important in explaining the extent to which, if at all, land inequality explains the asymmetry in education attainment across counties and in designing policies to remedy the situation.

Research objectives

The general objective of the study is to examine whether inequalities in land ownership explain regional inequalities in education attainment in Kenya. Specifically, the study seeks to answer whether inequalities in land ownership matter in education attainment, particularly at primary and secondary levels which are critical in human capital formation. To answer the question, the study examines whether the Gini of land ownership has any relationship with the Gini of education attainment in a county. This aspect examines whether the distribution of the two inequalities are related. The study also examines whether the Gini of land ownership has any relationship with the proportion of education attainment (primary and secondary) in counties. Lastly, we investigate the basic question of whether land ownership matters in education attainment of a household.

2. Literature review

Theoretical literature on education attainment

Educational attainment is a proxy of the component of human capital stock acquired at school. The highest educational level achieved converted to years of schooling is used as an indicator of education attainment. Unfortunately, any two people with the same level of education are unlikely to demonstrate equal competence. Equally, pupils and students in the same grade but different schools will most probably not demonstrate equal competence (Simkins, undated). Alternative measures of human capital such as international test scores and estimates of labour market outcomes have their weaknesses too.

Basic to higher education attainment have implications on future financial earnings of an individual. The differences in access and quality of education explain to a large part the differences in income between individuals (Autor, 2014; Checchi, 2008). At a wider level, the human capital in an educated population is an important factor of production. An educated population is associated with a higher standard of living. Thus, education attainment serves both personal and societal functions of economic growth.

Education attainment 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 and Mwabu, 2007). Parental education reflects household resources (Kabubo-Mariara and Mwabu, 2007) and the positive attitude of educated parents towards human capital development in their children (Al-Samarrai and Reilly, 2000).

The extent to which rational educated parents sponsor schooling engagements of their children depends on family assets, number of claimants in the family, parents' social class and attitude towards formal education (Al-Samarrai and Reilly, 2000). Since family assets may rise with level of parental education, higher educated parents may have more resources to invest in their children controlling for family size. From this perspective, the human capital of parents, as measured by the number of schooling years or highest level of education attained, influence the human capital of their children. Lillard and Willis (1994) and Haveman and Wolfe (1995) argue that this effect represents intergenerational transmission of human capital, social and economic well-being within families.

In making human capital investment decisions for their children, parents weigh the utility of taking a child to school versus the utility of keeping the child at home. If the expected utility from taking a child to school (prestige or satisfaction of having an educated family) exceeds the utility of keeping the child at home (e.g., earnings from child labour or income not spent on education), parents sponsor their children's education. If the converse holds, they keep the children at home (Gertler and Glewwe, 1990; Kabubo-Mariara and Mwabu, 2007). The number of years of schooling or highest grade attained by a child is in this case a good that yields utility to a household.

In a household with income constraints, a child's schooling has an opportunity cost of reduced consumption of other goods and services (Gertler and Glewwe, 1990). One additional year of schooling while compounding a child's human capital also reduces household consumption of other goods and services. Thus, schooling investments entail a trade-off between consumption of other goods and services and build-up of human capital.

The opportunity cost of investing in the education of a child is changed by the presence of another child in a household with income constraints. Butcher and Case (1994) argue that parents who intend to maximize the sum of their children's future incomes but are limited in their ability to borrow will invest more in children with the highest perceived marginal return to education. Thus, brighter children will receive the most education in a family; and in situations where parents place a higher premium on the education of males, they will receive more education than females. To this extent, credit constraints and sibling composition determine educational attainment in a family.

Large poor families derive lower utility from sending an additional child to school if some are already enrolled (Gertler and Glewwe, 1990; Al-Samarrai and 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 and Reilly, 2000). Deolalikar (1997) introduces a gender dimension to this argument when he posits that the presence of more adult females in a household raise the probability of boys' enrolment but not for girls.

Community characteristics that bear on education attainment include 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 and Jacoby, 1994; Case and Deaton, 1999). Urbanization had been noted in Galor et al (2009) to attract migrant workers and residents with education.

Empirical literature on education attainment

From an empirical study of Costa Rica, Arias et al (2016) find that people with greater levels of education escape poverty irrespective of their area of residence — rural, urban or planning region. Using propensity score-matching, they show that people who finish secondary education reduce poor shelter by between 8.0% and 33.0%, reduce low levels of knowledge by between 26.0% and 44.0%, and reduce poor consumption by between 12.0% and 30.0%. Completing secondary education in urban areas would have a significant impact on reducing poverty of shelter by about 36.0%, poverty of access to knowledge by 48.0%, and in access to other goods and services (consumption capacity) by 22.0%. Completing secondary education in rural areas would reduce poverty of shelter by 18.0%, poverty related to access to knowledge by 30.0%, and poverty in consumption capacity by 32.0%.

Kabubo-Mariara and Mwabu (2007), in a study of education attainment in Kenya, 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 negligible association between family size and expected education or intelligence.

The positive effect of parents' education and income levels correlates more with their daughters' education. Sackey (2007) in an examination of the determinants of school attendance and attainment in Ghana using micro-level data from the Ghana Living Standards Surveys, shows that even though parental education and household resources significantly determine schooling, the impact is differentiated between children of different genders. Household resources impact more on girls' school attendance than on boys. Interestingly, the impact is on the decline together with the impact of a father's education on the education of female children and the effect of mothers' education on boys' school attendance. Mothers' and fathers' education affect children of different gender differently and the effect is generally on the decline over time. Other determinants of education attainment from this study are school infrastructure, religion and urban residency.

Lam and Duryea (1999), in an examination of the effect of parental education on schooling and investments in children in Brazil, find that parental education influences their choice of quantity and quality of schooling for their children. Wherever the quality is uniform across children, there is trade-off between chosen education quality and quantity of education received by each child. The trade-off is more important in income-constrained households.

Regional imbalances mostly disadvantage female pupils and rural areas. Francis et al (1998) find that shortage of classrooms and qualified teachers in some areas of Nigeria negatively affects school attendance and grade attainment. In addition, during

high peak farming seasons and on market days, some female pupils miss school to help in farm and market activities. This partly explains the differences in education attainment between rural and urban areas in Nigeria. Sackey (2007), in a study of Ghana, concurs when he finds that residing in urban areas as opposed to rural areas increases chances of children going to school and completing various school levels.

Rural areas are relatively poorer, and rural children have a lower likelihood of attending school, or attaining high levels of education. Kabubo-Mariara and Mwabu (2007), using household survey data, find that only less than half of all the rural children that enrol in primary schools in Kenya proceed to class eight. Of those who enter secondary schools, again only less than half reach final grade. Rural areas in Kenya are also found to perform poorer in national examinations.

According to KNBS and SID (2013), the education level and gender of the household head influence 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.

Land ownership concentration and inequalities in education attainment

Inequalities in education attainment could be linked to land ownership concentration via credit. Land is suitable collateral for credit because of its immobility. However, family-owned plots under communal land tenure system can only be used for pledging in informal credit markets and not as collateral in formal credit markets. Owners of unencumbered land could be assumed to access credit easily. Since credit size varies with the value of the collateral, owners of small land sizes are constrained in the amounts of credit that they can borrow. Small credits attract relatively higher transaction costs in formal credit markets (Binswanger et al, 1995). In addition, commercial banks avoid lending to small rural borrowers using land collateral. In the event of default, it is difficult to sell rural land particularly where the land has dwellings. Credit helps to smooth consumption during low seasons (Deaton, 1991). If credit is sought to pay school fees, in its absence children remain out of school. To this extent, small landowners have lower prospect of keeping their children in school during low seasons.

Land size is important in productive engagements in rural areas. Self-employment in plots of less than two hectares using traditional methods may not provide adequate support to a decent livelihood. Rapsomanikis (2015) observes that the incomes that many smallholder farmers derive from crop and livestock production is often not enough to cover the basic needs of a family. Many of them engage in multiple informal economic activities besides farming to supplement their small farm incomes, or turn to the unskilled labour market where they supply their labour for low returns. Since income is an input in education production function, low incomes associated with working on small plots may be a limitation to education attainment in smallholder

households. Additionally, poor rural households are often neglected in terms of roads, access to piped water and electricity. These constraints further undermine education attainment in these households.

According to Srinivasan (1972), imperfections in a single market would not be sufficient to introduce a systematic relationship between farm size and say, productivity per unit of land. If credit is rationed according to farm size, but all other markets are perfect, market transactions in the different markets produce a farm structure that equalizes yields across farms of different sizes. But if there are imperfections in two markets, e.g., land rental and labour markets, or credit and labour markets, a systematic relationship can arise between farm sizes and say productivity. Where there is a binding constraint in the credit market, e.g., supply of working capital varying with the amount of land owned, the optimal size of the operated land will vary systematically with size of the owned holding, even if other markets are perfect. Such imperfections can create a systemic relationship between farm size and productivity.

Deininger and Squire (1998) and Easterly (2007) find an inverse relationship across countries between land inequality across landowners and human capital formation and growth. Land ownership concentration captures variations in local institutions (Cinnirella and Hornung, 2011) and social relations (Binswanger et al, 1995) not favourable to investments in public goods such as education. Galor et al (2009) theorize that land ownership concentration is associated with less investment in education, lower attainment in education, and prevents the emergence of human capital promoting institutions.

Erickson and Vollrath (2004) investigate whether there is a relationship between land inequality and public provision of education. They use average number of people working on any single holding to measure the spread of agricultural population per holding. They also examine the relationship using the measure of landholdings within landholders as measured by the Gini coefficient. Their regressions results show that lower land inequality across agricultural populations is associated with greater public provision of education, but land inequality within landholders has no relationship with public provision of education. The results hold when primary or secondary enrolment rates are the dependent variables.

Empirical literature on land ownership concentration and inequalities in education attainment

Cinnirella and Hornung (2011) find past land ownership concentration in Prussia to have negatively affected education attainment. To establish whether the effect is causal, they adopt an instrumental variables approach using soil characteristics at the county level to identify exogenous variation in farm size. They also control for land productivity under different crops to ensure the exclusion restriction is not violated. Soil quality correlates negatively with farm size and its effect on education is through farm size. The estimates suggest that the negative effect of land concentration on

education is indeed causal. Within county variation in land ownership, concentration is found to negatively affect changes in enrolment rates. Ramcharan (2010) study on the relationship between land inequality (measured by the Gini coefficient) and education expenditure using census data at the county level in the U.S. for the period 1890-1930 find that greater inequality is strongly associated with less redistribution and expenditure in education.

In India, districts historically dominated by landlords have been observed to record lower agricultural productivity as well as schooling scores compared to districts dominated by small-scale farmers with egalitarian land distribution (Banerjee and Iyer, 2005).

3. Methodology

The inequality measure

The paper uses the Gini coefficient as a measure of inequality, which we compute using Equation 1 (World Bank, 2002).

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

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

On education attainment, assume that parents make decisions regarding the educational attainment of their children and that parental utility is derived from consumption of goods purchased from the market (X), and home-produced or non-market goods (Z). The educational outcome of a child may be regarded as a non-market home-produced good.

The literature on educational attainment and individual's decision on how much education to obtain mainly uses three strands of approaches for analysis as categorized in Wilson (2001). The first is the human capital model that relies on the utility maximization theory. According to the model, individuals choose how much education to acquire and thereby build their human capital in response to the expected returns to education. From this perspective, education is an investment good and individuals choose incremental levels of education to acquire that are consistent with the economic or financial returns associated with those levels. An individual's background characteristics and circumstances affect both the schooling and the returns to education. Background characteristics, for example, determine expenditures on schooling, and this in turn influence schooling aspects and returns.

The second approach is the education production function that models education attainment as a product of school inputs, family background and environmental characteristics. From this approach, educational attainment is the outcome of inputs and production technology, and not so much a choice of the individual. This approach has wide appeal in empirical work.

The third approach is the estimation of a reduced-form demand equation of educational attainment without attempting to explain the mechanism through which the independent variables affect educational attainment. The approach is widely used in empirical studies that examine the relationship between family and neighbourhood characteristics on education attainment of a child.

Empirical specification

The study analysed whether inequalities in primary/secondary education attainment in a county were related to inequalities in the Gini of land ownership across counties in Kenya. The data on share of landholding by the minimal number of farms that hold 5%, 10%, 20%, 40%, 80% and 100% of the land, and county population was sourced from KIHBS 2005/06. The data helped to calculate land ownership Gini coefficients for each of the 47 counties. 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 (Jayne et al, 2003; William et al, 2014). From this data set, we also calculated the Gini of education attainment (primary and secondary) in the counties.

The study also used data 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). The data was sourced from the Kenya Population and Housing Census, 2009 (KNBS, 2009).

Following Galor et al (2009), Cinnirella and Hornung (2011) and Faguet et al (2016), the relationship between inequality in land ownership (Gini coefficient) and inequality in education attainment (Gini coefficient of primary/secondary education attainment) in 2005/2006 was specified as:

$$EduGini_{ij}=\beta_0+\beta_1 landGini_{i,}+\beta_2 lnpchhcexp_{i,}+\beta_3 Urban_{i,}+\beta_4 HHsize_{i,}+\beta_5 Muslim_{i,}+\beta_6 Pinf_{i,}+\beta_7 pcland_{i,}+\upsilon i \quad (2)$$

Where, $EduGini_{ii}$ is the Gini of education attainment (primary/secondary) in county *i,*

$landGini_i$ is Gini coefficient of land ownership 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 share of Muslims in county *i*,

$Pinf_i$ is county *i*'s regional political influence,

$pcland_i$ is per capita landholding in county *i*, and

υ_1 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. 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 education Gini, but on 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. The authors posit that when the 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. The predicted values from an OLS regression, for example, cannot be guaranteed to lie in the interval [0, 1]. From 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 land ownership in a county in 2006. Equation 3 tried to establish whether the relationship exists as follows:

$$Eduprop_{ijt}=\beta_0+\beta_1 landGini_{i,t-1}+\beta_2 lnpchhcexp_{i,t-1}+\beta_3 Urban_{i,t-1}+\beta_4 HHsize_{i,t-1}+\beta_5 Muslim_{i,t-1}+\beta_6 Pinf_{i,t-1}+\beta_7 pcland_{i,t-1}\,\upsilon_2 \quad (3)$$

Where, $Eduprop_{it}$ is the proportion of people in county *i* with 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 v_2 is the error term. Equation 3 was estimated using fractional IV probit regression method.

The study went further to examine whether education attainment in a household had any relationship with its land holding The study used KIHBS 2005/06 data and 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 eight 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:

$$Edu= f (S, X, F, T) \quad (4)$$

Where, Edu is education attainment 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 could be specified as:

$$hedu_i = g_0 + g_1 hhage + g_2 hhagesq + g3 hhsex + g_4 hhsize + g_5 muslim + g_6 lnpcexp + g_7 adultfemale + g_8 rural + g_9 land + g_{10} credit + \mu \quad (5)$$

Where, μ is the error term with usual assumptions. Table 3 provides definition, measurement and descriptive statistics of the variables used in estimating (2), (3) and (5).

Table 3: Variable definition, measurement and descriptive statistics

Variable	*Measurement*	*Obs.*	*Mean*	*Std Dev*	*Min*	*Max*
Dependent variables						
$EduGini_1$	Gini of primary education attainment in a county	47	0.5631	0.7974	0.2820	0.7974
$EduGini_2$	Gini of secondary education attainment in a county	47	0.8173	0.9438	0.5174	0.9438
$Eduprop_1$	Proportion of people in a county with complete primary education	47	0.1164	0.1799	0.0199	0.1799
$Eduprop_2$	Proportion of people in a county with complete secondary education	47	0.0829	0.2216	0.0135	0.2216
$Hhedu_i$	Average number of education years completed by household members	7146	5.3862	3.8186	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	0.6600	0.4736	0	1
hhsize	Household size in numbers	7146	4.258	2.524	1	28
Muslim	= 1 if HH is Muslim, =0 otherwise	7146	0.1276	0.3337	0	1
lnpchhexp	Log of per capita HH consumption expenditure	7146	8.534	0.714	2.240	13.222
adultfemale	No. of adult females in HH	7146	1.0934	0.7111	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	1.3985	0.4896	0	1
land	Owned family land size in acres	7146	0.7625	4.1186	0	201
landGini	Gini coefficient of land ownership in a county	47	0.5138	0.138	0.1291	0.8182
pcland	per capita land holding in a county	47	0.5749	0.2845	0.2110	2.0127
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.

Table 3 shows more male-headed households in the sample. About 12% of the households were Muslim. The average education attainment in a household is 5.3 years. The per capita household expenditure which is a proxy for household permanent income is Ksh5,084 ($e^{8.534}$). The average landholding in a household was less than one acre.

Land is a household resource that could have bearings on children's education

attainment. It could be an indicator of family resources and possibly ability to finance education. Household resources relax some of education supply constraints. Households with more resources could be expected to have more education stock, even though household resources do not always translate into more education stock. From another perspective, big land sizes are akin to rural areas. Nkedianye et al (2020) observe that household heads are more educated closer to urban centres where land sizes are smaller, and that more children enrol for school closer to urban centres than farther away. Urbanization, which is noted to affect education attainment positively, is not known to associate closely with big land holdings. Thus, a household with big landholding is likely to be in rural setting where infrastructure that supports education attainment is lower. For example, in the arid and semi-arid lands land inequality is highest coupled with poor infrastructure and pastoral livelihoods that curtail education attainment.

Education attainment could also be approached from the demand side. Demand for education is determined, not only by price, but also by a myriad of factors including personal interest, capability and perceived benefits or returns to education. Without effective demand, relaxation of supply constraints cannot guarantee growth in education stock. A resource-rich household could have low education attainment if its children lack effective demand for education. If the children feel materially comfortable they may lack the incentive and passion to pursue education. Therefore, the effect of resource abundance in a household on its education attainment could be positive or negative.

From the above, land is potentially endogenous in an education equation. To control for the potential endogeneity in Equation 11 arising from land ownership, landholding in a household was instrumented with annual average precipitation in the county where the household is located. Precipitation was strongly correlated with land ownership in a household, but not with its education attainment. Equation 8 was estimated using instrumental variable 2SLS regression.

Data

The data for the study was sourced from the Kenya Integrated Household Budget Survey (KIHBS) of the Kenya National Bureau of Statistics (KNBS) for 2005/06 and the National Population and Housing Census 2009. The year-long KIHBS survey covered clusters randomly selected from the National Sample Survey and Evaluation programme (NASSEP) IV. NASSEP maps the country into clusters selected with probability proportional to size from enumeration areas used during the 1999 Population and Housing Census. The sampling is stratified by district/county and urban/rural to ensure fair representation of an unequally distributed population. The survey covered 861 rural and 482 urban clusters. A sample of 13,430 households, 8,610 rural, 4,820 urban and five“replacement” households for each of the 1,339 clusters were surveyed.

4. Estimation results and discussion

Table 4 presents the regression results of the influence of land ownership 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 land ownership Gini on the Gini of inequalities in primary education attainment across counties in Kenya

Variable	Probit coefficients	Marginal effects, dy/dx
Land Gini	-.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 land inequality Gini but the relationship is statistically significant. A percentage

increase in household expenditure is associated with a 0.1011 decline in the primary education Gini. The Gini 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.

Table 5 presents the fractional IV probit regression results of the effect of land ownership 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 land ownership Gini on Gini for inequality in secondary education attainment across counties in Kenya

Variable	Probit coefficients	Marginal effects, dy/dx
Land Gini	. 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)	
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 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 is positively correlated with the inequality Gini for secondary education but the correlation is insignificant. According to the regression results in Table 5, inequalities in secondary school attainment across counties in Kenya are probably explained by average per capita household expenditure, urbanization, average household size and political influence in counties. An improvement in these variables reduces the probability of inequalities in secondary education attainment across the counties. A percentage increase in household expenditure is associated with a 0.1184 decline in the secondary education Gini. The Gini falls 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 experience a rise in their permanent income, their ability to finance secondary education could rise and this could bring down inequalities in secondary education attainment. The benefit could, however, be eroded by big household size. In a big household, more people lay claim to its income. If the income is constrained, some of the claimants may miss out in their demands. This explained 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 are probably reduced by urbanization. As noted in the literature, urbanization brings into an area people with more education. Thus, a percentage increase in urban population brings down the probability of inequality in secondary education attainment across counties by 0.1%.

Increasing political influence across counties probably reduces inequality in secondary education attainment across the counties in Kenya. As noted elsewhere, increasing political influence attracts 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 are delegated to the counties is an example of increasing county participation in high level governance. If the process is sustained, inequalities in education attainment across counties are likely to reduce.

Inequalities in land ownership 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 to pursue secondary education. In the 2004/05 financial year, the budget allocation for secondary school bursary fund increased from US$11.5 million in 2003/04 to US$13.8 million (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 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) that land ownership 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 land ownership 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 land ownership in the county in 2006. Table 6 shows the estimation results for the primary education equation, and Table 7 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 land ownership in a county

Variable	Logit coefficient	Marginal effect, dy/dx
Land Gini	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 one percentage increase in land ownership 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. While inequalities in land ownership could be increasing, the proportion of people in a county with an education rise over time thanks to government efforts in education financing as alluded to earlier. The same argument holds for per capita land holding. Consistent with earlier findings, 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, growing household size is associated with 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 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 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 land ownership in a county

Variable	Logit coefficient	Marginal effect, dy/dx
Land Gini	.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, proportions of education attainment across counties are 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 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) muted any effect that land Gini would have had on secondary education attainment across counties in Kenya.

Lastly, the study sought to find out whether land ownership has any relationship with education attainment in a household. This was achieved through instrumental variables 2SLS regression 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) have 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 school closer to urban centres than farther away where landholdings are bigger.

A big household size and adherence to Muslim faith negatively influenced the probability of education attainment in a household. Muslim households were known to emphasize religious teachings called Madrassa at the expense of formal education. Additionally, a sizeable proportion of Muslims are in pastoral areas where livelihood activities, as well as scant infrastructure, often undermine children's schooling.

Landholding 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 land ownership is muted by government financing of education.

5. Summary, conclusions and policy direction

The study examined whether inequalities in land ownership were associated with inequalities in education attainment at primary and secondary school levels. Using data from 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 land ownership 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 reduction of inequalities in education attainment across counties.

Notes

1 On a Lickert scale, if intensity of participation is ≤ 10%, implied political influence is low; if >10% but ≤ 20%, moderate; if >20% but≤ 30%, high; and if > 30% very high influence.

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Appendix

Table A1: Gini coefficients of land concentration across counties in Kenya, 2006

County	Coefficient	County	Coefficient	County	Coefficient
Nairobi	0.57	Machakos	0.52	Kajiado	0.43
Kiambu	0.48	Marsabit	0.45	Kericho	0.63
Kirinyaga	0.50	Meru	0.49	Laikipia	0.37
Murang'a	0.57	Tharaka	0.47	Nakuru	0.50
Nyandarua	0.36	Garissa	0.44	Nandi	0.55
Nyeri	0.40	Mandera	0.78	Narok	0.52
Kilifi	0.37	Wajir	No private land ownership	Samburu	0.82
Kwale	0.69	Homa Bay	0.74	Trans Nzoia	0.60
Lamu	0.36	Kisumu	0.64	Turkana	0.13
Mombasa	0.20	Siaya	0.44	Uasin Gishu	0.67
Taita Taveta	0.48	Migori	0.51	West Pokot	0.45
Tana River	0.44	Kisii	0.44	Bungoma	0.57
Embu	0.62	Nyamira	0.42	Busia	0.69
Isiolo	0.70	Baringo	0.55	Kakamega	0.59
Kitui	0.37	Bomet	0.46	Vihiga	0.67
Makueni	0.54	ElgeyoMarakwet	0.44		

Source: Author calculations from KNBS, 2005/06 data.

Table A2: Percentage of population in a county in Kenya with complete primary and secondary education, 2009.

County	Complete primary	Complete secondary
Nairobi	15.0	22.16
Kiambu	16.4	17.7
Kirinyaga	16.7	13.3
Murang'a	16.6	10.7
Nyandarua	18.0	10.0
Nyeri	17.4	16.0
Kilifi	10.5	5.5
Kwale	9.8	4.9
Lamu	11.5	6.1
Mombasa	17.1	17.6
Taita Taveta	16.7	9.1
Tana River	5.6	3.2
Embu	14.2	10.6

Isiolo	7.5	6.6
Kitui	13.1	4.7
Makueni	14.0	7.6
Machakos	15.4	10.9
Marsabit	3.6	2.4
Meru	13.8	7.5
Tharaka	13.1	7.9
Garissa	3.1	2.2
Mandera	2.9	1.5
Wajir	2.2	1.5
Homa Bay	12.6	6.3
Kisumu	13.3	9.8
Siaya	14.9	6.0
Migori	12.7	5.7
Kisii	11.3	12.1
Nyamira	12.4	14.1
Baringo	9.8	7.1
Bomet	13.3	7.8
Elgeyo Marakwet	13.6	8.1
Kajiado	11.2	11.6
Kericho	13.7	9.9
Laikipia	15.1	11.1
Nakuru	15.4	13.0
Nandi	11.9	7.3
Narok	8.1	4.5
Samburu	3.9	2.6
Trans Nzoia	11.9	8.5
Turkana	1.2	1.4
Uasin Gishu	13.2	12.3
West Pokot	4.5	2.3
Bungoma	10.9	8.2
Busia	10.5	5.7
Kakamega	11.6	7.2
Vihiga	12.6	7.8

Source: Calculated from Kenya National Population and Housing Census, 2009.

Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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Contact Us
African Economic Research Consortium
Consortium pour la Recherche Economique en Afrique
Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org