The Historical determinants of gender roles in Africa*

LUCIENNE TALBA

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Abstract

This paper gives another explanation of historical differences in gender roles across societies. I test the hypothesis put forth by Frederich Engels (1884) that societies that have domesticated cattle have developed more patriarchal values and then more inequality in gender roles. I find consistent with the hypothesis that ethnic groups that have domesticated cattle had less female participation in agriculture, less female inheritance of wealth, less matrilocal marriage, less matrilineal descent, more brideprice marriage. I identify the causal effect of presence of cattle by exploiting variations in environment suitable for keeping cattle. My IV estimates, based on these variations, confirm the OLS estimates.

Keywords: Gender roles, culture, cattle, Africa.

*Note of acknowledgement.

1 INTRODUCTION

The role of women varies significantly across societies. In some societies, women participate equally to men in employment outside the home. In others, the appropriate place of women is within the home.[1] It has been proven that non participation of females in the workplace is a brake for sustainable development.[2] Then, achieving gender equality is gaining traction in policy circles. One manifestation of that is the third Millenium Development Goals, aiming to promote gender equality. However, taking a suitable policy needs to understand why norms about gender roles differ across societies.

While some studies explain differences in gender roles with the capital intensity of the economy and per capita income (e.g., Goldin (1995), Galor and Weil (1996)), others explain theses disparities with differences in cultural beliefs about the appropriate place of women.[3] More recently, a new strand of literature has focused on the origins of these cultural beliefs. For instance, in an influantial paper, Alesina et al., (2013) argue that the use of plough cultivation is in origin of cultural beliefs about the appropriate place of women in society.

However, if plough cultivation explains the cross-country differences in cultural beliefs about gender roles, it seems unlikely that it determines wide disparities in gender roles observed in Africa, because of limited use of plough in this continent (White et al., 1985).[4] Further, previous studies have only focused on differences in participation in the workplace. However, it is known that, though Africa registered the highest women participation in the workplace, females are still dominated by males. For instance they do not take important decision within household and they do not have any property rights on wealth.

This paper gives another explanation of roots of gender inequality in Africa. It tests the hypothesis put forth by Engels (1884) that the origin of patriarchy is associated with the presence of large domesticated cattle. In particular, Engels identifies important differences between

1. See Alesina et al 2013.
2. Hakura et al. 2016
3. See Fernandez and Fogli (2009).
4. The dataset does not show variation in the use of plough cultivation within Africa

societies that had cattle and those which do not. Because in order to graze cattle women do not have high physical strength and could not stray far from their homes if they had young children, men had the comparative advantage in herding cattle (Eswaran, 2014). Thus, men could supply two kind of labor to graze cattle and to work on the farm. Women can only work in the farm. This made men wealthier than women, and then increased their bargaining power and put societies in a path on which patriarchal norms are adopted.

We test the Engels' hypothesis by studying the relationship between the pre-industrial presence of cattle and historical gender roles measured by female participation in agriculture, female inheritance, matrilocal residence, brideprice, polygyny and matrilineal descent. Consistent with the Engels' hypothesis, we find robust negative relationship between the presence of cattle and our different outcomes measuring equality in historical gender roles.

To understand whether this relationship is causal, we control for a set of historical ethnic groups' features. Our baseline controls include the suitability of the environment for agriculture, whether ethnic groups lived in tropical zone, their level of economic and political development, the daily average of temperature, the longitude and the absolute latitude, the average altitude and the suitability of the environment for malaria. We showed that our baseline results remain robust once we control for other historical features of ethnic groups that may be correlated with the precence of large cattle and equality in gender roles.

Even after controlling for several variables, there might be selection bias into the presence of cattle within an ethnic groups since it's not distributed randomly. To resolve this concern, we instrument the presence of cattle with the geographical suitability for cattle. We argue that the more an environment is suitable for keeping cattle, the higher is the likelihood to find cattle in this area. We then construct the main instrument, the cattle suitability index, using data from the FAO and from the United States Geological Survey (USGS). We find that the IV estimates are consistent with the OLS estimates. Presence of large domesticated cattle is associated with less equality in gender roles: less female participation in agriculture, less female inheritance of wealth and less matrilocal marriage, less matrilineal descend and more brideprice.

The rest of the paper is organized as follow. Section 2 outlines the hypothesis that we test, presenting a simple model that shows how inheritance and matrilocality are affected by the presence of cattle. In section 3, we describe data used and report OLS results. In section 4, we solve the issue of causality, reporting IV estimates. Section 5 concludes.

2 Conceptual Framework

To investigate the effect of the large presence of cattle on gender norms (participation in agriculture, post-marital residence and inheritance), I sketch a model of location and bequest in which bargaining power is a key factor. I suppose that each person lives for three periods (young, middle age and old age). The child's youth overlaps his parents' middle age, and the child's middle age overlaps his parents' old age. I make the simplifying assumption that children do not consume, they just receive bequest from their parents. In the second period, people get married and each couple have two children (a boy and a girl). We assume that only people in the middle age supply labor to the market and earn wages. They consume, give bequests to their children and make decision on their residence after marriage. In the third period of life, people do not work and they just consume from household's income.

We consider the society as being made up of two kinds of individuals : men and women. We suppose that men and women are equals in childhood and old age. But they differ only in the middle age in which they are endowed with different proportions of two kinds of labor input: high physical strength and low physical strength.

2.1 Production

There are three factors of production: Cattle (B), high physical labor (L_h) and low physical labor (L_l). High physical labor is the kind of labor used for breeding and grazing cattle. Men have comparative advantage in this kind of labor because grazing cattle in Sub-Saharan Africa necessitates to stray far from home to feed them and physical strength to control animals, this activity is not compatible with the role of women to rearing children. Low physical labor is the kind of labor used in shifting cultivation. Men and women have equal abilities because hoe or digging is used for this kind of agriculture. To simplify matters, we suppose that women do not have high physical strength.

The key assumption of this paper is that the richer in cattle is a society, the more highly rewarded is high physical labor relative to low physical labor. An increase in cattle raises the marginal product of high physical labor proportionally more than it raises the marginal product of low physical labor. Following **?**, we assume that cattle and high physical labor exhibit complementarity in production. We consider a constant-return-to-scale production function given by:

$$Y = a\left(\alpha B^{\rho} + (1-\alpha)\, L_h^{\rho}\right)^{1/\rho} + bL_l \tag{1}$$

Where $a, b > 0$ $\alpha \in (0,1)$ and $\rho \in (-\infty, 1)$. We assume that all factors of production earn their marginal products. Each man supplies one unit of high physical labor and one unit of low physical labor. Women supply between zero and one units of low physical labor. Let us denote by w_h and w_l the return to a unit of high physical labor and low physical labor respectively. Then, from the first order condition we get:

$$w_h = a(1-\alpha)\, L_h^{\rho-1}\left(\alpha B^{\rho} + (1-\alpha)\, L_h^{\rho}\right)^{(1-\rho)/\rho} \tag{2}$$

$$w_l = b \tag{3}$$

Men earn a wage of $y_m = w_h + w_l$ and women earn only $y_w = w_l$. Thus, an increase in the number of cattle holding other factors inchanged raises the relative wage gap between men and women. With cattle, men become more wealthier than women do.

2.2 Couple's location choice

In pre-modern time, Sub-Saharan Africa was a society where young couples tend to live either with bride's family (matrilocality) or with groom's family (patrilocality). We consider a man (m) and a woman (w) whose parents live in different locations. We do not consider a model of matching of men and women, but we rather consider that couples are born as such. The utility of individual i is given by $u_s^i(c)$, where $i \in \{0, 1\}$ and $s \in \{P, M\}$ is a state of the world (type of location, P for patrilocality and M for matrilocality). This utility depends upon the joint consumption of a private goods (c). Private goods are bought in the market place with a price equal to 1.

We assume that husband and wife have different preferences concerning where they live. The wife prefers to live near to her parents and the husband prefers to live near to his parents.

$$u_P^m > u_M^m \tag{4}$$

$$u_M^w > u_P^w \tag{5}$$

A couple chooses a joint location $L \in \{P, M\}$ that maximizes a weighted average of their individual utilities.

$$\begin{aligned} \max_{L,c} \quad & \delta(\mathrm{y_m}, \mathrm{y_w})\mathrm{u_L^m}(\mathrm{c}) + (1 - \delta(\mathrm{y_m}, \mathrm{y_w}))\mathrm{u_L^w}(\mathrm{c}) \\ \text{subject to} \quad & c = y_m + y_w \end{aligned} \tag{6}$$

The weight on the husband's utility depends on his income and his wife's income. When couples decide whether to choose between patrilocality and matrilocality, they solve for the maximum utilities they can get in both states of the world. For each location, they solve the following lagrangian.

$$\mathcal{L}_s = \delta(y_m, y_w)u_s^m(c) + (1 - \delta(y_m, y_w))u_s^w(c) + \lambda_s (y_m + y_w - c) \tag{7}$$

Where λ_s is the lagrangian multiplier in the state of the world s.

The first order condition is given by:

$\frac{\partial \mathcal{L}_s}{\partial c} = \delta u_s^{m\prime} + (1 - \delta)u_s^{w\prime} - \lambda_s$=0

$\frac{\partial \mathcal{L}_s}{\partial \lambda_s} = y_m + y_w - c = 0$

Let's denote by c^* the solution to this problem, substituting this solution into the objective function, gives the value function which is the maximand of the couple's utility function: $V_s(B) = \delta u_s^m(c^*) + (1-\delta)u_s^w(c^*)$. The effect of cattle on probability to choose patrilocality is given by $\frac{\partial(V_P(B)-V_M(B))}{\partial B}$.

According to the envelope theorem we have:

$$\Gamma_B \equiv \frac{\partial(V_P(B) - V_M(B))}{\partial B} = \frac{\partial(L_P(B) - L_M(B))}{\partial B} \tag{8}$$

Then, the effect of cattle on probability to choose patrilocality is given by:

$$\Gamma_B = \frac{\partial \delta}{\partial y_m}\frac{\partial y_m}{\partial B}\left[(u_P^m - u_M^m) + (u_M^w - u_P^w)\right] + (\lambda_P - \lambda_M)\,\frac{\partial y_m}{\partial B} \tag{9}$$

The first term in the RHS is positive from (4), (5) and because men's income is increasing with cattle, further men's bargaining power is increasing with their income. From the first order condition, $\lambda_s = \delta u_s^{'m} + (1-\delta)\, u_s^{'w}$. It is the bargaining weigthed sum of the man's and woman's marginal utility from income in the state of the world s. Since income does not depend neither of patrilocality nor matrilocality, we get $\lambda_P = \lambda_M$. We conclude that, patrilocal residential pattern results from the greater bargaining power of men combined with their preference to live close to their family.

Thus, a large presence of cattle in a society should raise the probability to choose patrilocality, since cattle increase men's income and then their bargaining power. Further, women will participate less in agriculture, since household's income increases.

2.3 Wealth transfer

Consider parents in their old age, in a patrilocal society. After marriage the son is still living with their parents and the daughter leaves the natal home. I denote by γ the probability that the daughter's wealth is being expropriated. We assume that this probability is increasing with cattle since patrilocality residence is more likely to emerge when cattle are present, $\gamma^{'}(B) > 0$.

Let $W > 0$ the parents' wealth , which they divide between the son and daughter. Denote x the share of estate allocated to the daughter. Assuming that the parents value the welfare of both their children, when they choose the amount of wealth to transfer to their children, they maximize the following problem:

$$\begin{aligned} \max_{x} \quad & \mathrm{U_p(u_s, u_d) = u_s(y_s + W - x) + \gamma u_d(y_d) + (1-\gamma)u_d(y_d + x)} \\ \text{subject to} \quad & 0 \leq x \leq W \end{aligned} \tag{10}$$

Where y_s and y_d is the income of the son and daughter respectively. Where u_s and u_d are increasing and concave. The first-order condition leads to the following relationship governing the choice of parents:

$$-u_s^{'}(y_s + W - x) + (1-\gamma)u_d^{'}(y_d + x) = 0 \tag{11}$$

Equation (11) characterizes the optimal choice of x (wealth allocated to the daughter). Differentiating x with respect to cattle, B, yields the following equation:

$$\frac{\partial x}{\partial B} = \frac{\partial x}{\partial y_s(B)} y_s^{'}(B) + \frac{\partial x}{\partial \gamma}\gamma^{'}(B) \tag{12}$$

The effect of cattle on daughter's inheritance depends directly on the income gap between children and indirectly on the probability that the daughter does not consume this inheritance. Total derivating equation (11) with respect to y_s gives us:

$\frac{\partial x}{\partial y_s(B)} = \frac{u_s^{''}}{u_s^{''}+(1-\gamma)u_d^{''}} > 0$

We also know that the son's income is increasing with cattle, $y_s^{'}(B) > 0$. In the other hand, taking the derivative of equation (11) with respect of γ yields:

$\frac{\partial x}{\partial \gamma} = \frac{u_d^{'}}{u_s^{''}+(1-\gamma)u_d^{''}} < 0.$

Given that $\gamma^{'}(B) > 0$, we conclude that the effect of cattle on daughter's inheritance is ambiguous, $\frac{\partial x}{\partial B} \lesseqgtr 0$, and depends directly on the son's income and on post marital location effect.

The above results can be formalized in the following proposition:

Proposition 2.1 *The impact of large presence of cattle (B) on couple's choice of location (L), women participation in agriculture (l_w) and share of wealth transfer to the daughter is:*

(i) $\frac{\partial L}{\partial B}$=patrilocality

(ii) $\frac{\partial l_w}{\partial B} < 0$

(iii) $\frac{\partial x}{\partial B} \lesseqgtr 0$

According to relation (i), presence of cattle in a society leads to the choice of patrilocality. This is due to the raise of men's income and then the increase of their bargaining power relative to women's bargaining power. Relation (ii) shows that an increase of cattle reduces women's labor supply in shifting agriculture, this is due to the income effect since the household income increases with cattle (through men's income).

The impact of cattle on women's inheritance is ambiguous, and depends on the income gap between men and women and on the women's location after marriage. First, cattle increase the son's income because they have the comparative advantage for working with cattle, and parents will transfer more to the daughter. On the other hand, because patrilocality residence emerges because of cattle and the daughter might be expropriated for that wealth by their in-laws, then parents will give less to the daughter as they are affraid that the wealth is being taken off from her.

3 Data Description

3.1 Data

The main data source used for the empirical analysis is the *Ethnographics Atlas* constructed by **?**. This dataset has been used by several economists for studies on ancient societies.[5]. It

5. See **?** and **?**

contains over hundred ethnographic information for 1267 ethnic groups around the world, and all the variables have been compiled by the same author and then are internally consistent (**?**).

I focus my analysis on African ethnic groups. The sample contains 533 ethnicities in which two societies have been entered twice [6]. I match spatially the atlas to Murdock's map (**?**), I could then localise each society geographically. Since there is no one to one match between the atlas and the map, I follow the algorithm provided by **?**. I was able to match 523 ethnic groups.

3.2 Outcome variables

I use the following three variables to capture the effect of cattle on women's well-being.

Female Participation in Agriculture. Agriculture was the main subsistence activity in Africa.[7] The *Ethnographic Atlas* classifies the societies into one of the following categories: (1) males only, (2) males appreciably more, (3) differentiated but equal participation, (4) equal participation, (5) females appreciably more and (6) females only. Using these information, I construct a dummy variable that equals to one if females do the majority of agricultural tasks[8].

Female inheritance. The database contains information on inheritance rules of land and movable property.[9] It groups each society into seven categories: (1) absence of individual property, (2) matrilineal (sister's sons), (3) other matrilineal heirs, (4) children with daughters receiving less, (5) children equally for both sexes, (6) other patrilineal heirs and (7) patrilineal (sons). Using this classification, I construct two indicator variables: *female land inheritance* and *female movable inheritance.* Both variables take the value one if children inherit equally for both sexes, if it is other matrilineal heirs or if there is absence of individual property[10].

Matrilocal residence. The transfer of residence after marriage is more common in developing countries, either wife move into the husband's group or husband move into the wife's group.

6. Chilcotin and Tokleau have been registered twice, deleting these observations leads our sample to 531 ethnic groups

7. 86 percents of the sample rely on agriculture as the main source of subsistence

8. The variable is equal to one if females are appreciably more or if only females do the agricultural tasks

9. Movable properties include livestocks (cattle, pigs, sheep, goats), clothes, arrow, etc...

10. In the sample, the absence of individual property rights is considered as communal property, we assume that children of both sexes enjoy equally of wealth in this case.

The role of women is affected dependently of the type of couple's residence after marriage.[11] The *Ethnographic atlas* classifies the transfer of residence at marriage after the first year as followed: (1) wife's to husband group, (2) couple to either group or neolocal, (3) husband to wife's group and (4) no common residence. We construct a dummy variable that equals to one if husband moves into wife's group and zero if wife moves into husband's group.

3.3 Explanatory variable

Our main explanatory variable is the presence of large domesticated cattle. The atlas gives information for whether an ethnic group historically owned cattle. I measure cattle with an indicator variable equals to one if large amount of cattle was present in society. Figure 1 shows the spatial presence of cattle in each ethnic in pre-colonial periode. While cattle were present in Eastern and Western Africa, they are relatively absent in tropical forest and in desert area.

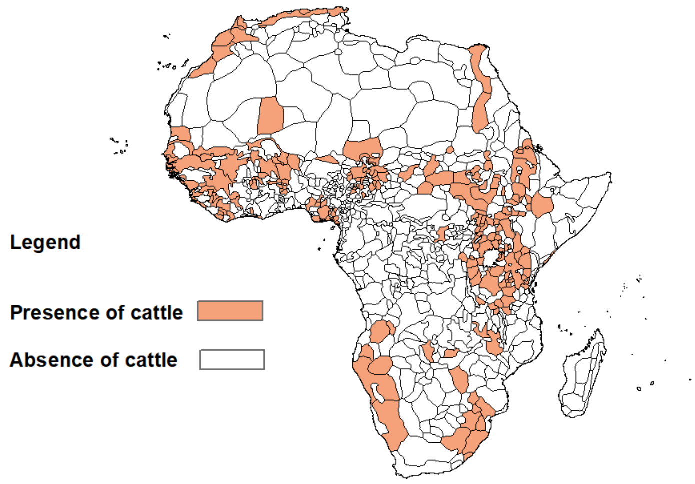

FIGURE 1: PRESENCE OF LARGE DOMESTICATED CATTLE

11. Alesina et al (2015) showed that women are more likely to experienced violence when they live in the husband group (patrilocality).

4 Empirical Specification

This subsection explores the statistical relationship between historical gender roles and presence of large domesticated cattle. To analyse this relationship, the following baseline specification equation is estimated:

$$Y_e = \alpha + \beta Cattle_e + X_e^{'}\Gamma + \epsilon_e \tag{13}$$

Where e indexes an ethnic group. The variable Y_e is one of our measures of gender roles (female participation in agriculture, matrilocal residence and whether females are allowed to inherit land and other wealth). $Cattle_e$ is a measure of the presence of large domesticated cattle in ethnic group e. Our coefficient of interest is β, that captures the relationship between the presence of cattle and gender roles. ϵ_e is the error term.

A crucial concern for the causal interpretation of the Ordinary Least Squares (OLS) estimates is that ethnics groups that had cattle may be different from other groups in terms of omitted variable that is also correlated with gender norms. I control for a set of covariates at the ethnic group level, $X_e^{'}$. It includes economic development that is measured by the density of ethnic groups' settlement. I group ethnicities into the following categories: (1) nomadic or fully migratory, (2) semi-nomadic, (3) semi-sedentary, (4) compact but not permanent settlements, neighboohoods of dispersed family homesteads, (5) separate hamlets, (6) forming a single community, compact and relatively permanent settlements and (8) complex settlements. I follow **?** and construct a variable that takes an integer value between 1 and 8 and increasing in the settlement density. I also control for the level of political complexity which is measured by the number of levels of jurisdictional hierarchies in society.

Geographic conditions and soil fertility may affect gender roles and presence of cattle in an ethnic group. I use the method developed by Nunn and Qian (2011), and control for a measure of agricultural suitability[12]. Using the same methodology, I control for the proportion of land that is in tropical or subtropical zones. I include also longitude, which controls for differences

12. The data are from FAO's Global Agro-Ecological Zones (GAEZ) 2002.

between the Western and Eastern parts of Africa. Absolute latitude captures differences between ecological area. Finally, I control for the malaria ecology index from Kiszweski et al.(2014). Since women are the principal caregiver in the household, even they are not sick, they might stay at home taking care of a sick household's member (Quisumbing et al., 2014), that could affect their participation in the work place outside the home.

Given that, some ethnic groups potentially shared common ancestry, it is likely that our observations are not independent. To correct this issue, I follow Alesina et al., (2013) and report Conley's standard errors that allow for spatial correlations. Another way to resolve this concern is to cluster standard errors at the level of cultural provinces (**?**)).[13]

4.1 OLS Results

Table 1 reports OLS estimates. In column 1 and 2, the dependent variable is female participation in agriculture. Column 3 and 4 shows the effect on norms about inheritance of land, while column 5 and 6 reports resuts on norms about inheritance of movable wealth (arrow, clothes, livestock,...). Column 5 and 6 reports estimates for matrilocal marriage. The odd numbered columns report the simplest specification, without controls. The estimates showed that in societies with cattle, women are less likey to participate in agriculture, to inherit land and movable wealth and are less likely to continue living in their natal home after marriage. All coefficients are negative and statistically significant. This is consistent with the hypothesis that the presence of cattle created more patriarchal values.

Not only are the coefficients statistically significant, but they are also economically meaningful. From column 2, presence of cattle in a society where cattle were not present is associated with a reduction of probability that female participate in agriculture of 20%, which is equal to 48.9% of the sample average for female participation in agriculture and 40.8% of its standard deviation. The probability that women inherit land decreases of 24.7%, which is 81.2% of the outcome's mean and 53.7% of its standard deviation. In the same way with the right of women to inherit

13. Murdock groups ethnicities sharing same culture into provinces from his book, Africa: Its People and Their Cultural History.

land, their likelihood to inherit any types of movable wealth reduces 24.5%, which is 73.8% of the outcome's mean and 51.9% of its standard deviation. Finally, The likelihood that patrilocal marriage emerges is 17.2%, which is 156% of the outcome's mean and 53.7% of its standard deviation.

TABLE 1: OLS estimates, the effect of presence of cattle on gender norms

	Participation in agriculture		Land inheritance		movable wealth inheritance		Matrilocal residence	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean of dep. var.	0.489		0.304		0.332		0.11	
Presence of cattle	-0.196***	-0.204***	-0.189***	-0.247***	-0.196***	-0.245***	-0.165***	-0.172***
	[0.057]	[0.056]	[0.048]	[0.046]	[0.047]	[0.046]	[0.031]	[0.031]
	(0.116)	(0.102)	(0.091)	(0.083)	(0.196)	(0.090)	(0.118)	(0.115)
Baseline controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	312	308	372	361	395	385	454	438
R^2	0.036	0.169	0.041	0.186	0.042	0.183	0.071	0.131

Notes. Regressions are estimated using OLS. The unit of observation is the ethnic groups located in Africa. The dependent variable is listed in each column. All dependent variables are dummy. The data for the dependent variable are from the *Ethnographic Atlas. Parenthesis reports standard errors clustered at the provinces level. Square braquets give conley (1999) standard errors correcting for cross-sectional spatial correlation (for a spatial correlation kernal cutoff of 100 KM). *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

I next assess the magnitude of the estimates. To do that, I calculate the proportion of the total variation they explain. Results shows that presence of cattle explains sizable proportion of disparities in gender roles across societies. For the female participation in agriculture, the inclusion of cattle increases the R-squared by 0.0368 (from 0.1326 to 0.1694). Then, the presence of cattle accounts for 3.68% of the total variation in the probability that females are participating in agriculture. When female inheritance of land is the dependent variable, the inclusion of cattle explains 6.66% of the total variation, and 6.25% when female inheritance is the dependent variable. For the matrilocal marriage, presence of cattle explains 7.45% of the total variation.

Several channels could explain the effects I find. One potential interpretation I emphasized in the previous session is that the presence of cattle has risen the men's bargaining power and has shifted society towards male dominance. To investigate this hypothesis, I use patrilineal descent rules as proxy for men's dominance. Rules of descent, are norms that define how generations are interconnected. There were some societies that used the matrilineality rules, that is when all children belong through their mother's lineality. When patrilineality is used, children belong to their father's kin group. Other societies as in western countries use bilateral descent rules, that is the belonging of children both to their father and mother's kin group. As children represented wealth in Africa, I consider that patrilineal descent group represents the men's power within a household. Table 2 shows that the presence of cattle increases the likelihood that an ethnic group practice patrilineality, that is the increase of men's power. Indeed, compared to ethnic groups without cattle, societies that owned cattle had about 17% to use patrilineality which is consistent with my hypothesis that cattle increased the men's bargaining power.

TABLE 2: More evidence of the effect of presence of cattle on gender norms

	Patrilineal descent		Bride Wealth		Polygyny	
	(1)	(2)	(3)	(4)	(5)	(6)
Mean of dep. var.	0.715		0.830		0.93	
Presence of cattle	0.168***	0.173***	0.134***	0.139***	-0.011	-0.024
	[0.036]	[0.037]	[0.033]	[0.034]	[0.022]	[0.021]
	(0.117)	(0.112)	(0.053)	(0.052)	(0.029)	(0.024)
Baseline controls	No	Yes	No	Yes	No	Yes
Observations	413	399	483	466	484	467
R^2	0.049	0.105	0.033	0.093	0.0005	0.09

Notes. Regressions are estimated using OLS. The unit of observation is the ethnic groups located in Africa. The dependent variable is listed in each column. All dependent variables are dummy. The data for the dependent variable are from the *Ethnographic Atlas. Parenthesis reports standard errors clustered at the provinces level. Square braquets give conley (1999) standard errors correcting for cross-sectional spatial correlation (for a spatial correlation kernal cutoff of 100 KM). *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

I present more evidence on other variables that reflect also patriarchal values that is the use of brideprice payment at the time of marriage and polygyny. I do find that the likelihood that brideprice marriage be used increases of 14%. This result is in line with Murdock's theory that brideprice is used to compensate parents to part with their children. Indeed, brideprice might had been increase because of patrilocality. I also find no effect on polygyny, this result could be expain by combination of two effects. Frist, polygyny might increase according to Becker's theory. As cattle's prensence could create more inequalities within a society, polygyny could increase in this society. Second, according to Boserup (1970), polygyny increases when women are more productive that men. As cattle decrease the relative productivity of women, I expect that polygyny might decrease. Thus, the combination of these effects could explain the no effect of presence of cattle on polygyny.

I now investigate whether my baseline results just reflect the effect of plough cultivation. Indeed, Alesina et al. (2013) showed that societies that used plough cultivation had less equal gender norms. My results could just reflect their findings as cattle were usually used to pull plough. To investigate this issue I added in my baseline specification the plough-use variable from Alesina et al. (2013). Results are reported in Table 3. In column 1, I find the results reported by Alesina et al. (2013), the use of plough cultivation is associated with a reduction of the probability that women participate in agriculture. More importantly the coefficient on presence of cattle remains negative and statistically significant, suggesting that cattle do not merely capture plough-use. Since women are not able to graze cattle, this findings could be an evidence of the income effect, that is cattle increase household's income and decrease the participation of women in agriculture.

Besides polygyny, plough does not explain other gender norms. But, the inclusion of plough in my baseline result does not change the coefficients and the significances on cattle, suggesting that cattle themselves matter more to explain the less equal gender norms in Africa than the use of plough cultivation does. However, the estimate on plough is negatif and significant for polygyny, in line with Boserup's idea that plough cultivation societies are characterized by a lower incidence of polygyny.

Plough cultivation do not affect other gender norms in Africa because plough agriculture was almost complete absent in Africa. For example only seven percent of societies used plough in my sample.

TABLE 3: CATTLE VERSUS PLOUGH

	Participation in agriculture	Land inheritance	movable wealth inheritance	Matrilocal residence	Patrilineal	Bride Wealth	Polygyny
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean of dep. var.	0.489	0.304	0.332	0.11	0.715	0.830	0.93
Presence of cattle	-0.180***	-0.240***	-0.240***	-0.170***	0.171***	0.143***	0.030
	[0.056]	[0.046]	[0.046]	[0.029]	[0.038]	[0.034]	[0.021]
Use of plough	-0.419***	-0.164	-0.101	-0.041	0.023	-0.077	-0.097*
	[0.120]	[0.104]	[0.107]	[0.073]	[0.092]	[0.083]	[0.052]
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	308	361	385	438	399	466	467
R^2	0.202	0.192	0.185	0.132	0.105	0.094	0.097

Notes. Regressions are estimated using OLS. The unit of observation is the ethnic groups located in Africa. The dependent variable is listed in each column. All dependent variables are dummy. The data for the dependent variable are from the *Ethnographic Atlas. Square braquets give conley (1999) standard errors correcting for cross-sectional spatial correlation (for a spatial correlation kernal cutoff of 100 KM). *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

4.1.1 Robustness of OLS estimates

We now test the robustness of our baseline estimates. First we test the robustness to alternative method, then we check if the results are stable for aternatives measures of gender roles and finally, we test the robustness to alternative determinants of gender roles that have been suggested by other scholars.

Robustness to alternative method

Given that our outcomes are all dummies, we run our baseline specification using probit method. We find estimates that are similar and statistically significant to our baseline estimates for all the outcomes.

Robustness to alternative measures of gender roles

We estimate our baseline equation using an aternative measures of gender roles. We measure the participation of females in agriculture by a categorial variable ranges from 1 to 5 increasing with the participation of females in agriculture. We did the same for female inheritance of movable property, the variable take the values range from 1 to 4 increasing with the right of women to inherit movable property. For matrilocal marriage we do not find an alternative way to measure it. We run an ordered probit for the first two variables. Estimates are reported in column (2) of Table 3. The estimates remain similar and statistically significant at conventional levels.

Controlling for alternative hypotheses

First it is more likely that locations that were economically more developped were more likely to own cattle. However, our baseline controls already contain a measure of economic development and results are negative and statistically significant.

It is also more likely that locations where cattle were present were more likely to be suitable for agriculture. Again, our baseline controls have already included a measure for agriculture suitability and estimates are negatif and statistically significant.

Another explanation for the origins of gender roles disparities was proposed by Martin and Voorhies (1975). They argued that, gender inequality arose as a result of type of crop cultivated. As cereal crop necessitate more secondary processing of the food preparation and storage or cooking, the high involvement of women in the secondary processing of cereal crops keeps them away from the field. We add to the baseline model the type of crop cultivated in the society. The variable for cereal is negative for all the outcomes as expected. More importantly, this variable does not change our baseline results that remain negative and statistically significant for all the outcomes.

Alsan (2013) found that the distribution of tsetse flies is positively correlated with the participation of women in agriculture. We control our results for the tsetse suitabiity index constructed by Alsan (2013). The estimates for the variable tsetse flies are positive and statistically significant confirming Alsan's results. Further the coefficient on female inheritance of movable and on matrilocal marriage remain stable and significant. However, the coefficient on agrculture is relatively zero, and not significant. This can be explained by the fact that the presence of cattle and the presence of tsetse flies are strongly correlated.

Previous work argues that population density plays a significant role in explaining differences in participation of women in Agriculture. It is possible to control for that using the historical population density from the atlas data. However, including this variable might be criticized since the population density could be considered as outcome then our estimates could be biased because of bad control (Angrist and Pishke, 2009). Including population density as a control does not change our baseline estimates.

4.2 Instrumental Variables Strategy

The negative relationships between gender norms and presence of cattle reported in the previous section is consistent with my hypothesis that cattle increased men's bargaining power and then shifted societies towards patriarchal values. However, these relationships could not be interpreted as causal. First, as ethnic group's choice to domesticated cattle is not random, it could be that some groups just had preferences towards animals' domestication and patriarchal values. Since these preferences cannot be measured with data, the above estimates could be biased and overestimated. Since my data is cross-sectional, I couldn't include indicatrice variable to resolve this issue. To address this issue, I use instrumental variables strategy. I exploit the idea that cattle live in area suitable for them and I use as instrument the habitat suitability index for cattle.

4.2.1 Constructing The Habitat Suitability Index for Cattle

Anthropological and histrorical evidence showed that cattle have been first domesticated elsewhere in Asia, and have been introduced in Africa by the way of Egypt about 9000 years ago (Epstein 1971). The two main species of cattle in Africa are Bos taurus, the European cattle and Bos indicus the humped zebu from South Asia (Deshler, 1963). In contrast to Europeans or United States' cattle that take advantage of supplemental feed, pre-colonial African cattle were kept under more rigourous environment. They drank from rivers or ponds (Deshler, 1963) and they fed bulk forages that includes grasses, natural pasture or the part of the plant left over

when crops grown for people are harvested (Lukuyu et al.,2007).
The habitat suitability index model has been developed by the US fish and wildlife services. The index provides a probability that a species will occur where that habitat occurs (Pandey, 2007). This model consists to choose variables that could influence the distribution of the species, construct their indexes and use a functional relationship of these indexes to obtain the habitat suitability index for the species.

Ganskop et al (2007) identified four factors that impact strongly the distribution of cattle: slope of terrain, availability of drinking water, presence of pasture and absence of diseases such that tripanomiasis. They argued that cattle prefer to feed on flat soil, avoiding terrain with high slope: a slope below ten degrees is considered as suitable for cattle grazing, while a slope above sixty degrees is unsuitable. A horizontal distance to water more than one kilometer is reported to be unsuitable. I use these information and the methodology developed by the U.S. Fish and Wildlife Services to construct the habitat suitability index for cattle.

My instrument contains three factors: terrain slope, availability of water and a presence of pasture. I do not include the tsetse flies suitability index because of the exclusion restriction assumption, since tsetse flies impact human directly and then affect the participation of women in agriculture (**?**). However I run a robustness check that control for tsetse suitability.

For each variable I calculate an index and I use them to get my final index. The cattle suitability index is given by:

$$CSI = pasturesuitability * (1 - terrainslope) * (1 - distancetoriver) \tag{14}$$

The index captures geographic and exogeneous factors that influence the distribution of cattle. I obtain information on suitability for pasture grasses and terrain slope from the FAO's Harmonized World Soil Database v 1.2 (HWSD)[14] and information on location of river are from the United States Geological Survey (USGS).[15]

14. the link for the dataset is : http://www.fao.org/soils-portal.
15. The link for the dataset is https://hydrosheds.cr.usgs.gov.

4.2.2 IV Specification

I begin by test whether the cattle suitability index is correlated with presence of cattle within ethnic groups. To do that, I estimate by OLS the following first stage relationship:

$$cattle_e = \gamma_0 + \gamma_1 CSI_e + X_e^{'}\gamma_2 + \mu_e \tag{15}$$

After reported the first stage, I use the predicted presence of cattle in the second stage, that I estimate using two stage least squares.

$$Y_e = \alpha + \beta Cattle_e + X_e^{'}\gamma + \epsilon_e \tag{16}$$

Where Y_e is one of our outcomes of interest. In all regression, I report Conley's standard errors that account for spatial correlation.

4.2.3 IV results

Table 6 reports IV estimates controlling for our baseline control variables. The first stage estimates are reported in panel B, and the second stage estimates in panel A. We standardize the effect sizes of the first stages. Then the results of the first stages are measured in standard deviations of the cattle suitability index. The results are calculated using a linear GMM estimator that is exactely similar to 2SLS estimator but allowing us to report the Conley's standard errors. The first stages estimates show that the historical habitat suitability for cattle is positively correlated with the presence of cattle. The first stages Cragg-Donald Wald F statistics range from 38-66, indicating that the instrument does not weakly indentified the endogeneous variable.

The IV estimates reported in panel A confirm the OLS estimates. Presence of cattle is associated with a decrease of probability that women participate in agricuture, less female inheritance af wealth and less matrilocality. Further, the magnitudes of the IV estimates are larger than the OLS estimates, suggesting the potential measurement error concern in the independent variable.

However, we can interpret our IV results as causal only if the exclusion restriction assumption is satisfied, that is if the cattle suitability index does not affect directely our outcomes.

4.2.4 The exclusion restriction and robustness

The main threat of the identification is that locations suitable for cattle only affect gender roles through the presence of cattle in these areas. However, there are many potential concerns with this assumption.

The differences between environents suitable for cattle may be correlated with geographic characteristics that affect gender roles. We test the robustness of our result by controlling for geographic features thet may be correlated with the suitability for the environment for cattle. Agriculture suitability, average temperature of locations may be correlated with the suitability for cattle. However, our baseline controls already include the agriculture suitability and the average temerature. The point estimates are negative and statistically significant.

We next check the robustness of the IV estimates to controlling for the additional covariates. First, it may likely that areas more suitable for cattle were also more suitable for cereal crops cultivation and then as showed Martin and Voorhies (1975), cereal crops reduce the particpation of women in agriculture because they require more secondary processing (winnong, grinding...) than do root crops. To address this concern, column (4) of Table 9 controls for cereal crops suitability, and the effect of the domestication of cattle remains strong and significant.

Second, areas suitable for cattle may also suitable for other animals like sheep and goats. Further, Burton and White (1984) stressed that in societies where sheep and goats are present women tend to take care of them by milking goats and produce wool from sheep, and then they participate less in agriculture. Column (8) controls for the presence of sheep and goats, and the results stands and coefficients are stable.

Third, it is more likely that the cattle suitability index is negatively correlated to areas suitable for tsetse flies, and areas suitable for tsetse flies increase the participation of women in agriculture (Alsan, 2013). If this is the case our exclusion restriction assumption may be violated. To resolve this concern, we control our regressions for the tsetse suitability index constructed by Alsan (2013). Column (9) of Table 9 shows that results stay stable and significant for all the outcomes, except for the female particpation in agriculture.

Fourth, to reassure that the estimated reported are not attribuable to the historical use of plough, we control for the historical use of plough cultivation, column (3) confiirms that resullts stand then cattle may affect gender roles independently of the use of plough.

Fifth, as mentionned by White et al, (1985), indigeneous slavery reduces the participation of women in agriculture. Results remain stable when we control for the presence of indigeneous slavery.

Sixth, We control for the population density, since population density leads to use of intensive cultivation with plough (Boserup, 1970) and then reduces the participation of women in agriculture. Estimates for female participation in agriculture remain stable, but we lose the significance for others outcomes. However, this is not a great concern, since population density is endogeneous,and controlling for that is a bad control.

We can stress that even if the exclusion restriction seems to be threatening for female participation in agriculture, the assumption is definitively satisfied for other outcomes.

We test the robustness of our estimates for alternatives methods. Column (1) of table 9 shows that results stay stable and significant using probit method (marginal effects are reported).

We also check the stability of the estimates for alternative measures of gender roles. Instead to use dummies variables, we use categorical variables that increase with the participation of women in agriculture and the right of women to inherit.[16] Column (2) reports ordered probit estimates at the second stages, we find that the estimates are stable and statistically significant.

Our results have accounted for spatial correlation reporting conley's standard errors, we test the robustness of our result also by clustering standard errors at the level of province to account for spatial correlation. Results are reported in column (7), even if we loss some significances

16. For other outcomes we are not able to define them differently.

the estimates remain quiet stable in sign and in magnitude.

5 Conclusion

This paper tests the Engels' hypothesis that the presence of cattle is an important determinant of historical gender roles. To do that, we used African ethnographics data on historical presence of cattle measured at the ethnicity level.

The findings suggest that presence of cattle is associated with less gender equality. Specifically, we have shown that locations where cattle were present have less participation of women in agriculture, less inheritance of wealth by female, less matrilocal marriage, less matrilineal descent and more brideprice. Controlling for plough cultivation suggests that not only plough cultivation determines gender roles but cattle also matter and determine gender roles independently of plough.

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Figures

Figure 2: Slope

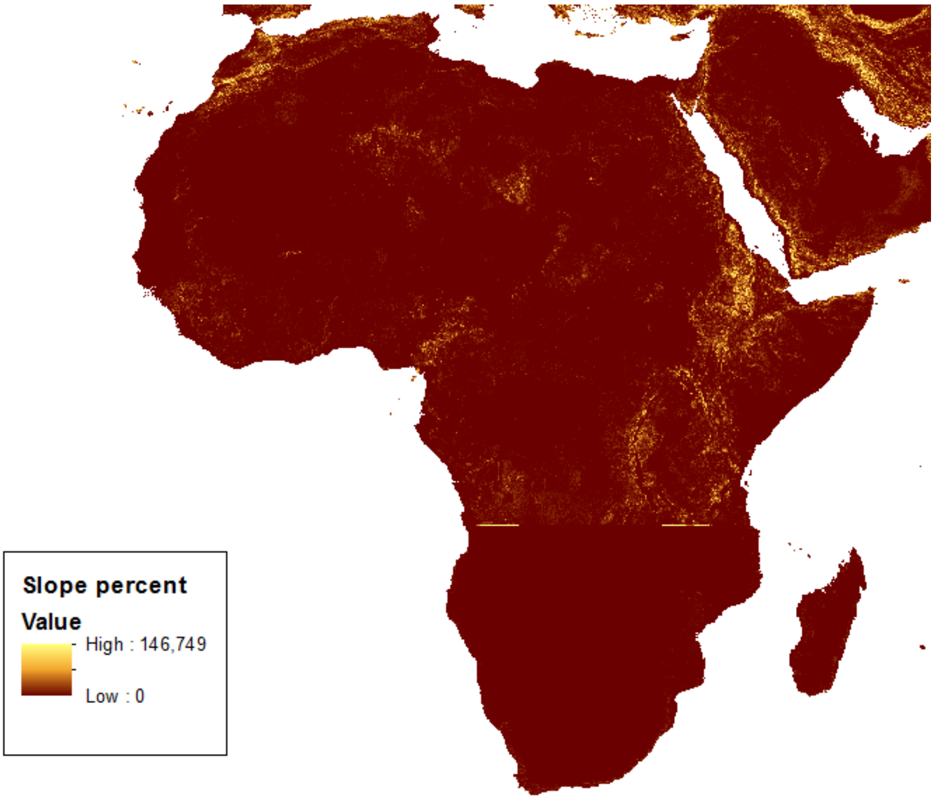


Figure 3: Inland Waterways

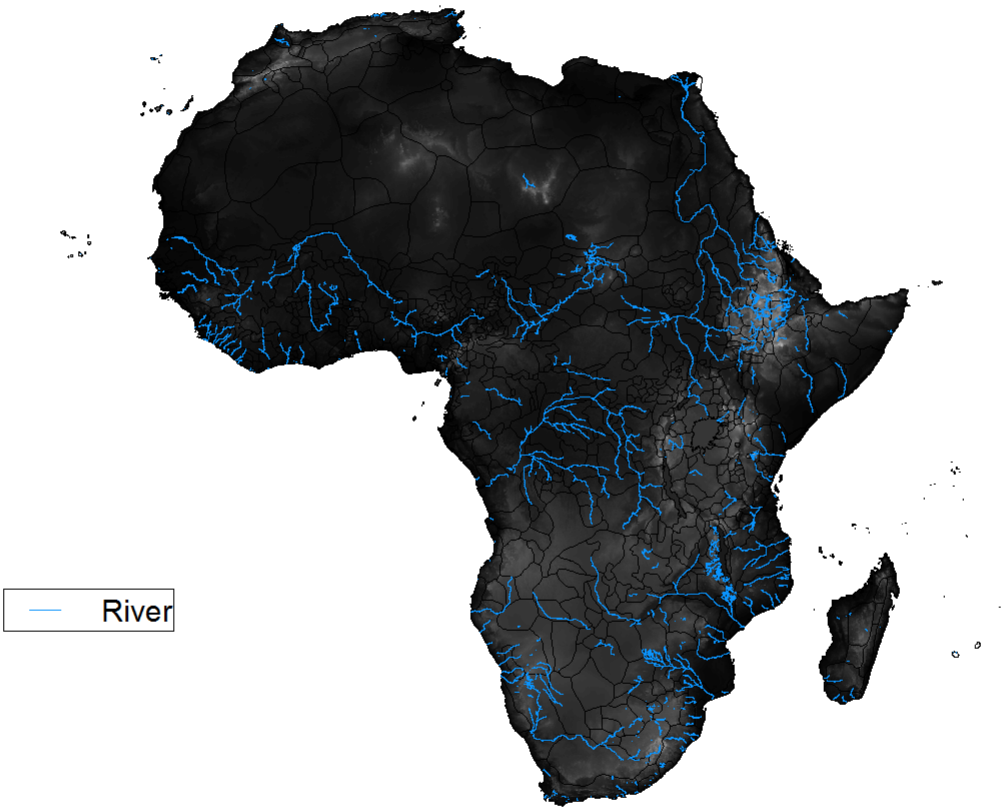


Figure 4: Wild Pasture Grasses

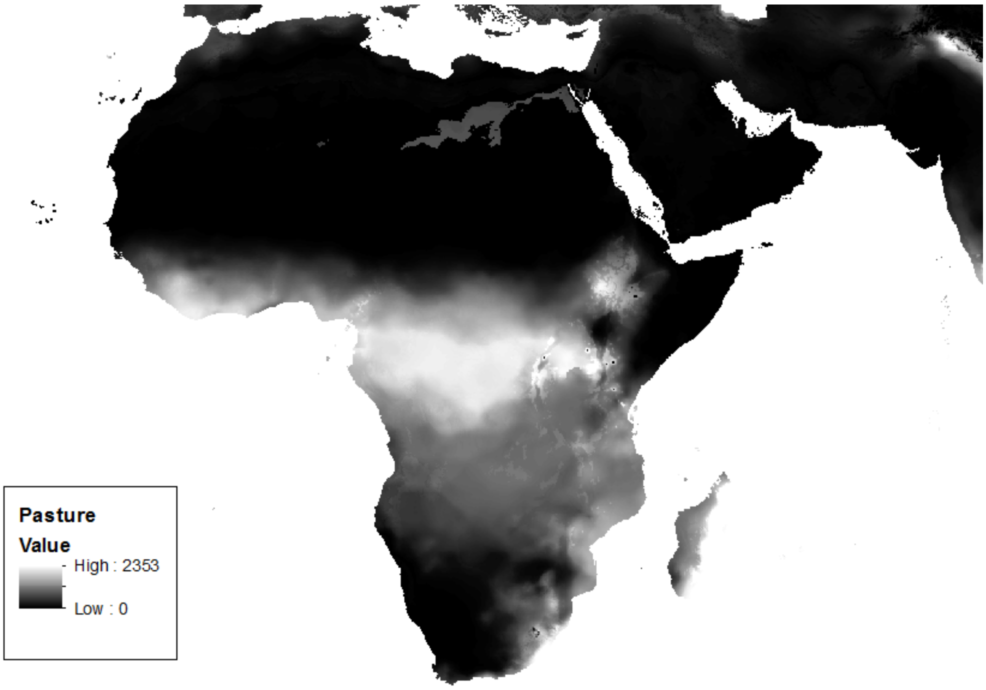
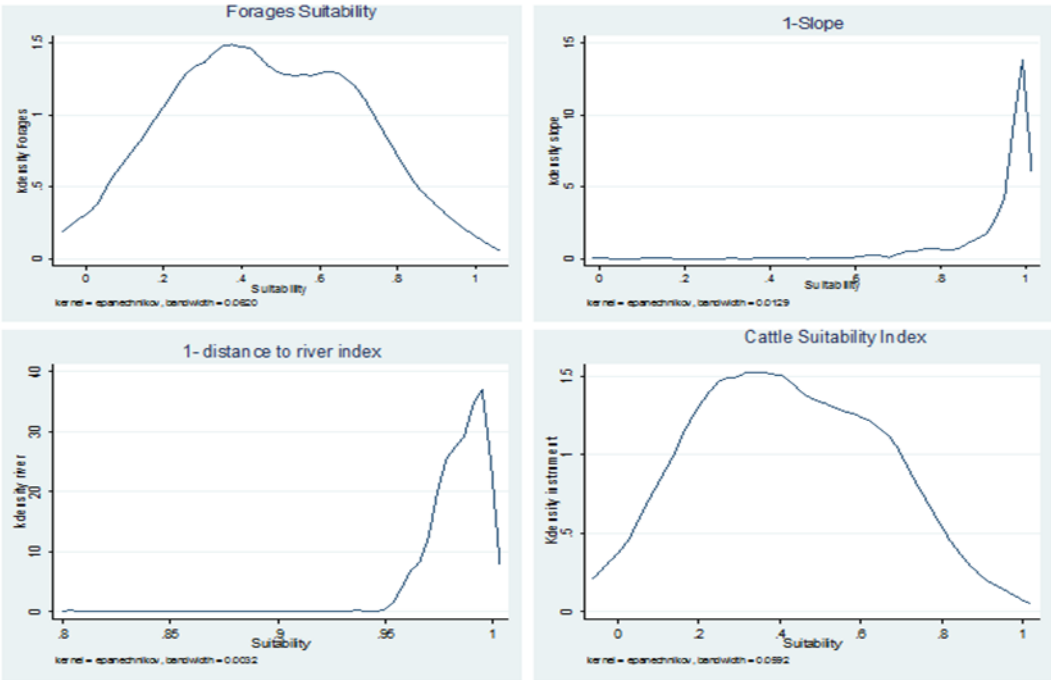


Figure 5: Components of the Cattle Suitability Index



Tables

TABLE 4: Main summary statistics

	Mean	**Std. Dev**	**Min**	**Max**	**N**
Female participation in agriculture	0.489	0.500	0	1	315
Female inheritance of land	0.304	0.461	0	1	398
Female inheritance of movable property	0.332	0.472	0	1	421
Matrilocal residence	0.11	0.32	0	1	490
Matrilineal descent	0.18	0.38	0	1	443
Brideprice	0.83	0.37	0	1	520
Polygyny	0.93	0.26	0	1	522
Presence of large domesticated cattle	0.58	0.49	0	1	484
Use of Plough cultivation	0.076	0.26	0	1	484
Economic development	5.72	1.80	1	8	484
Political complexity	2.92	0.67	2	4	469
Log population density (1700) inhab/Km^2	1.70	1.58	-5.72	5.06	398
Agricultural suitability index	0.53	0.20	0	0.91	522
Absolute latitude	9.71	7.44	0	37	522
Longitude	17.8	15.8	-17	48	522
Malaria ecology index	13.6	9.62	0	34.5	522
Proportion land area in Tropics	093	0.24	0	1	522
TseTse suitability index	0.0057	0.99	-3.12	1.50	522
Slope	0.070	0.13	0	1	475
Distance to river index	0.0157	0.014	0	0.197	469
Pasture suitability	0.458	0.235	0	0	1

TABLE 5: Correlation matrix

	Cattle	Plough	ecodev	Population	TSI	SI	Malaria	lon	a
Presence of large domesticated cattle	1								
Use of plough	0.146	1							
Economic development	0.018	-0.137	1						
Log of population density	0.257	0.145	0.420	1					
Tsetse suitability index	-0.372	-0.351	0.315	0.034	1				
Agricultural suitability index	-0.033	-0.303	0.396	0.275	0.319	1			
Malaria ecology index	-0.043	-0.342	0.295	0.149	0.376	0.513	1		
Longitude	0.120	-0.012	-0.216	-0.117	-0.235	-0.094	-0.388	1	
Absolute latitude	0.071	0.586	-0.243	-0.155	-0.448	-0.455	-0.253	-0.260	

TABLE 6: Correlation of outcomes

	Participation	Matrilocal	land	Movable	Matrilineal	Brideprice	Polygyny
Female participation in agr	1						
Matrilocal residence	0.14	1					
Female inheritance of land	0.09	0.62	1				
Female inheritance of movable	-0.10	0.68	0.66	1			
Matrilineal descent	0.14	0.89	0.68	0.76	1		
Brideprice	0.06	-0.25	-0.14	-0.17	-0.23	1	
Polygyny	0.11	0.05	0.04	-0.08	0.06	-0.06	1

TABLE 7: Main results-Ols estimates of the relationship between gender roles and presence of domestic cattle

Dependent Variables	(1)	(2)	(3)	(4)	(5)	Obs	No. Clusters	Sample mean
Female Participation in Agriculture	-0.183***	-0.203***	-0.221***	-0.196***	-0.190***	271	41	0.491
	(0.116)	(0.104)	(0.097)	(0.097)	(0.097)			
	[0.061]	[0.060]	[0.057]	[0.058]	[0.058]			
Female land inheritance	-0.133***	-0.146***	-0.147***	-0.154***	-0.152***	361	44	0.252
	(0.072)	(0.073)	(0.075)	(0.073)	(0.072)			
	[0.045]	[0.046]	[0.046]	[0.045]	[0.045]			
Female movable inheritance	-0.170***	-0.175***	-0.176***	-0.178***	-0.176***	384	44	0.234
	(0.086)	(0.088)	(0.089)	(0.089)	(0.088)			
	[0.041]	[0.042]	[0.042]	[0.043]	[0.043]			
Brideprice	0.134***	0.134***	0.135***	0.144***	0.148***	467	44	0.955
	(0.051)	(0.053)	(0.055)	(0.050)	(0.050)			
	[0.035]	[0.036]	[0.036]	[0.34]	[0.034]			
Polygyny	-0.001	0.002	0.003	0.010	0.008	458	44	0.950
	(0.025)	(0.027)	(0.027)	(0.027)	(0.028)			
	[0.020]	[0.020]	[0.018]	[0.018]	[0.019]			
Matrilocal marriage	-0.169***	-0.170***	-0.171***	-0.176***	-0.176***	440	44	0.120
	(0.119)	(0.118)	(0.119)	(0.118)	(0.118)			
	[0.032]	[0.032]	[0.033]	[0.32]	[0.033]			
Matrilineal descent	-0.170***	-0.173***	-0.173***	-0.177***	-0.177***	398	42	0.188
	(0.118)	(0.118)	(0.120)	(0.115)	(0.115)			
	[0.039]	[0.040]	[0.040]	[0.040]	[0.041]			
Economic Controls	No	Yes	Yes	Yes	Yes			
Climate Controls	No	No	Yes	Yes	Yes			
Geography Controls	No	No	No	Yes	Yes			
Malaria Controls	No	No	No	No	Yes			

Notes. Regressions are estimated using OLS. The unit of observation is the ethnic group located in Africa. The dependent variable is listed in the first left column. All dependent variables are dummies. Each cell in columns (1) to (5) reports a separate regression, the coefficient on the cattle is reported. The data for the dependent variable are from the *Ethnographic Atlas. The economics controls include a measure of economic development (measured by the density of group settlement) and a measure of political complexity (measure by the number of levels of jurisdictional hierarchies in the society). The climate variable is the mean of daily temperature from the year 1871. Geography contains the agriculture suitability index from FAO, the log mean altitude, longitude and absolute latitude. Malaria refers to the malaria ecology index constructed by Kiszewski et al., (2004). Parenthesis reports standard errors clustered at the provinces level. Square braquets give conley (1999) standard errors correcting for cross-sectional spatial correlation (for a spatial correlation kernal cutoff of 100 KM). *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

TABLE 8: IV ESTIMATES OF THE EFFECT OF PRESENCE OF CATTLE ON GENDER ROLES

Dependent Variables	Female participation in agriculture	Female land inheritance	Female movable inheritance	Matrilocal marriage	Matrilineal descent	Brideprice
Panel A: Second stage						
Presence of domestic cattle	-0.359***	-0.265***	-0.226***	-0.203***	-0.257***	0.017
	(0.091)	(0.063)	(0.062)	(0.074)	(0.051)	(0.075)
Panel B: First Stage						
Cattle Suitability Index	0.204***	0.199***	0.208***	0.209***	0.229***	0.147***
	(0.032)	(0.030)	(0.008)	(0.026)	(0.028)	(0.025)
F.statistic	38.95	43.31	51.05	60.86	66.10	32.38
Panel C: Reduced Form						
Cattle Suitability Index	-0.073**	-0.053**	-0.047**	-0.042**	-0.059**	0.011
	(0.033)	(0.025)	(0.007)	(0.018)	(0.023)	(0.021)
Panel D: Ordinary Least Square						
Presence of domesticated cattle	-0.190***	-0.152***	-0.176***	-0.176***	-0.177***	0.148***
	(0.058)	(0.045)	(0.043)	(0.033)	(0.041)	(0.034)
No. Obs.	267	326	350	399	362	0.955
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Regressions are estimated using 2SLS and OLS. The unit of observation is ethnic groups. Coefficients are reported with Conley's standard errors in parentheses. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.

TABLE 9: Robustness of OLS estimates

Dependent Variables	(1)	(2)	(3)	(4)	(5)
	Probit	Alternative measures	Plow	Cereal crops	Tsetse flies
Female Part Agriculture	-0.217***	-0.266**	-0.168***	-0.190***	-0.059
	(0.001)	(0.110)	(0.058)	(0.058)	(0.059)
Female land inheritance	-0.151***	-0.664***	-0.145***	-0.152***	-0.108**
	(0.001)	(0.126)	(0.045)	(0.045)	(0.047)
Female movable inheritance	-0.172***	-0.620***	-0.170***	-0.176***	-0.120**
	(0.042)	(0.126)	(0.042)	(0.043)	(0.047)
Brideprice	0.144***	N.A.	0.149***	0.148***	0.137***
	(0.042)		(0.034)	(0.034)	(0.037)
Matrilocal marriage	-0.182***	N.A.	-0.175***	-0.176***	-0.157***
	(0.035)		(0.040)	(0.032)	(0.034)
Matrilineal descent	-0.184***	N.A.	-0.173***	-0.177***	-0.110**
	(0.041)		(0.032)	(0.041)	(0.043)
Baseline Controls	Yes	Yes	Yes	Yes	Yes

Notes. The dependent variable is listed in the first left column. OLS estimates are reported. Each cell reports a separate regression, the coefficient on the cattle is reported. The data for the dependent variable are from the *Ethnographic Atlas. The baseline controls include economic development (measured by the density of group settlement) and a measure of political complexity (measure by the number of levels of jurisdictional hierarchies in the society). Mean of daily temperature from the year 1871. Geography contains the agriculture suitability index from FAO, the log mean altitude, longitude and absolute latitude. Malaria refers to the malaria ecology index constructed by Kiszewski et al., (2004). Parenthesis report conley's standard error. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

TABLE 10: Probit and IV estimates of the effect of domestication of cattle on gender roles

Dependent Variables	Female participation in agriculture	Female land inheritance	Female movable inheritance	Matrilocal marriage	Matrilineal descent
		Panel A: Second Stage Probit			
Presence of domestic cattle	-0.447***	-0.254***	-0.233***	-0.286***	-0.327***
	(0.022)	(0.048)	(0.043)	(0.002)	(0.006)
		Panel B: First Stage			
Cattle Suitability Index	0.204***	0.199***	0.208***	0.209***	0.229***
	(0.032)	(0.030)	(0.008)	(0.026)	(0.028)
F.statistic	38.95	43.31	51.05	60.86	66.10
		Panel C: Probit estimates			
Presence of domesticated cattle	-0.217***	-0.151***	-0.172***	-0.182***	-0.184***
	(0.001)	(0.001)	(0.042)	(0.035)	(0.041)
No. Obs.	267	326	350	399	362
Baseline Controls	Yes	Yes	Yes	Yes	Yes

Notes. Regressions are estimated using 2SLS with Probit model at the second stage. The first stages is obtained using linear regressions, and the second stages using probit regressions. Cragg-Donald Wald F-Statistics are reported. The unit of observation is the ethnic group located in Africa. The controls variables include our baseline controls. Coefficients are reported with conley's standard error in parentheses. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.

TABLE 11: OLS ROBUSTNESS TESTS OF THE RELATIONSHIP BETWEEN GENDER ROLES AND DOMESTICATION OF CATTLE

Dependent Variables	(1) Probit	(2) Alternative measures	(3) Plow	(4) Cereal crops	(5) Tsetse flies
Female Participation in Agriculture	-0.217***	-0.266**	-0.168***	-0.190***	-0.059
	(0.001)	(0.110)	(0.058)	(0.058)	(0.059)
Female land inheritance	-0.151***	-0.664***	-0.145***	-0.152***	-0.108**
	(0.001)	(0.126)	(0.045)	(0.045)	(0.047)
Female movable inheritance	-0.172***	-0.620***	-0.170***	-0.176***	-0.120**
	(0.042)	(0.126)	(0.042)	(0.043)	(0.047)
Brideprice	0.144***	N.A.	0.149***	0.148***	0.137***
	(0.042)		(0.034)	(0.034)	(0.037)
Polygyny	-0.003	N.A.	0.015	0.008	0.023
	(0.014)		(0.017)	(0.019)	(0.022)
Matrilocal marriage	-0.182***	N.A.	-0.175***	-0.176***	-0.157***
	(0.035)		(0.040)	(0.032)	(0.034)
Matrilineal descent	-0.184***	N.A.	-0.173***	-0.177***	-0.110**
	(0.041)		(0.032)	(0.041)	(0.043)
Baseline Controls	Yes	Yes	Yes	Yes	Yes

Notes. The dependent variable is listed in the first left column. OLS estimates are reported. Each cell reports a separate regression, the coefficient on the cattle is reported. The data for the dependent variable are from the *Ethnographic Atlas. The baseline controls include economic development (measured by the density of group settlement) and a measure of political complexity (measure by the number of levels of jurisdictional hierarchies in the society). Mean of daily temperature from the year 1871. Geography contains the agriculture suitability index from FAO, the log mean altitude, longitude and absolute latitude. Malaria refers to the malaria ecology index constructed by Kiszewski et al., (2004). Parenthesis report conley's standard error. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

TABLE 12: IV Robustness Tests

Dependent Variables	(1) Probit second stage	(2) Alternative measures Ordered probit	(3) Plow	(4) Cereal crops	(5) Indigenous Slavery
Female Participation in Agriculture	-0.447***	-0.310**	-0.308***	-0.359***	-0.331***
	(0.022)	(0.150)	(0.091)	(0.092)	(0.085)
Female movable inheritance	-0.233***	-0.304***	-0.210***	-0.223***	-0.162**
	(0.048)	(0.114)	(0.065)	(0.060)	(0.062)
Brideprice	0.144***	N.A.	0.149***	0.148***	0.194***
	(0.042)		(0.034)	(0.034)	(0.062)
Matrilocal marriage	-0.286***	N.A.	-0.199**	-0.203***	-0.146**
	(0.002)		(0.075)	(0.075)	(0.072)
Matrilineal descent	-0.327***	N.A.	-0.257***	-0.257***	-0.152***
	(0.006)		(0.043)	(0.051)	(0.041)
Baseline Controls	Yes	Yes	Yes	Yes	Yes

Notes. The dependent variable is listed in the first left column. 2SLS estimates are reported. Each cell reports a separate regression, the coefficient on the cattle is reported. The data for the dependent variable are from the *Ethnographic Atlas. The baseline controls include economic development (measured by the density of group settlement) and a measure of political complexity (measure by the number of levels of jurisdictional hierarchies in the society). Mean of daily temperature from the year 1871. Geography contains the agriculture suitability index from FAO, the log mean altitude, longitude and absolute latitude. Malaria refers to the malaria ecology index constructed by Kiszewski et al., (2004). Parenthesis report conley's standard error. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

TABLE 13: IV Robustness Tests Continued...

Dependent Variables	(6) Outliers	(7) Tsetse flies	(8) Presence of Sheep and Goats
Female Participation in Agriculture	-0.357***	-0.098	-0.790***
	(0.093)	(0.118)	(0.272)
Female land inheritance	-0.196***	-0.206***	-0.506***
	(0.055)	(0.094)	(0.182)
Female movable inheritance	-0.192***	-0.304***	-0.404***
	(0.068)	(0.114)	(0.184)
Brideprice	0.148***	0.194***	0.137***
	(0.034)	(0.062)	(0.037)
Matrilocal marriage	-0.202***	-0.124***	-0.201*
	(0.075)	(0.086)	(0.118)
Matrilineal descent	-0.242***	-0.175***	-0.387***
	(0.043)	(0.080)	(0.091)
Baseline Controls	Yes	Yes	Yes

Notes. The dependent variable is listed in the first left column. 2SLS estimates are reported. Each cell reports a separate regression, the coefficient on the cattle is reported. The data for the dependent variable are from the *Ethnographic Atlas. The baseline controls include economic development (measured by the density of group settlement) and a measure of political complexity (measure by the number of levels of jurisdictional hierarchies in the society). Mean of daily temperature from the year 1871. Geography contains the agriculture suitability index from FAO, the log mean altitude, longitude and absolute latitude. Malaria refers to the malaria ecology index constructed by Kiszewski et al., (2004). Parenthesis report conley's standard error. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

TABLE 14: IV WITH CONTROLS

Dependent Variables	(1)	(2)	(3)	(4)
Female Participation in Agriculture	-0.336***	-0.534***	-0.356***	-2.207**
	(0.108)	(0.150)	(0.094)	(1.083)
Female land inheritance	-0.186***	-1.241***	-0.205***	-2.062
	(0.047)	(0.174)	(0.055)	(4.033)
Female movable inheritance	-0.185***	3.437	-0.198***	-3.117
	(0.062)	(4.302)	(0.066)	(7.288)
Matrilocal marriage	-0.221***	2.136	-0.204***	51.226
	(0.078)	(5.073)	(0.076)	(1097.487)
Matrilineal descent	-0.230***	-1.094	-0.250***	0.579
	(0.042)	(1.542)	(0.043)	(1.461)
Slope index	Y			Y
Pasture index		Y		Y
Distance to river			Y	Y
Baseline Controls	Yes	Yes	Yes	Yes

Notes. The dependent variable is listed in the first left column. 2SLS estimates are reported. Each cell reports a separate regression, the coefficient on the cattle is reported. The data for the dependent variable are from the *Ethnographic Atlas. The baseline controls include economic development (measured by the density of group settlement) and a measure of political complexity (measure by the number of levels of jurisdictional hierarchies in the society). Mean of daily temperature from the year 1871. Geography contains the agriculture suitability index from FAO, the log mean altitude, longitude and absolute latitude. Malaria refers to the malaria ecology index constructed by Kiszewski et al., (2004). Parenthesis report conley's standard error. *, **, *** indicate the level of significance at the 10, 5 and 1 percent level.*

TABLE 15: The roles of historical plough-use

	Female participation in agriculture		Female movable inheritance		Matrilocal Marriage		Female inheritance of land		Matrilineal descent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Presence of domestic cattle	-0.190***	-0.183***	-0.176***	-0.162***	-0.176***	-0.164***	-0.152***	-0.128***	-0.177***	-0.171***
	[0.058]	[0.062]	[0.043]	[0.043]	[0.033]	[0.032]	[0.045]	[0.045]	[0.041]	[0.040]
Plough		-0.363***		0.120**		-0.003		0.142**		0.031
		[0.058]		[0.050]		[0.020]		[0.057]		[0.102]
Alesina Baseline controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Baseline controls	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
No. Obs.	267	267	399	359	440	375	326	336	398	362
Mean dpt. var.	0.49	0.49	0.161	0.161	0.120	0.120	0.193	0.193	0.188	0.188