OF CATTLE AND (WO)MEN: ANIMAL DOMESTICATION AND GENDER DISPARITIES IN SUB-SAHARAN AFRICA

Lucienne Talba *

November 5, 2022

Norms about gender roles may be rooted in historical traditions and practices whose effects persist until the current time. However, the nature of these historical roots differ across the world. This paper examines, in the context of Sub-Saharan Africa, Engels (1884) hypothesis that the origin of these differences was the domestication of cattle. Cattle-based societies had more gender inequality, as measured by female participation in agriculture, inheritance rules, and other marriage customs. These disparities persisted among the descendants of these societies and cannot be attributed to plough cultivation or pastoralism. The evidence suggests gender inequality is affected by cattle through the channel of gender imbalance in wealth holdings, which ultimately led to a shift towards patriarchal norms that have persisted to the present day. *JEL* Codes: J16, N37, Z1.

*I thank Joshua Lewis and three anonymous referees, as well as Nicola Lacetera, Leonard Wantchekon, Raphael Godefroy, Andriana Bellou, Nathan Nunn, Shari Eli, and participants at University of Montreal. My thanks also to the 2020 Eastern Economic Association, the 2019 Canadian Economics Association (CEA), the 2019 Africa Meeting of the Econometric Society, Eastern American Economics Association (EAEA), and the 2017 Canadian Network for Economic Historians (CNEH). All mistakes are my sole responsibility.
Contact information: Lucienne Talba, Rotman School of Management, University of Toronto, 105 St George St Toronto, ON M5S 3E6 Email: lucienne.talba@utoronto.ca E-mail: lucienne.talba@utoronto.ca.

1 Introduction

"The domestication of cattle constituted the world historical defeat of the female sex."

Engels (1884)

There are wide differences in the roles of women across the world, and these variations are more important across societies in Sub-Saharan Africa (Alesina, Giuliano, and Nunn 2013; Teso 2019; Graziella and Dimico 2019). In 2000, female participation rates ranged from 33% in Senegal to 88% in Mozambique (World Bank 2011), and these differences are mirrored in reported attitudes about the role of women in society.[1] Understanding the deep roots of these differences is crucial for the design of effective policies aimed at reducing gender inequality and promoting women's empowerment (World Bank 2011). Recent studies have investigated the historical origins of these disparities, examining the role of plough cultivation (Alesina, Giuliano and Nunn 2013), tsetse fly (Alsan 2015), pastoralism (Becker 2019), and the slave trade (Teso 2019). But

This paper examines a prominent anthropological hypothesis first proposed by Engels (1884) that differences in gender roles in Africa have their origin in the domestication of cattle. Cattle were highly valued in precolonial Africa, and were the dominant source of wealth and medium of exchange.[2] Because cattle herding required travelling long distances and working in close proximity to large animals, activities that were incompatible with child rearing, this wealth was typically held by men. Thus, anthropologists argue that the introduction of cattle around 5,000 BCE led to a shift towards patriarchal norms that favored men and placed women in a subservient position (Aberle 1961; Holden and Mace 2003). Despite these claims, there is very limited causal empirical evidence of this relationship.

1. The proportion of women in the *Demographic and Health Survey* (DHS) who respond "husband alone" to the statement "person who should have greater say: visits to family or relatives" ranged from 72% in Senegal to 24% in Mozambique.

2. Cattle provided food, clothing, and cooking fuel and were used as a form of insurance against climatic shocks (Schneider 1964; Marshall and Hildebrand 2002). In Africa, cattle were less valued for tractive power, given the unsuitability of the land for plough cultivation (Pryor 1985; Green 2013).

I investigate the relationship between historical cattle adoption and women's outcomes in both precolonial and contemporary Africa. First, I study the link between historical cattle presence and women's outcomes in the precolonial period. This analysis combines information on precolonial characteristics (cattle presence, female participation in agriculture, and other norms governing women's role in society) across 533 African ethnic groups from Murdock's (1967) *Ethnographic Atlas* with geographical data on historical ethnic homelands from Murdock's Map (1959). I find a significant negative relationship between historical cattle presence and female participation in agriculture. The results are stable across a range of specifications and are robust to controls for a number of historical ethnic group characteristics including political development and economic complexity as well as controls for the geographic conditions of the ethnic homeland (tropical climate, longitude, absolute latitude, a measure of agricultural suitability, and malaria ecology index). I also find that cattle-based societies were more likely to adopt other norms that disadvantaged women, including patrilineal inheritance rules, in which family wealth is transferred to sons, and patrilocality marriage customs, in which the wife co-resides with the husband's family after marriage.

I explore whether the historical presence of cattle continues to influence women's outcomes today. To investigate this question, I use data from the Demographic and Health Surveys (DHS) on more than 400,000 women from 24 Sub-Saharan African countries for the period 1992 to 2016. I link individuals to historical ethnic groups in the *Ethnographic Atlas*, building on a procedure developed by Michalopoulos, Putterman, and Weil (2016) and Alesina, Brioschi, and La Ferrara (2021), from which I am able to match 85% of the sample took a historical ethnic group.

The results show consistent evidence that women whose ancestors herded cattle are significantly less likely to work today. The coefficient estimates are large in magnitude and stable across specifications, implying that female descendants of cattle-based societies have participation rates that are 4 percentage points lower than those of non cattle-based societies. Consistent with the labor market evidence, I also find that historical cattle presence is associated with higher rates of fertility and polygynous marriage and a decrease in women's role in household decision making.

Nevertheless, these patterns may not reflect the causal impact of cattle on women's outcomes due to issues of omitted variables bias, reverse causality, and measurement error. Consider, for example, the Maasai tribe, a cattle-herding society with strong patriarchal norms. Since there are no records on the Maasai prior to the introduction of cattle, it is impossible to assess whether the adoption of cattle led to the creation of these patriarchal norms, or whether the adoption of cattle was simply a consequence of pre-existing male-oriented culture.

To establish the causal impact of historical cattle presence on gender norms, I adopt an instrumental variable strategy that exploits differences across ethnic homelands in suitability of geo-climatic conditions for cattle raising. Agronomists have identified three factors as critical determinants for cattle prosperity: abundant pasture, available water sources, and sufficiently flat terrain for migration (Marshall and Hilderbrand 2002; Mattioli et al. 2000; and Murray, Morrison and Whitelaw 1982). Motivated by the agronomic literature, I construct an index for cattle suitability (CSI) as the interaction of these three factors, using grid-cell level data from FAO's *Global Agro-Ecological Zones* (GAEZ v3.0) 2011 database (Fisher et al. 2002) and the ESRI's Natural Earth dataset.[3] I aggregate my grid-cell level CSI measure to an average cattle suitability across historical ethnic homeland and use this variable as an instrument for historical cattle presence.[4] The IV estimates support the baseline findings. I find a negative and statistically significant relationship between historical presence and women's participation in both the precolonial and modern periods. I also find similar effects for various measures of women's empowerment and gender norms.

Next, I explore the mechanisms underlying the relationship between historical cattle

3. This functional form reflects the fact that inputs are not substitutable. For example, an increase in available pasture for grazing is of limited value if there are no available sources of water.

4. There is a strong first-stage relationship, with F-statistics for the excluded instrument, typically exceeding 16.

presence and women's outcomes. The results cannot be attributed to plough cultivation. The estimates for historical cattle presence are unchanged when I control for the traditional practice of plough agriculture, as reported in the *Ethnolographic Atlas*, or when I instrument for traditional plough presence using local geo-climatic suitability for "plough-positive" crops (Alesina, Giuliano and Nunn 2013). These results suggest that, in Africa at least, cattle presence did not influence women's outcomes through historical agricultural practices. These findings contrast with the views of Boserup (1970), who argues that men's physical comparative advantage in controlling large animals during plough cultivation ultimately led to a shift in gender roles. Instead, these patterns likely reflect the fact that soil characteristics in Africa were largely unsuitable for plough agriculture (Pryor 1985; Green 2013).[5] Whereas traditional plough cultivation played an important role in gender norms in other regions (Alesina, Giuliano and Nunn 2013), its effect was limited in Africa, and the technology cannot account for the large differences in participation across cattle-based and non-cattle-based societies.

I assess a number of alternative explanations for the observed link between historical cattle presence and women's outcomes. First, I examine whether the patterns can be attributed to pastoralism rather than cattle ownership per se. Anthropologists have argued that pastoralist societies often adopt patriarchal norms (i.e., patrilocality and low female participation in agriculture) as a means of reducing paternal uncertainty due to extended male absences associated with herding (Becker 2019; Xia 1992). To assess this hypothesis, I include controls for other herded animals—sheep and goats—in the main specifications. The effects for historical cattle presence are unaffected by these covariates. In addition, I show that the results cannot be attributed to the tsetse fly, historical exposure to the slave trade, or a number of historical ethnic group characteristics. Taken together, these results provide strong support for the view that historical cattle presence, by creating a large gender imbalance in wealth holdings in pre-industrial Africa, led to a historical shift in gender norms

5. Just 7% of precolonial ethnicities used plough cultivation (Murdock 1967).

that continues to influence women's outcomes today.

Why are modern gender roles still shaped by historical cattle presence? One possibility is that these animals continue to play a crucial role in economic and social life, so the forces that operated historically are still at work today. Alternatively, the traditional roles that emerged in pre-industrial Africa may continue among the descendants of cattle herders in the modern era, even if cattle no longer play a dominant role in society. This persistence could arise from the continuity of cultural norms or endogenous changes in formal institutions that inhibited women's participation over the long run. To address these questions, I first estimate the effect of historical cattle presence among descendants who reside in urban versus rural areas. Intuitively, since cattle are rarely held in urban areas, this comparison distinguishes the direct effect of contemporary cattle ownership from the legacy of the animal's presence among one's ancestors. The coefficient estimates are virtually identical across the two sub-samples, suggesting an important role for the transmission of cultural beliefs. Furthermore, I exploit the fact that roughly half of the contemporary sample no longer resides within their historical ethnic homeland to separately identify the effects of historical ethnic-based cattle presence from historical location-based cattle presence. I find that ancestral cattle ownership has a significant negative impact on contemporary women's participation decisions, whereas historical location-based ownership has no significant impact on participation. Taken together, these findings suggest that historical cattle ownership primarily shaped long-run outcomes through a persistent change in cultural attitudes regarding the role of women in society.

This paper contributes to two strands of the literature. First, it is directly related to the literature on determinants of gender roles. Previous studies have documented the importance of economic development (Goldin 1994 and 2006; Ross 2008; Duflo 2012), medical progress (Goldin and Katz 2002; Albanesi and Olivetti 2007; Miller 2009), and improvements in labor-saving consumer durables in the household (Greenwood et al. 2005; Graham, Hirai and Kim 2016; Lewis 2018). Others have emphasized social and cultural factors including patrilocality (Dyson and Moore 1983; Chakraborty and Kim 2010; Ebenstein 2014; Bau 2021), patrilineality (Deininger et al. 2013; Lowes 2017 and 2018), and brideprice and dowry (Arnold et al. 1998; Das Gupta 2003; Lowes and Nunn 2017; Ashraf et al. 2020). I contribute to this literature by showing how historical cattle presence created a large gender imbalance in wealth, which led to a shift in gender norms that continues to affect women's outcomes today.

Second, the paper contributes to the literature on the persistence of historical and cultural causes of gender roles. Previous work has demonstrated the persistent influence of historical factors on women's outcomes, including the role of traditional plough cultivation on women's participation and fertility (Alesina, Giuliano, and Nunn 2011 and 2013), the long-run effect of the Neolithic revolution on current gender norms (Hansen, Jensen, and Skovsgaard 2015), the effect of the African slave trade on polygyny and women's participation in the labor force (Edlund and Ku 2011; Fenske 2015; Dalton and Cheuk Leung 2014; and Teso 2019), and the role of pastoralism in women's outcomes (Voigtlander and Voth 2013; Becker 2019). I contribute to this literature by showing how the introduction of cattle in Africa around 5,000 BCE led to a shift towards patriarchal norms and continues to affect women's outcomes today. By studying these relationships in both the historical and modern contexts, I am able to track the evolution of these norms over an extended time horizon.

The paper proceeds as follows: Section 2 discusses the history of cattle and the role of women in Africa; Section 3 describes the data construction; Section 4 presents the empirical strategy; Section 5 presents the results for precolonial analysis; Section 6 presents the results for contemporary data; and Section 7 concludes.

2 Cattle and the Role of Women in Sub-Saharan Africa

Anthropologists argue that early African societies were matriarchal, with lineage and inheritance passed through the mother's line, but that over time many adopted patriarchal norms (Morgan 1871; Engels 1884). Since Engels (1884), a number of scholars have argued that the source of this transition was the introduction of cattle (Aberle 1961; Holden and Mace 2003).

Cattle were first introduced to Africa around 5,000 BCE through the migration of farmers from the Middle East (Epstein and Mason 1984; Mukasa 1989). The animals were crossbred with wild African aurochs to constitute an indigenous African cattle population which can be classified into four major categories: humpless Bos taurus, humped Bos indicus (zebu), sanga (crossbreding of Bos taurus and humped Bos indicus), and zenga (sanga and zebu backcross).[6]

Vegetation type, percent slope of soils, and availability of water were the main factors that drove geographic spread of cattle throughout Africa (Senft, Rittenhouse and Woodmansee 1985; George et al. 2007; Owens, Launchbaugh and Holloway 1991). Specifically, George et al. (2007) argue that locations suitable for keeping cattle must have high quality and quantity of pasture with sufficient water and a flat slope. More precisely, the physiological features of cattle do not allow them to travel more than 3.2 km per day for water or to graze on a slope above 10%; they must consume at least 36 lb (16.33 kg) of pasture per day. These requirements are consistent with the geographic pattern of cattle throughout the continent. For instance, zebu cattle are widespread in the Sahel and Savannah, but are nearly absent in the Sahara and Kalahari desert (Green 2013). The tsetse fly has been identified as another factor that slowed down the spread of cattle in the continent. As noted by Diamond (1997, 186): "The spread southward of Fertile Crescent domestic animals through Africa was stopped or slowed by climate and disease, especially by trypanosome diseases carried by tsetse flies. [...] The advance of cattle, sheep, and goats halted for 2,000 years at the northern edge of the Serengeti Plains, while new types of human economies and livestock breeds were being developed." Over time, herders bred cattle resistant to trypanosome disease (Hannote et al. 2000). For example, the Bos taurus subspecies, which are resistant

6. See Hanotte et al., (2000) for further details on African cattle characteristics.

to trypanosome diseases, are commonly found in the tsetse fly belt around Central and West Africa. However, their small size and their low productivity make them useless in the fields, and they are primarily valued for cultural purposes (Murray, Morrison and Whitelaw 1982).

Anthropological records highlight the essential economic role of cattle in precolonial Africa. For agricultural societies, cattle provided an important source of insurance against volatile climatic conditions (Marshall and Hilderbrand 2002). They provided the main source of animal protein, they were used as draft power in the fields, and their dung was used as fertilizer and fuel (Schneider 1957). Cattle were also used as a means of exchange to acquire grain from another man who had a surplus. Given these economic benefits, cattle were highly valued in precolonial societies and considered the central source of societal wealth (Schneider 1957; Comaroff 1990). As Burchell (1822, 347) states: "From the possession of cattle, the distinction of men into richer and poorer classes has followed as natural consequence."

According to custom, men held ownership over cattle. Deshler (1963) identifies two major reasons for this unequal distribution of societal resources. First, the cattle indigenous to Africa are large, with sharp horns that make them dangerous to corral, especially for women with young children (see Figure 1). For instance, the Ankole longhorn cattle from Central and East Africa usually weigh 900 lb (approximately 400 kg) for males and 700 lb (approximately 300 kg) for females, and their horns can measure 6 to 8 ft (2 to 2.5 m) in length.[7] Second, because cattle consume large amounts of pasture and drink an average of 10 gallons (approximately 45.5 L) of water per day, in the dry season herders had to travel long distances and spend many days away from camp, an activity that was incompatible with child rearing. This view is outlined by Dupire (1963, 75), who argues: "To look after the cattle [...] demands activities of which a woman is physically incapable." She continues: "It would be beyond a woman's strength to draw water for the herd in the dry season, to go on long marches to reconnoitre for grazing lands, to protect the herd against wild animals and thieves, to hold her own with a buyer at the market, to castrate bulls, or to train the pack

7. See Deshler (1963) for more details.

oxen. This hard, dangerous life, full of uncertainty and of prolonged absences from the camp, would be incompatible with the duties of motherhood, which require a more sedentary and more regular life." In line with the narrative, cattle herding was a male dominated activity in almost 80% of precolonial African societies according to the Murdock's (1967) *Ethnographic Atlas*.

The presence of cattle in African societies coincided with a number of patriarchal social norms. One such norm is patrilineality, in which lineage and inheritance are passed through the father's line. Engels (1884) argues that early hunter-gatherer societies practiced matrilineality, but the domestication of cattle improved men's position in the family, which they used to overthrow matrilineal descent and establish a new norm in favor of their own children. Patrilineality made women dependent on husbands for their wealth. Empirical support for this argument is provided by Aberle (1961), who finds that matilineality is more likely to evolve in horticultural societies, while patrilineality is practiced in pastoralist societies with a large presence of cattle. He concluded that "the cow is the enemy of matriliny, and the friend of patriliny." Holden and Mace (2003) provide further support for this hypothesis.

Cattle presence has also been linked to patrilocality norms, in which the wife takes residence with the husband's kinship group after marriage (Vroklage 1952). The practice of patrilocality is often associated with a brideprice, for which cattle provide the typical form of payment (Goldschmidt 1974). This payment provides the husband rights to his wife's labor and reproductive capabilities (Anderson 2007). Further, patrilocal residence is associated with lower investment in female health and education; parents, who anticipate these future, post-marriage living arrangements, may direct resources to their sons, who will continue to work on family farms (Jayachandran 2015).

Finally, the presence of cattle might increase women's fertility. Cattle-based societies may have developed gender preferences that favored sons (Gitungwa 2018). These preferences could reflect the value of sons as helpers in management, and also their insurance value for livestock herding, in the case of the father's death. These preferences could promote fertility in an effort to acquire a son—at the cost for females of participating in work outside the home.

3 Data Construction

This paper explores whether the historical presence of cattle affected women's outcomes in the precolonial and contemporary periods. The precolonial analysis relies on the *Ethnographic Atlas* data, and the contemporary investigation on the combination of the *Ethnographic Atlas* with the Demographic and Health Surveys (DHS). The next sections present these data sets and describes the matching procedure I use to combine the *Ethnographic Atlas* with the DHS data.

3.1 Precolonial Data

The information on ethnic groups' precolonial traits comes from Murdock's (murdock1967ethnographic) *Ethnographic Atlas*. The *Atlas* is a compilation of ethnographic and anthropological data and archives of missionary studies that George Peter Murdock assembled and published in 29 installments in the journal *Ethnology* between 1962 and 1980. It contains information on historical characteristics of 1,267 societies from around the world, 533 of which are from Africa.

Although the *Atlas* contains the best available cross-cultural data, its greatest shortcoming is that ethnic groups are observed in different periods of time. The approximate date of observation ranges from 1830 to 1960.[8] Thus, ethnic groups observed in 1830 may systematically differ from societies observed in 1960 due to the passage of time (Henderson and Whatley 2014). Fortunately, this is not an issue that prohibits the use of the data set since most of the characteristics of African societies are thought to remain stable over time.

8. The *Ethnographic Atlas* attempts to describe in as much detail as possible the characteristics of the ethnicities it describes before their contacts with Europeans.

Murdock's *Ethnographic Atlas* has been widely used. Alesina, Giuliano, and Nunn (2013) aggregated the *Ethnographic Atlas* at the country level to show that the historical use of plough agriculture predicts contemporary gender inequalities. Michalopoulos, Putterman, and Weil (2016) have combined this data with the Demographic and Health Surveys data set to show that individuals whose ancestors relied on agriculture for subsistence are today more educated and wealthier. Alesina, Brioschi, and Ferrara (2021) have investigated the determinants of violence against women in Africa, showing that ancestral socioeconomic conditions explain intrafamily violence today.

In order to determine the spatial locations of the ethnic groups in the *Atlas*, I follow previous work and combine it with Murdock's (1959) Map.[9] This map provides the geographic boundaries of approximately 830 African ethnic groups. In total, I matched 522 African ethnic groups from the *Ethnographic Atlas* to the Murdock Map. Figure 2 portrays the boundaries of African ethnic groups in the late 19th and early 20th centuries.

My main explanatory variable is an indicator for the precolonial presence of large domesticated cattle. I also construct a continuous measure of the society's dependence on cattle, which is calculated as the interaction of cattle presence and the degree to which the society relied on husbandry for subsistence (ranges 0 to 100%). Figure 3 shows the spatial variation in precolonial presence of cattle for African ethnic groups in the *Ethnographic Atlas*. Cattle were historically present among 58% of ethnic groups. Their presence was concentrated in the Sahel and along the east and west coasts, regions that had ample pasture and flat soil. Meanwhile, few ethnic groups raised cattle in the tropical forest due to the inadequate pasture and the endemic tsetse fly.

I use the following outcomes for the precolonial analysis. *Female Participation in Agriculture* is a dummy variable that takes the value of 1 if women in the ethnic group performed the majority of agricultural tasks and 0 otherwise. This outcome is relevant to

9. Since the ethnicity names from the Murdock Map do not always coincided with the names from the *Ethnographic Atlas*, Fenske (2014), and Michalopoulos and Papaioannou (2013) constructed a concordance rule that allows researchers to link the groups from the *Atlas* to the groups in the Map.

capture female empowerment since societies characterized by lower female participation in agriculture tend towards unequal gender norms that subordinate women to men (Alesina, Giuliano and Nunn 2013). *Patrilineal inheritance* is an indicator variable for whether an ethnic group practiced patrilineal inheritance systems relative to matrilineal inheritance. In patrilineal inheritance systems, inheritance is traced through male members. Studies have shown that women are less competitive relative to men in patrilineal kinship system (Gneezy, Leonard and List 2009; Andersen et al. 2013). *Patrilocality* takes the value of 1 if patrilocal residence was the rule within an ethnic group as compared to matrilocality and 0 otherwise. The patrilocality tradition entails a married couple living with the parents of the husband. In this case, women are more likely to experience violence (Alesina, Brioschi and La Ferrara 2021). *Brideprice* is a dummy equal to 1 if an ethnic group practiced brideprice marriage and 0 otherwise. *Polygyny*, the practice of a single man having multiple wives, is equal to 1 if polygyny marriage was the rule and 0 otherwise.

In the precolonial analysis, I include a set of control variables measured at the ethnicity level. Longitude controls for differences between the eastern and the western parts of the continent. Absolute latitude and proportion of land in tropical and sub-tropical regions capture differences in agricultural and ecological areas. I include a measure of agricultural suitability from the Food and Agricultural Organization (FAO). Kiszewski et al.'s (2004) malaria ecology index controls for different forms of malaria. Finally, I use the *Ethnographic Atlas* to control for political complexity and economic development. Political complexity is measured based on the levels of jurisdictional hierarchies in the ethnic group and economic development using density of ethnic groups settlements.

3.2 Contemporary data

To study the effects of historical cattle adoption on contemporary women's outcomes, I use data from the *Demographic and Health Surveys* (DHS). The DHS are nationally representative household surveys which cover over 90 developing countries. They consist of individual-level data sets that provide information on a range topics including female labor participation, education, female decision making within the household, and marriage market outcomes (age at first marriage, fertility, polygyny, and sons preferences). The DHS also provides individual characteristics such as age, religion, and literacy. Importantly, the surveys provide information on ethnicity, allowing me to identify descendants of the ethnic groups reported in the Murdock data sets. I use 84 surveys from the DHS, covering 24 Sub-Saharan African countries over the period 1992 to 2016. My final data set is a sample of 1,065,768 individuals of which about 72% are women aged 15 to 49.

The main outcome of interest is an indicator for female labor force participation, FLFP, that equals to 1 if the respondent is currently working or had worked in the 12 months before the survey and 0 otherwise. Since the DHS does not provide information as to whether individuals are looking for jobs, I consider that an individual does not work if she did not work in the 12 months prior to the survey. I also construct indicators for employment by occupation for the following occupations: domestic service, agriculture, manual, clerical, and sales. Other outcomes include *fertility*, measured by the woman's number of children ever born; *education*, which ranges from 0 to 5 for categories "no education," "incomplete primary," "complete primary," "incomplete secondary," "complete secondary," and "higher"; *son preferences*, an indicator variable that takes the value of 1 if the respondent prefers to have a male child and 0 otherwise; *age at first marriage*, measuring a woman's age at first marriage; and *polygyny*, which is equal to 1 if the respondent has co-wives and 0 otherwise. *Female decision making* captures whether females play the dominant role in household decisions over specific issues such as health care, large purchases, visits to relatives, how many children to have, food to be cooked, and what to do with women's earnings. This variable ranges from 0 to 4 and is increasing with women's ability to make household decisions.

I include a set of controls including respondent's age and age squared, a quadratic in national income per capita, and survey-year fixed effects. I also add the covariates used for precolonial analysis. Table 2 reports the summary statistics from the DHS data.

3.3 Linking Contemporary Outcomes to Historical Ethnic Groups

To investigate the long-run impact of cattle on contemporary outcomes, I match individual-level data from the DHS to Murdock's ethnic group data based on ethnic names reported in the modern surveys. Because ethnic groups in the DHS often do not coincide with historical ethnic names, I employ a matching procedure that builds on and extends those used by Michalopoulos, Putterman, and Weil (2016) and Alesina, Brioschi, and La Ferrara (2021).

The matching techniques are as following. First, I match DHS ethnic groups with ethnic names in Murdock's *Atlas*. If no match is found, I use the data set from Nunn and Wantchekon (2011), who constructed a concordance between the ethnic groups names in the Afrobarometer and the names in the *Atlas*; I then use this information to find the Atlas equivalent for ethnicities included in both the Afrobarometer ethnicities and the DHS. For example, Nunn and Wantchekon (2011) link the ethnicity "Pokot," which is included in the DHS and Afrobarometer, to the "SUK" ethnic group in Murdock's *Atlas*. The 22nd edition of the *Ethnologue*, a pamphlet containing information on more than 7,111 spoken languages, allows me to identify alternate variants of DHS ethnic names and use these to link to the *Atlas*. For example, *Ethnologue* lists "Foula Fout," "Fouta Djallon," "Fulbe," "Fulfulde Jalon," "Fullo Fuuta," "Futa Fula," "Futa Jallon," "Fuuta Jalon," "Jalon," and "Poular" as alternatives names for the DHS ethnic group "Pular." I match these groups with the ethnic name "Futajalon" in the *Ethnographic Atlas*. I then use information from the *Joshua Project*, a database of more than 9,803 ethnic groups, to identify more possible links between the DHS and the *Ethnographic Atlas*. Following Alesina, Brioschi, and La Ferrara (2021), I identify three potential cases in which there are links between these two sources: 1) DHS and Murdock ethnic-group names are listed as alternative names by the *Joshua Project*; 2) the ethnic name in the *Atlas* is identified as a superset of the ethnic group in the DHS; and 3) the ethnic group in the *Atlas* is a subset of the DHS ethnicities. For the remaining unmatched ethnicities in the DHS, I use Wikipedia to identify alternate spellings of ethnic names. For example, the DHS ethnic group "Djerma" is listed as an alternative name for "Zerma," the name reported in the *Atlas*. Finally, I draw on other sources such as *Peoplegroups.org* and *Zyama.com* to match the remaining ethnic-group names.

Overall, I am able to match 84.5% of observations from the DHS to the *Ethnographic Atlas*, which represents 1,065,768 respondents belonging to 169 ethnic groups.

4 Empirical Strategy

4.1 OLS Specification

To examine the effects of cattle presence on precolonial outcomes, I estimate the following equation:

$$Y_e = \alpha + \beta Cattle_e + Z_e^{'}\Gamma + \epsilon_e \tag{1}$$

Where e indexes ethnic group. $Cattle_e$ is an indicator for the historical presence of cattle among an ethnic group e.[10] The coefficient of interest is β, which captures the relationship between cattle and the various precolonial outcomes.

The term Z_e denotes a vector of socioeconomic and geographic variables that may be correlated with both the adoption of cattle and precolonial gender roles. I use information reported in Murdock's *Atlas* to construct a control for the economic complexity of ethnic groups, measured in integer values from 1 to 8, increasing with the settlement density.[11] Because historical settlement density may have been endogenously determined by the

10. In some specifications, $Cattle_e$ is a continuous variable for historical reliance on cattle, measured as the interaction of cattle presence and the degree to which the society relied on husbandry for subsistence.

11. The *Ethnographic Atlas* grouped ethnicities into the following categories: (1) nomadic or fully migratory, (2) semi-nomadic, (3) semi-sedentary, (4) compact but not permanent settlements, neighborhoods of dispersed family homesteads, (5) separate hamlets, (6) forming a single community, (7) compact and relatively permanent settlements, and (8) complex settlements.

presence of cattle, I report results with and without this covariate. I also construct a control for political hierarchy, which takes values from 0 to 4 based on the number of political jurisdictions.[12] I also control for the year the ethnic group was reported observed in the *Ethnographic Atlas*. In addition, I control for a number of geographic conditions of ethnic homelands that might simultaneously influence gender norms and the presence of cattle. These controls include an index for agricultural suitability and the proportion of the ethnic homeland that falls in tropical or subtropical zones from the FAO. I also control for the malaria suitability index from Kiszewski et al. (2004), given the link between malaria and women's labor force participation (Quisumbing et al. 2014). Finally, I control for ethnic homeland longitude and absolute latitude, which captures differences between the eastern and western parts of the continent.

For inference, I cluster the standard errors at the level of ethnic provinces to account for potential correlation in outcomes across ethnicities that belong to the same ethnic hierarchy.[13] These provinces are described by Murdock (1959) and capture both spatial and genealogical correlations. This approach allows for potential correlation across ethnicities that share common ancestors, cultural histories, or geography. For example, the migration patterns during the Bantu expansion may have led to a correlation in outcomes across geographically diffuse ethnicities that nevertheless share a common lineage. I also report Conley (1999) standard errors, which correct for spatial correlation between the observations, as robustness checks.

To examine the effect of precolonial cattle presence on contemporary women's outcomes, I estimate the following equation:

$$Y_{i,e,c} = \alpha + \beta Cattle_e + Z_e^{'}\Gamma + X_{i,c}^{'}\Theta + \epsilon_i \tag{2}$$

where i indexes individuals, e ethnic groups, and c countries. My coefficient of interest

12. A score of 0 designates stateless societies, a score of 1 indicates paramount chiefdom, and scores of 3 and 4 indicate groups that were part of large states, with 4 indicating a larger state than 3.

13. This method has been used by Alsan (2015).

β captures the average treatment effect of the historical adoption of cattle. The term Z'_e includes the historical ethnic group–level control variables, while $X'_{i,c}$ represents a vector of individual country covariates for respondent's age, age squared, survey-year fixed effects, and a quadratic in national per capita income.[14] Finally, I cluster the standard errors at the ethnic group level to account for within-group correlation of the residuals. Z'_e includes previous historical ethnic group–level control variables.

4.2 IV Specification

The OLS specifications may not identify the causal effects of cattle presence on women's role in society. First, it is possible that there is an omitted variable that both determines cattle presence and women's outcomes. Consider, for example, the Maasai tribe, a cattle-herding society with strong patriarchal norms. Since there are no records on the Maasai prior to the introduction of cattle, it is impossible to assess whether the adoption of cattle led to the creation of these patriarchal norms, or whether the adoption of cattle was simply a consequence of pre-existing male-oriented culture. Second, the recording of cattle presence in precolonial societies is likely to be measured with error. Ethnographers observed ethnic groups each at a single point in time. As a result, some societies may have only recently acquired the animals, whereas others may have been formerly reliant on cattle only to lose them to disease, war, slave raids, or theft. The Tonga tribe for example, used to keep cattle but lost them on the eve of colonization due to raids and the rinderpest epidemic of 1896 (Dixon-Fyle 1983). Based on an observation in 1940, they were recorded in the *Ethnographic Atlas* as not keeping cattle . This form of measurement error will tend to bias the OLS estimates towards zero.

To address these issues, I use an instrumental variable strategy. Agronomists have identified three important determinants of cattle presence: abundant pasture, available water sources, and sufficiently flat terrain for migration (Murray, Morrison and Whitelaw 1982;

14. Given endogeneity concerns, I report the results with and without the national income covariates.

Bailey et al. 1996; Mattioli et al. 2000; George et al. 2007). They argue that the physiology of cattle requires a high quality and quantity of forage sources, which makes it difficult for them to travel more than 3.2 km a day for water, especially on land with a slope above 10%. Motivated by these arguments, I construct an index for cattle suitability (CSI) that is the interaction between (1) the soil suitability for pasture, (2) distance to nearest water source, and (3) the measure of land-slope gradient.[15]

Two assumptions must hold for *CSI* to be a valid instrument. First, it must be a strong predictor of the presence of cattle. This assumption is supported by the estimates of the first-stage regression in Section 5. The second assumption requires that changes in an ethnic group's *CSI* do not correlate with the error term from the estimation equation; there is no reason the combination of three factors should independently affect women's outcomes. To verify this argument, I control for each component of the *CSI* in the robustness checks.

To map the spatial distribution for cattle suitability, I develop a habitat suitability index (HSI) model for cattle population. HSI models were originally developed by the U.S. Fish and Wildlife Services in 1981. These models are constructed in three steps: (1) The first step identifies factors influencing animals' distribution; (2) the second step develops suitability index functions for each individual factor; (3) the third step combines these functions into a functional form equation for the HSI.[16] HSI models are commonly used to determine habitat suitability of species, generally when the actual distribution of these species is not observed. Furthermore, they are simple to use and understand and have been identified as overcoming the limitations of other models such as multiple regression models (Pandey 2007).

Suitability for pasture data are from the FAO's *Global Agro-Ecological Zones* (GAEZ v3.0) 2011 database (Fisher et al. 2002). The GAEZ data set provides information on land suitability for pasture and for vegetables such as cassava, millet, and shrubs for 3 arc-seconds in Global Land Cover (Fisher et al. 2002). These data are constructed by

15. Tsetse fly has been identified as another predictive factor for cattle presence (Hanotte at al. 2000). While I do not include tsetse fly in the index, I control for Alsan's (2015) tsetse suitability index in the robustness tests.

16. For more details see Pandey (2007).

combining various land cover maps, including vegetated land, forest resources assessment, irrigated land areas, protected areas inventory, and population density inventory. Data on suitability for pasture are ranged 0 to 100. Data on terrain slope are also from *GAEZ*, which provides terrain slope gradient data for each 3-arc-second grid. The terrain slopes have been compiled using elevation data from the Shuttle Radar Topography Mission (SRTM), which is available as 3-arc-second digital elevation models. I use the median terrain slopes of 3-arc-second grid-cells, which are grouped into eight categories.[17] Data on the locations of rivers and lakes are from Esri's Natural Earth data set, available at 1:10 m scale. The data provides river and lake centerlines of the world. I calculate the cost distance to water for each grid-cell (rivers or lakes), and I reclassify the resulting distance as follows: (1) distances below 1.6 km taking the value 1, (2) distances between 1.6 km and 3.2 km taking the value 0.5, and (3) distances of more than 3.2 km taking the value of 0.

I restrict the geographic extent of my analysis to Africa, using a spatial resolution of 5×5 km grid cells. Rescaling the previous factors to lie between zero and one, I calculate the CSI according to the following equation:

$$CSI = Pasturesuitability \times (1 - Distancetowater) \times (1 - Terrainslope) \tag{3}$$

This functional form reflects the non-substitutability across geographic inputs of these three factors. For example, a lack of local sources of water cannot be offset by more pastoral land for grazing.[18] The CSI is the standardized value of this functional form.

Figure 4 reports values of the CSI. The Sahel and the temperate zones are zones with high indexes for cattle suitability. Furthermore, locations with cattle presence from the *Ethnographic Atlas* coincide with places suitable for cattle.

17. Details on data are in the appendix.
18. In the empirical analysis, I explore the robustness of the results to an additive model of the three inputs.

5 Precolonial Results

5.1 Cattle Presence and Female Participation in Agriculture

This subsection reports the relationship between historical cattle presence and precolonial outcomes. Table 3 reports the results from different OLS specifications. Column 1 reports the baseline results without controls. In column 3, I include geographic covariates for agricultural suitability, longitude and absolute latitude, malaria ecology index, and date of observation. In column 5 and 7, I add covariates for the degree of economic complexity and political hierarchy in precolonial societies.

The results show that the historical presence of cattle is associated with lower relative participation of women in agriculture.[19] The point estimates are stable and statistically significant across the various specifications, ranging from -0.194 to -0.204. The magnitude of the effect is large: a one standard deviation increase in historical cattle presence (0.487) is associated with a reduction of female participation in agriculture of 9.9% (0.204×0.487), which is equal to 20.5% of the sample mean for female participation in agriculture.

Table 4 further explores the relationship between cattle presence and women's role in agricultural production. The analysis is based on specific agricultural tasks, information that is available for a subset of historical ethnicities from Murdock and White's (1969) Standard Cross-Cultural Sample (SCCS).[20] The estimates show that cattle presence is negatively associated with women's participation in all agricultural tasks including land clearance, soil preparation, planting, crop tending, and harvesting. One possible explanation for the negative relationship between cattle presence and women's participation in agriculture found in Tables 3 and 4 is that women were the primary caretakers for cattle. While this explanation contradicts the historical narrative, it could explain the withdrawal of women from agricultural work. I explore this possibility, estimating the relationship between historical cattle presence and women's relative participation in animal husbandry. Table 5,

19. Female participation is measured relative to male participation.

20. I use this data because the *Ethnographic Atlas* does not provide information on agricultural tasks.

column 1 reports the results. The coefficient estimates are large, negative, and statistically significant. Another explanation for the negative relationship between cattle presence and women's participation in agriculture and husbandry is that women were responsible for fishing. Table 5, column 2 documents a negative and statistically insignificant relationship between historical cattle presence and women's relative participation in fishing. Together, these findings suggest that historical cattle presence did not cause a shift of women's labor from agriculture to husbandry or fishing, consistent with the historiography. Instead, the domestication of cattle appears to have led to a broad decrease in precolonial female participation in agriculture. In fact, to the extent that cattle domestication caused a decline in male agricultural labor, as they devoted increased time to animal husbandry, the estimates for relative female participation in agriculture may understate the overall effect on women's agricultural work.

The OLS estimates presented so far, while strong and statistically significant, might not be causal due to reverse causality, omitted variable bias, or measurement error. To address these issues, I estimate IV regression, using the CSI as an instrument for historical cattle presence. I begin by verifying the first-stage relationship between the CSI and historical cattle presence. Figure 6 supports the relationship showing that the presence of cattle is positively correlated with land suitability for keeping cattle. The bottom panel of Table 3 shows the first-stage estimates. The Kleibergen-Paap $F-$statistics on the excluded instruments document that the CSI is a strong predictor of cattle presence, with F statistics that are all greater than 10.

Odd columns in Table 3 report the IV results for female participation in agriculture. Overall, the IV estimates confirm the results from the OLS regressions in terms of sign and statistical significance. Historical cattle presence is negatively associated with historical participation of women in agriculture. In addition, Table 5, columns 2 and 4 show the IV estimates for female participation in husbandry and fishing. The results confirm the OLS estimates and document a negative relationship between historical cattle presence and historical participation of women in husbandry and fishing. In general, the IV estimates are larger than the OLS coefficients in term of magnitude, which could reflect measurement error in the OLS specification.

5.2 Cattle Versus Plough Cultivation

So far, I have presented evidence that the adoption of cattle was negatively associated with women's participation in agriculture. However, the presence of large domestic cattle may have allowed societies to adopt plough agriculture, which has been shown to independently contribute to reducing female labor force participation (Alesina, Giuliano and Nunn 2013). Because the soil characteristics in Africa are generally unsuitable for plough agriculture, however, there is limited scope for this mechanism.[21] Just 7% of precolonial ethnicities used plough cultivation. Nevertheless, in this section, I investigate the extent to which the effect of cattle on women's participation can be attributed to greater reliance on plough cultivation.

Table 6, column 3 reports the OLS estimates for plough cultivation. I find that historical use of plough cultivation is negatively associated with female participation in agriculture, consistent with the patterns found by Alesina, Giuliano, and Nunn (2013). Column 4 reports the results from IV regressions that use the suitability of locations for the cultivation of plough-positive versus plough-negative crops.[22] The IV estimates for plough cultivation are negative and remain statistically significantly despite the weak first-stage relationship.[23]

Next, I explore whether the negative relationship between historical cattle presence and female participation in agriculture can be attributed to plough cultivation. Table 6, columns 5 and 6 report the results from OLS and IV regressions that include separate indicators for

21. The thin topsoil of Africa combined with the concentration of the nutrients on the surface makes the use of plough inefficient (Pryor 1985; Green 2013).

22. The suitability for plough-positive crops measures the average suitability for wheat, barley, and rye, normalized by the overall suitability for cultivation in general, whereas the suitability for plough-negative crops is the average suitability for sorghum, foxtail millet, and pearl millet, normalized by the overall suitability for cultivation in general.

23. The F statistic of 3.3 on the excluded instruments is consistent with the limited adoption of this technology throughout Africa.

cattle presence and plough cultivation.[24] The coefficients on cattle remain large, negative, and statistically significant in these specifications. Together, these results suggest that the effects of cattle on women's historical participation in agriculture cannot be attributed to plough cultivation. The coefficient estimates for plough cultivation are also negative and statistically significant. Since all plough-based ethnic groups in the sample also raised cattle, these estimates capture the differential effect of cattle in societies that also used plough cultivation. The negative coefficients imply that some fraction of the overall effects of cattle presence on women's participation were mediated through the use of plough cultivation. Together, these findings suggest that the use of plough cultivation cannot fully account for the negative relationship between cattle presence and women's participation in agriculture in precolonial African societies.

5.3 Robustness checks

A first concern with the results presented so far is that precolonial cattle presence was systematically related to the tsetse fly, which could directly affect female participation in agriculture through the disease environment (Alsan 2015). The IV specification, which relies on variation in local suitability for cattle rearing based on the CSI rather than actual cattle presence, should be less subject to these concerns. In fact, Figure 5 shows no correlation between the suitability of climate for tsetse flies and the CSI. To further investigate this question, I re-run the main specification, controlling for the tsetse fly suitability index. Table 7, column 1 shows that the OLS estimates for cattle presence remain large and negative, albeit imprecise. Note that controlling for tsetse fly suitability index increases the standard errors for cattle since tsetse flies and cattle are strongly (negatively) correlated, reducing precision. However, the IV estimates presented in column 2 remain large, negative, and statistically significant. This is consistent with the absence of correlation between tsetse suitability and the CSI presented in Figure 5.

24. In the IV specification, I instrument for cattle with the CSI and plough cultivation with the suitability for plough-positive and plough-negative crops. The F statistic from the excluded instruments is 17.

A second concern is that the results might be attributed to pastoralism rather than cattle ownership per se. Anthropologists have argued that pastoralist societies often adopt patriarchal norms (i.e., patrilocality and low female participation in agriculture) as a means of reducing paternal uncertainty due to extended male absences associated with herding (Becker 2019; Xia 1992). To assess this hypothesis, I include controls for other herded animals—sheep and goats—in the main specifications. The effects for historical cattle presence are unaffected by these covariates.

A third shortcoming is that elements of CSI may have influenced women's participation in agriculture directly, independently of the presence of cattle. For example, proximity to rivers might cause women to devote more time to water collection, reducing the time available for agricultural production. Importantly, because the CSI is constructed as a combination of the three factors interacted, I am able to test the individual influence of each factor. Table 8 reports the results from IV estimates based on the CSI that also control for each factor individually. The results do not change.

Table 7, columns 3 to 10 report the results from alternate specifications that control for a range of additional historical controls including ethnic group land area, indigenous slavery, and the natural logarithm of initial population density. The estimates for cattle presence are generally unaffected by these various covariates.

Finally, I assess the robustness of inference to alternative forms of cross-group correlation in outcomes. The baseline specification corrects for within-ethnic language correlation. This form of clustering allows for correlation in outcomes, even across geographically disparate groups, for example, due to the Bantu expansion. Table 9 also reports results based on Conley (1999) standard errors with a cutoff of 10 degrees longitude and latitude. In columns 2 and 3, I cluster the standard errors by country, and in columns 4 and 5, I use multiway clustering by country and by language families (Cameron, Gelbach, and Miller 2011). These alternative forms of clustering have little impact on the standard errors.

5.4 Cattle Presence and Women's Role in Society

The historical presence of cattle may have had broad effects on women's role in society that extended beyond their participation in agricultural production. In this subsection, I explore the relationship between historical cattle presence and a broad range of precolonial women's outcomes including polygyny, brideprice marriage, the use of patrilocal residence, and patrilineal inheritance and lineage systems.

Table 10, columns 7 and 8 report the results for patrilineal inheritance, measured as a dummy variable for whether an ethnic group used patrilineal inheritance as opposed to a matrilineal system. Across both the OLS and IV specifications, I find positive and statistically significant effects, indicating that historical cattle presence is associated with a shift towards inheritance rules that favor men. These patterns are consistent with anthropological research that has linked the emergence of patrilineal norms to the control of private property by men (Engels 1884) and found that these norms are common among pastoralist societies (Holden and Mace 2003).

Columns 5 and 6 report the results for patrilocality, measured by an indicator variable for whether patrilocality was the mode of residence as opposed to matrilocality. Historical cattle presence is associated with statistically significant differences in patrilocality, with cattle-based societies more likely to adopt norms in which the wife resides with the husband's family. This finding is in line with anthropological studies that argue that patrilocality norms emerge together with the practice of patrilineality (Trivers 1972, Xia 1992, and Becker 2019).[25]

In Columns 3 and 4, I investigate the relationship between cattle presence and the practice of brideprice marriage. The dependent variable *Brideprice* is an indicator for whether an ethnic group's prevalent mode of marriage was characterized by a brideprice payment from the husband to the bride's family.[26] The results show no relationship between historical

25. This effect does not appear to be driven by paternal uncertainty; I will later explore the source of this effect.

26. The variable *Brideprice* includes brideprice or wealth to the bride's family, bride service, and token

cattle presence and the traditional practice of brideprice marriage.[27] This might result from two contracting effects. On the one hand, anthropologists have linked brideprice marriage to patrilocality, as brideprice compensates the family of the bride for taking the daughter from their group (Vroklage 1952). If cattle presence is positively correlated with patrilocality, I would expect to see a positive relationship between cattle presence and brideprice marriage. On the other hand, Boserup (1970) has hypothesized that brideprice is linked to women's participation in agriculture: Paying a brideprice gives the husband's family rights to the bride's labor. To the extent that cattle presence is negatively correlated with female participation in agriculture, a negative relationship between cattle presence and brideprice marriage is expected.

Finally, columns 1 and 2 report the results for polygny. The dummy *Polygyny* is equal to 1 if the ethnic group's prevalent mode of marriage was polygyny, which allows men to have multiple wives, as opposed to monogamous marriage. The coefficient estimates are small and statistically insignificant, which might reflect two offsetting effects.[28] On the one hand, polygyny is linked to wealth inequality among men (Becker 1974; Grossbard 1976). To the extent that the presence of cattle increased wealth inequality *among* men, I would expect higher polygyny in these societies. On the other hand, Boserup (1970) argues that having multiple wives is more profitable for men when women contribute to agricultural production. In this case, given that cattle presence is negatively correlated with female participation in agriculture, it may also be negatively associated with polygyny.

Together, the patterns in Table 10 show that the historical presence of cattle had broad effects on the role of women in precolonial African societies that extended beyond their agricultural participation. In the next section, I explore the extent to which historical cattle presence continues to shape contemporary women's outcomes.

---

brideprice to the the bride's family.

27. One should keep in mind that more than 95% of ethnic groups in the sample practiced brideprice marriage; the lack of correlation may simply reflect a lack of variation in the dependent variable.

28. The results might also reflect the fact that there is no variation in the practice of polygyny: The mean for polygyny is 0.95.

6 Historical Cattle Presence and Contemporary Women's Outcomes

I explore whether the historical adoption of cattle continues to influence contemporary female labor force participation. The analysis is based on DHS data for the years 1992 to 2016: I match ancestral cattle presence to individuals based on their stated ethnicity (see section 3.3). In Section 6.1 I report the OLS and IV results for female labor force participation; in Sections 6.2 to 6.3 I explore the mechanisms driving the relationship between cattle and female labor force participation, including the role of plough cultivation, various historical norms related to women's role in society, and the link between historical cattle presence and other contemporaneous women's outcomes; finally, in Section 6.4, I examine the extent to which the long-run effects on women's labor force participation were driven by the persistence of cultural norms.

6.1 Historical Cattle Presence and Contemporary Female Labor Force Participation

Table 11 presents the OLS and IV estimates of the effect of historical cattle presence on contemporary female participation in the labor force. The even columns document the OLS estimates, and the IV coefficients are reported in odd columns. In columns 1 and 2 I report the estimates, including the same historical ethnic group–level controls as in the precolonial analysis.[29] In columns 3 and 4 I add a set of survey-year fixed effects; in columns 5 and 6 I include individual-level controls (a quadratic measure of the respondent's age). Finally, in columns 7 and 8 I add country-level controls including country income per capita and income per capita squared.

I find that women whose ancestors raised cattle are less likely to participate in the labor

29. The covariates include the suitability of the ethnic group's location for agriculture, the proportion of the location that is tropical or subtropical, longitude and absolute latitude coordinates, malaria ecology index, a measure of historical economic complexity, and a measure of historical political hierarchies.

force today. The OLS estimates are negative and statistically significant across the various specifications. The point estimates are large in magnitude: Historical cattle presence is associated with a 3.1 to 4.9% decrease in modern female participation in the labor force, which is equivalent to 5 to 7.7% decrease relative to mean participation among descendants of ethnic groups without cattle.

To address potential bias in the OLS results, I use the CSI as an instrument for historical cattle presence. Figure 6 shows a strong positive first-stage relationship between historical cattle presence and the CSI, indicating that cattle were more likely to be present in places suitable for herding activities. Figure 7 depicts a negative reduced-form relationship between the CSI and contemporary female labor force participation, consistent with OLS findings.

Odd columns of Table 11 report the IV estimates. The bottom panel reports the first-stage results. The Kleibergen-Paap F statistics on the excluded instruments are greater than 10, consistent with the strong first-stage relationship. The top panel reports the two-stage least squares results. The IV estimates support the results from the OLS regressions in terms of both sign and statistical significance. Across the various specifications, the IV estimates range from -0.11 to -0.13 and are all statistically significant. These IV coefficients are larger than the OLS estimates, which could reflect measurement error in the identification of precolonial cattle presence in the Murdock (1967) data (see section 5.1 for a discussion). The fact that the IV estimates exceed the OLS results provides further evidence against reverse causality, which should tend to bias the OLS estimates away from zero.

To further explore the link between historical cattle presence and contemporaneous female labor force participation, I estimate the OLS and IV relationship for different occupational outcomes, measured as a series of dummy variables for female employment in different occupations (domestic, agriculture, manual, clerical, and sales). Table 12 reports these results. The OLS results reveal heterogeneous effects across occupational categories: Historical cattle presence is negatively associated with a woman's likelihood of working in a sales occupation, but positively related to employment in domestic services. One potential explanation of these results is that ethnic groups that adopted cattle adopted patriarchal norms that kept women within the home. The IV estimates confirm the OLS regressions in term of sign, but the estimates are no longer statistically significant.

6.2 Alternative Mechanisms: Plough Cultivation, Pastoralism, and Other Historical Gender Norms

The historical adoption of cattle led to a large gender imbalance in wealth holdings due to the physiological requirements involved in raising and herding these large animals. Standard non-cooperative theories of marriage matching predict that this imbalance should lead to a shift in household bargaining power that favors men (Manser and Brown 1980; McElroy and Horney 1981; Lundberg and Pollak 1993). In this subsection, I examine whether there were alternative channels through which cattle presence influenced long-run female labor force participation.

In Table 13, I explore whether the observed relationship between historical cattle presence and contemporaneous female labor force participation can be attributed to differences in plough cultivation. For reference, columns 1 and 2 report the baseline results from the OLS and IV specifications. Columns 3 and 4 report the direct estimate for historical plough cultivation on modern female labor force participation. There is a strong negative relationship in the OLS specification. Nevertheless, the IV point estimates are very noisy and statistically insignificant due to the weak first-stage relationship.[30] Columns 5 and 6 report the results from models for female labor force participation that include both historical cattle presence and plough cultivation. One should keep in mind that all ethnicities that historically relied on plough agriculture also owned cattle, so the plough coefficients capture the additional effects of plough cultivation on female labor force participation among societies

30. The F statistic for the excluded instruments is 0.47. Unlike the precolonial analysis, which was based on variation across 297 ethnic groups, the contemporaneous effects rely on variation across 161 ethnicities. Given the low rates of plough cultivation, there is simply not enough data to identify this first-stage relationship in the African context.

that herded cattle.

The results for historical cattle presence are not driven by plough cultivation. Column 5 of Table 13 shows that the coefficient on cattle remains negative and statistically significant after controlling for plough. I also find a significantly negative correlation between plough and female labor force participation (column 5 of Table 12), consistent with Alesina, Giuliano, and Nunn (2013). In column 6 of Table 12 I report IV results using the CSI and land suitability for plough-positive versus plough-negative crops as instruments for the two endogenous variables. The coefficient on cattle remains negative, while the coefficient on plough is positive. Both estimates are imprecise due to the fact that the instruments for plough cultivation have little explanatory power in Africa. Given this weak instrument issue, in column 7 of Table 12 I report the results from regressions that use only the CSI as an instrument for historical cattle presence and control directly for historical plough cultivation. The coefficients on both explanatory variables are negative and statistically significant. In fact, the coefficient estimates for historical cattle presence are virtually identical to the baseline specification, suggesting that the influence of historical cattle presence on contemporaneous female labor force participation was not mediated through plough-based agricultural technology.

Cattle could affect female mobility through male absence. Men from pastoralist societies are more likely to spend days away from villages to herd animals. Recent research has shown that male absence generated incentives to regulate female sexuality and mobility (Becker 2019). If male absence alone is sufficient to generate the observed results, I would expect to see a similar association between female labor force participation and the presence of other herding animals, such as sheep and goats. To test for this, I regress my main outcome on an indicator for whether ancestors had sheep or goats. The coefficient for sheep and goat herding in column 2 of Table 15 has the opposite sign. The effect of the presence of sheep and goats is positively associated with female labor force participation. This is consistent with the argument put forward by anthropologists that sheep and goats tend to be women's property, and consequently, the presence of these animals tends to increase female empowerment (Deere and Doss 2006). In column 3, I control for sheep and goat herding; historical adoption of cattle continues to have a sizeable negative impact on female labor force participation, albeit one that is statistically insignificant. These findings suggest that the effect of cattle on today's female labor force participation is not driven by male-absence culture.[31]

A third possibility is that historical cattle presence led to a broad shift towards patriarchal norms that were unconducive to women's employment. I explore this question in Table 15. These models report the OLS and IV results for historical cattle presence, controlling for other historical societal norms (patrineal descent, patrilocal marriage, polygyny marriage, and brideprice marriage).[32] Controlling for ancestral patrilineal norms reduces the coefficient on cattle from -0.044 to -0.029, although it remains statistically significant, consistent with patrilineal regimes acting as potential transmission mechanisms for the long-run decrease in female labor force participation. Columns 5 to 12 show that none of the other historical norms (patrilocality, polygyny, or brideprice) have any impact on the main estimates.

The results in this section suggest that the negative relationship between historical cattle presence and contemporaneous female labor force participation was not driven by plough agricultural technology, male absence associated with pastoralism, or changes in the norms governing marriage. Instead, the results appear to be consistent with the historical adoption of cattle having led to a shift in bargaining power that ultimately caused societies to adopt norms and cultures that favored men.

31. Controlling for patrilocality does not change the results, providing further evidence against pastoralism and male absence combined as a mechanism driving he results.

32. These results provide suggestive evidence for the mediating influence of these various factors given the endogeneity of the covariates.

6.3 Historical Cattle Presence, Fertility, Marriage, and Household Decision-Making

In this section I examine the effect of cattle on fertility and on marriage market outcomes such as polygyny, early marriage, and women's empowerment.

To explore the link between historical cattle presence and fertility, I use information from the DHS on the number of children a woman has ever born and re-estimate my preferred specification with fertility as the dependent variable. Column 7 of Table 16 documents a positive and statistically significant relationship between cattle and fertility. Descendants of cattle-based ethnicities had 0.35 to 0.63 additional children, which represents a 12 to 21% increase in fertility. The results are consistent with the historical narrative: Historical cattle presence developed son preference for herding and is therefore likely to increase women's fertility. It is also in line with the general shift in bargaining power, since men prefer larger families.

Did cattle also affect marriage market outcomes such as age of marriage and polygyny? The decline in female labor force participation may have led to a decrease in the age of marriage if women were dependent on their husband's income for subsistence. Cattle may also have increased the practice of polygyny by increasing inequality in wealth holdings *among* males (Becker 1974). I examine the effects on age at first marriage in columns 1 and 2 in Table 16. The results show that the historical presence of cattle is associated with higher rates of early marriage, with estimates ranging from -0.78 to -2.0.

Columns 3 and 4 report the results for polygynous marriage, measured as an indicator for whether a woman had co-wives.[33] In both the OLS and IV specifications, I estimate positive and statistically significant effects of historical cattle presence, suggesting that ancestors from cattle-based societies were more likely to enter into polygynous marriage, with effect sizes that range from 15 to 30%. It is notable that historical cattle presence influences contemporaneous polygynous marriage rates despite having no influence on the practice in

33. Roughly 33% of respondents in the sample reported that they were part of a polygynous marriage.

precolonial Africa (Table 10, columns 1 and 2). One potential explanation is that the unequal distribution of assets across males arose only in the postcolonial period (Van de Walle 2009). Alternatively, the divergence in findings could simply reflect the near universality of this practice in precolonial Africa.[34]

Lastly, I investigate whether cattle were related to women's bargaining power within the household. The analysis is based on self-reported questions from the DHS that capture women's ability to make decisions within the home. These questions include who makes decisions on specific issues such as health care, large purchases, visits to relatives, how many children to have, food to be cooked, and what to do with money women earn. I construct an ordered variable, *Female decision-making within household*, that ranges from 0 to 6, increasing with women's empowerment within the household.[35] Columns 5 and 6 of Table 16 document that women from ethnic groups that historically had cattle are today less likely to make decisions within their household. Column 5 induces that having ancestors that had cattle is associated with a reduction of 0.5 in the number of decisions women make within the home. These results provide further evidence that the historical adoption of cattle led to a shift in household bargaining power that favored men.

6.4 Persistence

Why does historical cattle presence influence contemporaneous female labor force participation? One explanation is that animals still play a central role in these societies, and the forces that influenced women's outcomes in precolonial Africa continue to operate today. An alternative explanation is that the patterns may reflect cultural persistence. The historical presence of cattle may have fundamentally altered norms about women's role in society and these norms may have persisted even after the direct influence of the animals waned.[36] In this section, I shed light on this question and explore the extent to which the

34. Polygyny is reported among 483 of the 508 societies in the Murdock's Atlas.

35. Women typically report making 2 to 4 decisions within their household.

36. Nunn (2012) proposed to view culture as a set of decision-making heuristics or rules of thumb that are used in the case of uncertain environments. According to Boyd and Richardson's 1988 models, when

long-run effects can be attributed to a persistent shift in cultural norms.

I begin by examining the extent to which the main results can be attributed to cultural persistence. Specifically, I investigate whether cattle have similar effects on women's employment in urban versus rural areas. Intuitively, the estimates for female labor force participation in urban areas should capture the independent effect of cultural norms since cattle are largely absent from these areas,[37] whereas the effects among the rural population represent the combined influence of the direct effect of cattle and persistent cultural norms. Although this comparison may be biased due to endogeneity in individuals' locational choices, to the extent that migrants to urban areas are generally less attached to historical cultural values, the estimates for the urban population tend to *understate* this cultural persistence channel.

I split the sample into urban and rural residence and re-estimate the baseline specifications. The results are presented in Table 17. The estimates for historical cattle presence are very similar across the two sub-samples. The point estimates are all large, negative, and statistically significant. The findings among the urban sample, in particular, provide strong evidence for a cultural persistence channel. Although cattle are largely absent from urban areas, the cultural norms they influenced over generations are portable and continue to shape women's employment outcomes.

To further explore the role of cultural persistence, I exploit information on current location of residence in the DHS data to construct a location-based indicator for historical cattle presence. This variable is equal to one if the individual currently resides in an ethnic homeland territory in which cattle were historically present. I re-run my preferred specifications, including both ethnicity-based and location-based measures of historical cattle presence. Identification in these models is based on the fact that roughly half of the DHS

information is costly or imperfect, it is optimal to develop rules of thumb in decision-making. These sets of decision-making heuristics are considered values and social norms and are transmitted across generations (Teso 2019).

37. Only 5% of urban households from the DHS own cattle.

respondents no longer reside within their former ethnic homeland.[38] Columns 1 and 2 from Table 20 report the effects of cattle presence on female labor force participation, my main result presented so far. The estimates are all large, negative, and statistically significant. Columns 3 and 4 report the coefficients for the OLS and IV estimates when the explanatory variable is location-based cattle presence. The OLS estimates are large and negative but insignificant. The IV estimates are negative and statistically significant, suggesting that cattle presence affects female labor force participation through location-fixed factors such as local institutions. Columns 5 and 6 report the estimates when I include both ethnicity-based cattle presence and location-based cattle presence. The results show that controlling for location-based cattle presence does not alter the coefficients for ethnicity-based cattle presence. In addition, the estimates for location-based cattle presence are no longer significant. Together, these results provide further evidence for the cultural legacy of cattle, independent of their contemporaneous influence on female labor force participation.

Lastly, I investigate the role of colonization in the persistent effect of historical cattle presence. I exploit the fact that French and English colonizers developed different policies of assimilation. In contrast to the English indirect rule, French colonizers adopted a policy of assimilation which promoted French over African culture. I use data from Laporta et al. (2008), and I examine whether cattle affect women's employment differently in former French versus English colonies. I re-estimate the baseline specifications including a dummy for French colonization and an interaction term between cattle presence and French colonization. The results are presented in Table 21. Columns 1 and 2 report the main result presented so far. Column 3 presents the OLS estimates of the effect of French colonization on female labor force participation. The coefficients are large, negative, and statistically significant. Women from French-colonized countries are more likely to participate in the workplace today compared to those from English-colonized countries. Columns 6 and 7 report the

38. This out migration may have occurred either in the current generation or in previous generations, in the century since much of the Murdock data were assembled. Columns 7 and 8 of Table 20 show that historical ancestral cattle presence is unrelated to the probability that individuals have left their ancestral homeland.

coefficients for the OLS and IV estimates when I include the interaction term, a dummy for French colonization, and historical cattle presence. The OLS estimates on historical cattle presence remain stable, although statistically insignificant. The IV estimates are negative and statistically significant at 10%. However, the estimates for the interaction term between French colonization and historical cattle presence are statistically significant for neither OLS nor IV specifications. Taken together, these results provide consistent evidence that cattle have not influenced women's employment in French versus English colonies differently.

7 Conclusion

Anthropologists have long considered the presence of cattle as an important determinant of patriarchal norms in Africa. I empirically test this hypothesis in both the precolonial and modern era. My analysis relies on both information on historical ethnic norms from the *Ethnographic Atlas* and data from *Demographic and Health Surveys* on modern women's outcomes. To establish the causal impact of historical cattle presence on gender roles, I exploit geo-climatic factors as a source of plausibly exogenous variation in the likelihood of historical cattle adoption.

The paper's findings show that cattle-based societies had more historical gender inequality, as measured by female participation in agriculture, inheritance rules, and other marriage customs. Moreover, I find that gender inequality has persisted into the modern era, with descendants of cattle-based societies having lower labor force participation rates, marrying at younger ages, having higher fertility rates, and participating less in household decision-making. The results cannot be attributed to either plough agriculture or pastoralism. Instead, the findings are consistent with a setting in which the historical adoption of cattle led to a shift of resources to men, which ultimately caused societies to adopt patriarchal norms that have persisted to the present day, even in areas where cattle no longer play an important role in society.

This paper adds to our understanding of the origins of the large differences in gender roles throughout Sub-Saharan Africa. In addition to establishing the role of cattle domestication in driving these patterns, the results demonstrate the persistence of traditional norms regarding the role of women in society, and how these norms can outlast the initial economic forces that created them. Understanding the sources of this persistence, and how policy can best be designed to break these patterns, is a potentially fruitful area for future research.

References

Aberle, David F. "Matrilineal descent in cross-cultural comparison." *Matrilineal kinship*, 1961, 655–730.

Albanesi, Stefania, and Claudia Olivetti. *Gender roles and technological progress*, 2007.

Alesina, Alberto, Benedetta Brioschi, and Eliana La Ferrara. "Violence Against Women: A Cross-cultural Analysis for Africa." *Economica* 88, no. 349 (2021): 70–104.

Alesina, Alberto, Paola Giuliano, and Nathan Nunn. "Fertility and the Plough." *American Economic Review* 101, no. 3 (2011): 499–503.

———. "On the origins of gender roles: Women and the plough." *The Quarterly Journal of Economics* 128, no. 2 (2013): 469–530.

Alsan, Marcella. "The effect of the tsetse fly on African development." *American Economic Review* 105, no. 1 (2015): 382–410.

Andersen, Steffen, Seda Ertac, Uri Gneezy, John A List, and Sandra Maximiano. "Gender, competitiveness, and socialization at a young age: Evidence from a matrilineal and a patriarchal society." *Review of Economics and Statistics* 95, no. 4 (2013): 1438–1443.

Anderson, Siwan. "The economics of dowry and brideprice." *Journal of Economic Perspectives* 21, no. 4 (2007): 151–174.

Arnold, Fred, Minja Kim Choe, and Tarun K Roy. “Son preference, the family-building process and child mortality in India.” *Population studies* 52, no. 3 (1998): 301–315.

Ashraf, Nava, Natalie Bau, Nathan Nunn, and Alessandra Voena. “Bride price and female education.” *Journal of Political Economy* 128, no. 2 (2020): 591–641.

Bailey, Derek W, John E Gross, Emilio A Laca, Larry R Rittenhouse, Michael B Coughenour, David M Swift, and Phillip L Sims. “Mechanisms that result in large herbivore grazing distribution patterns.” *Rangeland Ecology & Management/Journal of Range Management Archives* 49, no. 5 (1996): 386–400.

Bau, Natalie. “Can policy change culture? Government pension plans and traditional kinship practices.” *American Economic Review* 111, no. 6 (2021): 1880–1917.

Becker, Anke. “On the economic origins of restrictions on women’s sexuality,” 2019.

Becker, Gary S. “A theory of marriage: Part II.” *Journal of political Economy* 82, no. 2, Part 2 (1974): S11–S26.

Bertocchi, Graziella, and Arcangelo Dimico. “The long-term determinants of female HIV infection in Africa: The slave trade, polygyny, and sexual behavior.” *Journal of Development Economics* 140 (2019): 90–105.

Boserup, Ester, Su Fei Tan, and Camilla Toulmin. *Woman’s role in economic development.* Routledge, 1970.

Boyd, Robert, and Peter J Richerson. *Culture and the evolutionary process.* University of Chicago press, 1988.

Burchell, William John. *Travels in the interior of southern Africa.* Vol. 1., 1822.

Cameron, A Colin, Jonah B Gelbach, and Douglas L Miller. “Robust inference with multiway clustering.” *Journal of Business & Economic Statistics* 29, no. 2 (2011): 238–249.

Chakraborty, Tanika, and Sukkoo Kim. "Kinship institutions and sex ratios in India." *Demography* 47, no. 4 (2010): 989–1012.

Comaroff, John L. "Goodly beasts, beastly goods: cattle and commodities in a South African context." *American ethnologist* 17, no. 2 (1990): 195–216.

Conley, Timothy G. "GMM estimation with cross sectional dependence." *Journal of econometrics* 92, no. 1 (1999): 1–45.

Dalton, John T, and Tin Cheuk Leung. "Why is polygyny more prevalent in Western Africa? An African slave trade perspective." *Economic Development and Cultural Change* 62, no. 4 (2014): 599–632.

Das Gupta, Monica, Jiang Zhenghua, Li Bohua, Xie Zhenming, Woojin Chung, and Bae Hwa-Ok. "Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea." *The Journal of Development Studies* 40, no. 2 (2003): 153–187.

Deere, Carmen Diana, and Cheryl R Doss. "The gender asset gap: What do we know and why does it matter?" *Feminist economics* 12, nos. 1-2 (2006): 1–50.

Deininger, Klaus, Aparajita Goyal, and Hari Nagarajan. "Women's inheritance rights and intergenerational transmission of resources in India." *Journal of Human Resources* 48, no. 1 (2013): 114–141.

Deshler, W. "Cattle in Africa: Distribution, Types and Problems." *Geographical Review*, 1963.

Diamond, Jared. "Guns." *Germs and Steel: The Fates of Human Societies, Vintage*, 1997, 186.

Dixon-Fyle, Mac. “Reflections on Economic and Social Change among the Plateau Tonga of Northern Rhodesia, c. 1890-1935.” *The International Journal of African Historical Studies* 16, no. 3 (1983): 423–439.

Duflo, Esther. “Women empowerment and economic development.” *Journal of Economic literature* 50, no. 4 (2012): 1051–79.

Dupire, Marguerite. “The position of women in a pastoral society.” *Women of tropical Africa*, 1963, 47–92.

Dyson, Tim, and Mick Moore. “On kinship structure, female autonomy, and demographic behavior in India.” *Population and development review*, 1983, 35–60.

Ebenstein, Avraham. “Patrilocality and missing women.” *Available at SSRN 2422090*, 2014.

Edlund, Lena, and Hyejin Ku. “The African slave trade and the curious case of general polygyny,” 2011.

Engels, Friedrich. *The origin of the family, private property and the state: in the Light of the Researches of Lewis H. Morgan.* Hottingen-Zurich, 1884.

Epstein, H., and I. Mason. “Cattle. In: (ed. Mason IL) Evolution of Domesticated Animals.” *Longman, New York*, 1984.

Fenske, James. “African polygamy: Past and present.” *Journal of Development Economics* 117 (2015): 58–73.

———. “Ecology, trade, and states in pre-colonial Africa.” *Journal of the European Economic Association* 12, no. 3 (2014): 612–640.

Fischer, Günther, HT Van Velthuizen, MM Shah, and Freddy O Nachtergaele. “Global agro-ecological assessment for agriculture in the 21st century: methodology and results,” 2002.

George, Melvin, Derek Bailey, Michael Borman, David Ganskopp, Gene Surber, and Norm Harris. "Factors and practices that influence livestock distribution." *University of California Agriculture and Natural Resources Communication Services, ANR Publication* 8217 (2007): 20.

Gitungwa, Henriette. "The Relationship of Male and Female Pastoralist Income with Household Food Security and Nutrition Status in Tanzania: Maasai, Sukuma, and Barabaig Ethnic Groups.," 2018.

Gneezy, Uri, Kenneth L Leonard, and John A List. "Gender differences in competition: Evidence from a matrilineal and a patriarchal society." *Econometrica* 77, no. 5 (2009): 1637–1664.

Goldin, Claudia. "The quiet revolution that transformed women's employment, education, and family." *American economic review* 96, no. 2 (2006): 1–21.

———. *The U-shaped female labor force function in economic development and economic history.* Technical report. National Bureau of Economic Research, 1994.

Goldin, Claudia, and Lawrence F Katz. "The power of the pill: Oral contraceptives and women's career and marriage decisions." *Journal of political Economy* 110, no. 4 (2002): 730–770.

Goldschmidt, Walter. "The economics of brideprice among the Sebei and in East Africa." *Ethnology* 13, no. 4 (1974): 311–331.

Graham, Jay P, Mitsuaki Hirai, and Seung-Sup Kim. "An analysis of water collection labor among women and children in 24 sub-Saharan African countries." *PloS one* 11, no. 6 (2016): e0155981.

Green, Erik. "Production systems in pre-colonial Africa." *The History of African Development. African Economic History Network. Online at https://www. aehnetwork. org/textbook/. Accessed* 6, no. 27 (2013): 2017.

Greenwood, Jeremy, Ananth Seshadri, and Mehmet Yorukoglu. "Engines of liberation." *The Review of Economic Studies* 72, no. 1 (2005): 109–133.

Grossbard, Amyra. "An economic analysis of polygyny: The case of Maiduguri." *Current anthropology* 17, no. 4 (1976): 701–707.

Hanotte, Olivier, CL Tawah, DG Bradley, M Okomo, Y Verjee, J Ochieng, and JEO Rege. "Geographic distribution and frequency of a taurine Bos taurus and an indicine Bos indicus Y specific allele amongst sub-Saharan African cattle breeds." *Molecular ecology* 9, no. 4 (2000): 387–396.

Hansen, Casper Worm, Peter Sandholt Jensen, and Christian Volmar Skovsgaard. "Modern gender roles and agricultural history: the Neolithic inheritance." *Journal of Economic Growth* 20, no. 4 (2015): 365–404.

Henderson, Morgan, and Warren Whatley. "Pacification and gender in colonial Africa: evidence from the Ethnographic Atlas," 2014.

Holden, Clare Janaki, and Ruth Mace. "Spread of cattle led to the loss of matrilineal descent in Africa: a coevolutionary analysis." *Proceedings of the Royal Society of London. Series B: Biological Sciences* 270, no. 1532 (2003): 2425–2433.

Jayachandran, Seema. "The roots of gender inequality in developing countries." *economics* 7, no. 1 (2015): 63–88.

Joshi, McLaughlin, and Phillips. "Types and breeds of African cattle." *FAO Agricultural Studies*, no. 37 (1957).

Kiszewski, Anthony, Andrew Mellinger, Andrew Spielman, Pia Malaney, Sonia Ehrlich Sachs, and Jeffrey Sachs. "A global index representing the stability of malaria transmission." *The American journal of tropical medicine and hygiene* 70, no. 5 (2004): 486–498.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. “The economic consequences of legal origins.” *Journal of economic literature* 46, no. 2 (2008): 285–332.

Lewis, Joshua. “Infant Health, Women’s Fertility, and Rural Electrification in the United States, 1930–1960.” *The Journal of Economic History* 78, no. 1 (2018): 118–154.

Lowes, Sara. “Matrilineal kinship and gender differences in competition.” *Unpublished Manuscript*, 2018.

———. “Matrilineal kinship and spousal cooperation: Evidence from the matrilineal belt.” *Unpublished manuscript. URL: https://scholar. harvard. edu/files/slowes/files/lowes_matrilineal. pdf*, 2017.

Lowes, Sara, and Nathan Nunn. “Bride price and the wellbeing of women.” *Towards Gender Equity in Development*, 2017, 117.

Lundberg, Shelly, and Robert A Pollak. “Separate spheres bargaining and the marriage market.” *Journal of political Economy* 101, no. 6 (1993): 988–1010.

Manser, Marilyn, and Murray Brown. “Marriage and household decision-making: A bargaining analysis.” *International economic review*, 1980, 31–44.

Marshall, Fiona, and Elisabeth Hildebrand. “Cattle before crops: the beginnings of food production in Africa.” *Journal of World prehistory* 16, no. 2 (2002): 99–143.

Mattioli, Raffaele C, Vijay S Pandey, Max Murray, and Julie L Fitzpatrick. “Immunogenetic influences on tick resistance in African cattle with particular reference to trypanotolerant N’Dama (Bos taurus) and trypanosusceptible Gobra zebu (Bos indicus) cattle.” *Acta Tropica* 75, no. 3 (2000): 263–277.

McElroy, Marjorie B, and Mary Jean Horney. “Nash-bargained household decisions: Toward a generalization of the theory of demand.” *International economic review*, 1981, 333–349.

Michalopoulos, Stelios, and Elias Papaioannou. "Pre-colonial ethnic institutions and contemporary African development." *Econometrica* 81, no. 1 (2013): 113–152.

Michalopoulos, Stelios, Louis Putterman, and David N Weil. *The influence of ancestral lifeways on individual economic outcomes in Sub-Saharan Africa.* Technical report. National Bureau of Economic Research, 2016.

Miller, Grant. "Contraception as development? New evidence from family planning in Colombia." *The Economic Journal* 120, no. 545 (2009): 709–736.

Morgan. "Systems of consanguinity and affinity of the human Family." *Washington*, 1871.

Mukasa-Mugerwa, E. "A review of reproductive performance of female Bos indicus (zebu) cattle. ILCA Monograph 6." *Addis Ababa, Ethiopia*, 1989.

Murdock, George P, and Douglas R White. "Standard cross-cultural sample." *Ethnology* 8, no. 4 (1969): 329–369.

Murdock, George Peter. "Africa its peoples and their culture history," 1959.

———. "Ethnographic atlas: a summary." *Ethnology* 6, no. 2 (1967): 109–236.

Murray, Max, W Ivan Morrison, and DD Whitelaw. "Host susceptibility to African trypanosomiasis: trypanotolerance." *Advances in parasitology* 21 (1982): 1–68.

Nunn, Nathan. "Culture and the historical process." *Economic History of Developing Regions* 27, no. sup1 (2012): S108–S126.

Nunn, Nathan, and Leonard Wantchekon. "The slave trade and the origins of mistrust in Africa." *American Economic Review* 101, no. 7 (2011): 3221–52.

Owens, M Keith, KAREN L Launchbaugh, and JW Holloway. "Pasture characteristics affecting spatial distribution of utilization by cattle in mixed brush communities." *Rangeland Ecology & Management/Journal of Range Management Archives* 44, no. 2 (1991): 118–123.

Pandey, Vibhuti. “Analysis and modeling of cattle distribution in complex agro-ecosystems of south Florida.” PhD diss., University of Florida, 2007.

Pryor, Frederic L. “The invention of the plow.” *Comparative Studies in Society and history* 27, no. 4 (1985): 727–743.

Quisumbing, Agnes R, Ruth Meinzen-Dick, Terri L Raney, André Croppenstedt, Julia A Behrman, and Amber Peterman. “Closing the knowledge gap on gender in agriculture.” In *Gender in agriculture*, 3–27. Springer, 2014.

Ross, Michael L. “Oil, Islam, and women.” *American political science review* 102, no. 1 (2008): 107–123.

Schneider, Harold K. “Economics in East African aboriginal societies.” *Economic transition in Africa*, 1964, 108–123.

———. “The subsistence role of cattle among the Pakot and in East Africa.” *American Anthropologist* 59, no. 2 (1957): 278–300.

Senft, RLLR, LR Rittenhouse, and RG Woodmansee. “Factors influencing patterns of cattle grazing behavior on shortgrass steepe.” *Rangeland Ecology & Management/Journal of Range Management Archives* 38, no. 1 (1985): 82–87.

Teso, Edoardo. “The long-term effect of demographic shocks on the evolution of gender roles: Evidence from the transatlantic slave trade.” *Journal of the European Economic Association* 17, no. 2 (2019): 497–534.

Trivers, Robert. *Parental investment and sexual selection.* Vol. 136. Biological Laboratories, Harvard University Cambridge, MA, 1972.

Van de Walle, Nicolas. “The institutional origins of inequality in Sub-Saharan Africa.” *Annual Review of Political Science* 12 (2009): 307–327.

Voigtländer, Nico, and Hans-Joachim Voth. "How the West" Invented" fertility restriction." *American Economic Review* 103, no. 6 (2013): 2227–64.

Vroklage, Bernh. "Bride price or dower." *Anthropos*, no. H. 1./2 (1952): 133–146.

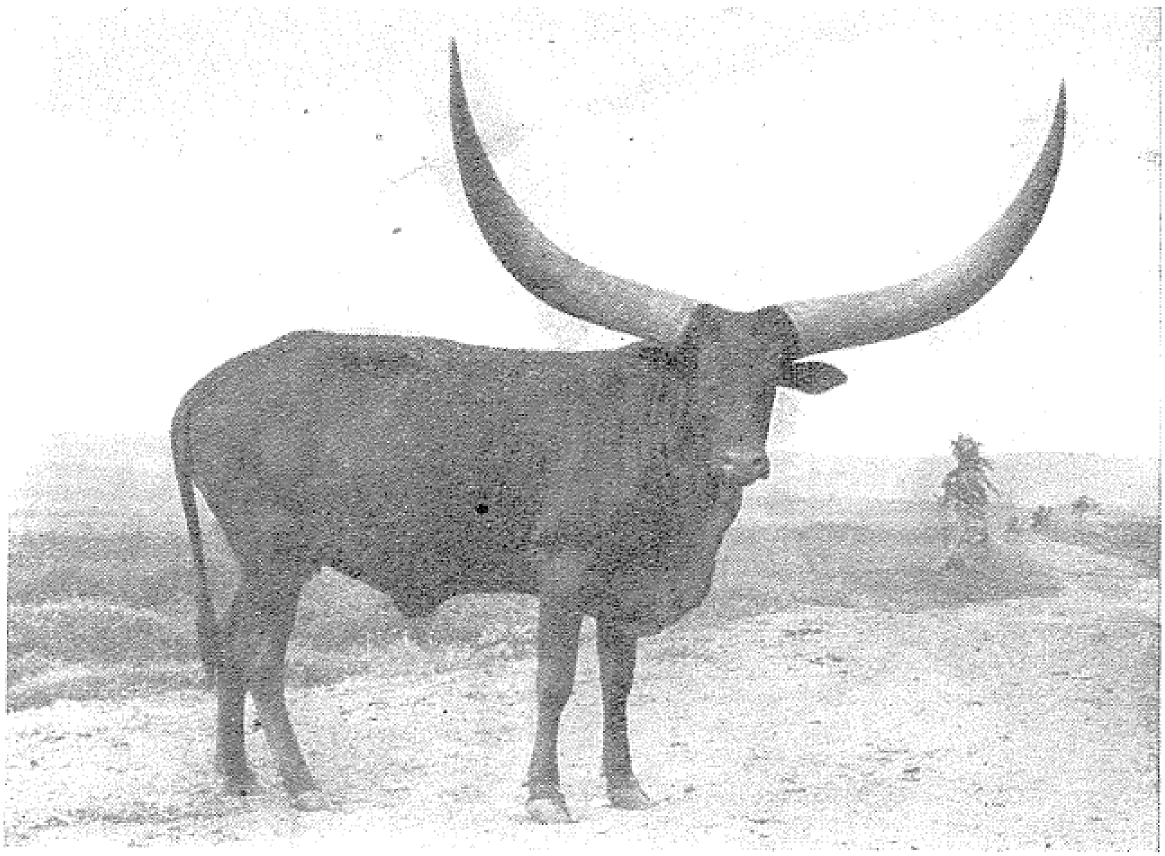
World-Bank. *World development report 2012: Gender equality and development*. The World Bank, 2011.

Xia, Xuhua. "Uncertainty of paternity can select against paternal care." *The American Naturalist* 139, no. 5 (1992): 1126–1129.

Appendix

Tables and Figures

Figure 1: An Ankole cow in Uganda



Notes: This figure from Joshi, McLaughlin, and Phillips (1957) shows an Ankole cow in Uganda. The horns measure 52 in. (132 cm) between the tips.

Figure 2: Precolonial ethnic-group boundaries

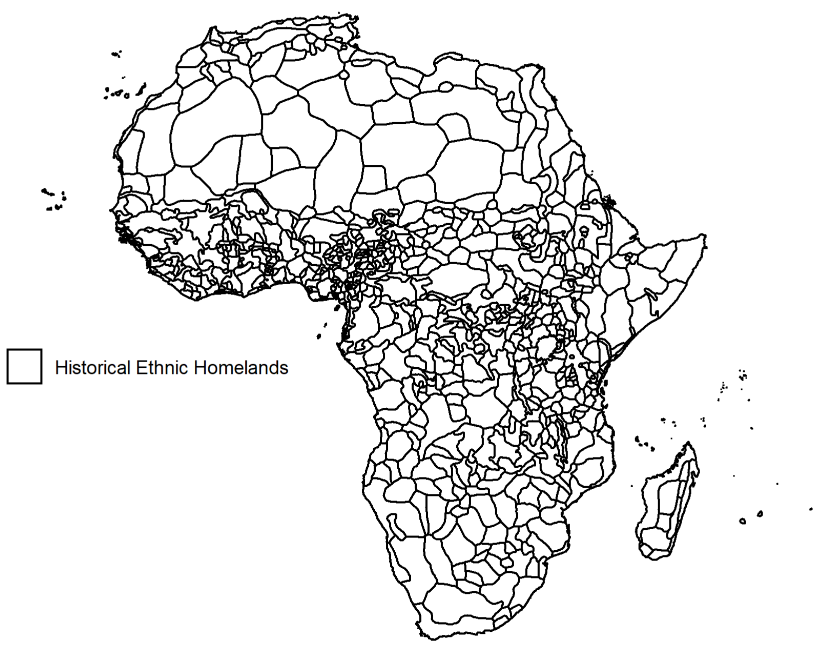


Figure 3: Distribution of cattle during the precolonial period

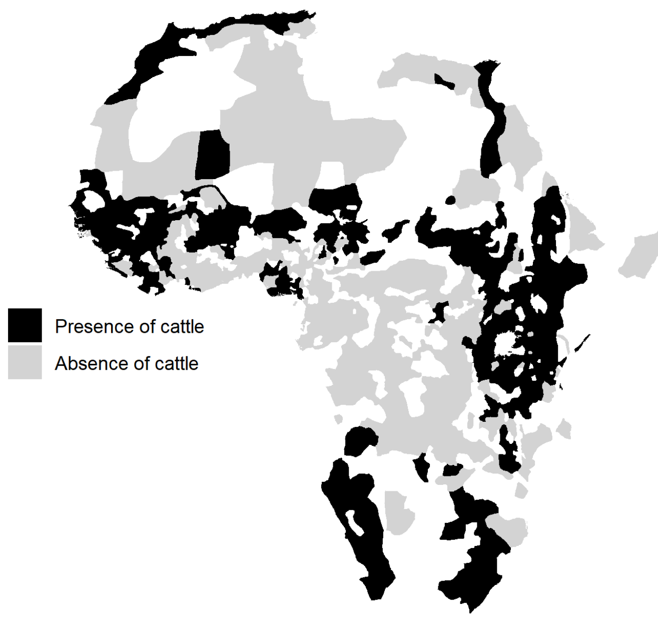


Figure 4: Distribution of places suitable for rearing cattle

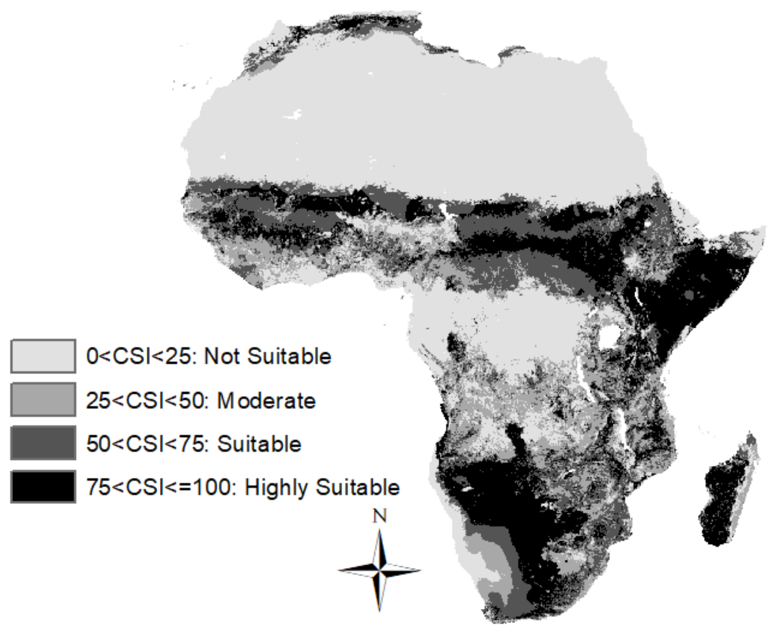


Figure 5: Correlation between places suitable for rearing cattle and places suitable for tsetse flies

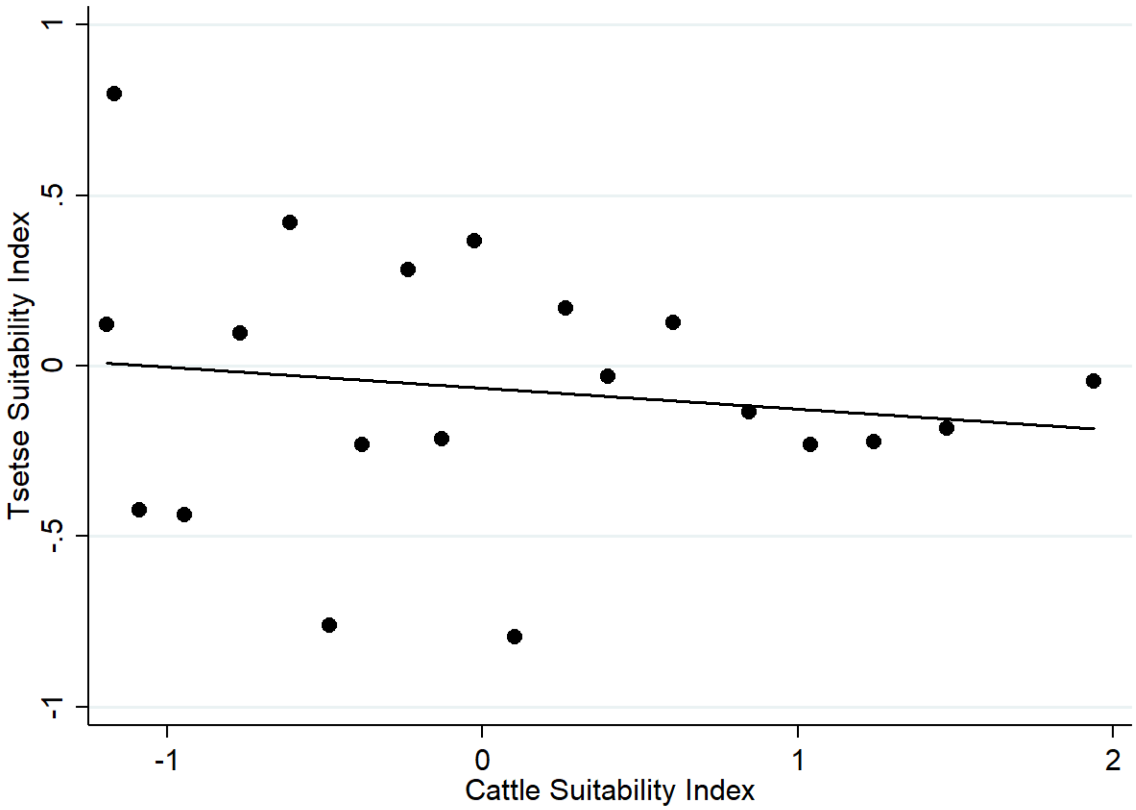
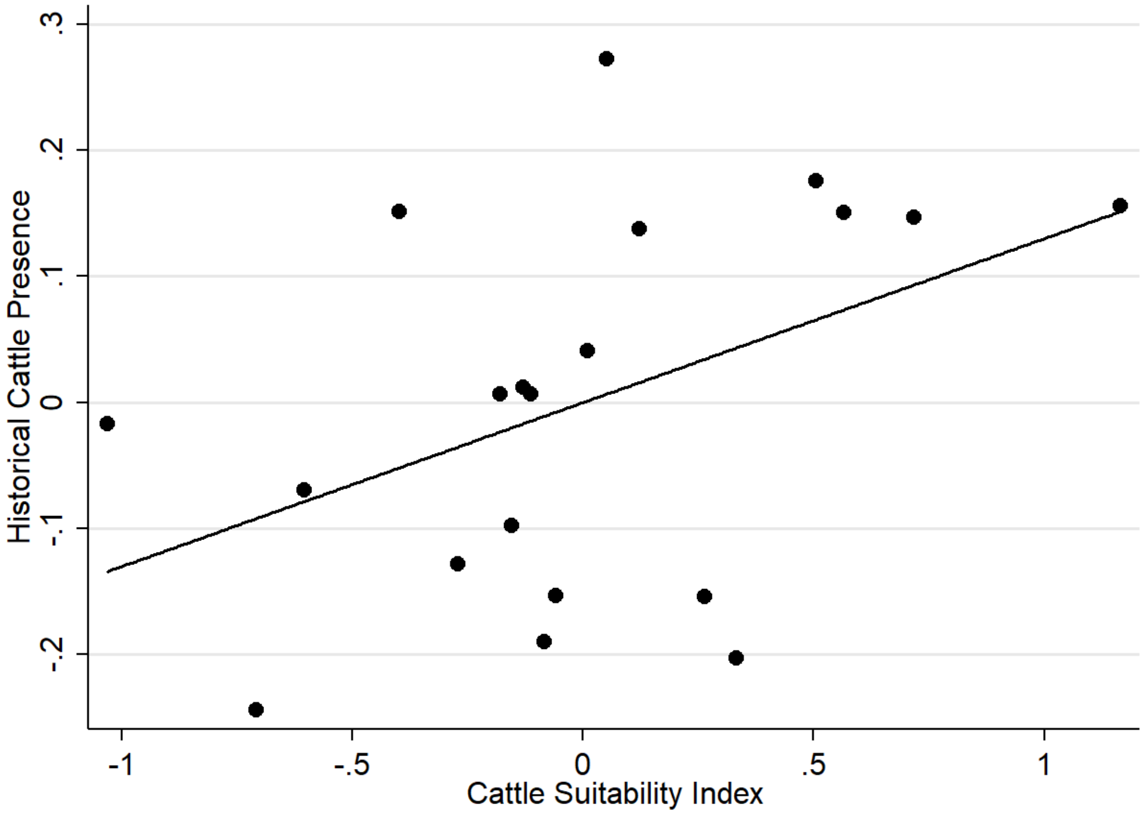
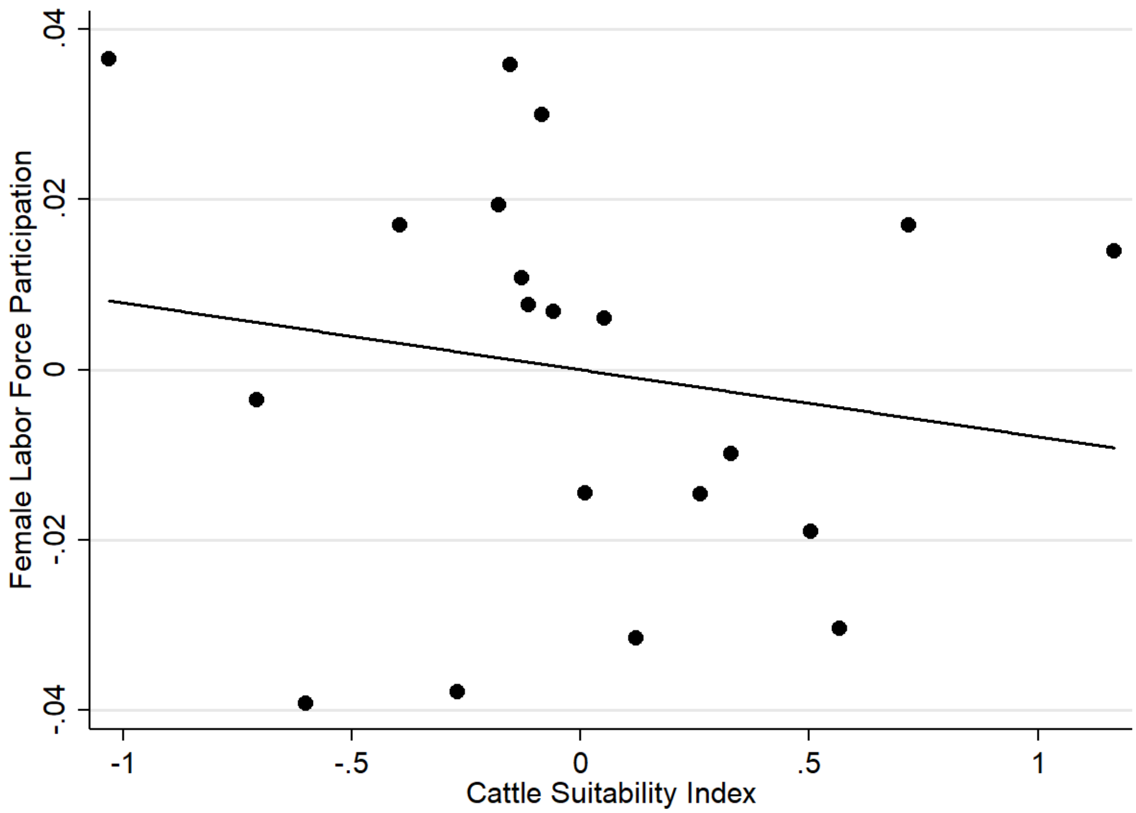


Figure 6: Places suitable for cattle associated with higher presence of cattle



Notes: Binscatter plot. Cattle were present in places suitable for rearing cattle. The figure shows a nonparametric representation of the first-stage. It is constructed by first partialing out the baseline controls, by regressing the variables "Historical presence of cattle" and "CSI" on the full list of controls. The residuals from the regression of "CSI" on the controls are then divided in 20 equal-sized bins and, in each bin, I plot the mean of the residuals from the regression of "Historical cattle presence" on the controls. Finally, the best-fit line is estimated on the underlying data.

Figure 7: Places suitable for cattle associated with lower female labor force participation



Notes: Binscatter plot. The figure shows a nonparametric representation of the reduced form. It is constructed by first partialing out the baseline controls, by regressing the variables "FLFP" and "CSI" on the full list of controls. The residuals from the regression of "CSI" on the controls are then divided in 20 equal-sized bins and, in each bin, I plot the mean of the residuals from the regression of "FLFP" on the controls. Finally, the best-fit line is estimated on the underlying data.

Table 1: Summary statistics

Variable	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max	Obs
	Presence of cattle					Absence of cattle				
Ethnographic Atlas Variables										
Female participation agriculture	0.406	0.492	0	1	192	0.608	0.49	0	1	120
Female participation husbandry	0.183	0.388	0	1	164	0.457	0.504	0	1	46
Female participation fishing	0.25	0.435	0	1	92	0.342	0.477	0	1	79
Polygyny	0.956	0.205	0	1	274	0.95	0.218	0	1	201
Brideprice	0.96	0.196	0	1	277	0.932	0.252	0	1	206
Patrilocality	0.966	0.182	0	1	263	0.797	0.403	0	1	192
Patrilineal inheritance	0.921	0.271	0	1	189	0.68	0.468	0	1	128
Patrilineal lineage	0.909	0.289	0	1	230	0.736	0.442	0	1	182
Plough use	0.112	0.315	0	1	278	0.029	0.169	0	1	206
Economic development	5.661	1.657	1	8	277	5.79	1.98	1	8	205
Political complexities	1.883	0.666	1	3	266	1.965	0.681	1	3	201
Geographical variables										
CSI	0.193	0.958	-1.189	2.307	276	-0.304	0.827	-1.189	2.183	202
Slope	0.508	0.341	0	1	276	0.67	0.305	0	1	202
Distance to water	0.872	0.233	0	1	276	0.88	0.278	0	1	202
Pasture suitability	0.556	0.353	0	1	276	0.275	0.312	0	1	202
SI	0.515	0.182	0	0.911	278	0.547	0.215	0.091	0.885	206
Proportion in tropics	0.922	0.265	0	1	278	0.949	0.21	0	1	206
Malaria index	13.496	10.633	0	34.491	278	13.882	8.431	0	34.083	206
TSI	-0.362	0.987	-3.119	1.495	278	0.445	0.789	-2.136	1.495	206
Plough Negative	0.635	0.068	0.518	0.852	265	0.667	0.061	0.518	0.852	192
Plough Positive	0.114	0.123	0	0.423	265	0.099	0.099	0	0.365	192

Table 2: Summary statistics (continued)

Variable	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max	Obs
	Presence of cattle					Absence of cattle				
SCCS variables										
Land clearance	0.038	0.196	0	1	26	0	0	0	0	11
Soil preparation	0.154	0.368	0	1	26	0.364	0.505	0	1	11
Planting	0.308	0.471	0	1	26	0.636	0.505	0	1	11
Crop Tending	0.346	0.485	0	1	26	0.636	0.505	0	1	11
Harvesting	0.269	0.452	0	1	26	0.818	0.405	0	1	11
DHS Variables (women sample)										
FLFP	0.54	0.498	0	1	245000	0.639	0.48	0	1	153000
Agriculture	0.273	0.445	0	1	225000	0.316	0.465	0	1	150000
Clerical	0.007	0.082	0	1	225000	0.008	0.088	0	1	150000
Manual	0.077	0.267	0	1	225000	0.085	0.279	0	1	150000
Domestic	0.019	0.136	0	1	225000	0.008	0.088	0	1	150000
Sales	0.197	0.398	0	1	225000	0.196	0.397	0	1	150000
Number of Children	3.099	2.944	0	22	248000	2.87	2.741	0	18	155000
Age First Marriage	17.435	3.897	2	48	189000	18.176	4.103	5	49	114000
Household Decisions	1.67	1.512	0	4	58263	2.286	1.436	0	4	49162
Polygyny	0.383	0.486	0	1	165000	0.254	0.435	0	1	97415
Age	28.34	9.455	15	49	248000	28.444	9.422	15	49	155000
Rural	0.678	0.467	0	1	248000	0.608	0.488	0	1	155000
Education Attainment	1.045	1.389	0	5	248000	1.584	1.436	0	5	155000

Table 3: OLS and IV estimates: The effect of the precolonial presence of cattle on female participation in agriculture

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A. OLS and second stage							
	Dependent variable: Female participation in agriculture relative to male							
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.194**	-0.829***	-0.202***	-0.332*	-0.203***	-0.372**	-0.204***	-0.379**
	(0.085)	(0.302)	(0.073)	(0.189)	(0.073)	(0.186)	(0.072)	(0.192)
Geography Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Economic Development	No	No	No	No	Yes	Yes	Yes	Yes
Political Complexity	No	No	No	No	No	No	Yes	Yes
Observations	304	304	304	304	304	304	304	304
R-squared	0.036		0.186		0.192		0.192	
	Panel B. First Stage							
	Dependent Variable is precolonial presence of cattle							
Cattle Suitability Index		0.133***		0.204***		0.207***		0.209***
		(0.031)		(0.035)		(0.036)		(0.038)
Partial R-squared		0.059		0.109		0.111		0.108
F-stat		14.58		27.43		26.49		25.59

Notes. The unit of observation is an ethnic group from the *Ethnographic Atlas*. The variable *female participation in agriculture* takes the value 1 if female participated more than male and 0 otherwise. The mean of the dependent variable is 0.484. The mean for the variable *historical presence of cattle* is 0.618 and the standard deviation is 0.487. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, and malaria ecology index. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. Coefficients are reported with robust standard errors in parenthesis clustered at the level of cultural province. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 4: OLS and IV estimates: The effect of the precolonial presence of cattle on female participation in agricultural tasks

	(1)		(2)		(3)		(4)		(5)	
	Land Clearance		Soil Preparation		Planting		Crop Tending		Harvesting	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.013	0.470	-0.113	-1.629	-0.199	-1.738	-0.154	1.917	-0.458***	-0.935
	(0.029)	(0.873)	(0.169)	(2.500)	(0.217)	(2.757)	(0.165)	(3.565)	(0.148)	(1.780)
Geography Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37	37	37	37	37	37	37	37	37	37
F-stat		0.3		0.3		0.3		0.3		0.3

Notes. The unit of observation is an ethnic group from the *Standard Cross-Cultural Sample*. All dependent variables are dummies for female participation in agricultural tasks. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, and malaria ecology index. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. Coefficients are reported with robust standard errors. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 5: OLS and IV estimates: The effect of precolonial presence of cattle on female participation in husbandry and fishing

	(1)		(2)	
	Husbandry		Fishing	
	OLS	IV	OLS	IV
Historical Cattle Presence	-0.250***	-0.499**	-0.018	-0.047
	(0.082)	(0.246)	(0.073)	(0.258)
F-stat		11.90		9.78
Geography Controls	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes
Observations	206	204	169	167
R-squared	0.117	-	0.100	-
Partial R-squared	-	0.076	-	0.109
No. Clusters	91	91	82	82

Notes. The unit of observation is an ethnic group from the *Ethnographic Atlas*. The variables *Husbandry* and *Fishing* are dummies for female participation in husbandry and fishing respectively. The mean for the variable *historical presence of cattle* is 0.618 and the standard deviation is 0.487. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, and malaria ecology index. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. Coefficients are reported with robust standard errors in parenthesis clustered at the level of cultural province. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 6: OLS and IV estimates: The effect of cattle versus plough agriculture on female participation in agriculture

	(1)	(2)	(3)	(4)	(5)	(6)
	Female participation in agriculture relative to male					
	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.204***	-0.379**			-0.179**	-0.554***
	(0.072)	(0.192)			(0.069)	(0.167)
Historical plough use			-0.471***	-1.957***	-0.423***	-1.141**
			(0.132)	(0.756)	(0.128)	(0.552)
F-stat		25.59		3.28		17.46
Geography Controls	Yes	Yes	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes	Yes	Yes
Observations	304	304	304	297	304	297
R-squared	0.192	-	0.198	-	0.226	-
Partial R-squared	-	0.11	-	0.14	-	0.18
No. Clusters	107	107	107	103	107	103

Notes. OLS estimates in odd numbered columns, and IV estimates in even numbered columns. I instrument for *Historical Cattle Presence* with the CSI and for *Historical plough use* with the suitability location for cultivating plough-positive versus plough-negative crops from Alesina, Giuliano, and Nunn (2013). The unit of observation is an ethnic group from the *Ethnographic Atlas*. The dependent variable takes the value 1 if females participated more than males in agriculture and 0 otherwise. The mean for the variable *historical presence of cattle* is 0.618 and the standard deviation is 0.487. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, and malaria ecology index. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. Coefficients are reported with robust standard errors in parenthesis clustered at the level of cultural province. *, **, *** indicate the level of significance at the 10, 5. and 1% level.

Table 7: Robustness tests of the effect of cattle on female participation in agriculture: Controlling for observables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Dependent variable: Female participation in agriculture relative to male									
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.122	-0.390*	-0.246**	-0.926	-0.183**	-0.365*	-0.183**	-0.364*	-0.101	-0.282
	(0.077)	(0.209)	(0.118)	(0.714)	(0.074)	(0.201)	(0.071)	(0.203)	(0.080)	(0.220)
Tsetse Suitability Index	0.148***	0.097*								
	(0.034)	(0.054)								
Presence of sheep and goats			-0.053	-0.702						
			(0.136)	(0.685)						
Ethnic group land area					0.081	0.047				
					(0.050)	(0.058)				
Indigenous Slavery							0.002	-0.000		
							(0.097)	(0.095)		
Log of Population Density									-0.004	0.017
									(0.027)	(0.034)
Geography Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	304	304	304	304	304	304	274	274	238	238
R-squared	0.207	-	0.192	-	0.200	-	0.226	-	0.207	-
Partial R-squared	-	0.10	-	0.03	-	0.10	-	0.11	-	0.11
F-stat		22.14		3.91		23.31		23.83		19.58

Notes. The unit of observation is an ethnic group from the *Ethnographic Atlas*. The dependent variable *female participation in agriculture* takes the value 1 if females participated more than males and 0 otherwise. The mean for the variable *historical presence of cattle* is 0.618 and the standard deviation is 0.487. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, and date of observation. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. Coefficients are reported with robust standard errors in parenthesis clustered at the level of cultural province. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 8: IV estimates. Robustness tests of the effect of cattle on female participation in agriculture: Controlling for CSI factors

	(1)	(2)	(3)	(4)	(5)
	Female participation in agriculture relative to male				
	Second Stage estimates				
Historical Cattle Presence	-0.379**	-0.430**	-0.469**	-0.518***	-0.537***
	(0.192)	(0.168)	(0.188)	(0.162)	(0.162)
Slope index		✓			✓
Distance to water index			✓		✓
Pasture suitability index				✓	✓
F-stat	25.59	29.97	24.13	29.56	28.38
Observations	304	304	304	304	304
Geography Controls	Yes	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes	Yes

Notes. The unit of observation is an ethnic group from the *Ethnographic Atlas*. The dependent variable *female participation in agriculture* takes the value 1 if females participated more than males and 0 otherwise. The mean for the variable *historical presence of cattle* is 0.618 and the standard deviation is 0.487. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, and malaria ecology index. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. Standard errors are clustered at the level of cultural province dimensions. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 9: Robustness tests of the effect of cattle on female participation in agriculture: Alternative clustering

	(1)	(2)	(3)	(4)	(5)	(6)
	Female participation in agriculture relative to male					
	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.202**	-0.379**	-0.204**	-0.379	-0.204*	-0.379
	(0.096)	(0.146)	(0.101)	(0.245)	(0.105)	(0.251)
Conley SE	✓	✓				
SE clustered by country			✓	✓		
Multiway clustering					✓	✓
F-stat		25.59		9.89		27.5
Geography Controls	Yes	Yes	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes	Yes	Yes
Observations	304	304	304	304	304	304

Notes. The unit of observation is an ethnic group from the *Ethnographic Atlas*. The dependent variable *female participation in agriculture* takes the value 1 if females participated more than males and 0 otherwise. The mean for the variable *Historical Cattle Presence* is 0.618 and the standard deviation is 0.487. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, and malaria ecology index. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. The Conley (1999) standard errors account for spatial correlation with cut-offs of 50 degrees latitude and 50 degrees longitude. The multi-way clustering have been computed using the method developed by Cameron, Gelbach, and Miller (2011) and clusters standard errors along the country and cultural province dimensions. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 10: Precolonial adoption of cattle and other gender norms: OLS, second-stage estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Polygyny		Brideprice		Patrilocality		Patrilineal land inheritance		Patrilineal lineage	
Mean of dep. Var.	0.956		0.95		0.891		0.821		0.825	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	0.009	-0.006	0.026	0.014	0.173***	0.222**	0.257***	0.472*	0.174**	0.193
	(0.029)	(0.047)	(0.023)	(0.063)	(0.056)	(0.104)	(0.071)	(0.243)	(0.067)	(0.146)
F-statistic		39.76		40.37		41.26		14.03		45.27
Geography Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	459	453	465	459	438	432	308	305	398	395
R-squared	0.128	0.124	0.011	0.010	0.126	0.125	0.193	0.178	0.121	0.120
No. Clusters	111	111	107	107	106	106	98	98	108	108

Notes. The unit of observation is an ethnic group from the *Ethnographic Atlas*. The dependent variables are all dummies for the practice of each cultural norm. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Geography Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, and malaria ecology index. "Economic development" is an index of settlement density, and "Political complexity" is an index for the levels of jurisdictional hierarchies. Coefficients are reported with robust standard errors in parenthesis clustered at the level of cultural province. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 11: OLS and IV estimates, the effect of cattle on Female labor force participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Female labor force participation							
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	OLS and Second-Stage estimates							
Historical Cattle Presence	-0.049**	-0.110*	-0.046***	-0.134**	-0.044***	-0.130**	-0.031**	-0.106*
	(0.024)	(0.065)	(0.015)	(0.054)	(0.015)	(0.052)	(0.014)	(0.056)
Observations	393,407	393,407	393,407	393,407	393,407	393,407	391,931	391,931
R-squared	0.049	0.046	0.171	0.166	0.241	0.236	0.244	0.240
Dep. var. mean unaffected	0.638	0.638	0.638	0.638	0.638	0.638	0.645	0.645
	First Stage: Dependent variable is Historical Cattle Presence							
Cattle Suitability Index		0.254***		0.236***		0.236***		0.213***
		(0.057)		(0.059)		(0.059)		(0.064)
Observations		393,407		393,407		393,407		391,931
R-squared		0.329		0.406		0.406		0.419
F-statistic		19.79		16		16		10.94
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	No	No	No	No	Yes	Yes	Yes	Yes
Country-level Controls	No	No	No	No	No	No	Yes	Yes
No. Clusters	161	161	161	161	161	161	158	158

Notes. The unit of observation is a female respondent from *DHS*. The dependent variable *Female labor force participation* is an indicator variable which takes the value 1 if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The top panel reports the OLS and the second-stage estimates of *Historical Cattle Presence*; the bottom panel shows the first-stage estimates of *Cattle Suitability Index*. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *Country-level Controls* include income per capita for year 2000 and income per capita squared for year 2000. The *F-statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 12: OLS and IV estimates: The effect of historical cattle adoption on occupation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Domestic		Agriculture		Manual		Clerical		Sales	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	0.016***	0.014	0.025	0.074	0.001	-0.077**	-0.001	-0.006	-0.037**	-0.023
	(0.004)	(0.015)	(0.022)	(0.073)	(0.013)	(0.037)	(0.001)	(0.004)	(0.017)	(0.066)
F-statistic		11.34		11.34		11.34		11.34		11.34
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	369,072	369,072	369,072	369,072	369,072	369,072	369,072	369,072	369,072	369,072
R-squared	0.034	0.034	0.081	0.080	0.025	0.012	0.004	0.004	0.060	0.060
No. Clusters	155	155	155	155	155	155	155	155	155	155
Dep. var. mean unaffected	0.007	0.007	0.315	0.315	0.086	0.086	0.007	0.007	0.198	0.198

Notes. The unit of observation is a female respondent from the *DHS*. *Domestic* is an indicator that takes the value of 1 if the respondent worked within a household as a domestic servant. *Agriculture* is a dummy for the respondent being employed in agriculture. *Manual* is an indicator that takes the value 1 if the respondent is employed in manual activities. *Clerical* is an indicator that takes the value 1 if the respondent is employed in clerical jobs. *Sales* is an indicator that takes the value 1 if the respondent is employed in sales activities. *Historical Cattle Presence* is an indicator variable taking the value of 1 if ethnic group kept cattle in precolonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 13: OLS and IV estimates, the effect of cattle versus plow agriculture on female labor force participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Female labor force participation						
	OLS	IV	OLS	IV	OLS	IV	IV†
Historical Cattle Presence	-0.044***	-0.130**			-0.044***	-0.073	-0.130**
	(0.015)	(0.052)			(0.015)	(0.061)	(0.052)
Historical plough use			-0.150***	46.51	-0.134***	10.24	-0.102***
			(0.032)	(56.74)	(0.029)	(48.67)	(0.035)
F−Statistic for cattle		16				8.77	16
F−Statistic for plow				0.47		0.31	
F−Statistic all		16		0.47		0.21	16
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	393,407	393,407	393,407	393,198	393,407	393,198	393,407
R-squared	0.241	0.13	0.239	0.00	0.241	0.21	0.13
No. Clusters	161	161	161	161	160	160	161
Dep. var. mean unaffected	0.645	0.645	0.490	2.161	0.490	2.871	2.871

Notes. The unit of observation is a female respondent from the *DHS*. The dependent variable *Female labor force participation* is an indicator variable which takes the value 1 if the respondent has worked in the last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 14: OLS and IV estimates: Investigating the mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Female labor force participation							
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.044***	-0.130**	-0.049	-0.005	-0.042**	-0.122**	-0.044***	-0.130**
	(0.015)	(0.052)	(0.038)	(0.042)	(0.016)	(0.052)	(0.015)	(0.052)
Historical Sheep and Goats Presence			0.005	-0.279				
			(0.037)	(0.215)				
Historical Polygyny					-0.099	-0.009		
					(0.061)	(0.079)		
Historical Brideprice							-0.003	0.000
							(0.026)	(0.034)
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	392,005	392,005	392,005	392,005	388,419	388,419	393,481	393,481
R-squared	0.243	0.239	0.243	0.229	0.238	0.234	0.239	0.235
F-stat		10.92		5.47		19.41		16.67

Notes. The unit of observation is a female respondent from the *DHS*. The dependent variable *Labor force participation* is an indicator variable which takes the value 1 if the respondent has worked in the last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 15: OLS and IV estimates: Investigating the mechanisms (continued)

	(9)	(10)	(11)	(12)	(13)	(14)
	Dependent variable: Female labor force participation					
	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.040**	-0.145**	-0.046***	-0.241**	-0.029*	-0.136**
	(0.018)	(0.073)	(0.017)	(0.111)	(0.016)	(0.054)
Historical Patrilocality	0.017	0.047				
	(0.028)	(0.040)				
Historical Patrilineal Inheritance			0.017	0.080		
			(0.023)	(0.065)		
Historical Patrilineal Lineage					-0.009	0.034
					(0.025)	(0.032)
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	375,944	375,944	296,437	296,437	325,061	325,061
R-squared	0.232	0.226	0.239	0.219	0.223	0.217
F-stat		15.35		5.60		24.33

Notes. The unit of observation is a female respondent from the *DHS*. The dependent variable *Labor force participation* is an indicator variable which takes the value one if the respondent has worked in the last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 16: OLS and second-stage estimates: The effect of historical cattle presence on fertility, polygyny, and women's empowerment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Age First Marriage		Polygyny		Female decision Household		Number of Children	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.780**	-2.011***	0.0469*	0.102*	-0.474***	-0.783***	0.354***	0.634***
	(0.367)	(0.681)	(0.0258)	(0.0560)	(0.119)	(0.258)	(0.105)	(0.226)
F-statistic		17.18		21.74		18.46		19.79
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	241,304	241,304	259,874	259,874	105,617	105,617	398,885	398,885
R-squared	0.047	0.19	0.134	0.21	0.202	0.21	0.601	0.20
No. Clusters	158	158	157	157	114	114	161	161
Dep. var. mean unaffected	18.17	18.17	0.254	0.254	2.286	2.286	2.87	2.87

Notes. The unit of observation is an ethnic group from the *Ethnographic Atlas*. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 17: OLS and second-stage estimates: Rural versus urban location

	(1)	(2)	(3)	(4)
	Female Labor Force Participation			
	OLS	IV	OLS	IV
	Rural		Urban	
Historical Cattle Presence	-0.049***	-0.151**	-0.047**	-0.119**
	(0.016)	(0.063)	(0.016)	(0.051)
F-statistic		15.11		16.77
Observations	255,837	255,837	137,570	137,570
R-squared	0.253	0.246	0.238	0.235
Historical Controls	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
No. Clusters	159	159	158	158
Dep. var. mean unaffected	0.610	0.610	0.484	0.484

Notes. The unit of observation is a female respondent from the *DHS*. The dependent variable *Female labor force participation* is an indicator variable which takes the value 1 if the respondent has worked in the last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 18: OLS and IV estimates: The effect of historical presence of cattle on female labor force participation, robustness to other measures of the presence of cattle

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Dependent variable: Female labor force participation									
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.043***	0.0003	-0.025***	-0.035*	-0.022***	-0.041***	-0.022***	-0.040***	-0.019***	-0.036**
	(0.013)	(0.032)	(0.009)	(0.019)	(0.005)	(0.015)	(0.005)	(0.015)	(0.005)	(0.017)
Observations	397,727	397,727	393,481	393,481	393,481	393,481	393,481	393,481	392,005	392,005
F-stat		9.64		19.77		19.45		19.45		11.48
No. Clusters	161	161	161	161	161	161	161	161	160	160
Historical Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	No	No	No	No	Yes	Yes	Yes	Yes	Yes	
Individual Controls	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Country-level Controls	No	No	No	No	No	No	No	No	Yes	Yes
Dep. var. mean unaffected	0.639	0.639	0.642	0.642	0.642	0.642	0.642	0.642	0.645	0.645

Notes. The unit of observation is a female respondent from the *DHS*. Standard errors in parenthesis are clustered at the ethnicity level. The dependent variable *FLFP* is an indicator variable which takes the value 1 if the respondent has worked in the last 12 months. *Historical Dependence on Cattle* is a range 0–9 measuring the degree to which society depended on cattle for subsistence. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *Country-level Controls* include income per capita for year 2000 and income per capita squared for year 2000. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 19: OLS estimates: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Dependent variable: Female labor force participation									
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.044***	-0.130**	-0.046	-0.156	-0.048*	-0.124	-0.044*	-0.111	-0.043*	-0.131
	(0.015)	(0.052)	(0.027)	(0.173)	(0.025)	(0.117)	(0.025)	(0.109)	(0.025)	(0.102)
Transatlantic slave trade			-0.000	-0.001						
			(0.001)	(0.002)						
Distance to Sea					0.000	0.000				
					(0.000)	(0.000)				
Railway contact							-0.012	-0.011		
							(0.026)	(0.027)		
Total missions Area									-26.99	-17.87
									(20.99)	(24.39)
Observations	393,481	393,481	234,276	234,276	234,276	234,276	234,276	234,276	234,276	234,276
R-squared	0.239	0.235	0.227	0.221	0.228	0.225	0.227	0.225	0.228	0.223
Partial R-squared		0.13		0.02		0.04		0.04		0.06
F-stat		15.98		1.29		2.62		3.01		4.01

Notes. The unit of observation is a female respondent from *DHS*. The dependent variable, *Female labor force participation* is an indicator variable which takes the value 1 if the respondent has worked in the last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Baseline Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, a measure of political complexity, age and age squared, and survey-year fixed effect. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 20: OLS and second-stage estimates: Ancestral versus location effect

	(1)	(2)	(3)	(4)	(5)	(6)
	Female Labor Force Participation					
Mean of dep. Var.	0.578	0.578	0.578	0.578	0.578	0.578
	OLS	IV	OLS	IV	OLS	IV
Ethnicity-based cattle presence	-0.044**	-0.130**			-0.049***	-0.152*
	(0.015)	(0.052)			(0.014)	(0.085)
Location-based cattle presence			-0.023	-0.109*	0.007	0.032
			(0.015)	(0.059)	(0.013)	(0.095)
F-statistic		15.66		16.97		8.09
Observations	393,407	393,407	393,407	393,407	393,407	393,407
R-squared	0.240	0.235	0.239	0.234	0.240	0.235
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. Clusters	161	161	161	161	161	161

Notes. The unit of observation is a female respondent from the *DHS*. The dependent variable *Female labor force participation* is an indicator variable which takes the value 1 if the respondent has worked in the last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The top panel reports the OLS and the second stage estimates of *Historical Cattle Presence*, the bottom panel shows the first stage estimates of *Cattle Suitability Index*. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.

Table 21: French versus English colonization

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: Female Labor Force Participation						
Mean of dep. Var.	0.578	0.578	0.484	0.484	0.484	0.484	0.484
	OLS	IV	OLS	OLS	IV	OLS	IV
Historical Cattle Presence	-0.044***	-0.130**		-0.045***	-0.138***	-0.041	-0.206*
	(0.015)	(0.052)		(0.017)	(0.052)	(0.025)	(0.106)
French Colonization			0.046*	0.050**	0.057**	0.054*	0.001
			(0.026)	(0.024)	(0.027)	(0.031)	(0.077)
Cattle X French Colonization						-0.009	0.126
						(0.039)	(0.152)
F-statistic		16			16.39		10.39
Observations	393,407	393,407	393,198	393,198	393,198	393,198	393,198
R-squared	0.241	0.236	0.240	0.241	0.236	0.241	0.232
No. Clusters	161	161	160	160	160	160	160
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. The unit of observation is a female respondent from the *DHS*. The dependent variable *Female labor force participation* is an indicator variable which takes the value 1 if the respondent has worked in the last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of 1 if the ethnic group had cattle in precolonial times. The top panel reports the OLS and the second-stage estimates of *Historical Cattle Presence*; the bottom panel shows the first-stage estimates of *Cattle Suitability Index*. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" include agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, economic development, and a measure of political complexity. The *Individual Controls* are age and age squared. The *F statistic* is the value of the Kleibergen-Paap F statistic on the excluded instrument. Coefficients are reported with robust standard errors in parenthesis clustered at the ethnicity level. *, **, *** indicate the level of significance at the 10, 5, and 1% level.