

Land inequality and spatial dimension: Evidence from household surveys

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ABSTRACT

To promote social justice and support inclusive development in East Africa, addressing land inequality is essential. Kenya and Uganda illustrate the complex factors driving land inequality in sub-Saharan Africa. During colonial times, extensive fertile lands were often alienated from local communities and given to colonial authorities, resulting in persistent land disparities. This study assesses land inequality in both countries using household surveys and the Gini and Theil indices. For background, we examine colonial history, land tenure regimes, and theories of structural inequality. Our findings show that Uganda has higher inequality than Kenya, with regional differences playing a major role in these patterns. Kenya's inequality is lower, with some intergroup differences, such as those linked to gender, residence, religion, and marital status, having a limited impact. In Uganda, a small elite group controls the majority of the land, as indicated by Lorenz curves and spatial maps. The results highlight the need for country-specific policies: Kenya should adopt community approaches, while Uganda should utilise regional strategies. These initiatives require a collaborative effort from stakeholders, including governments, agencies, and civil society, to support inclusive initiatives. This analysis guides efforts to improve land equality and governance, promoting fairness and development in East Africa.

Introduction

Land inequality has re-emerged as a pressing concern in development policy, particularly in sub-Saharan Africa, where land remains a cornerstone of livelihoods and wealth (Anseeuw, 2020; Djurfeldt, 2020). Recent global assessments warn that the distribution of agricultural land is far more skewed than previously recognised, with the wealthiest 10% of rural populations owning an estimated 60% of land value while the poorest 50% own just 3% (Chancel et al., 2022). This growing disparity has grave implications: it threatens the livelihoods of hundreds of millions of smallholder farmers and landless communities (Becher, 2023; Chancel et al., 2022). It has been linked to a 41% increase in global land inequality over recent decades (Becher, 2023; Chancel et al., 2022). Nowhere are these issues more salient than in Eastern Africa. Land is an essential resource for Kenya and Uganda, not only as the foundation of agricultural productivity but also as the bedrock of social identity, political power, and cultural heritage. An equitable distribution of land is therefore critical for both economic growth and social cohesion. Indeed, cross-country evidence suggests that countries with more egalitarian land distribution tend to enjoy higher levels of growth, greater social stability, and fewer conflicts, whereas highly concentrated land

ownership often breeds grievances and unrest (Chikaire et al., 2011; Kabari & Nwogo, 2021). Addressing land inequality is thus imperative for achieving inclusive growth, reducing poverty, and fostering long-term peace in the region.

Both Kenya and Uganda exemplify the complex historical and structural drivers of land inequality in sub-Saharan Africa. During the colonial era, large tracts of fertile land were alienated to European settlers or colonial authorities, laying the groundwork for enduring disparities in land ownership. Kenya, whose economy was shaped by settler agriculture, colonial policies dispossessed indigenous communities on a massive scale, creating a legacy of landlessness that persisted after independence (Shanguhya, 2022). The problem of landlessness in Kenya began with the seizure of land by British colonialists and has been perpetuated by influential individuals in the top echelons of the post-independence government (Shanguhya, 2017). Uganda, while not a settler colony to the same extent, also experienced profound disruptions to customary land tenure under British rule. The 1900 Uganda Agreement and subsequent policies consolidated large estates (such as the *Mailo* lands in the central region) and privileged a few traditional and colonial elites, leaving many smallholders with insecure or informal claims. These colonial legacies established dual land tenure systems –

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statutory titles alongside customary arrangements – that still shape land access today. Both countries emerged from colonialism with highly skewed land distributions and legal ambiguities that favoured elite control over vast areas, planting the seeds of structural inequality.

In the post-colonial period, the trajectories of land governance in Kenya and Uganda diverged significantly, yet both struggled to rectify historical injustices. In Uganda, the state nominally recognised customary land rights after independence, but weak governance and political manipulation often undermined their enforcement (Bélair et al., 2023; Obika, 2022). Waves of land grabbing, sometimes facilitated by local authorities, have been reported, capitalising on gaps in formal legal protections for customary landholders (Coldham, 2000). The landmark Land Act of 1998 was intended to strengthen tenure security for customary occupants (Ashukem, 2020; Tatwangire & Holden, 2011); however, its implementation has been inconsistent (Ashukem, 2020). To this day, many rural Ugandans remain vulnerable to losing their land due to limited formalisation and corruption in land administration. In Kenya, efforts at land redistribution and reform have repeatedly been marred by corruption, favouritism, and elite capture, resulting in only incremental progress toward equity. Post-independence political elites, often the beneficiaries of colonial allocations, continued to concentrate land in their own hands or those of their supporters. Notably, attempts to settle landless populations and adjudicate land claims (for example, the resettlement schemes after the Mau war or the post-1963 “Million Acres” program) achieved only partial success, frequently succumbing to patronage and misallocation. Kenya’s recent constitutional reforms, especially the 2010 Constitution and the Community Land Act 2016, have formally acknowledged community land rights and aimed to devolve land governance. However, translating these laws into practice remains a challenge. As of the mid-2020s, a significant portion of community land in Kenya remains unregistered, and institutional frameworks to safeguard communal and pastoralist territories are still being established. In both countries, weak land governance, as evidenced by inadequate land registries, overlapping legal regimes, and poor enforcement of rights, continues to exacerbate inequality in land ownership (Di Matteo, 2022; Wily, 2018).

Context, novelty, and contributions

The persistent inequality in land distribution carries profound implications for development, social justice, and stability in Kenya and Uganda. Land is the primary asset for most households in these largely agrarian economies, serving as a vital source of income, food security, and intergenerational wealth transfer. When access to land is unequal, it often aligns with and reinforces other social cleavages, such as wealth, gender, ethnicity, or region, thereby entrenching poverty and marginalisation (Deininger et al., 2009; Holden et al., 2013). For example, land ownership in both countries remains skewed against certain marginalised groups, including women (who face cultural and legal hurdles to inheriting or controlling land) and pastoralist or indigenous communities whose land rights have historically been neglected. The consequences of land inequality for development are far-reaching. Research has shown that rural poverty is closely tied to a lack of land or insecure tenure (Chikaire et al., 2011), and that unequal land distribution can dampen agricultural investment and productivity by concentrating land in fewer hands, thereby reducing the incentive to use each parcel optimally. In Uganda and Kenya, despite periods of robust GDP growth and modernisation, land inequality has persisted and, in some locales, worsened over time. Contemporary surveys and analyses indicate that the benefits of economic growth have not sufficed to equalise land ownership; in certain regions, the gap between large landowners and smallholders has even widened (Djurfeldt, 2020; Reynolds et al., 2020). This enduring disparity undermines rural development efforts and fuels social tension. In Kenya, unresolved land grievances have been linked to periodic conflicts (such as clashes in the Rift Valley). In Uganda, land disputes are prevalent, occasionally escalating into violence or

exacerbating persistent insecurity in some areas of the country (Rugadya, 2009). It is increasingly recognised that without deliberate policy action, land inequality could become a “ticking time bomb” for the region (Anseeuw, 2020), especially as a burgeoning young population enters land-scarce rural economies.

Given this context, there is a clear need to explore the dynamics of land inequality in Kenya and Uganda; an analysis that not only documents the severity of the inequality but also probes its spatial characteristics and group dimensions. Surprisingly, however, contemporary literature offers limited quantitative insight into these questions. While numerous studies have examined land tenure systems or land reforms in East Africa (focusing on legal frameworks or case studies of specific communities), fewer have measured the *extent* of land inequality at the household level across regions or investigated whether inequality is clustered in particular areas. National statistics (such as aggregate Gini coefficients for land ownership) provide a starting point, but they conceal important nuances; for instance, are there pockets of extreme inequality in certain provinces? Do differences between regions account for most of the inequality, or do disparities within communities dominate the picture? Furthermore, how does land inequality intersect with factors such as land tenure type, the gender of the household head, or urban-rural location? These questions remain largely unanswered in the empirical and explorative research on East Africa. To fill this knowledge gap, our study poses two central research questions: How endemic is inequality in land ownership among households in Kenya and Uganda? Moreover, is this inequality clustered in space, or does land inequality exhibit spatial randomness? In other words, we determine the overall degree of land ownership inequality in each country and assess whether high-inequality areas are geographically concentrated or dispersed, with no clear spatial pattern.

Answering these questions is not only of academic interest but also of practical significance. Identifying spatial clusters of land inequality could point policymakers to hotspots where interventions (such as land redistribution programs, tenure formalisation, or targeted rural development projects) are most urgently needed. Conversely, evidence of spatial randomness in inequality would imply that broad-based national strategies are required, since uneven land distribution is a generalised problem not confined to a few locales. Furthermore, understanding whether inequality is driven more by between-group differences (for example, one region versus another, or landowners versus landless) or by within-group differences (inequality among households within the same region or group) can help tailor policy solutions. If between-region inequality is high, region-specific policies or resource allocations may be warranted; if within-community inequality dominates, the focus might shift to local institutions and intra-community power structures.

This study makes several contributions to the literature on land inequality and offers a novel approach to analysing these issues in Kenya and Uganda. First, we provide up-to-date empirical estimates of land ownership inequality using nationally representative household survey data from both countries. By compiling and harmonising recent household-level survey data on landholdings (area and value), we produce robust measures of inequality that can be compared across Kenya and Uganda, an improvement over anecdotal or outdated figures. Second, we go beyond the single-metric approach, such as relying solely on the Gini coefficient, by employing a suite of inequality indices that capture different aspects of the distribution. In particular, we calculate the Gini coefficient, the most commonly used measure of inequality, alongside the Theil index, a generalised entropy measure. Theil’s advantage is that it is decomposable, meaning we can break down overall inequality into the portion arising *within* subpopulations and the portion arising *between* them. We utilise this property to decompose inequality by various groupings: by region (to quantify geographic disparities), by rural versus urban location, by the gender of the household head, and by land tenure category (e.g., freehold, leasehold, customary). This decomposition pinpoints where land distribution injustices are most pronounced. For instance, our analysis can reveal whether within-

region inequality outweighs between-region inequality, or whether disparities among households of different tenure systems are greater than disparities across districts. Third, we incorporate a spatial analytical dimension rarely seen in studies of land inequality. Using georeferenced data, we test for spatial autocorrelation in inequality measures, examining whether areas with high (or low) land inequality are geographically clustered. This involves calculating statistics, such as Moran's I , to determine if there are spatial patterns in inequality or if the distribution of inequality is random across space. By investigating spatial clustering, we address the second research question directly and provide evidence on whether land inequality has a geographic footprint (for example, concentrated in certain historical "high inequality belts") or whether pockets of large landowners and land-poor smallholders are scattered throughout without obvious spatial concentration. Finally, our methodological toolkit encompasses inequality indices that are less frequently employed, notably the Mehran and Kakwani indices, which complement the Gini and Theil measures. These indices place additional weight on different parts of the distribution (the Mehran index, for instance, emphasises the lower tail of land distribution by weighting gaps that affect the poorest landowners more heavily). By applying *Mehran and Kakwani measures*, we ensure that our assessment captures nuances of inequality that traditional metrics, such as the depth of deprivation among the smallest landholders, may overlook. This is particularly relevant in agrarian settings where a significant share of households owns very little or no land, a group for whom marginal increases in land access could have outsized benefits.

Conceptual frameworks on land inequality

Historical and structural roots

African land inequality often originates from historical and structural factors. Colonial land tenure systems established and entrenched unequal ownership patterns that persist to this day (Carmody & Taylor, 2016; Frankema, 2009). In Kenya, the colonial administration allocated the most fertile areas, known as the White Highlands, to European settlers, thereby dispossessing indigenous communities and creating a legacy of highly skewed land distribution (Coldham, 1979; Fibaek & Green, 2019; Kilson, 1957; Wayumba, 2015). However, the colonial experience differed in Uganda. The 1900 Buganda Agreement established a dual system of private estates (Mailo land) for elites and customary tenure for others, thereby creating structural inequality in land access (McKnight, 2000; Summers, 2014). Even after independence, many colonial-era landholding inequalities persisted, as post-colonial land reforms were often limited or captured by elites. Early land policies often favoured the interests of a minority (colonial settlers or allied local elites), leaving most smallholders with insecure rights (Mabikke, 2016a, 2016b; Pedersen et al., 2012). Such *structural inequality* means that the initial distribution of land assets can shape broader income and wealth disparities (Berman et al., 2016). Land inequality is a root cause of overall inequality in many African countries, often exerting a more significant long-term impact than income inequality (Rutherford, 2012).

Customary vs. statutory tenure systems

The coexistence of customary and statutory land tenure systems is a key historical factor. In Uganda, roughly 80% of the land is held under customary tenure (Batungi & Rüther, 2008) (unregistered communal or family land), while the remainder is held under statutory systems like freehold, leasehold, or mailo tenure (Musunguzi et al., 2021). Customary systems have traditionally sought to provide equitable access within communities, but their egalitarian elements have occasionally been undermined by fragmentation and informal sales brought by population pressure and commercialisation. Kenya undertook systematic land titling in some regions, following the Swynnerton Plan in the 1950s,

converting customary lands to freehold titles (Greiner, 2017; Wamukaya & Mbatia, 2019). However, other areas remained as *trust land* (now community land), especially in pastoral rangelands. These different tenure histories shape inequality, where titled land can be bought and sold, allowing accumulation by wealthy individuals. However, strict customary norms might limit the accumulation of extreme concentrations (Kresse & van der Krabben, 2022; Lisk, 2013), though local elites can still capture community land. In hindsight, post-independence land reforms in both countries have struggled to balance customary rights with formalisation. For example, Kenya's 2010 Constitution and 2012 Land Act sought to address historical injustices and strengthen community land rights (Bassett, 2017; Pas et al., 2023), while Uganda's 1998 Land Act recognised customary tenure and protected tenants on *Mailo* land (Okuku, 2006; Pedersen et al., 2012). However, due to implementation gaps, inequities rooted in colonial land policies and tenure dualism persist (Frankema, 2009; Raimi, 2024).

Modern land concentration and land grabbing

In recent decades, large-scale land acquisitions by foreign and domestic investors have emerged as a new driver of land inequality (Sändig, 2021; Sullivan et al., 2023). Uganda and Kenya have attracted land deals for agriculture, biofuels, mining, and conservation (Doss et al., 2014; Oberlack et al., 2021). Weak land governance and loopholes in the law have enabled influential individuals and foreign corporations to acquire vast tracts of land, often at the expense of local communities. Oxfam reports in Uganda reveal that the government's transfer of public or community lands to private investors (sometimes illegally) has intensified inequality, as wealth from land becomes concentrated in the hands of a few (Oxfam, 2012). In Kenya, cases of land adjudication and privatisation have sometimes been marred by corruption (Chiweshe, 2021; Lengoiboni et al., 2021), leading to land conflicts, particularly in fertile areas such as the Rift Valley and coastal regions.

These practices reflect what scholars refer to as a "present-day colonial state" dynamic, where power imbalances between citizens and the state facilitate dispossession (Carmody & Taylor, 2016). Land grabbing often exploits historical inequalities (Cotula, 2012); for instance, on Kenya's coast, where colonial-era absentee landlordism left locals landless, new investors now acquire land, perpetuating local marginalisation (Jumba et al., 2020). Overall, the structural inequality established by history is reinforced by contemporary processes of wealth accumulation through the land (Frankema, 2009; Njieassam, 2019; Peters, 2004). Far from being a historical phenomenon, the legacy of inequitable land allocations and widespread land grabbing remains embedded in East Africa's contemporary land tenure system, where highly unequal patterns of ownership continue to reflect decades of politically driven accumulation and dispossession.

Land inequality and gender dimensions

Gender inequality in land ownership is a pronounced structural issue in both countries, rooted in patrilineal norms (Lusasi & Mwaseba, 2020; Supraptiningsih et al., 2023). Customary practices have traditionally vested land in men's control, with women gaining access only through male relatives (fathers, husbands) and often losing rights upon widowhood or divorce (Djurfeldt, 2020; Supraptiningsih et al., 2023). Despite legal reforms granting equal property rights (e.g., Kenya's Constitution 2010 affirms women's right to own land [Bassett, 2017]; Uganda's Land Act 1998 prohibits gender discrimination in land rights), a significant gender gap persists between law and practice (Hunt, 2004; Okuku, 2006). In Uganda, women comprise 73% of the agricultural workforce yet own only about 7% of the land (Mabikke, 2016b; Pedersen et al., 2012), highlighting a significant disparity. In Kenya, fewer than 7% of women are reported to be sole registered landowners, compared to approximately 30% of men (Anseeuw, 2020; Raimi, 2024). Most Kenyan

women who own land are joint owners through marriage (Linkow, 2019). Moreover, only ~10% of land titles in Kenya are in women's names, which account for an even smaller fraction of the total land area (Davison, 2019; Linkow, 2019; Santpoort et al., 2021). This gendered land inequality is both a cause and a consequence of wider gender inequalities. Without secure land assets, women have less collateral for credit, weaker bargaining power within households, and greater vulnerability to poverty (Singbo et al., 2023). Female-headed households, widows, or single mothers often have smaller landholdings and less secure tenure, which can contribute to higher poverty rates among those households (Sungjo, 2021). Therefore, addressing land inequality requires a gender lens, acknowledging that, for women to benefit equally from land ownership, reforms of norms and legal empowerment are necessary.

Data and methodology

Household survey data

Uganda National Panel Survey/Living Standards Measurement Study (UNPS-LSMS). As part of the standardised World Bank Living Standards Measurement Study Surveys (LSMS) program, we use data from the Uganda National Panel Survey 2019–20. In 2019, 3,098 households were included in this nationally representative poll, and the list contained 16,886 individual records (household members). While a corresponding individual-level dataset (Individual Household Survey 2019) includes demographic and socioeconomic information for each household member, the household dataset (Harmonised LSMS Household Survey 2019) offers aggregated household-level information, such as land ownership and usage. The agriculture module of the survey records comprehensive land data, such as crop production, inputs, and actual land holdings, as well as land the household has access to through usage rights. This means the data include the size of land parcels that a household owns or cultivates, the tenure arrangements (owned, operated, customary, rented), and attributes of each household member (such as gender, age, the household head's religion, and other characteristics).

Because the Uganda survey is a multi-year panel, each household is identified by a household ID (hhid) and the survey year. To prepare the 2019 cross-sectional dataset for analysis, we generated a unique household identifier by concatenating the hhid with the year (2019). This composite key ensures that each household in the 2019 LSMS data is uniquely identified (for example, if the same hhid appeared in earlier waves). Using this key, we merged the household-level file ($N = 3,098$) with the individual-level file ($N = 16,886$) in a many-to-one join, effectively linking each person's information to their household. In practice, the merge involved grouping records by hhid, year, and then matching them: all individuals sharing the same household ID and year were linked to each household's record. The result is an integrated dataset for Uganda in 2019, in which each household (and its associated landholdings) is linked to the characteristics of its members. This allows us, for instance, to identify the gender of the household head or the household's marital status, and to associate those attributes with the household's land ownership details for further analysis (Uganda Bureau of Statistics (UBOS), 2021).

KIHBS and KCHSP

We draw on the 2015/16 Kenya Integrated Household Budget Survey (KIHBS) and the Kenya Continuous Household Surveys Programme (2021), both conducted by the Kenya National Bureau of Statistics. The 2015/16 KIHBS sampled approximately 23,880 households across 2,388 clusters nationwide, covering all 47 counties of Kenya as distinct domains for analysis. From this survey, we utilise two components: (i) the household-level data on land holdings and agriculture, and (ii) the individual-level microdata (household roster). The household survey

includes detailed *land-related indicators on agricultural holdings*, such as the size of land parcels owned or cultivated by the household and the area under cultivation. The land holdings data in our dataset consists of 25,925 observations representing cultivated and total *agricultural parcels* associated with the surveyed households (Households with multiple land parcels have one record per parcel; hence, more observations than households). The household microdata contains 68,677 individual records and captures demographic information for household members. In practice, not all KIHBS households are engaged in farming; our focus is on those households that report owning or cultivating land. So, the 68,677 individual records correspond to household members from KCHSP. The KIHBS collected land ownership, use, and tenure information for each parcel, along with standard socio-economic variables (income, expenditure, education), making it suitable for analysing land distribution. It also recorded household head characteristics (including gender and religion) and the household's location (county and sub-county), which we leverage for disaggregated inequality analysis (Kenya National Bureau of Statistics (KNBS), 2022).

The KIHBS uses a hierarchical identification system in which each household is identified by combining a cluster ID with a unique household ID within that cluster. To merge the landholding data with the individual data, we first constructed a composite household key by combining the cluster identifier and the household ID. In practice, we created a unique ID by *concatenating the cluster.id and hhid* to serve as a merge key. This key uniquely identifies each household across the two datasets. We then used the *generated unique ID* to merge the household land holdings and household microdata. This was essentially a one-to-one merge; each unique household (*identified by cluster and hhid*) can have multiple individual records (from the roster) and one or more land records (one per parcel). We ensured the merge brought together the total land information for households, including their attributes. The merged Kenya dataset thus contains one consolidated record per household (*with household-level land metrics*) alongside appended individual-level details, such as the household head's gender, age, and other characteristics. This structure enables the analysis of land ownership at the household level while still allowing us to filter or group households by the attributes of their members (*e.g., by the gender of the landowner or head of household*).

Gini coefficient computation

The Gini coefficient is used as a summary measure of land distribution inequality. We calculate the Gini coefficient for the distribution of landholding size per household, treating each household as a unit and using either land owned or land cultivated. The Gini coefficient ranges from 0 (perfect equality, where every household has the same amount of land) to 1 (perfect inequality, where a single household owns all the land). In practice, land Gini tends to be high when a small fraction of owners controls a large share of the total land (Frosini, 2012; Oancea & Pirjol, 2019). For example, earlier studies show land Gini values of around 0.8–0.9 in Latin America, indicating an extremely unequal distribution, and about 0.5 in many Asian countries (Azadi & Vanhaute, 2019; Jensen & Sørensen, 2012; Shatkin, 2016). We calculate the Gini index at the national level for each country and its subgroups, including by region, by the gender of the household head, and by land tenure type (*e.g., Kenya*). Because many urban or land-poor households own no land, we report Gini coefficients, including and excluding landless households, to understand the impact of landlessness on inequality (treating landholdings as zero often substantially raises the measured inequality). We use the standard formula based on the Lorenz curve of land distribution to compute Gini coefficients. For robustness, bootstrapping and household weights are used to estimate confidence intervals for the Gini coefficient, accounting for the survey sampling design.

Measures of land inequality

To complement and strengthen the Gini, we use the Theil index, a measure from the generalised entropy family, which has the advantage of decomposability (Malakar & Mishra, 2017; Marchetti & Tzavidis, 2021).

Gini coefficient

The Gini Index (G) captures the degree of land ownership concentration, ranging from 0 (perfect equality) to 1 (maximum inequality). It is computed as:

$$G = \frac{\sum_{i=1}^N \sum_{j=1}^N |X_i - X_j|}{2N^2 \bar{X}} \quad (1)$$

where X_i and X_j are the landholdings of individuals i and j , and $\bar{X}$ is the mean land size.

Theil Index and decomposition

The Theil Index (T) allows for decomposition into within-group and between-group inequality:

$$T = \sum_{i=1}^N \left(\frac{X_i}{\bar{X}} \log \frac{X_i}{\bar{X}} \right) \quad (2)$$

The Theil Index is decomposed as follows:

Between-group inequality (T_b): Differences between groups (e.g., gender, region).

Within-group inequality (T_w): Disparities within each group.

$$T = T_b + T_w$$

Theil's T is 0 when all households have equal land and increases as inequality rises; unlike the Gini coefficient, it is unbounded above. While less intuitive than the Gini index, the Theil index enables us to partition overall inequality into **within-group** and **between-group** components. We apply this by defining groups, such as regions or districts, or by gender or tenure categories.

Regional decomposition (Uganda)

We calculate the proportion of national land inequality attributable to regional disparities (e.g., mean land per household varies across Central, Eastern, and Northern Uganda) rather than to regional inequalities. Theil ensures that the sum of the within-region indices and the between-region term equals the total. This helps determine whether spatial disparities or local inequalities are the bigger drivers.

Gender decomposition

To calculate the within-group inequality, we divide households into male-headed and female-headed groups and measure the variation in average land ownership between them. We anticipate a significant difference between male- and female-headed households, suggesting a structural gender disparity given the predominance of males in land acquisitions.

Tenure and religion-based decomposition (Kenya)

To determine whether inequality is greater under one tenure system and faith, and the extent to which average differences between tenure systems and religions contribute to overall inequality, we classify households in Kenya by primary land tenure (e.g., customary land vs freehold or mailo titles) and religion.

Rural-Urban decomposition

Although most urban households have little or no land, quantifying differences in landholdings between rural and urban households helps

understand the contribution of rural inequality to overall societal inequality.

Spatial analysis

We use basic spatial analysis techniques to visualise and analyse sub-regional disparities (Drukker, 2008; Pisati, 2001). At the county and religion levels, we display the land Gini coefficients. The four traditional regions of Uganda: Central, Eastern, Northern, and Western, as well as counties, sub-counties, and the county of household birth, are taken into account. To illustrate the extent of land skewness among families in both counties, Lorenz curves are constructed using total and cultivated land areas. To contextualise inequality, we also examine the spatial distribution of average land by county, which is exclusive to both countries. There may occasionally be a mix of large farms and many land-poor households in an area with high inequality. On the other hand, a region with low inequality may imply universally small landholdings, which could still be a sign of land scarcity. However, this paper's spatial analysis is exploratory and descriptive due to data limitations and the necessity for more precise and accurate interpretation (Abelairas-Etxebarria and Astorkiza, 2020).

Results and discussion

Using the Gini and Theil's entropy index (a GE (1) inequality measure) and associated decomposition techniques, we examine land inequality in the two nations. We focus on how various demographic subgroups, including marriage status, tenure type, and residence (rural/urban), as well as the gender of the household head, region, religion, relationship to the household head, tenure types, and marital status, contribute to overall inequality. We also examine Lorenz curves and cumulative land inequality plots to visualise distributional patterns and map counties to identify spatial patterns. This analysis presents the findings in a structured manner, highlighting where inequality is most pronounced and comparing the underlying drivers in Kenya and Uganda. Our analyses are reported in tables and figures for both countries. Table 1 presents the national land inequality results for both countries, using different inequality indices. However, the Theil index and Gini coefficients are our main metrics of interest. In Table 2a, we reported land share, population share, mean land, and the group Theil index by residence (rural vs urban) and by gender and regional categories (Central Eastern, Northern, and Western) for Uganda. Table 2b reports the overall Theil index and the Theil for in-between and within values for Uganda. We repeated the same patterns for Kenya. Table 3a contains the land share, population share, mean land, and group Theil index for all categories considered for Kenya. In addition, we documented the Theil overall index, both between and within categories, in Table 3b. We also visualised our results with the Lorenz curves for both countries (Figs. 1, 2, 3, and 4), mapping of the mean land distribution and Theil index (Figs. 5,6, 7, Figs. 11 and 12), the cumulative distribution of land inequality (Figs. 8, 9, 10, and 13), Gini coefficients by counties (Kenya—Fig. 14), and religion (Kenya—Fig. 15). In the following section, we interpret and discuss our findings in detail.

Overall levels of land inequality

Land inequality is more spatially clustered in Uganda, with the highest-inequality counties concentrated in the central region. On the other hand, land inequality varies widely across counties in Kenya, with high-inequality counties somewhat geographically dispersed rather than concentrated in one area. At the national level, Uganda exhibits substantially greater land inequality than Kenya. Theil's index for total land distribution in Uganda is 1.244, roughly double Kenya's at 0.612. This indicates a far more uneven land distribution in Uganda. The Gini coefficients confirm this contrast: Uganda's land Gini coefficient is 0.668, compared to Kenya's 0.519, indicating that land ownership is more

Table 1
National land inequality (aggregate level).

Inequality measures	Total land Kenya	Cultivated land	Total land Uganda	Cultivated land
Theil index (GE(a), a = 1)	0.612	0.152	1.244	1.123
Gini coefficient	0.519	0.276	0.668	0.646
Relative mean deviation	0.384	0.232	0.498	0.480
Coefficient of variation	3.527	0.632	1.628	1.538
Standard deviation of logs	0.955	0.480	1.046	1.009
Mehran measure	0.653	0.349	0.840	0.822
Piesch measure	0.453	0.240	0.582	0.558
Kakwani measure	0.227	0.079	0.366	0.345
Mean Log Deviation (GE (a), a = 0)	0.496	0.134	0.143	0.131
Entropy index (GE(a), a = -1)	0.766	0.130	0.531	0.484
Atkinson inequality measures (eps = 1)	0.391	0.125	0.094	0.089

Table 2a
Land share and group Theil index (Uganda).

Residence	Land share	Pop share	Mean land	Group Theil
Rural	0.908	0.763	0.895	0.638
Urban	0.092	0.237	0.292	1.504
Gender				
Male	0.468	0.470	0.750	0.771
Female	0.532	0.530	0.753	0.803
Region				
Central	0.139	0.255	0.414	1.288
Eastern	0.202	0.228	0.674	0.656
Northern	0.472	0.280	1.282	0.656
Western	0.186	0.238	0.595	0.669

Table 2b
Between and within group Theil Index (Uganda).

Description	Theil between	Theil within
Region	0.094	0.746
Gender	0.069	0.771
Residence	0.002	0.838
County	0.295	0.545
Sub-county	0.388	0.452

concentrated in Uganda. In other words, the share of land held by the top portion of landowners is much larger in Uganda than in Kenya. The higher entropy (Theil) measure in Uganda indicates that the disparity includes a wide gap between the largest and smallest landowners, as well as a thicker tail of extensive landholdings. Correspondingly, Kenya's lower Theil and Gini suggest a relatively more equitable, though still unequal, distribution of land assets.

Total vs. cultivated land

An interesting divergence emerges when comparing *total land* with cultivated land (see Table 1 and Figs. 1–4). In Kenya, inequality in cultivated land is dramatically lower than in total land. The Theil index for cultivated land is only 0.152 (with a Gini coefficient of ~0.276). This implies that the distribution of agricultural land actively being farmed is relatively egalitarian, and many Kenyan smallholders have comparable farm sizes. By contrast, Uganda's cultivated land inequality remains extremely high (*Theil* 1.123, *Gini* ~0.646), nearly as high as its total land inequality. The fact that Kenya's overall land inequality (*Theil* 0.612) far exceeds its cultivated land inequality suggests that non-cultivated land, possibly rangelands, fallow land, or land held idle by large owners, drives much of the disparity. In Uganda, however, even

Table 3a
Land share and group Theil index (Kenya).

Residence	Land share	Pop share	Mean land	Group Theil
Rural	0.683	0.675	1.548	0.665
Urban	0.317	0.325	1.493	0.497
Gender				
Male	0.474	0.487	1.490	0.475
Female	0.526	0.513	1.569	0.735
Relation				
Head	0.258	0.260	1.441	0.537
Spouse	0.150	0.135	1.614	1.197
Son/daughter	0.480	0.487	1.430	0.508
Grandchild	0.064	0.073	1.261	0.434
Sister/brother	0.008	0.009	1.328	0.459
Father/mother	0.007	0.006	1.744	0.730
Nephew/niece	0.010	0.009	1.577	0.576
In-laws	0.011	0.011	1.473	0.548
Religion				
Catholics	0.185	0.158	1.790	1.185
Protestants	0.314	0.319	1.509	0.469
Evangelical churches	0.146	0.143	1.562	0.561
African Instituted Churches	0.031	0.029	1.606	0.435
Orthodox	0.002	0.002	1.114	0.351
Islam	0.291	0.318	1.401	0.452
Hindu	0.001	0.002	1.305	0.210
Traditionalists	0.008	0.009	1.282	0.300
No religion/Atheist	0.012	0.010	1.844	0.575
Other Christians	0.008	0.007	1.643	0.469
Other religions	0.001	0.001	1.336	0.508
Tenure types				
Freehold	0.970	0.968	1.534	0.614
Leasehold	0.014	0.019	1.142	0.418
Others	0.014	0.012	1.788	0.494
Marital Status				
Monogamous marriage	0.334	0.314	1.630	0.847
Polygamous marriage	0.015	0.016	1.443	0.360
Living together	0.006	0.005	1.921	0.629
Separated	0.028	0.028	1.502	0.621
Divorced	0.007	0.009	1.294	0.379
Widow/widower	0.043	0.043	1.513	0.558
Never married	0.277	0.282	1.501	0.490

Table 3b
Between- and within-group Theil index (Kenya).

Description	Theil between	Theil within
Gender	0	0.611
Relation	0.002	0.618
Religion	0.004	0.608
Tenure types	0.001	0.611
Marital status	0.001	0.61
County	0.001	0.611
Country of birth	0.014	0.598

productive agricultural land is highly unequally distributed. This points to structural differences. Kenya's post-colonial land reforms and smallholder settlement schemes may have distributed farmland more evenly, whereas in Uganda, extensive holdings persist even in cultivation.

From a Lorenz curve perspective, these figures indicate that in Uganda, a small fraction of households own the majority of the land (see Figs. 1 and 2). For example, the bottom half of Ugandan households likely controls only a tiny percentage of the total land. At the same time, the top decile owns a disproportionately large share (consistent with a Gini coefficient of ~0.67). Kenya's Lorenz curve (see Figs. 3 & 4) lies closer to the line of equality; the bottom 50% in Kenya holds a larger share of land than their Ugandan counterparts, and the concentration at the top is less extreme, though still significant, with a Gini coefficient of ~0.52. To understand how different socio-economic categories contribute to these patterns of inequality, we conduct a subgroup analysis.

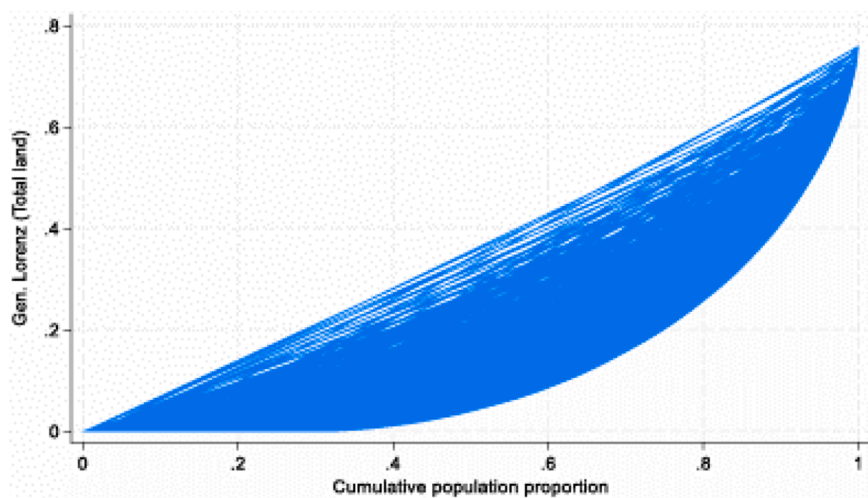


Fig. 1. Lorenz land inequality for total land area (Uganda).

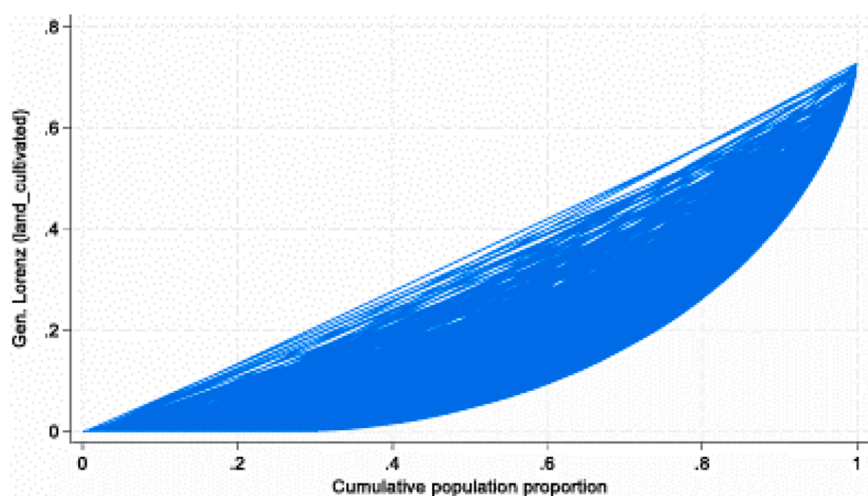


Fig. 2. Lorenz land inequality for cultivated land (Uganda).

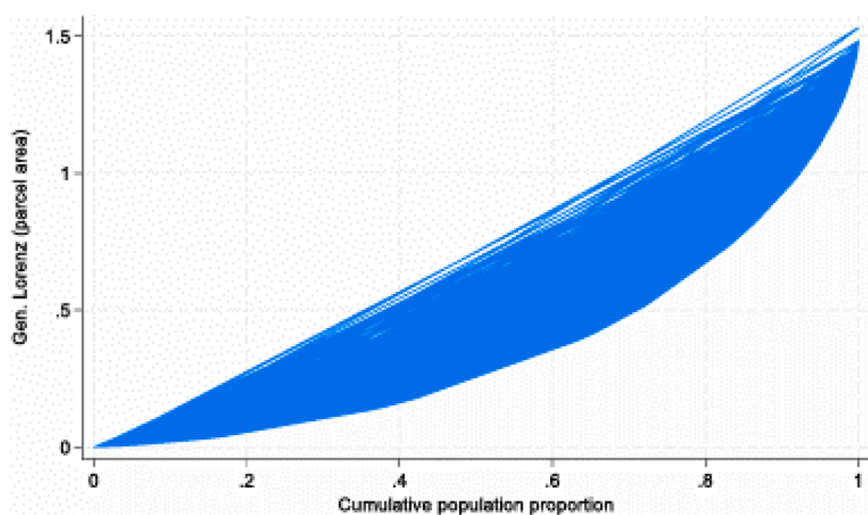


Fig. 3. Lorenz land inequality for total land area (Kenya).

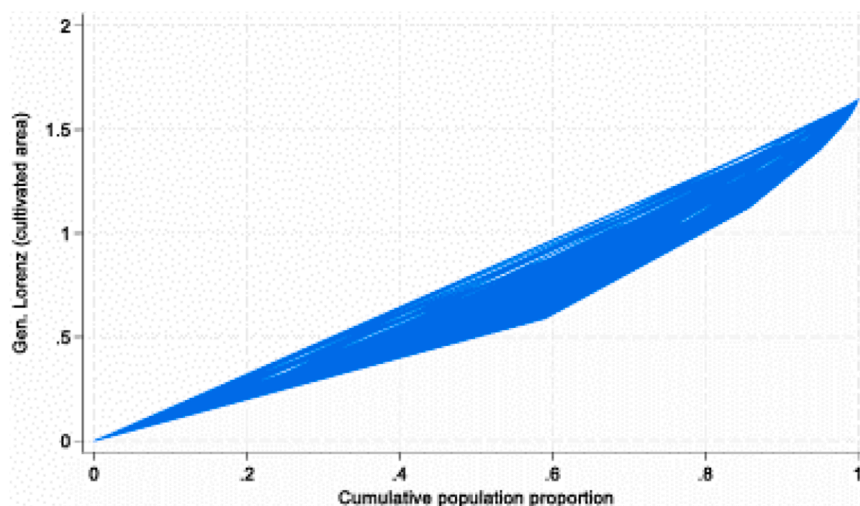


Fig. 4. Lorenz land inequality for cultivated land (Kenya).

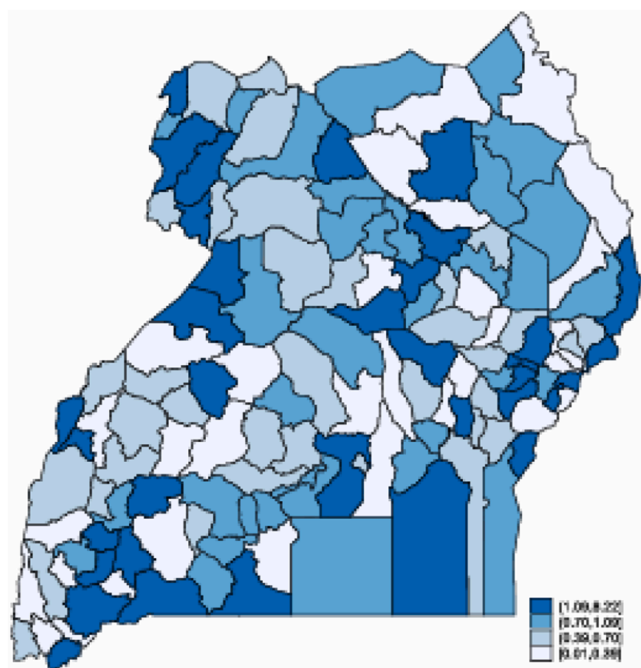


Fig. 5. Mean land distribution by sub-County (Uganda).

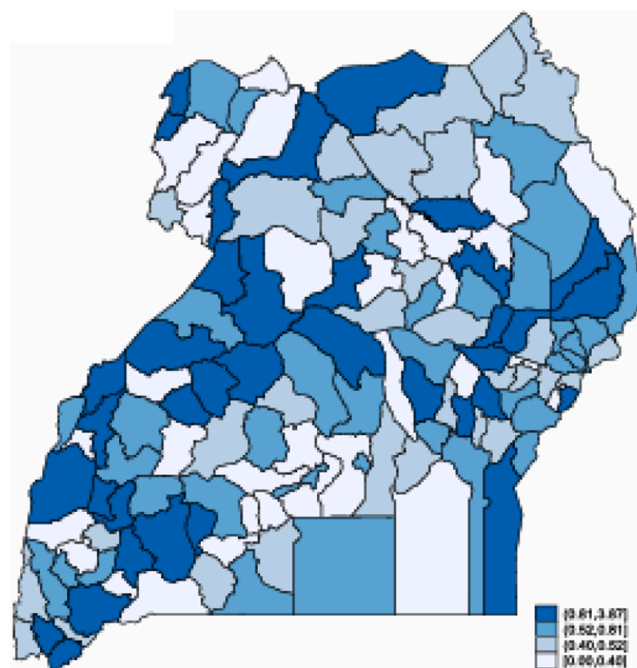


Fig. 6. Theil land inequality index by county (Uganda).

Rural vs. urban disparities

Uganda has a stark urban-rural divide in terms of averages, but within-group inequality is more pronounced. Urban and rural households differ significantly in terms of access to land. Urban households (about 23.7% of the population) command only 9.2% of the country's land. This translates to a very low average landholding for urban dwellers, roughly 0.292 hectares, compared with a national average of 1.0 (in the data, the mean land per urban household is ~0.292 hectares, compared with ~0.895 hectares in rural areas). Rural households (76.3% of the population) hold the remaining 90.8% of land, so on average, a rural household has about three times more land than an urban household (see Table 2a). Despite this significant gap in mean holdings, the Theil decomposition finds *nearly zero between-group inequality* attributable to residence in Uganda (Theil between ≈ 0.002). This somewhat counterintuitive result arises because inequality within each residence group is exceptionally high, overwhelming the

difference in group means. On the other hand, inequality *among urban households* is highly pronounced. The urban subgroup's Theil index is 1.504, indicating a very unequal distribution of the little land urban families hold. Many urban households are fundamentally landless, while a few own substantial parcels (perhaps as absentee owners or peri-urban landholders), resulting in high intra-urban inequality. Rural households also experience considerable internal disparity (Theil's index of 0.638), though less extreme than in urban areas. Thus, in Uganda, urban versus rural status affects average landholding (urban households have far less land). Nevertheless, overall land inequality is driven mainly by large variations within rural and urban populations, rather than by the gap between them.

For Kenya, the rural-urban contrast is far less severe. Rural households comprise about 67.5% of the population and own 68.3% of the land, whereas urban households, 32.5% of the population, own 31.7%. These figures indicate that, on average, rural and urban Kenyan households have very similar land endowments, which are roughly

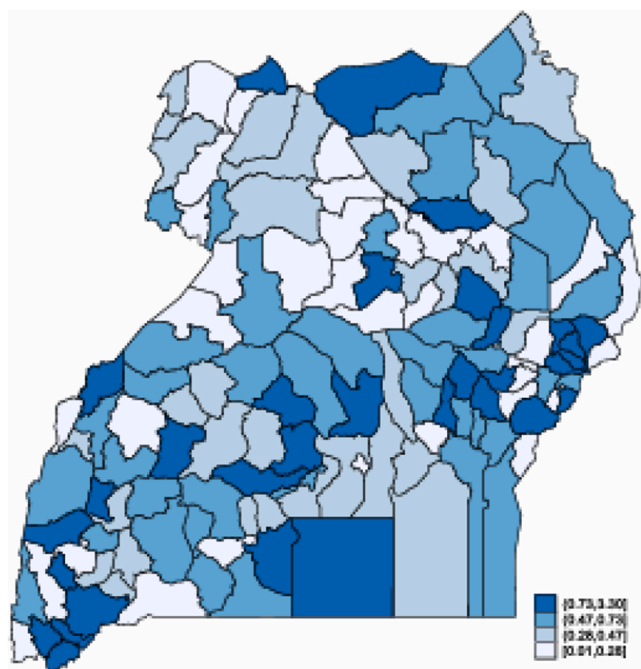


Fig. 7. Theil land inequality index by sub-County (Uganda).

proportional to their population shares. Indeed, the mean landholding of a rural household is approximately 1.548 hectares, compared to 1.493 hectares for an urban household, with virtually no significant difference. The Theil index between rural and urban groups in Kenya is 0.000 (essentially zero), confirming that there is *no systematic inequality attributable to residence per se*. Moreover, inequality *within* the urban subgroup is relatively modest in Kenya (urban Theil coefficient ~ 0.497), which is much lower than the urban inequality observed in Uganda. This suggests that in Kenya, urban households are more homogeneous in terms of land ownership. This suggests that some individuals may own a small plot or none, but fewer extreme outliers own vast amounts of land within the urban category. Rural Kenya exhibits higher within-group inequality (rural Theil ~ 0.665), reflecting differences between small-holder farmers and large landowners. Nonetheless, compared with Uganda, Kenya's rural inequality remains moderate. Overall, Kenya exhibits a balanced rural-urban land distribution and moderate internal disparities. In contrast, Uganda exhibits a significant rural-urban income

disparity, accompanied by pronounced inequalities within each group. One implication is that urban landlessness in Uganda is a serious issue (a small elite owns the limited urban land). Conversely, Kenya's land inequality issues primarily lie within the rural sector, among farms of varying sizes.

Regional and spatial inequality (regional gaps in Uganda)

Land inequality in Uganda exhibits a notable spatial dimension at the regional level. Uganda's four major regions, Central, Eastern, Northern, and Western (see Fig. 10 below), have markedly different landholding patterns. The Central region (which includes the capital and surrounding districts) stands out for its relative land scarcity and high inequality. Central Uganda accounts for approximately 25.5% of the population but only 13.9% of the total land area. The average land per person in Central is thus very low (a mean landholding of only 0.414, less than half the national average). Nevertheless, within the Central region, land distribution is highly unequal (Theil index of 1.288, the highest among regions), likely reflecting a legacy of land concentration (e.g., historical mailo estates and urban land markets in Buganda). In contrast, the Northern region has the opposite profile: it accounts for only 28.0% of the population but 47.2% of the land, resulting in a relatively large average land per household (mean index 1.282, approximately 128% of the national average). Northern Uganda's within-region inequality (Theil 0.656) is much lower than in the Central region. This suggests that land in the North is more evenly distributed among households (perhaps due to communal land traditions and lower population density), even though people there generally have more land. The Eastern and Western regions fall in between: Eastern holds approximately 20.2% of the land for 22.8% of the people (mean ~ 0.674) with a Theil index of 0.656, while Western has 18.6% of the land for 23.8% of the people (mean ~ 0.595) with a Theil index of 0.669. These figures suggest that Eastern and Western Uganda exhibit moderately high internal inequality, although not as pronounced as that in Central Uganda. Overall, the region of residence contributes a *significant but minority share of Uganda's inequality*; differences between regions account for about 11% of Uganda's total Theil index. In other words, if every household within each region had such a regional average land size, Uganda's Theil index would still be 0.094 (out of 0.840 in this particular decomposition) due to region-level disparities. This non-trivial between-region component reflects the gap between land-rich areas (such as the North) and land-poor areas (such as Central). Nonetheless, the remaining $\sim 89\%$ of inequality is attributable to variation within regions, reinforcing the point that even within each region, there is a broad spectrum of

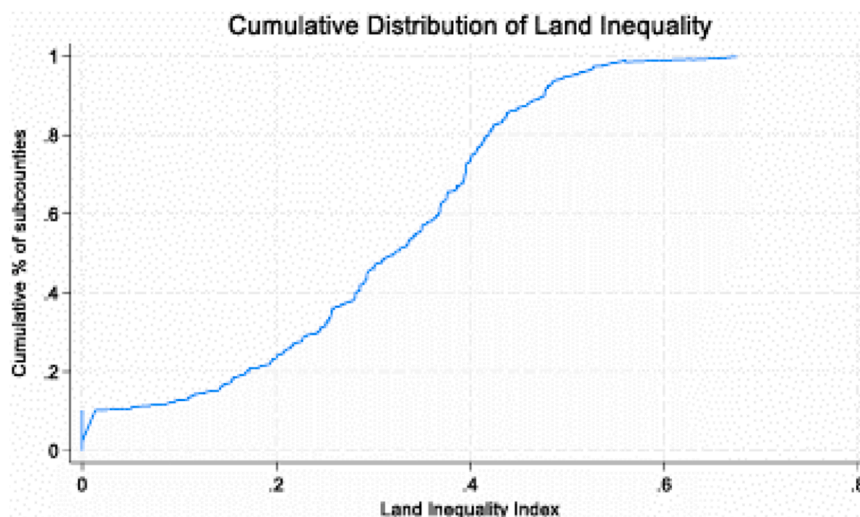


Fig. 8. Cumulative land inequality by sub-County (Uganda).

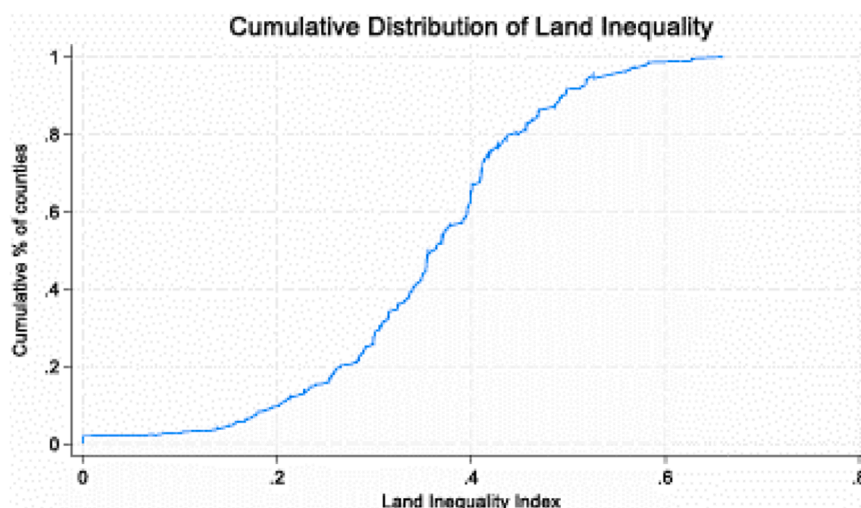


Fig. 9. Cumulative land inequality by County (Uganda).

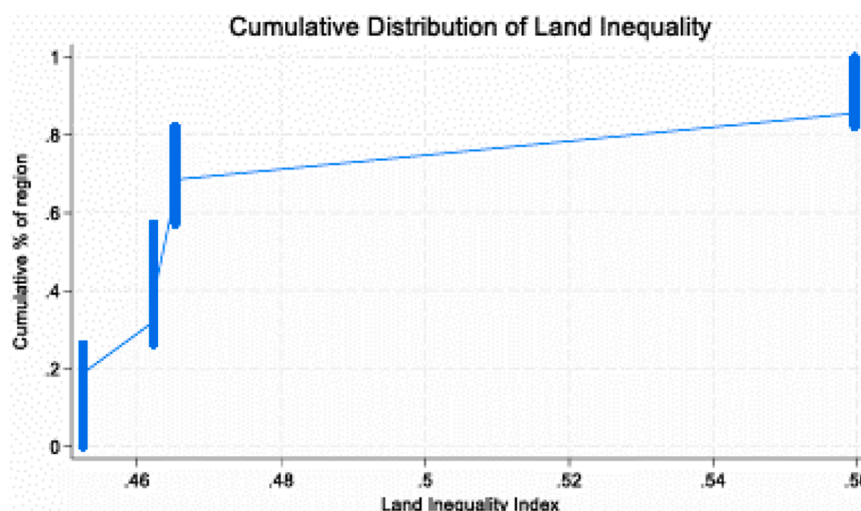


Fig. 10. Cumulative land inequality by Region (Uganda).

landownership sizes.

Local-level concentration (Uganda's counties and sub-counties)

While broad regions capture some inequality in Uganda, even finer geographic units reveal a striking pattern of spatial concentration. The decomposition by *county* and *sub-county* reveals that differences across localities account for a greater portion of Uganda's inequality. Between-county inequality accounts for about 0.295 of the Theil, roughly 35% of total inequality. Between sub-counties, this accounts for 0.388 (approximately 46% of the total). These high between-group shares mean that certain counties or sub-counties have far higher average land per person than others, contributing heavily to overall inequality. Indeed, a *cumulative land inequality plot by sub-county* (See Fig. 8) illustrates this vividly. When sub-counties are ranked by their per-capita land endowment, the top 20% hold a disproportionately large cumulative share of land. In contrast, the bottom sub-counties, often those in the Central region or other densely populated areas, account for only a small portion of the land despite containing a large share of the population. Uganda's land is spatially concentrated, and many rural households have little land. In contrast, a few areas, for instance, parts of the north or sparsely populated districts, have land-rich households. The cumulative inequality by county (see Fig. 9) similarly shows uneven

land distribution across counties. However, averaging at the county level slightly smooths it compared with the more granular sub-county view. These spatial inequalities highlight that geography is a key driver of land inequality in Uganda. By contrast, in Kenya, such plots (if drawn by county) would be much closer to the parity line, reflecting the negligible difference between-county Theil. The Kenyan case suggests that within-county Lorenz curves show the most pronounced inequality, whereas across counties, the Lorenz curve is nearly diagonal (equal shares). Thus, Uganda's most pronounced structural driver is location (with certain districts far better endowed with land per capita), whereas Kenya's land inequality is not strongly tied to broader differences in location.

Regional differences in Kenya

According to the Theil decomposition in Table 3b, broad regional or county land ownership disparities are surprisingly minimal in Kenya. When grouping by county (the primary sub-national unit in Kenya's administrative structure), virtually 0% of total inequality is between counties (Theil_{between} = 0.001 out of 0.612). This suggests that no particular region or county in Kenya has a systematically higher or lower average landholding than another, at least not to a degree that is statistically significant in the context of the inequality index. Simply put, an

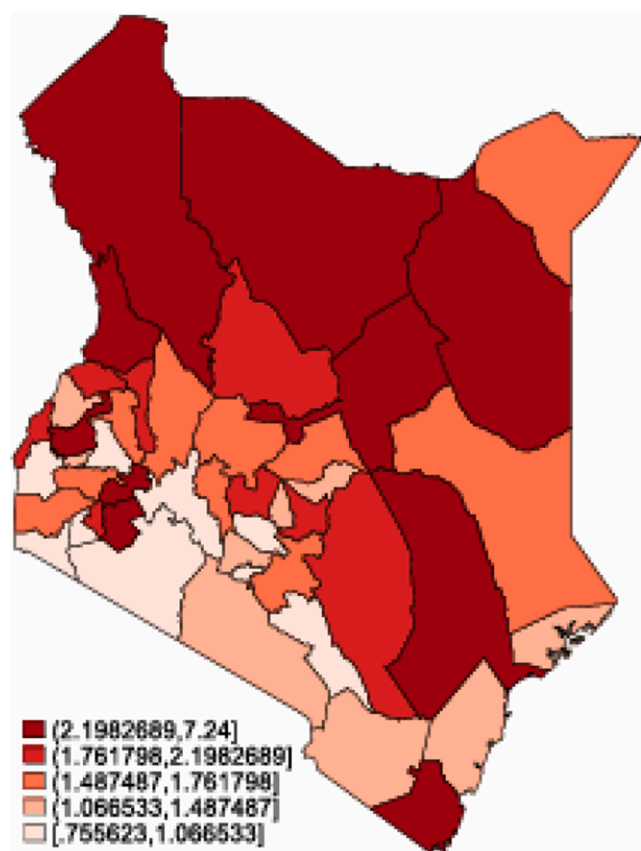


Fig. 11. Mean land distribution by County (Kenya).

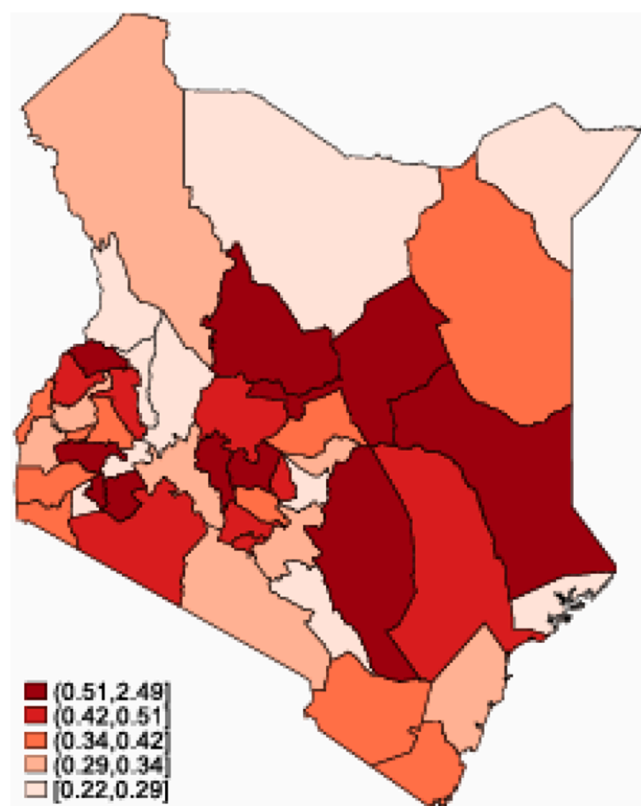


Fig. 12. Theil land inequality index by County (Kenya).

average household in a traditionally land-scarce region (e.g., densely populated Kisii) versus a land-abundant region (e.g., parts of the Rift Valley) ends up with similar landholding when averaged out. Any regional advantages (such as some counties with large farms) are offset by population distribution and other factors, so region-level gaps do not drive national inequality. Indeed, Kenya's land inequality appears to be a localised phenomenon within each county rather than a regional difference. This finding may appear counterintuitive, given Kenya's history, for instance, in the former "White Highlands" areas versus others. However, it suggests that large landowners and land-poor farmers coexist in most counties. The evenness of regional averages could be attributed to post-independence land redistribution, which created smallholder communities in high-potential regions. At the same time, large ranches remained in semi-arid areas, netting out differences in the aggregate. Thus, unlike in Uganda, spatial location at the regional level in Kenya does not markedly advantage or disadvantage households with respect to land ownership.

Gender and household headship

Male vs. female-headed households: The gender of the household head, specifically sex, has a minimal impact on land inequality in either country (Table 3a). In Uganda, female-headed households hold approximately 53.2% of land, corresponding to their 53.0% share of the population, indicating parity. Male-headed households (46.8% of land; 47.0% of population) are similarly proportional. Consequently, the average landholding of a female-headed household is virtually identical to that of a male-headed household (about 0.75 vs 0.75 in normalised terms). Their between-group component for gender in Uganda is only 0.069 ($\approx 8\%$ of total inequality), indicating a very minor contribution. Kenya exhibits a similarly minimal gender gap: female-headed households ($\sim 51.3\%$ of the population) own roughly 52.6% of the land, indicating a slightly larger mean land size than in male-headed households, although not dramatically so (mean index of approximately 1.57 for female-headed households vs 1.49 for male-headed households). Their decomposition for Kenya assigns effectively 0% of inequality to gender differences (Theil_{between} = 0.000). In both countries, whether a man or a woman heads a household does not systematically advantage or disadvantage their land ownership on average. Given common concerns about women's land rights, this finding is significant. Regarding land sizes, female-headed households, in aggregate, are not worse off than male-headed households in the analysis (see Table 3a for a complete overview).

Within-group inequality by Gender: While between-gender inequality is negligible, there are slight differences in the within-group inequality of male-headed vs female-headed households, as reported in Table 3b. In Kenya, land is more unequally distributed among female-headed households (Theil index of 0.735) than among male-headed households (Theil index of 0.475). This could suggest that female headship often arises in varied circumstances. For example, some female-headed households are widows who inherited substantial land, whereas many others have only a tiny amount, leading to greater dispersion. By contrast, male-headed households might cluster more around the middle (most smallholder male-headed families operate similarly sized farms, with relatively fewer extremely land-rich or land-poor male-headed households). In Uganda, the within-group Theil index for female heads (0.803) is only marginally higher than that for male heads (0.771), a trivial difference. Essentially, both subpopulations exhibit high internal inequality. These subtleties, however, do not alter the main conclusion that the gender of the household heads is not a key factor in land inequality in either country. The inequality is overwhelmingly due to differences among households within the same gender group rather than to any systematic male–female divide.

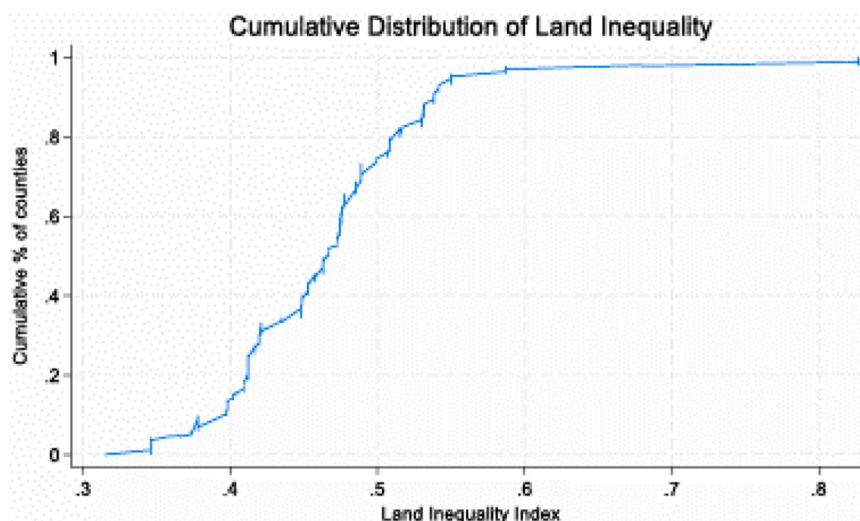


Fig. 13. Cumulative land inequality by County (Kenya).

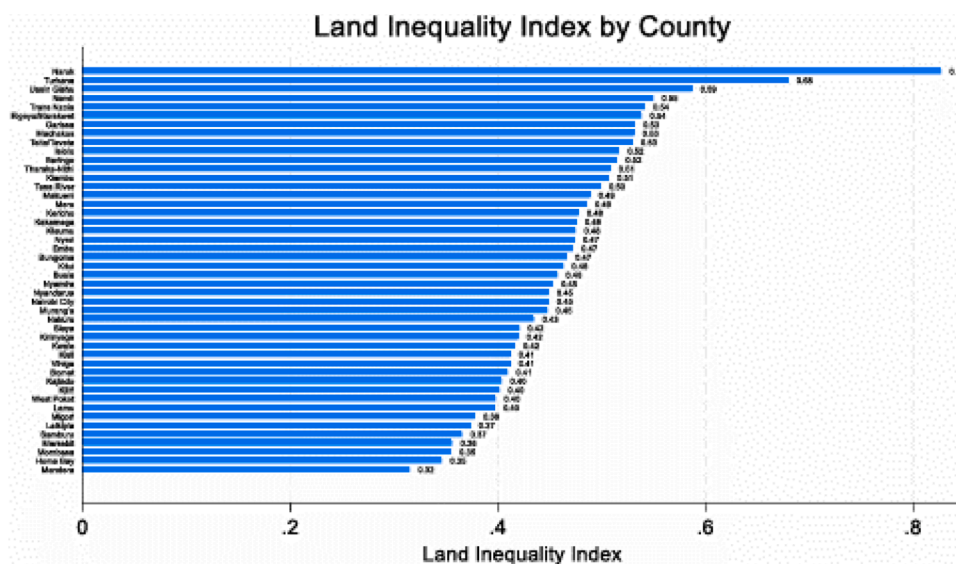


Fig. 14. Land inequality by County (Kenya).

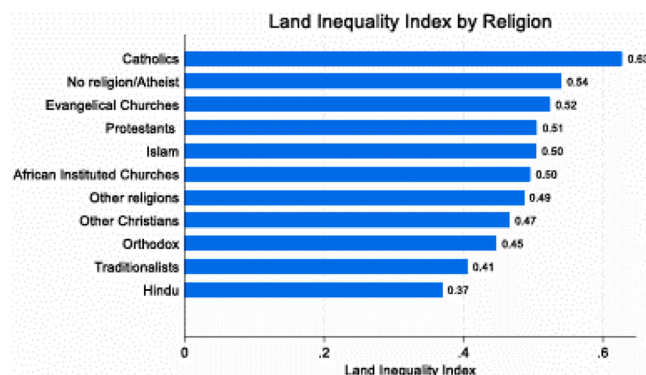


Fig. 15. Land inequality by religion (Kenya).

Household head vs. other members (relation to head)

We also consider how land is distributed among individuals, depending on their relationship to the household head (although this analysis was detailed for Kenya; see Table 3a). In Kenya, the analysis reveals that household heads and their immediate family members collectively hold the majority of the land; however, inequality persists even within these categories. Household heads constitute ~26.0% of individuals and control 25.8% of land (mean land per head ~1.441 times the overall per-capita mean). The Theil index among household heads is 0.537, indicating moderate inequality in landholding size. Spouses account for ~13.5% of individuals and hold 15.0% of the land (a slightly higher per-capita mean of ~1.614). Interestingly, inequality *among spouses* is relatively high (Theil 1.197, the highest among all relation categories). This likely reflects the fact that many spouses (typically wives in male-headed households) have little or no land registered in their names. In contrast, a minority (for example, wives in

wealthier or polygamous households) may own substantial land individually, a very unequal distribution within the spouse category. Sons and daughters (including adult children) comprise roughly 48.7% of individuals and hold 48.0% of land (mean ~ 1.43). Within this group, inequality is lower (*Theil* 0.508), perhaps because most children have no land of their own, with a few adult children having received land, resulting in a somewhat more uniform land ownership status for the majority. Other relations (grandchildren, siblings, and the head's parents) constitute a tiny share of the population and land (0.5–1% each). These tend to have moderate inequality indices (0.43–0.73), but given their tiny weight, they contribute little to overall inequality.

Marital status of the household head

Marital status correlates with specific household characteristics that may influence land ownership (for instance, widowed or single individuals might have different land access than married couples). However, the decomposition of the head's marital status reveals minimal between-group inequality, especially in Kenya (Table 3a). In Kenya, classifying households by the head's marital status yields a between-group Theil of only 0.001 (virtually 0% of total inequality). This indicates that no marital-status group consistently owns significantly more or less land than any other, on average. Indeed, married monogamous couples are the largest group and serve as a baseline: households with a monogamously married head comprise 31.4% of the population and hold 33.4% of the land, with an average land size approximately 1.63 times the national mean. In comparison, never-married heads (which include young single individuals) account for 28.2% of the population, with 27.7% of the land (mean ~ 1.50 times the average), only slightly less. Widowed heads (4.3% of the population, owning 4.3% of the land, mean ~ 1.51) are also roughly on par. Even polygamously married heads (a small subset of 1.6%) hold 1.5% of the land (mean ~ 1.44 times the average). These slight differences in group means explain why between-group inequality is essentially nil.

However, there are differences in *within-group* inequality across marital statuses, reflecting the heterogeneity within each category. In Kenya, households headed by a monogamously married person exhibit relatively high internal inequality (*Theil* index: 0.847). This is not surprising, as this category is large and encompasses everything from smallholders with limited resources to wealthy farmers headed by a married person. Polygamous-marriage households, despite the stereotype of vast landholdings in polygamous families, actually show a lower within-group *Theil* (0.360). This lower inequality may be due to the prevalence of polygamous households. At the same time, few could be uniformly distributed among medium-to-large landowners or have culturally similar land allocation, resulting in less variation among them. Widowed heads have a moderate *Theil* index (~ 0.558), suggesting that inequality in that group is not extreme (some widows have retained sizable land, others very little, but not as polarised as others). Never-married heads show *Theil* ~ 0.490 , again moderate. In Uganda, though not detailed in the provided tables, one can expect a similar story: the majority group (likely monogamously married heads) will mirror overall inequality, and no marital-status category will drive inequality on its own. Polygamy is more common in Uganda than in Kenya. However, the share of polygamous households remains relatively small, so even if they had distinct landholdings, the impact on national inequality would be limited.

In summary, marital status is not a significant determinant of land inequality in either country. Married, single, divorced, or widowed household heads all exhibit significant internal variation, and their group averages do not differ substantially from one another. The subtle nuances (such as monogamous households in Kenya being more internally unequal, or polygamous ones having somewhat lower variance) offer sociological insight but do not alter the aggregate picture; land inequality cuts across all household types, regardless of the head's marital status.

Religion and land inequality

Religious affiliation can sometimes intersect with ethnicity, region, or cultural practices, thereby affecting land ownership. For example, specific missionary-educated communities might have different land tenure histories, or religious institutions might hold land. The Kenyan data include a rich breakdown by religion, revealing interesting differences *within* religious groups, though again, negligible *between-group* inequality in aggregate. Based on the Kenya results, no single religion dominates landholding on average; the between-group *Theil* for religion is only 0.004 (less than 1% of the inequality). However, the internal inequality of some religious groups is striking.

Religious groups in Kenya

The two largest Christian denominations, *Catholics* and *Protestants*, exhibit divergent levels of internal inequality. Catholic-affiliated households (approximately 15.8% of the population) hold 18.5% of Kenya's land. Their average land per household is about 1.79 times the national mean, indicating that Catholics have slightly above-average land endowments. Notably, the distribution of land among Catholic households is extremely unequal (*Theil* 1.185). This suggests that, within predominantly Catholic communities, a subset of families controls vast landholdings, while many others have relatively little. Historically, some Kenyan regions with a strong Catholic presence (for example, parts of the Rift Valley and Western Kenya) saw the creation of large farms (through colonial settlements or church land grants), which may help explain this inequality. In contrast, Protestant households (31.9% of the population, holding 31.4% of the land) have an average land size almost parallel to the national mean (mean index ~ 1.01). Their within-group *Theil* index is only 0.469, indicating a much more egalitarian distribution of land among Protestants. This could reflect the influence of areas such as central Kenya (historically Protestant, e.g., Anglican/Presbyterian among the Kikuyu), where land was more uniformly redistributed into smallholdings after independence, resulting in relatively equal farm sizes in those communities (see Table 3a).

Muslim households form another significant group in Kenya, comprising about 31.8% of surveyed households and owning 29.1% of land. This percentage in the data is higher than Muslims' share of Kenya's overall population; it might be inflated by sampling or by including predominantly Muslim pastoral communities. The average landholding for Muslim-headed households is slightly below the national mean (mean index approximately 0.92). Within-group inequality among Muslims is relatively low (*Theil* 0.452), comparable to that of Protestants. This suggests a relatively uniform land distribution in predominantly Muslim areas of Kenya. For instance, many coastal and northeastern communities have communal land arrangements or uniformly small plots, leading to less internal disparity. Other minority religions show small sample sizes but some noteworthy points: for example, households with no religion/atheist have a high average land (mean ~ 1.84) and moderate inequality (*Theil* 0.575), though they form only $\sim 1\%$ of the population; Hindu households (tiny fraction 0.2%) unsurprisingly hold a very minor share of land (0.1%) and have low average land (since most Kenyan Hindus are urban-based with minimal land). Evangelical and African Instituted Churches (AIC) fall under the broad Protestant umbrella but are listed separately. Evangelical Christians (14.3% pop) have a mean land of ~ 1.56 and a *Theil* of 0.561, while AIC adherents (2.9% pop) have a mean of ~ 1.61 and a *Theil* of 0.435. These views are roughly in line with those of mainstream Protestants, who tend to moderate their stance on inequality. However, Evangelicals exhibit higher inequality than Anglicans and Presbyterians, possibly because they represent both small farmers and some large, landowning revivalist communities (see Fig. 15 for the Gini coefficient).

Religion in Uganda: The dataset summary for Uganda did not detail land distribution by religion. However, Uganda's population is primarily split between Catholic and Protestant (Anglican and other Protestant

denominations), along with a minority of Muslims (~14%). If a similar analysis were done, one might expect relatively small between-group differences. Historically, Catholic and Protestant communities in Uganda overlap considerably in terms of ethnicity and region (both groups are present in most regions), so their access to land may not differ systematically. The Central region (Buganda) has a significant Catholic and Protestant population; given Central's high inequality, both religious groups are likely to exhibit high inequality. If anything, a plausible pattern is that Uganda's *religious* breakdown might mirror its regional pattern. For instance, there are numerous Catholics in western Uganda (where the average landholding is intermediate), and Protestants in the north (where land is more abundant but more evenly distributed). Without specific data, one can only speculate. Still, it is reasonable to conclude that religion is not a primary driver of inequality in Uganda either; any effect would be indirect, via regional or ethnic correlations. However, the findings in Kenya highlight that specific communities (like Catholic-identifying ones) have particularly acute internal land disparities. This could be an avenue for further research into why, for example, Catholic households in Kenya are more likely than other groups to range from land-poor to very land-rich. It may relate to historical mission lands or demographic patterns rather than religion itself.

In conclusion, religious affiliation per se does not create large average differences in landholding in Kenya (and likely in Uganda), but it does show up in the *unevenness within groups*. Thus, while we do not see one religion monopolising land, the Catholic-Protestant contrast in Kenya's inequality structure is an interesting sociocultural facet of land inequality. It underscores that the drivers of within-group inequality can sometimes align with community or cultural lines, even if those lines do not underpin between-group disparities at the national scale.

Land tenure and ownership regimes

Land tenure types often influence land distribution patterns, whether land is held under freehold title, leasehold, or customary tenure (Greiner, 2017; Kenrick et al., 2023; Nchanji et al., 2023). A secure title might enable accumulation, whereas communal/customary arrangements might constrain extreme inequality (Antonio & Griffith-Charles, 2019; Ayinpoya Akafari et al., 2021; Coldham, 2000). The analysis for Kenya included tenure types (Table 3a), revealing that tenure differences contribute almost nothing to overall inequality. In Kenya's data, most of the land (over 97%) is categorised as freehold (private ownership). This is expected, as Kenya's post-independence land system has converted many areas to individual titles. The internal inequality of the freehold category (Theil 0.614) mirrors the national disparity, as it encompasses nearly all landowners, indicating that inequality exists among freehold owners. A tiny share of land (~1.4%) falls under "other" tenure (which may include communal or trust land or customary tenure in certain areas), and another ~1.4% under leasehold tenure. These minor categories have their own Theil indices (~0.494 for others, 0.418 for leasehold). Still, because they represent such a tiny fraction of land and population, differences in their inequality do not affect the national picture. The between-group Theil for tenure in Kenya is a mere 0.001, effectively zero, indicating that having land under a freehold title vs. leasehold or other forms does not systematically lead to different average land sizes.

In Uganda, we anticipate greater diversity in tenure systems (e.g., customary tenure is widespread, with the unique *Mailo* tenure in Central Uganda, as well as freehold/leasehold titles). The provided Uganda tables lumped tenure categories in a simplified manner (possibly treating most private and customary land as freehold for analysis, accounting for 97% of the land, with tiny shares for *leasehold and other tenure types*). The implication is that, similar to Kenya, one tenure form dominates the sample (likely a combination of customary and freehold). Thus, tenure type per se is not a divider of inequality. If customary lands in Uganda were treated as *others*, they would constitute only ~1.4% of the land in the table, which is inconsistent with the known reality (customary

tenure covers a large portion of Uganda's land). In any event, *the inequality in Uganda spans all tenure types*. Whether land is held with formal title or under customary arrangements, small holdings and large holdings are found in both. For example, in the central Mailo tenure areas, some customary tenants have small plots, while a few landlords hold extensive estates. In freehold-titled areas, both small farms and plantations are found. Therefore, we can infer that the tenure system itself is not driving differences in who has more land; instead, the underlying distribution of land within each tenure category matters.

One point to note is that land tenure security and distribution are related. Kenya's near-universal private tenure might facilitate land markets that, over time, concentrate land, yet in this comparison, Kenya ended up *less* unequal than Uganda, where customary tenure remains common. This suggests that other factors (population pressure, historical initial distributions) overshadow tenure form. In summary, *tenure types cannot explain land inequality in both countries*; for example, freehold tenure is not more unequally distributed than customary tenure. Both systems can accommodate inequality if the context allows. The policy takeaway is that simply changing tenure formalisation is unlikely to reduce inequality without addressing who controls the land within each system.

Inequality decomposition: between-group vs. within-group contributions

Theil index decomposition summarises how much of the total inequality is due to differences between groups (inter-group inequality) versus within-group disparities, bringing together the category analyses. Practically *all* of Kenya's land inequality is within groups. For every categorical grouping considered, including residence, gender, region (sub-county and county), religion, tenure, and marital status, the between-group component is essentially zero. For instance, rural and urban contributed 0.0, gender 0.0, and religion 0.004, as noted. Even dividing by county of birth (a proxy for ethnic or geographic origin) yields only a tiny 0.014 (approximately 1.4%) between-group share. The largest between-group share observed in Kenya was 1% (for country of birth, outside our primary focus). This overwhelming dominance of within-group inequality means that the factors contributing to Kenya's unequal land distribution operate at the micro level within every subgroup of society. Whether we examine rural farmers, male-headed households, or Protestant households, we find a wide dispersion of land sizes, nearly as wide as the nation's overall distribution. No broad demographic or regional category has a uniformly higher or lower land endowment that would account for the inequality. In numerical terms, for Kenya's Theil (0.612), the "between" portion for any major grouping was at most 0.001–0.004, with the remainder (over 99%) coming from within-group variance. This points to diffuse inequality: large landowners and land-poor households are spread across all regions, religions, and other demographics, rather than a single region or group owning most of the land.

In Uganda's case, while most inequality is also within-group, there are a few notable between-group contributions. As discussed, the *region* accounts for approximately 0.094 of Uganda's Theil (11.2%), reflecting differences between the north, central, and other regions. Gender contributes 0.069 (~8.2%), a small share in absolute terms, but interestingly, a higher share than in Kenya (perhaps due to female-headed households having slightly higher average land ownership in Uganda, or due to data nuances). Despite large mean differences, rural versus urban residence contributes only 0.002 (~0.2%), which is effectively negligible, given the high within-variance. Regarding finer geography, the between-county rate is 0.295 (35%), and the between-sub-county rate is 0.388 (46%). These two are substantial and indicate that much inequality is structured by locality. If we aggregated people by sub-county, almost half of the national inequality is attributable to differences in sub-county averages. This is a crucial distinction from Kenya. Even without individual data, one can infer that Uganda has high inequality by noting that some sub-counties have significantly more land

per capita than others (e.g., a sparsely populated northern sub-county versus a densely populated central sub-county). In Kenya, performing a similar aggregation by sub-county would likely not capture much inequality because villages tend to have comparable land endowments on average (the inequality is within villages).

Other categories, such as religion, relationship to head, or marital status, were not explicitly decomposed for Uganda in the summary. Still, given the Kenya result and Uganda's patterns, it is safe to assume the effects between them are minimal. If we grouped Ugandans by religion, household headship, or spouse status, we would still find that the bulk of inequality remains within those groups. Theil's additive decomposition indicates that location-based groupings (small geographic units) are the primary factors explaining a non-negligible fraction of Uganda's inequality. In contrast, in Kenya, no grouping by broad attributes explains much. In essence, Uganda's inequality has a layered structure: part of it stems from the uneven development of different areas (a legacy of historical, political, and ecological factors), and the rest from rich-poor differences within each area. Kenya's inequality is almost entirely the latter, with the former nearly absent from aggregate statistics.

Lorenz curves and cumulative distribution insights

The Lorenz curves of land distribution further illustrate the contrast between Kenya and Uganda (see Figs. 1, 2, 3, and 4). The Lorenz curve plots the cumulative percentage of land owned against the cumulative percentage of households (ordered from smallest to largest landholding). A perfectly equal distribution would be a 45-degree line; the more it bows downward, the greater the inequality. Using the Gini coefficients as a guide, Uganda's Lorenz curve lies significantly further from the equality line than Kenya's. For example, consider the halfway point: in Kenya, the bottom 50% of households might own on the order of 10–20% of the land (given Gini ~ 0.52), whereas in Uganda the bottom 50% likely own well under 10% (perhaps just a few percent) of the land, meaning half of Ugandan households occupy a negligible share of the land pie. Correspondingly, Uganda's top 10% of landowners control an overwhelming share, quite possibly above 50% of all land, whereas Kenya's top 10% control somewhat less (maybe ~ 30 –40%, consistent with a lower Gini). Although precise percentages are not given in the text, the cumulative land distribution curves would show Uganda's curve starting very flat (indicating a large proportion of households with tiny slivers of land) and rising sharply near the end as the land of the largest owners is added. While still far from diagonal, Kenya's curve would rise steadily, reflecting a larger middle class of landholders and a smaller number of landless families.

The cumulative inequality plots by sub-county and county in Uganda (see Figs. 8 and 9) offer a different perspective by aggregating spatially. Fig. 8 (cumulative land inequality by sub-county) likely ranks sub-counties from lowest to highest land per capita and then shows the cumulative land owned by those sub-counties' populations. This curve underscores that a small fraction of sub-counties (those with high land-to-person ratios, often in low-population areas) account for a disproportionate share of Uganda's total land. Visually, one would see that, say, the first 50% of sub-counties (typically the more densely populated ones) might encompass well over 50% of the population but cover a much smaller fraction of total land area – the curve remains low until the large-land sub-counties come in towards the right. Fig. 9 (by county) smooths this a bit (since counties average multiple sub-counties), but still shows inequality: a minority of counties hold a large chunk of land. These cumulative plots complement the Lorenz curve by highlighting spatial concentration: not only are there inequalities among individuals, but those individuals are clustered in certain localities. In Uganda, the spatial Lorenz curve (for sub-counties) is quite bowed, meaning a highly uneven geographic distribution of land resources. In Kenya, if one were to create a similar cumulative plot by county, it would be almost a straight line, confirming that each county's population has a roughly

proportional share of land, with no county dominating land ownership. Thus, Kenya's Lorenz inequality is almost entirely *within each county's population*, whereas Uganda's overall Lorenz is an amalgam of *within-community inequality and large between-community gaps*.

In practice, these distributional insights suggest that addressing land inequality in Uganda may require targeted interventions in specific regions, such as land redistribution or tenure reform in areas where land is concentrated. In contrast, in Kenya, policies should aim to address broad-based inequality across nearly all communities, for example, by strengthening land ceilings or anti-land-concentration measures nationwide, since inequality is not confined to one province or group. The Lorenz curve highlights how extreme Uganda's scenario is: the bottom tail of the distribution includes many households that are essentially landless, both rural and urban. While showing inequality, Kenya's curve suggests a larger base of smallholders with non-trivial landholdings, which is why the Gini is lower.

Conclusion

Land inequality is a serious issue in Kenya and Uganda, but it manifests differently in each country. Uganda's land inequality is more severe and structurally driven by geography. Theil index analysis reveals that Uganda has roughly twice Kenya's level of inequality, with highly concentrated landholdings among a small segment of the population. A notable portion of this inequality stems from regional and local disparities – people in certain regions (especially the north) have, on average, significantly more land than those in others (the central region), and even more so, a few sub-counties enjoy abundant land, while many others face scarcity. This means that Uganda's inequality has both a between-group component (spatial inequity) and a within-group component (rich vs. poor within each area). Lorenz curves confirm an extremely skewed distribution, indicating that many Ugandan households have negligible land. On the other hand, Kenya's land inequality, while significant, is more homogeneously distributed across the nation. Virtually none of Kenya's inequality is explained by broad categories such as region, gender, or religion; instead, the high dispersion within each category drives it. In Kenya, each community tends to have a mix of relatively land-poor and land-rich households living alongside one another. The overall inequality is lower than that of Uganda, likely reflecting historical differences. For instance, Kenya implemented more extensive smallholder settlement schemes, thereby preventing absolute landlessness among a larger share of rural families. Perhaps stronger land market dynamics also kept farm sizes from diverging as widely as in Uganda. Kenya's Lorenz curve is closer to the equality line, suggesting a more substantial middle tier of landowners. Moreover, Kenya's cultivated land is relatively evenly distributed, implying that many households have access to some farmland. In contrast, Uganda's cultivated land is nearly as unequal as total land, suggesting that even productive land is concentrated in a few hands.

In both countries, *certain groups exhibit particularly high internal inequality* (for example, Catholic-affiliated households and female-headed households in Kenya, or urban households and communities in the Central region of Uganda). Still, none of these groups explains national inequality on its own. Theil decomposition highlights that policy solutions must address within-group inequality, such as land fragmentation, elite land accumulation, and the lack of access for low-income individuals, rather than assuming that transferring land between broad groups would resolve the issue. For Uganda, reducing spatial inequality might be key: investing in land access programs for densely populated regions or in better land use in underutilised areas could help close the between-region gaps. Since spatial factors are relatively unimportant in Kenya, the focus might be on overall land redistribution or preventing excessive consolidation by the wealthy across the country.

Overall, the findings demonstrate that while land inequality remains a significant challenge in both Kenya and Uganda, its underlying drivers differ substantially. Uganda's markedly higher levels of inequality are

shaped not only by disparities among households but also by pronounced spatial imbalances in land distribution across regions and localities. In contrast, Kenya's inequality is largely embedded within communities and social groups, reflecting disparities in access and ownership that cut across geographic and demographic boundaries. These results suggest that land inequality is not a uniform phenomenon and therefore requires context-specific policy responses. More broadly, the persistence of highly concentrated land ownership in both countries underscores the enduring influence of historical land allocation processes and highlights the need for policies that address both structural inequities and contemporary patterns of land accumulation.

Policy recommendation

Ultimately, this study provides a comprehensive analysis of land inequality in Kenya and Uganda, offering new insights into a long-standing issue of importance in development studies. Our comparative approach highlights how two countries with shared historical threads and geographic proximity can nonetheless exhibit markedly different dynamics of inequality. Notably, our findings indicate that Uganda currently experiences substantially higher land inequality than Kenya. For example, the inequality entropy measure (Theil index) in Uganda is more than double that in Kenya. This contrast underscores the role of country-specific factors (such as Uganda's pronounced regional disparities and post-conflict land reallocations, versus Kenya's somewhat more egalitarian smallholder system) in shaping outcomes. At the same time, we find that in both countries most inequality exists within communities rather than between them, suggesting that broad societal structures, such as class and local power relations, drive land concentration more than simple geographic differences. Intriguingly, our spatial analysis reveals that land inequality itself is not strongly clustered geographically. In other words, while large landholdings may be localised (for instance, commercial farms in certain districts), the overall *inequality levels* do not form distinct spatial enclaves. This pattern challenges assumptions about region-specific inequality and highlights the presence of widespread structural factors. These insights carry significant policy implications. They suggest that achieving land justice and inclusive growth will require differentiated national strategies that respond to each country's context. In Kenya, where overall land inequality is lower and much of the disparity occurs within communities, policy efforts might focus on community-level solutions, for example, strengthening local land governance, addressing elite capture in communal lands, and ensuring vulnerable groups (such as women, youth, and pastoralists) have access to land. Uganda, facing higher inequality and clear regional imbalances, may need to prioritise region-focused initiatives, such as targeted land redistribution or development programs in the most unequal areas (e.g., regions with historically large estates or high levels of landlessness). Prioritising sub-counties with the highest levels of land inequality through tailored land administration, land registration, dispute resolution mechanisms, and complementary agricultural support services could enhance both equity and the productive use of land resources. Nonetheless, across both countries, there is a need to bolster land administration systems by completing land registration, reconciling customary and statutory tenure, and combating corruption so that land policies can be implemented fairly and effectively. The introduction of inclusive, context-appropriate land reforms, backed by political will and the support of civil society and development partners, is critical to redressing the entrenched inequalities documented in this study. By shedding light on the magnitude, sources, and spatial pattern of land inequality in Kenya and Uganda, our analysis provides an evidence base to inform such policies and to stimulate further scholarly and public debate on how to foster equity in land ownership as a foundation for sustainable development.

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CRediT authorship contribution statement

Raphael Kweyu: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing. **Stephen Kehinde Medase:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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Data availability

Data will be made available on request.

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