

The Historical Determinants of Gender Roles in Sub-Saharan Africa

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Abstract

There are wide differences in gender roles across societies in Sub-Saharan Africa. This study examines an anthropological hypothesis, first proposed by Engels (1884), that the origin of these differences was the historical domestication of cattle. I investigate the relationship between historical cattle presence and women's outcomes in both pre-colonial and contemporary Africa. The analysis combines ethnographic data on historical cattle presence with measures of pre-colonial gender roles, and contemporary women's outcomes. To address potential endogeneity in historical cattle adoption, I adopt an instrumental variables approach that leverages geo-climatic factors affecting the suitability of ethnic homelands for cattle-raising. The results show that cattle-based societies had more historical gender inequality, as measured by female participation in agriculture, inheritance rules, and other marriage customs. This gender inequality persisted among the descendants of these societies: I find that women from cattle-based societies had lower labour force participation rates, married at younger ages, had higher fertility rates, and were less likely to participate equally in household decision-making. I estimate large effects on women's outcomes even among descendants who lived in areas where cattle were not present, suggesting an important role for cultural persistence. These patterns are robust to a range of specifications and controls, and cannot be attributed to plough cultivation, pastoralism, or exposure to the slave trade. Instead, the findings are consistent with the introduction of cattle having created a large gender-imbalance in wealth holdings, which ultimately led to shift towards patriarchal norms that have persisted to present day.

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1 Introduction

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

Engels (1884)

There are vast disparities in women's labour force participation across Sub-Saharan Africa. In 2000, female participation rates ranged from 33% in Senegal to 88% in Mozambique (World Bank, 2001). These differences are mirrored in reported attitudes about the role of women in society.¹ An understanding the deep roots of these differences is crucial for the effective design of policies aimed at reducing gender inequality and promoting the empowerment of women (World Bank 2015; Ashraf et al. 2018).

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 pre-colonial 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 BC led to shift towards patriarchal norms that favoured men and placed women in subservient position (Holden and Mace 2003; Aberle 1961).

I investigate the relationship between historical cattle adoption and women's outcomes in both pre-colonial and contemporary Africa. To begin, I study the link between historical cattle presence and women's outcomes in the pre-colonial period. This analysis combines information on pre-colonial characteristics (cattle presence, female participation in agriculture, and other norms over 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, economic complexity, as well as controls for the geographic conditions of the ethnic homeland (tropical climate, longitude, absolute latitude, a

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, 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 unsuitable land for plough cultivation (Pryor 1985; Green 2013).

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 patrilocal 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 Ferrara (2016), from which I am able to match 85 percent of the sample to an 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 from cattle-based societies have participation rates that are 4 percentage points lower than those from non cattle-based societies. Consistent with the labour market evidence, I also find that historical cattle presence is associated with higher rates of fertility and polygynous marriage, and a decreased role in women’s household decision-making.

The baseline analysis shows a strong link between historical cattle presence and women’s role in society in both pre-colonial and contemporary Africa, consistent with Engel’s hypothesis. 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 society with strong patriarchal norms that herded cattle. 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, 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 pre-colonial 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 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 *Ethnographic 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 2018; 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

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.

5. Just 7 percent of pre-colonial ethnicities used plough cultivation (Murdock, 1969).

large gender-imbalance in wealth-holdings in pre-industrial Africa, led to a historical shift in gender norms 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 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 shed light on 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 the 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), improvements in labor-saving consumer durables in the household (Greenwood et al. 2005; Graham, Hirai and Kim 2016; Lewis 2018). While others emphasized social and cultural factors including patrilocality (Dyson and Moore 1983; Chakraborty and Kim 2010; Ebenstein 2014; Bau 2016), patrilineality (Deininger et al. 2013; Lowes 2017 and 2018), brideprice and dowry (Arnold et al. 1998; Das Gupta 2003; Lowes and Nunn 2017; Ashraf et al. 2016). I contribute to this literature by showing how the historical cattle presence created large gender-imbalance in wealth, which led to a shift in gender norms that continues to affect women’s outcome today.

Second, the paper generally 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, 2013, and 2011), the long-run effect of the Neolithic revolution on current gender norms (Hansen, Jensen, and Skovsgaard 2015), the effect of the Africa’s slave trade on polygyny and women’s participation in the labor force (Edlund and Ku 2011; Fenske 2015; Dalton and Cheuk Leung 2014; and E. Teso 2018), the role of pastoralism on women’s outcomes (Voigtlander and Voth 2013; Becker 2018). I contribute to the literature by showing how the introduction of cattle in Africa around 5,000 BC led to shift towards patriarchal norms, and persistently affects women’s outcomes even after. 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 pre-colonial 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 that were passed through 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 BC, 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 indigeneous African cattle population which can be classified into four major categories: humpless *Bos taurus*, humped *Bos indicus* (zebu), sanga (crossbreeding 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; Ganskopp et al. 2007; Owens, Launchbaugh and Holloway 1991). Specifically, Ganskopp et al. (2007) argues

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

that locations suitable for keeping cattle must have high quality and quantity of pasture, with sufficient water, and flat slope. More precisely, the physiological features of cattle do not allow them to travel more than 3.2 kilometers per day for water, or to graze on slope above ten percent, they must consume at least 36 lbs of pasture per day. These requirements are consistent with the geographic pattern of cattle throughout the continent. For instance, the zebu cattle, one of the major type of cattle in Africa, were widespread in the Sahel and Savannah, but were nearly absent in the Sahara and Kalahari desert (Green, 2013). The tsetse fly had been identified as another factor that slowed down the spread of cattle in the continent. As noted Diamond (1997, p. 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, cattle that were resistant to trypanosome disease were bred (Hannote et al., 2000). For example, the *Bos taurus* subspecies, which are resistant, are commonly found in the tsetse fly belt around Central and West Africa. However, their small size and their low productivity made them useless in the fields, and they were primarily valued for cultural purposes (Murray, Morrison and Whitelaw 1982).

Anthropological records highlight the essential economic role of cattle in pre-colonial 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 means of exchange to acquire grain from another man who has surplus. Given these economic benefits, cattle were highly valued in pre-colonial societies, and considered the central source societal wealth (Schneider 1957; Comaroff 1990). As Burchell (1822, p. 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 were large, with sharp horns that made them dangerous to corral, especially for women with young children (see Figure I). For instance, the Ankole longhorn cattle from central and eastern Africa usually weigh 900lb for males and 700lb for females, and their horn can measure six to eight feet in length.⁷ Second, because cattle consume large amounts of pasture and drink an average of 10

7. See Deshler (1963) for more details.

gallons 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, p.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 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 male dominated activity in almost 80% of the societies in Africa 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 custom, but that the domestication of cattle improved men's position in the family, which they used to overthrow matrilineal descent and established a new norm in favor of their own children. Under patrilineal custom, lineage and inheritance were transmitted from father to sons, so women became dependent on husbands for their wealth. Empirical support for this argument is provided by Aberle (1961), who finds that matrilineality 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 matriline, and the friend of patriline". Further support for this hypothesis was provided by Holden and Mace (2003).

Cattle presence has also been linked to patrilocal norms, in which the wife takes residence with the husband's kinship group after marriage (Vroklage, 1952). The practice of patrilocal residence is often associated with a bride price, for which cattle provide the typical form of payment (Goldschmidt, 1974). This payment provides the husband rights to women's labor and reproductive capabilities (Anderson, 2007). Further, patrilocal residence is associated with lower investment in female health and education, this might reflect the fact that parents, who anticipate these future post-marriage living arrangements, will 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 pre-colonial and contemporary periods. The pre-colonial 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 datasets, and describe the matching procedure I use to combine the *Ethnographic Atlas* with the DHS data.

3.1 Pre-colonial Data

The information on ethnic groups pre-colonial traits comes from Murdock’s (1967) *Ethnographic Atlas*. The Atlas is a compilation of ethnographic, anthropological, 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 in which 533 are from Africa.

Although the Atlas is 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 1960⁸. 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.

Murdock’s Ethnographic atlas has been widely used. Alesina, Giuliano and Nunn (2013) aggregated the *Ethnographic Atlas* at 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 Demographic and Health Surveys dataset in order to show that individuals whose ancestors relied on agriculture for subsistence are today more educated and wealthier. Alesina, Brioschi and Ferrara (2016) have investigated the determinants of violence

8. The Ethnographic Atlas is intended to describe as much as possible the characteristics of the ethnicities before their contacts with Europeans.

against women in Africa, they showed that ancestral socioeconomic conditions explain intrafamily violence today.

In order to determine the spatial locations of the ethnic groups, I follow previous work and combine the Atlas with the Murdock’s (1959) Map⁹. This map provides the geographic boundaries of approximatively 830 African ethnic groups. In total, 522 African ethnic groups from the Ethnographic Atlas are matched to the Murdock’s Map. Figure II (a) portrays boundaries of African ethnic groups in the late 19th and early 20th century.

My main explanatory variable is an indicator for the pre-colonial 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 II (b) shows the spatial variation in pre-colonial 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 in the ethnic group women performed the majority of agricultural tasks. This outcome is relevant to capture females empowerment since societies characterized by fewer participation of females in agriculture tend to unequal gender norms that subordinate women over men (Alesina, Giuliano and Nunn (2013)). *Patrilineal inheritance* is an indicator variable for whether ethnic group practiced patrilineal inheritance systems relative to matrilineal inheritance. In patrilineal inheritance systems, inheritance is traced through male members. Studies showed that women are less competitive relative to men in patrilineal kinship system (Gneezy, Leonard and List 2009; Andersen et al. 2013). *Patrilocal residence* takes the value of 1 if patrilocal residence was the rule within ethnic group as compared to matrilocality. The patrilocal tradition is the fact that married couple lives with the parents of the husband. In this case, women are more likely to experienced violence (Alesina, Brioschi and Ferrara, 2016). *Brideprice* is a dummy equals to 1 if ethnic group practiced brideprice marriage, and zero otherwise. *Polygyny* equals to 1 if polygyny marriage was the rule, and zero otherwise.

In the precolonial analysis, I include a set of controls variables measured at the ethnicity-level.

9. Since the ethnicity names from the Murdock’s 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 to link the groups from the Atlas to the groups in the Map.

Longitude controls for differences between the eastern and the western part of the continent. Absolute latitude and proportion of land in tropical and sub-tropical capture differences in the agricultural and ecological areas. Altitude is a I include a measure of agricultural suitability from the Food and Agricultural Organization (FAO). Malaria ecology index from Kiszewski et al. (2004) control for different forms of malaria. Date of observation controls for differences in the years of observation of ethnic groups in the Ethnographic Atlas. Finally, I control for political complexity and economic development from the *Ethnographic Atlas*. Political complexity is measured by the levels of jurisdictional hierarchies in the ethnic group. Economic development, measured 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 households surveys which cover over 90 developing countries. They consist in individual-level datasets which provide information on a range topics including female labor participation, education, female decision making within 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 datasets. I use 84 surveys from DHS, covering 24 Sub-Saharan African countries over the period 1992-2016. My final dataset is a sample of 1,065,768 individuals, in which about 72 percent are women aged between 15 to 49.

The main outcomes of interest is an indicator for female labor force participation, FLFP, that equals to one if the respondent is currently working or had worked in the twelve months before the survey. Since the DHS does not provide information whether individuals are looking for jobs, I consider that an individual does not work if she did not work for more than a year. I also construct indicators for employment by occupation for the follow occupations: domestic service, agriculture, manual, clerical, and sales. Other outcomes include *fertility*, measured by the woman’s number of children ever born; *education* ranges from 0 to 5 for categories “no education”, “incomplete primary”, “complete primary”, “incomplete secondary”, “complete secondary”, and “higher”; *son preferences* is an indicator variable that takes the value of one if respondent prefers to have a son child; *age at first marriage* measuring woman’s age at first marriage; and *polygyny*, which is equal to one if the respondent has co-wives. *female decision-making*, captures whether females played 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 also construct the variable *attitude towards violence*, which measures the share of specific cases for which female agrees that violence against women is justified.¹⁰

I include a set of controls including respondent’s age and age squared, a quadratic in national income per capita, survey year fixed effects. I also add covariates used for precolonial analysis. Table II 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 DHS often do not coincide with historical ethnic names, I employ a matching procedure that builds on extends those used by Michalopoulos, Putterman and Weil (2016) and Alesina, Brioschi and Ferrara (2016).

The matching techniques is as following. First, I match DHS ethnic groups that coincide with ethnic names in the Murdock Atlas. If no match is found, I use the dataset 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 match Afrobarometer ethnicities that match uniquely to ethnicities in the DHS. For example, the ethnicity "Pokot" which is included in DHS and Afrobarometer, which the Nunn (2011) file links to the "SUK" ethnic group in Murdock’s *Atlas*. For the remaining unmatched data, I use the 22nd edition of the *Ethnologue*, a pamphlet containing information of more than 7,111 spoken languages in the world, to identify alternate variants of DHS ethnic names and use these to link to the Atlas. For example, the ethnic group in the DHS "Pular" can be listed as alternative names by *Ethnologue* as "Foula Fouta"; "Fouta Djallon"; "Fulbe"; "Fulfulde Jalon"; "Fullo Fuuta"; "Futa Fula"; "Futa Jallon"; "Fuuta Jalon"; "Jalon"; and "Poular". I match these groups with the ethnic names "Futajalon" in the *Ethnographic Atlas*. For remaining unmatched groups, I use information from the Joshua Project, a database of more than 9,803 ethnic groups, to identify possible links between the DHS and the *Ethnographic Atlas*. Following Alesina, Brioschi and Ferrara (2016), I identify three potential links cases in which there are links between

10. The respondents are asked whether a husband is justified in hitting or beating his wife under different events: the wife goes out without telling him; the ife neglects their children; the wife argues with him; the wife refuses to have sex with him; the wife burns the food.

these two sources: 1) DHS and Murdock ethnic groups 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; 3) the ethnic group in the *Atlas*, is a subset of the DHS ethnicities. For remaining unmatched ethnicities in DHS, I use Wikipedia to identify alternate spelling 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 as *Peoplegroups.org*, and *Zyama.com* to match the remaining ethnic groups name.

Overall, I am able to match 84.5 percent of observations from the DHS to the *Ethnographic Atlas*. Totalling 1,065,768 respondents matched to their ancestral characteristics from the *Atlas*, equivalent to 169 ethnic groups.

4 Empirical Strategy

4.1 OLS Specification

To examine the effects of cattle presence on pre-colonial outcomes, I estimate the following equation:

$$Y_e = \alpha + \beta Cattle_e + Z_e' \Gamma + \epsilon_e \quad (1)$$

Where e indexes ethnic group. $Cattle_e$ is an indicator for the historical presence of cattle among ethnic group e .¹¹ The coefficient of interest is β , which captures the relationship between cattle and the various pre-colonial outcomes.

The term Z_e denotes a vector of socioeconomic and geographic variables that may be correlated with both the adoption of cattle and pre-colonial gender roles. I use information reported in the Murdock Atlas to construct a control for the economic complexity, measured in integer values from 1 to 8 that are increasing in the density of ethnic group's settlement.¹² Because historical settlement density may have been endogenous determined by the 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.¹³ I also control for the year the ethnic group

11. In some specifications, $Cattle_e$ is measured as 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.

12. 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, compact and relatively permanent settlements and (8) complex settlements.

13. A score of 0 designates stateless societies, a score of 1 is using to indicate paramount chiefdom, a score of 3 and 4 indicate groups that were part of large states.

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 Stability Index from Kiszewski et al., (2004), given the link between malaria and women’s labour force participation (Quisumbing et al., 2014). Finally, I control for ethnic homeland longitude and absolute latitude, that capture differences for the eastern and western part 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.¹⁴ These provinces are described by Murdock (1959) capture both spatial and genealogical correlations. This approach allows for potential correlation across ethnicities that shared common ancestors, cultural histories, or geography. For example, the migration patterns during the Bantu expansion may have led to correlation in outcomes across geographically diffuse ethnicities that nevertheless shared 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 pre-colonial cattle presence on contemporary women’s outcomes, I estimate the following equation:

$$Y_{i,e,c} = \alpha + \beta Cattle_e + Z'_e \Gamma + X'_{i,c} \Theta + \epsilon_i \quad (2)$$

where i indexes individuals, e ethnic groups, and c countries. My coefficient of interest 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 years fixed effects, and a quadratic in national per capita income.¹⁵ Finally, I cluster the standard errors at the ethnic group level, in order 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

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

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

and women’s outcomes. Consider, for example, the Maasai tribe, a society with strong patriarchal norms that herded cattle. 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 pre-colonial 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 only lost them on the eve of colonization due to raids and the rinderpest epidemic of 1896 (Dixon-Fyle, 1983). However, the Tonga has been observed in the *Ethnographic Atlas* in 1940, and recorded as no cattle keepers. 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 Whitela 1982; Bailey et al. 1996; Mattioli et al. 2000; Ganskopp et al. 2007). They argue that the physiology of cattle requires high quality and quantity of forage sources; and makes them difficult to travel up to 3.2 kilometers a day for water, specially on land slope above ten percent. 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.¹⁶

Two assumptions must hold for *CSI* to be a valid instrument. First, Cattle Suitability Index 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 ethnic group’s *CSI* was uncorrelated with the error term from the estimation equation. There is no reason the combination of three factors should independently have effects on women’s outcomes. To verify this argument, I control for each component of the *CSI* in the robustness.

To map the spatial distribution for cattle suitability, I develop a Habitat Suitability Index (HSI) model for cattle population. HSI models was 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

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

individual factors; and (3) the third step combines these functions into a functional form equation for the HSI.¹⁷ HSI models are commonly used to determine habitat suitability of species, generally when the actual distribution of these species is not observed. Further, they are simple to use and understand, and has 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. The GAEZ data set provides information on land suitability for pasture and other vegetables such as cassava, millet, and shrubs, for 3 arc-seconds in Global Land Cover (GLC2000) (Fischer et al., 2012). These data are constructed by 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 is ranged 0 to 100. Data on terrain slope are also from the FAO's *Gaez* which provides terrain slope gradients data for each 3 arc second grid. The terrain slope 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 categories¹⁸. Data on location of rivers and lakes are from the ESRI's Natural Earth dataset available at 1:10m scales. The data provides rivers and lakes centerlines of the world. I calculate the cost distance to water for each grid-cells (rivers or lakes), and I reclassify the resulting distance as followed: (1) distance below 1.6 km taking the value 1; (2) a value of 0.5 is given to distance between 1.6 to 3.2 kilometers; and (3) distance more than 3.2 km is assigned a value of zero.

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 lye between zero and one, I calculate the cattle suitability index (CSI) according to the following equation:

$$CSI = Pasturesuitability \times (1 - distancetowater) \times (1 - Terrainslope)$$

This functional form reflects the non-substitutability across geographic inputs. For example, a lack of local sources of water cannot be offset by more pastoral land for grazing.¹⁹ The Cattle Suitability Index is the standardized value of this functional form.

Figure III reports values of the CSI in panel B and the presence of cattle across pre-colonial

17. For more details see Pandey (2007).

18. Details on data are in appendix.

19. In the empirical analysis, I explore the robustness of the results to an additive model of the three inputs.

ethnic groups in Africa in panel A. The Sahel and the temperate zones are zones with high index for cattle suitability. Further, Locations with cattle presence from the *Ethnographic Atlas* coincide with places suitable for cattle.

5 Pre-colonial Results

5.1 Cattle Presence and Female Participation in Agriculture

This subsection reports the relationship between historical cattle presence and pre-colonial outcomes. Table III 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 pre-colonial societies.

The results show that the historical presence of cattle is associated with lower relative participation of women in agriculture.²⁰ The point estimates are stable across the various specifications ranging from -0.198 to -0.205. These effects are large and statistically significant, implying that female participation was 42 percent lower in cattle-based societies.

Table IV 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).²¹ The estimates show that cattle presence is negatively associated with women 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 III and IV 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 V, 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

20. Female participation is measured relative to male participation.

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

in agriculture and husbandry is that women were responsible for fishing. Table V, 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 labour from agriculture to husbandry or fishing, consistent with the historiography. Instead, the domestication of cattle appears to have led to a broad decrease in pre-colonial female participation. In fact, to the extent that cattle domestication caused a decline in male agricultural labour, as they increased time to animal husbandry, the estimates for relative female participation in agriculture may understate the overall in their 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 cattle suitability index (CSI) as an instrument for historical cattle presence. I begin by verify the first-stage relationship between the CSI and historical cattle presence. Figure VII supports the relationship showing that the presence of cattle is positively correlated with land suitability for keeping cattle. The bottom panel of Table III shows the first stages estimates. The Kleibergen-Paap F–statistics on the excluded instruments document that the *CSI* is a strong predictor of the cattle presence, with F-statistics that are all greater than 10.

Odd columns in Table III reports 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 V 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 reduced female labour force participation (Alesina, Giuliano and Nunn, 2013). Because the soil

characteristics in Africa are generally unsuitable for plough agriculture (Pryor, 1985),²² however, there is limited scope for this mechanism. In fact, just 7 percent of pre-colonial ethnicities used plough cultivation. Nevertheless, in this section I investigate the extent to which the effect of cattle on women’s participation can be attributable to greater reliance on plough cultivation.

Table VI, col. 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.²³ The IV estimates for plough cultivation are negative and remain statistically significant, despite the weak first stage relationship.²⁴

Next, I explore whether the negative relationship between historical cattle presence and female participation in agriculture can be attributable to plough cultivation. Table VI, col. 5 and 6 report the results from OLS and IV regressions that include separate indicators for cattle presence and plough cultivation.²⁵ 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 pre-colonial African societies.

5.3 Robustness checks

A first concern with the results presented so far is that pre-colonial cattle presence was systematically related to the tsetse fly, which could directly affect female participation in agriculture through the

22. The thin topsoil of Africa combined with the concentration of the nutrients on the surfaces makes the use of plough inefficient Green (2013).

23. 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.

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

25. 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.

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 IV shows no correlation between the suitability of climate for tsetse flies and the CSI. To further investigate this question, I re-run the main specifications, controlling for the tsetse fly suitability index (see Alsan (2015)). Table VII column 1 shows that the OLS estimates for cattle presence remain large, negative, albeit imprecise. Note that controlling for TSI 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 the tsetse suitability and the CSI presented in Figure IV.

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 2018; 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 VIII reports the results from IV estimates based on the CSI that also control for each factor individually. The results do not change.

Table VII, cols. 5 to 12 report the results from alternate specifications that control for a range of additional historical controls including export slave trade, ethnic group land area, indigenous slavery, initial population density, and the level of reliance in fishing. The estimates for cattle presence are generally unaffected by these various covariates. In addition to these various controls, I have also explored the robustness of the results to alternative method, including probit and bipoit specification. The results remain the same in term of sign, significance and magnitude.

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 IX also reports results based on Conley (1999) standard errors with 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 the multiway clustering by country and by family languages (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 pre-colonial women’s outcomes including polygyny, brideprice marriage, the use of patrilocal residence, and patrilineal inheritance and lineage system.

Table X, cols. 7 and 8 report the results for patrilineal inheritance, as measured as a dummy variable for whether ethnic group used patrilineal inheritance as opposed to 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 favour men. These patterns are consistent with anthropological research that has linked the emerge of patrilineal norms to the control of private property by men (Engels, 1884), and have found that these norms are common among pastoralist societies (Holden and Mace, 2003).

Cols 5 and 6 report the results for patrilocality, measured by an indicator variable for whether patrilocal 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 2018).²⁶

In Cols 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 the prevalent mode of marriage of the ethnic group was characterized by a brideprice payment from the husband to the bride’s family.²⁷ The results show no relationship between historical cattle presence and

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

27. The variable *Brideprice* includes brideprice or wealth to the bride’s family, bride service, and token bride price to the the bride’s family.

the traditional practice of bride price marriage.²⁸ This might result from two contracting effects. On the one hand, anthropologists have linked bride price marriage to patrilocality, as bride price 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 bride price marriage. On the other hand, Boserup (1970) has hypothesized that bride price is linked to women participation in agriculture, paying a bride price is a right 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, cols 1 and 2 report the results for polygyny. The dummy *Polygyny* is equal to 1 if the prevalent mode of marriage of the ethnic group was polygyny, the custom that 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.²⁹ 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 agriculture 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 X show that the historical presence of cattle had broad effects on the role of women in pre-colonial African societies that extended beyond their labour market participation. In the next section, I explore the extent to which the historical cattle presence continues to shape contemporary women’s outcomes.

6 Historical Cattle Presence and Contemporary Women’s Outcomes

I explore whether the historical adoption of cattle continues to influence contemporary female labour force participation. The analysis is based on DHS data for years 1992-2016, where I match

28. One should keep in mind that more than 95 percent of ethnic groups in the sample practiced brideprice marriage, the no correlation might only result of the no variation to identify in the dependent variable.

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

ancestral cattle presence to individuals based on their ethnic names (see section 3.3). In Section 6.1 I report the OLS and IV results for female participation; in Section 6.2 to 6.3, I explore the mechanisms driving the relationship between cattle and female LFP, 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 women’s participation were driven by persistence in cultural norms.

6.1 Historical Cattle Presence and Contemporary Female Labour Force Participation

Table XI presents the OLS and IV estimates of the effect of the historical cattle presence on contemporary females 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 groups level controls as in precolonial analysis³⁰. 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 respondents 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 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 percentage point decrease in modern female participation, which is equivalent to 5 to 7.7 percent 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 V 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 VI depicts a negative reduced-form relationship between the CSI and contemporary female LFP, consistent with OLS findings.

Odd columns of Table XI reports 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

30. The covariates include the suitability for the ethnic group 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.

results. The IV estimates support the results from the OLS regressions in terms of both sign and statistical significance. Across the various specification 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 pre-colonial 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 participation, I estimate the OLS and IV relationship for different occupational outcomes, measured as a series of dummy variables for female employment in different occupation (domestic, agriculture, manual, clerical, and sales). Table XII reports these results. The OLS results reveal heterogeneous effects across occupational categories: Historical cattle presence is negatively associated with the females likelihood of working in 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 statistical 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, given 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 favoured 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 influence long-run female participation.

In Table XIII, I explore whether the observed relationship between historical cattle presence and contemporaneous female LFP can be attributed to difference 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 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.³¹ Columns 5 and

31. The F-statistic for the excluded instruments is 0.47. Unlike the pre-colonial analysis, which was based on

6 report the results from models for female LFP that include both historical cattle presence and plough cultivation. One should keep in mind that all ethnicities that historical relied on plough agriculture also owned cattle, so the plough coefficients capture the additional effects of plough cultivation on female LFP among societies that herded cattle.

The results for historical cattle presence are not driven by plough cultivation. Column 5 of Table XIII 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 XII), consistent with Alesina, Giuliano and Nunn (2013). In column 6 of Table XII, 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 XII, 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 labour 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 out of villages to herd animals. Recent research has shown that male absence generated incentives to regulate female sexuality and mobility (Becker, 2018). If male absence alone is sufficient to generate the observed results, I would expect to see similar association between female labor force participation and the presence of other herding animals such as sheep and goat. To test for this, I regress my main outcome on an indicator for whether ancestors had sheep or goat. The coefficient for sheep and goat herding in column 2 of Table XV has the opposite sign. The effect of the presence of sheep and goat is positively associated with female participating in the workplace. This is consistent with the argument put by anthropologists that sheep and goats tended to be women 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 sizeable negative impact on FLFP, albeit statistically

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 to identify this first-stage relationship in the African context.

insignificance. These findings suggest that the effect of cattle on today’s FLFP is not driven by male absence culture.³²

A third possibility is that historical cattle presence led to a broad shift towards patriarchal norms that were uncondusive to women’s employment. I explore this question in Table XV. These models report the OLS and IV results for historical cattle presence, controlling for other historical societal norms (patrilineal descent, patrilocal marriage, polygyny marriage, and brideprice marriage).³³ 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 a potential transmission mechanisms for the long-run decrease in women’s 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 on contemporaneous women’s 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 shift in bargaining power that ultimately caused societies to adopt norms and cultures that favoured men.

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 empowerment.

To explore the link between historical cattle presence and fertility, I use information from the DHS on the number of children woman has ever born, and re-estimate my preferred specification with fertility as dependent variable. Columns 7 of Table XVI 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 percent increase in fertility. The results are consistent with the historical narrative, the historical cattle presence developed son preference for herding, and therefore is morelikely to increase women fertility. It is also in line with the general

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

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

shift in bargaining power, since men prefer larger family.

Did cattle also affect marriage market outcomes such as age of marriage, polygyny? The decline in women's labour force participation may have led to decrease in the age of marriage if women were dependent on 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 XVI. 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 the woman had co-wives.³⁴ In both the OLS and IV specifications, I estimate positive and statistically significant effects on 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 percent. It is notable that historical cattle presence influence contemporaneous polygynous marriage rates, despite having no influence on the practice in pre-colonial Africa (Table X, cols. 1 and 2). One potential explanation is that the unequal distribution of assets across males arose only in the post-colonial period (Van de Walle, 2009). Alternatively, the divergence findings could simply reflect the near universality of this practice in pre-colonial Africa.³⁵

Lastly, I investigate whether cattle were related to women's bargaining power within household. The analysis is based on self-reported questions from 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 within household*, that ranges from 0 to 6, increasing with women empowerment within household.³⁶ Columns 5 and 6 of Table XVI document that women from ethnic groups that had cattle are today less likely to make decision within household. Column 5 induces that having ancestors that had cattle is associated with a reduction of 0.5 women decision within the home. These results provide further evidence that the historical adoption of cattle led to shift in household bargaining power that favoured men.

34. Roughly 33 percent of respondents in the sample reported that they belonged in a polygynous marriage.

35. 483 in 508 societies in the Murdock database are reported to have used the practice of polygyny.

36. Women typically report making 2 to 4 decisions within household.

6.4 Persistence

Why does historical cattle presence still influence contemporaneous female participation? One explanation is that animals still play a central role in these societies, and the forces that influenced women’s outcomes in pre-colonial 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.³⁷ In this section, I shed light on this question, and explore the extent to which the long-run effects can be attributable 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 has similar effects on women’s employment in urban versus rural area. Intuitively, the estimates for female participation in urban areas should capture the independent effect of cultural norms since cattle are largely absent from these areas³⁸, 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 with 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 XVII. 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, provides 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

37. 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 1988 models, when information is costly or imperfect, it is optimal to develop rules of thumb in decisions making. These set of decision-making heuristics are considered as values and social norms transmitted across generations (E. Teso, 2018).

38. Only 5 percent of urban household from DHS own cattle.

in which cattle was 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 respondents no longer reside within their former ethnic homeland.³⁹ Columns 1 and 2 from Table XX report the effects of cattle presence on female labour 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 the location-based cattle presence. The OLS estimates are large, negative, but insignificant. The IV estimates are negative and statistically significant, suggesting that cattle presence affects female 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. In addition, the estimates for the location-based cattle presence are no longer significant. Together, these results provide further evidence for the cultural legacy of cattle, independently from their contemporaneous influence on women’s participation.

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 pre-colonial and modern era. My analysis relies on both information on historical ethnic norms from the *Ethnographic Atlas* with 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 labour 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

39. This outmigration may have occurred either by the current generation or by previous generations, in the century since much of the Murdock data was assembled. In column 7 and 8 of Table XX shows that historical ancestral cattle presence is unrelated to the probability that individuals have left their ancestral homeland.

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 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.

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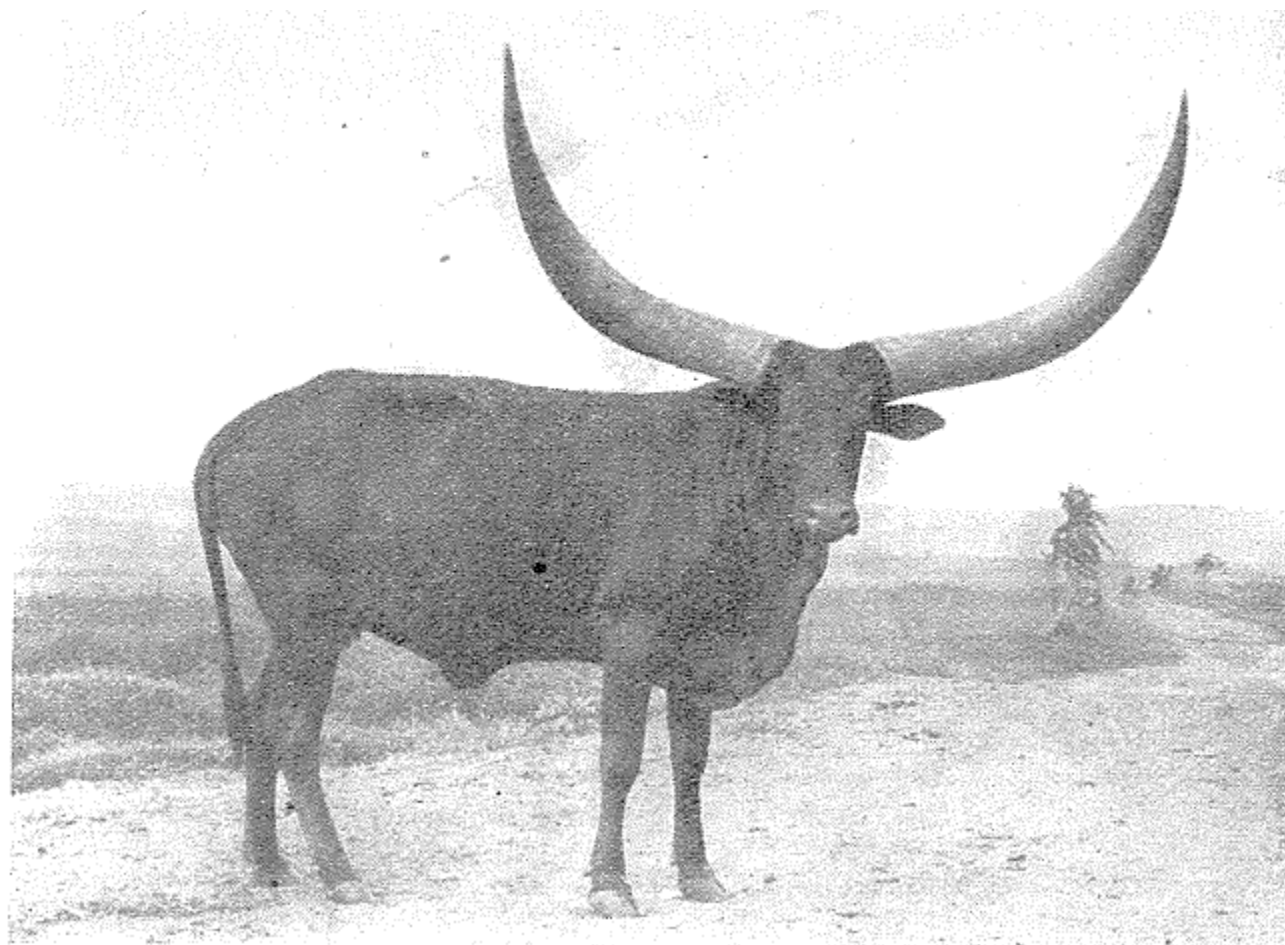
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Tables and Figures

FIGURE I: AN ANKOLE COW IN UGANDA



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

FIGURE II: ETHNIC GROUPS BOUNDARIES AND PRE-COLONIAL PRESENCE OF CATTLE

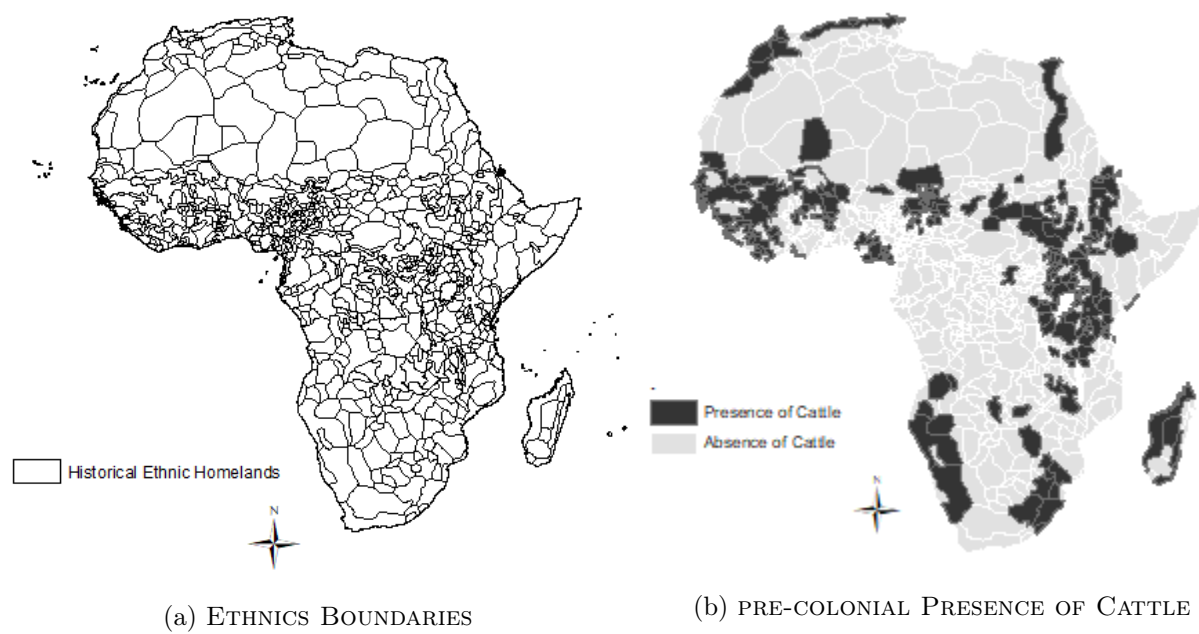


FIGURE III: PRE-COLONIAL PRESENCE OF CATTLE AND CATTLE SUITABILITY INDEX

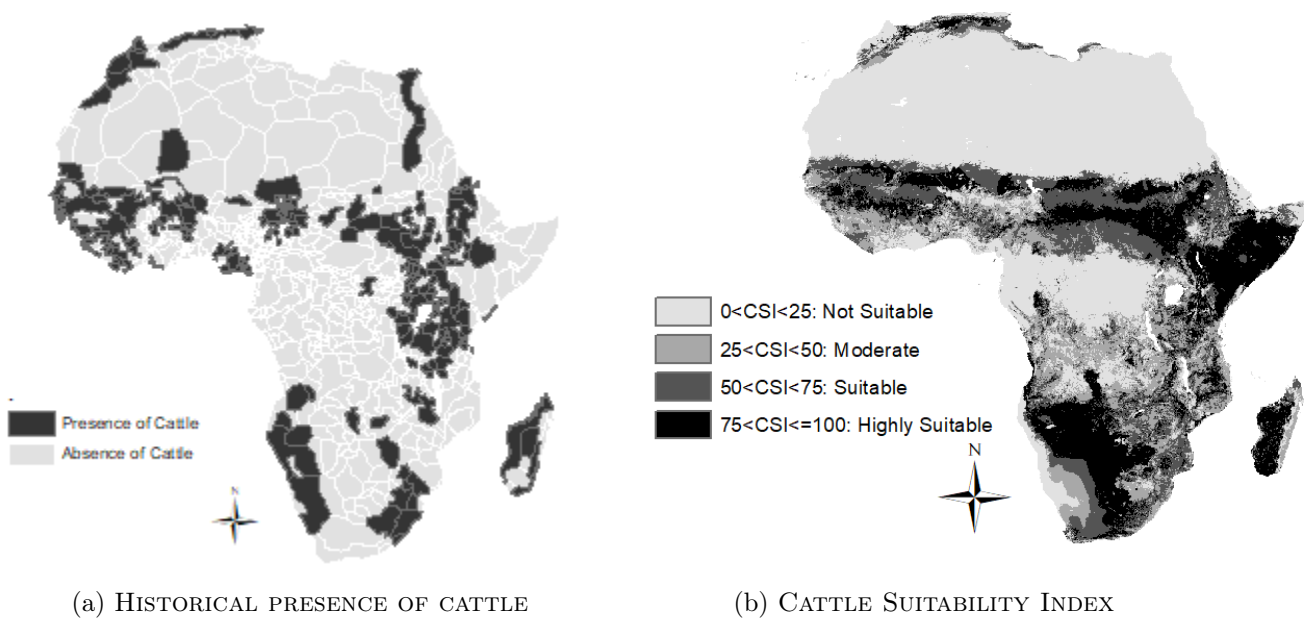
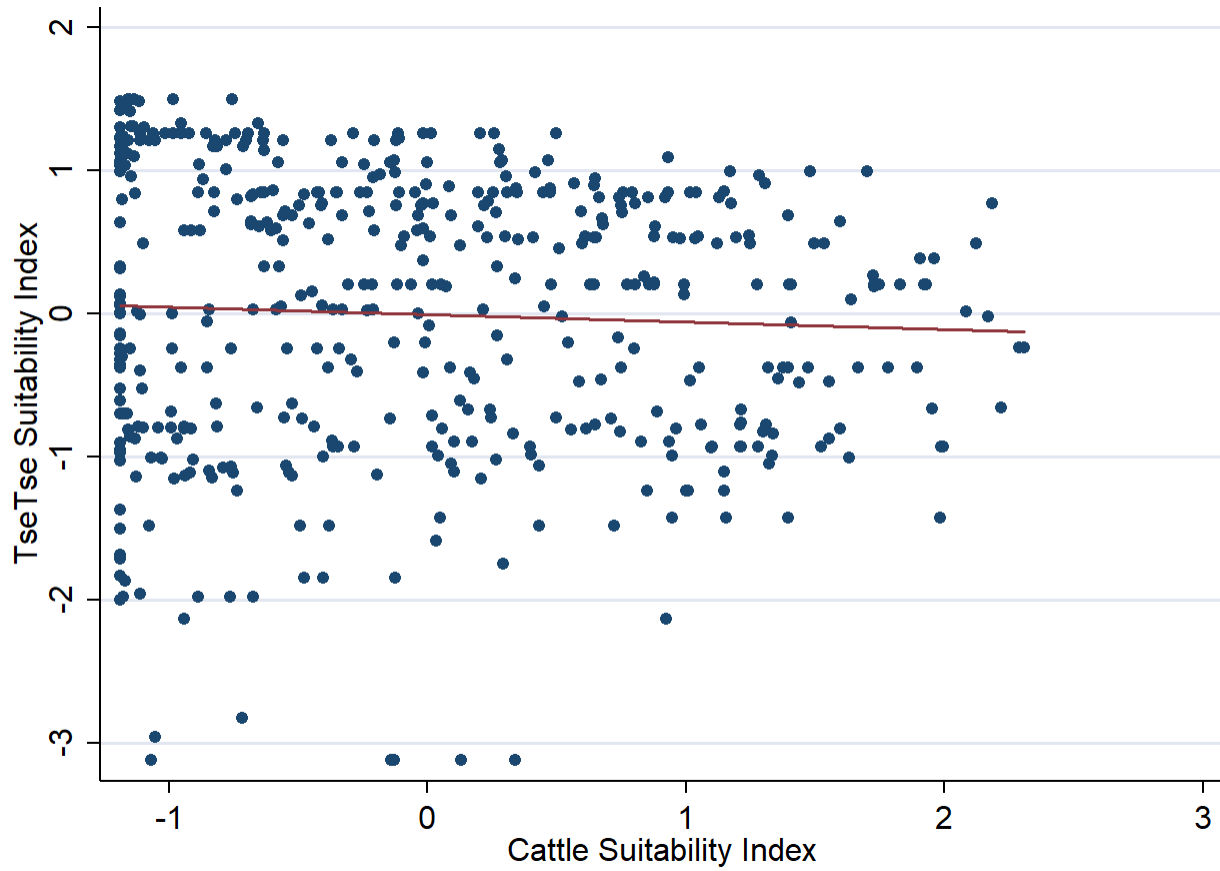
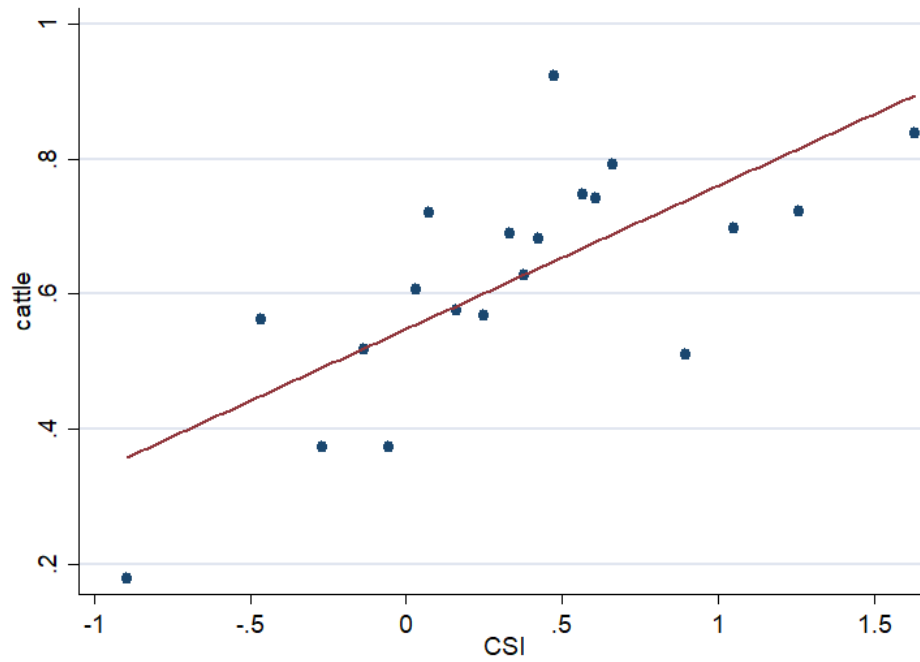


FIGURE IV: TseTse Suitability Index versus Cattle Suitability Index



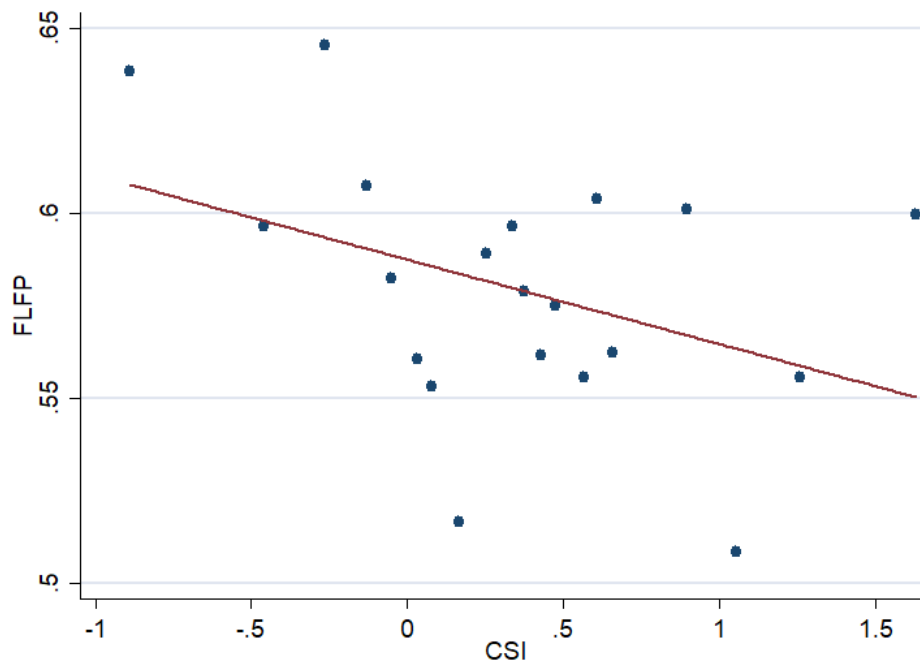
Notes: This figure shows that the tsetse suitability and cattle suitability index are not correlated.

FIGURE V: HISTORICAL ADOPTION OF CATTLE AND CATTLE SUITABILITY INDEX



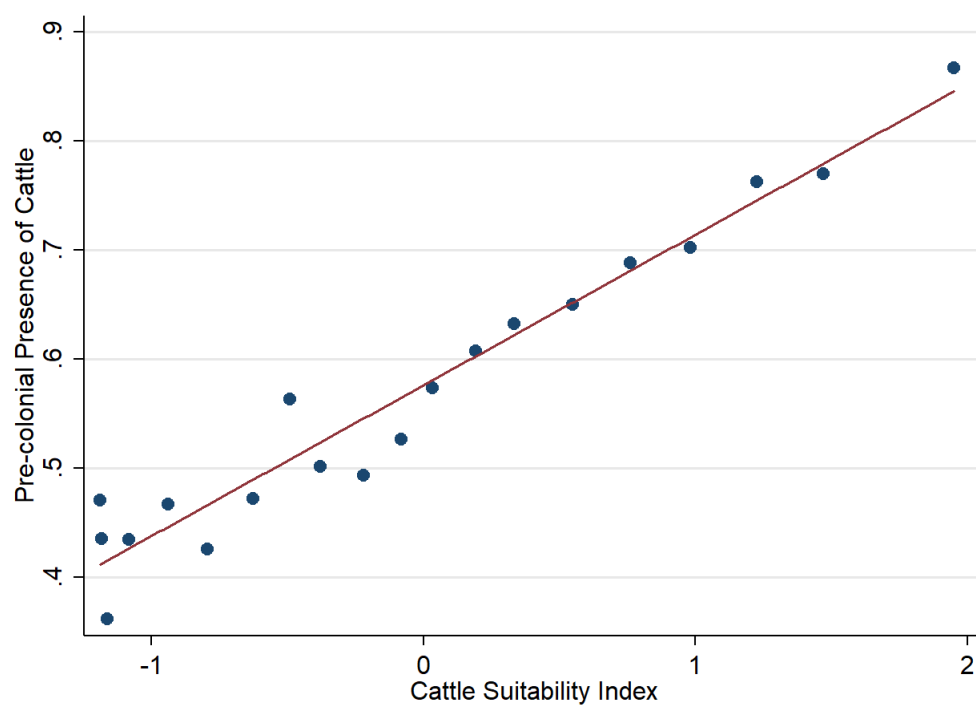
Notes: Binscatter plot. precolonial presence of cattle and cattle suitability index for African ethnic groups conditional on controls.

FIGURE VI: FLFP AND CATTLE SUITABILITY INDEX



Notes: Binscatter plot. FLFP and cattle suitability index conditional on controls.

FIGURE VII: PRE-COLONIAL PRESENCE OF CATTLE AND CATTLE SUITABILITY INDEX



Notes: Binscatter plot. pre-colonial presence of cattle and cattle suitability index for African ethnic groups conditional on geography controls.

TABLE I: SUMMARY STATISTICS

Variable	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max	Obs
	Presence of cattle					Absence of cattle				
<i>Ethnographic Atlas Variables</i>										
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
<i>Geographical variables</i>										
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 II: SUMMARY STATISTICS (CONTINUED)

Variable	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max	Obs
	Presence of cattle					Absence of cattle				
<i>SCCS variables</i>										
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
<i>DHS Variables (women sample)</i>										
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 III: OLS AND IV ESTIMATES, THE EFFECT OF THE PRE-COLONIAL 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	-0.199** (0.084)	-0.802*** (0.292)	-0.203*** (0.073)	-0.328* (0.187)	-0.205*** (0.073)	-0.371** (0.185)	-0.204*** (0.072)	-0.379** (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	308	308	308	304	308	308	308	304
No. Clusters	109	109	109	109	109	109	107	107
Dep. var. mean unaffected	0.605	0.606	0.605	0.606	0.605	0.607	0.602	0.603
Panel B. First Stage								
Dependent Variable is pre-colonial presence of cattle								
Cattle Suitability Index		0.133*** (0.031)		0.204*** (0.035)		0.207*** (0.036)		0.209*** (0.038)
F-stat		15.4		29.07		27.72		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 for the variable *historical presence of cattle* is 0.574 and the standard deviation is 0.495. The "Geography Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, 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 percent level.

TABLE IV: OLS AND IV ESTIMATES, THE EFFECT OF THE PRE-COLONIAL 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 (0.029)	0.470 (0.873)	-0.113 (0.169)	-1.629 (2.500)	-0.199 (0.217)	-1.738 (2.757)	-0.154 (0.165)	1.917 (3.565)	-0.458*** (0.148)	-0.935 (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
Dep. var. mean unaffected	0	0	0.363	0.363	0.636	0.636	0.636	0.636	0.818	0.818
F-stat		0.3		0.3		0.3		0.3		0.3

Notes. The unit of observation is an ethnic group from the *the Standard Cross-Cultural Sample*. All dependent variables are dummies for female participation in agricultural task. The mean for the variable *historical presence of cattle* is 0.574 and the standard deviation is 0.495. The "Geography Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, 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. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.

TABLE V: OLS AND IV ESTIMATES, THE EFFECT OF PRE-COLONIAL PRESENCE OF CATTLE ON FEMALE PARTICIPATION IN HUSBANDRY AND FISHING

	(1)		(2)	
	Husbandry		Fishing	
	OLS	IV	OLS	IV
Historical Cattle Presence	-0.250*** (0.082)	-0.499** (0.246)	-0.018 (0.073)	-0.047 (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	0.076	0.100	0.109
No. Clusters	91	91	82	82
Dep. var. mean unaffected	0.466	0.477	0.428	0.450

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 0.574 and the standard deviation is 0.495. The "Geography Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, 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 percent level.

TABLE VI: 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*** (0.0725)	-0.379** (0.192)			-0.179** (0.0695)	-0.554*** (0.167)
Historical plough use			-0.471*** (0.132)	-1.957*** (0.756)	-0.423*** (0.128)	-1.141** (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	307	304	307	300	307	297
R-squared	0.192	0.165	0.11	0.14	0.226	0.18
No. Clusters	107	107	107	103	107	103
Dep. var. mean unaffected	0.602	0.603	0.602	0.607	0.602	0.609

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 0.574 and the standard deviation is 0.495. The "Geography Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, 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 percent level.

TABLE VII: 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)	(11)	(12)
	Dependent variable: Female participation in agriculture relative to male											
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.112 (0.080)	-0.399** (0.198)	-0.183** (0.074)	-0.365* (0.201)	-0.183** (0.071)	-0.364* (0.203)	-0.101 (0.081)	-0.282 (0.220)	-0.246** (0.118)	-0.926 (0.714)	-0.171** (0.073)	-0.333 (0.203)
TseTse Suitability Index	0.310*** (0.074)	0.211* (0.105)										
Presence of sheep and goats			-0.053 (0.136)	-0.702 (0.685)								
Ethnic group land area					0.081 (0.051)	0.046 (0.058)						
Indigenous Slavery							0.002 (0.097)	-0.000 (0.095)				
Log of Population Density									-0.004 (0.027)	0.017 (0.034)		
Reliance on Fishing											0.069** (0.026)	0.053* (0.029)
F-stat		24.68		23.31		23.83		19.58		3.91		22.56
Observations	304	308	304	304	274	274	238	238	304	304	304	304
R-squared	0.285	0.277	0.200	0.172	0.226	0.197	0.207	0.182	0.192	0.094	0.211	0.189
Geography Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Development	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political Complexity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	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 female participated more than male and 0 otherwise. The mean for the variable *historical presence of cattle* is 0.574 and the standard deviation is 0.495. The "Geography Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, 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 percent level.

TABLE VIII: 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					
<i>Second Stage estimates</i>					
Historical Cattle Presence	-0.379** (0.192)	-0.430** (0.168)	-0.469** (0.188)	-0.518*** (0.162)	-0.537*** (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 female participated more than male and 0 otherwise. The mean for the variable *historical presence of cattle* is 0.574 and the standard deviation is 0.495. The "Geography Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation. "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 percent level.

TABLE IX: 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** (0.096)	-0.379** (0.146)	-0.204** (0.101)	-0.379 (0.245)	-0.204* (0.105)	-0.379 (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 female participated more than male and 0 otherwise. The mean for the variable *historical presence of cattle* is 0.574 and the standard deviation is 0.495. The "Geography Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation. "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 cutoffs of 50 degrees latitude and 50 degrees longitude. The multiway 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 percent level.

TABLE X: PRE-COLONIAL 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 (0.029)	-0.006 (0.047)	0.026 (0.023)	0.014 (0.063)	0.173*** (0.056)	0.222** (0.104)	0.257*** (0.071)	0.472* (0.243)	0.174** (0.067)	0.193 (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" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, 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 percent level.

TABLE XI: 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
<i>OLS and Second Stage estimates</i>								
Historical Cattle Presence	-0.049** (0.024)	-0.110* (0.065)	-0.046*** (0.015)	-0.134** (0.054)	-0.044*** (0.015)	-0.130** (0.052)	-0.031** (0.014)	-0.106* (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
<i>First Stage: Dependent variable is Historical Cattle Presence</i>								
Cattle Suitability Index		0.254*** (0.057)		0.236*** (0.059)		0.236*** (0.059)		0.213*** (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 one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial 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" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XII: 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*** (0.004)	0.014 (0.015)	0.025 (0.022)	0.074 (0.073)	0.001 (0.013)	-0.077** (0.037)	-0.001 (0.001)	-0.006 (0.004)	-0.037** (0.017)	-0.023 (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 *DHS*. *Domestic* is an indicator that takes the value of one if the respondent work within household as domestic servant. *Agriculture* is a dummy for the respondent being employed in agriculture. *Manual* is an indicator that takes the value one if the respondent is employed in manual activities. *Clerical* is an indicator that takes the value one if the respondent is employed in clerical jobs. *Sales* is an indicator that takes the value one if the respondent is employed in sales activities. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group kept cattle in pre-colonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XIII: 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*** (0.015)	-0.130** (0.052)			-0.044*** (0.015)	-0.073 (0.061)	-0.130** (0.052)
Historical plough use			-0.150*** (0.032)	46.51 (56.74)	-0.134*** (0.029)	10.24 (48.67)	-0.102*** (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 *DHS*. The dependent variable, *Female labor force participation* is an indicator variable which takes the value one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XIV: 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*** (0.015)	-0.130** (0.052)	-0.049 (0.038)	-0.005 (0.042)	-0.042** (0.016)	-0.122** (0.052)	-0.044*** (0.015)	-0.130** (0.052)
Historical Sheep and Goats Presence			0.005 (0.037)	-0.279 (0.215)				
Historical Polygyny					-0.099 (0.061)	-0.009 (0.079)		
Historical Brideprice							-0.003 (0.026)	0.000 (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 *DHS*. The dependent variable, *Labor force participation* is an indicator variable which takes the value one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XV: 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** (0.018)	-0.145** (0.073)	-0.046*** (0.017)	-0.241** (0.111)	-0.029* (0.016)	-0.136** (0.054)
Historical Patrilocality	0.017 (0.028)	0.047 (0.040)				
Historical Patrilineal Inheritance			0.017 (0.023)	0.080 (0.065)		
Historical Patrilineal Lineage					-0.009 (0.025)	0.034 (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 *DHS*. The dependent variable, *Labor force participation* is an indicator variable which takes the value one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XVI: OLS AND SECOND STAGE ESTIMATES: THE EFFECT OF HISTORICAL CATTLE PRESENCE ON FERTILITY, POLYGyny, AND WOMEN 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** (0.367)	-2.011*** (0.681)	0.0469* (0.0258)	0.102* (0.0560)	-0.474*** (0.119)	-0.783*** (0.258)	0.354*** (0.105)	0.634*** (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" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XVII: 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*** (0.016)	-0.151** (0.063)	-0.047** (0.016)	-0.119** (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 *DHS*. The dependent variable, *Female labor force participation* is an indicator variable which takes the value one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Historical Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XVIII: OLS AND IV ESTIMATES, THE EFFECT OF HISTORICAL PRESENCE OF CATTLE ON FLFP, ROBUSTNESS TO OTHER MEASURE 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 Dependence on Cattle	-0.043*** (0.013)	0.0003 (0.032)	-0.025*** (0.009)	-0.035* (0.019)	-0.022*** (0.005)	-0.041*** (0.015)	-0.022*** (0.005)	-0.040*** (0.015)	-0.019*** (0.005)	-0.036** (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	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 *DHS*. Standard errors in parenthesis are clustered at the ethnicity level. The dependent variable *FLFP* is an indicator variable which takes the value one if the respondent has worked in last 12 months. *Historical Dependence on Cattle* is range 0-9 measuring the degree to which society depended on cattle for subsistence. The "Historical Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XIX: OLS ESTIMATES: ROBUSTNESS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dependent variable: Female labor force participation											
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Historical Cattle Presence	-0.044*** (0.015)	-0.130** (0.052)	-0.046 (0.027)	-0.156 (0.173)	-0.048* (0.025)	-0.124 (0.117)	-0.044* (0.025)	-0.111 (0.109)	-0.043* (0.025)	-0.131 (0.102)	-0.072*** (0.014)	-0.160*** (0.053)
Tansatlantic 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 (0.026)	-0.011 (0.027)				
Total missions Area									-26.99 (20.99)	-17.87 (24.39)		
Ruggedness											0.206*** (0.035)	0.270*** (0.062)
Observations	393,481	393,481	234,276	234,276	234,276	234,276	234,276	234,276	234,276	234,276	393,481	393,481
R-squared	0.239	0.235	0.227	0.221	0.228	0.225	0.227	0.225	0.228	0.223	0.244	0.239
Partial R-squared		0.13		0.02		0.04		0.04		0.06		0.12
F-stat		15.98		1.29		2.62		3.01		4.01		13.82

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 one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial times. The mean for the variable *Historical Cattle Presence* is 0.574 and the standard deviation is 0.495. The "Baseline Controls" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, economic development, and 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 percent level.

TABLE XX: 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** (0.015)	-0.130** (0.052)			-0.049*** (0.014)	-0.152* (0.085)
Location-based cattle presence			-0.023 (0.015)	-0.109* (0.059)	0.007 (0.013)	0.032 (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 *DHS*. The dependent variable, *Female labor force participation* is an indicator variable which takes the value one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial 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" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.

TABLE XXI: 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*** (0.015)	-0.130** (0.052)		-0.045*** (0.017)	-0.138*** (0.052)	-0.041 (0.025)	-0.206* (0.106)
French Colonization			0.046* (0.026)	0.050** (0.024)	0.057** (0.027)	0.054* (0.031)	0.001 (0.077)
Cattle X French Colonization						-0.009 (0.039)	0.126 (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 *DHS*. The dependent variable, *Female labor force participation* is an indicator variable which takes the value one if the respondent has worked in last 12 months. *Historical Cattle Presence* is an indicator variable taking the value of one if ethnic group had cattle in pre-colonial 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" includes: the agricultural suitability, the proportion of area in tropical zone, longitude and absolute latitude coordinates, malaria ecology index, date of observation, 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 percent level.