On the Historical Roots of Gender Norms: Evidence from Matrilineal Societies in Sub-Saharan Africa

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Abstract

This paper studies both the geoclimatic origins and the long-term impacts of matrilineal kinship systems, where inheritance is along the maternal line, in Sub-Saharan Africa. Exploiting cross-ethnic group variations in geoclimatic conditions, I first document that land suitability for root crops and its unsuitability for the husbandry of large domesticated animals both positively predict the incidence of matrilineal kinship systems. I explain these findings by two theories. The first explains matrilineality by the prevalence of extensive hoe agriculture in root crops, where women tend to perform most tasks such as planting and harvesting. The second argues that matrilineality is less likely to emerge in environments favorable to movable property (like large animals) as opposed to immovable property (such as lands). I then examine the long-term impacts of matrilineal institutions and find that matrilineal-origin women are less educated than their patrilineal counterparts, suggesting a substitution between human capital (education) and physical capital (landed property) in parental investment's choices. In addition, I explore underlying mechanisms and find that matrilineal-origin women are more likely to own a land/house alone in rural areas, bringing evidence of a persistence of matrilineal institutions over time. Those insights have implication on the labor and marriage markets: since matrilineal women already have assets, they are less likely to invest in education and get a "white-collar job", they do not seek for a rich or educated partner, and contribute the most to household expenditures. The causal interpretation of the results is supported by a geographic regression discontinuity analysis and underlines the importance of cultural norms in the implementation of large-scale development policies.

Keywords: Matrilineality, Ecological Origins, Cultural Persistence, Female Education.

JEL Codes: B15, D10, J16, Z13.

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1 Introduction

Gender norms and attitudes vary significantly accross societies. The larger gaps between men and women are observed in developing countries where women are often less empowered, less educated and are subject to more domestic violence. Different factors can influence the status of women in society, one of them is social institutions. In fact, social norms, as long-term stable sets of rules, duties and behaviors between people, can have a sizeable influence on the organization of individuals, families and societies, and thus, might affect the status of women in that respect.

Kinship systems are important social institutions that organize human lives in societies: they define how lineage and inheritance are traced, the obligations of family members, the distribution of resources and the production management among relatives. Historically, there exists different types of inheritance systems depending on the type of descent: *bilineal* descent systems, in which the descent inherits through both male and female ancestors equally, and *unilineal* descent systems, in which kin is defined using only one of the two parents. In *matrilineal* kinship systems, inheritance and group affiliation are exclusively traced through the female line, as opposed to *patrilineal* kinship systems, in which a descent belongs to his father's kinship group and inheritance can only be passed through the male line. It is worth noting that matrilineal and patrilineal systems are not symmetrically opposed: while in matrilineal systems husbands and wives keep strong allegiances with their own lineages, a wife is integrated into the husband's group in patrilineal systems. Hence, belonging to a matrilineal kinship system might have significant implications for women.

Matrilineal societies are less common than patrilineal ones. They can be found around the world, but are most particularly present along the *Matrilineal Belt* in Central Africa: from current Gabon and Angola to Tanzania and Mozambique (see figure 6). Although there exists different types of matrilineal societies, they share a sizeable number of characteristics. Matrilineal cultures may favor women empowerment in different respects. First, this system allows women to hold more resources, mainly immovable properties like lands, compared to other inheritance systems, potentially increasing women's bargaining power within the household. Second, women from matrilineal societies might have a higher status for structural reasons based on other cultural norms related to matrilineality such as matrilocality, the practice of living close to the wife's relatives. Third, matrilineal women might be more valued *per se* for intrinsic reasons (Hrdy, 2011; Lowes, 2017).

While there exists no unifying theory on the origins of matrilineality, some anthropologists and evolutionary biologists have argued that matrilineality was a social norm created as an adaptative process in response to certain types of social and ecological environments. Matrilineality would be more beneficial with certain types of production like hoe agriculture and low agricultural productivity (Aberle, 1961) but is rarely found in association with animal husbandry, pastoralism and large domesticated animals (Aberle, 1961; Holden and Mace, 2003; Murdock, 1949). Additionally, this kinship system can be understood as a daughter-biased investment that would be more advantageous in low paternity certainty environments in which it would be more beneficial for a father to invest in his sister's children instead of his own offsprings to ensure the transmission of his heritage, as maternity is observable contrary to paternity (Fortunato, 2012, Hartung, 1985).

The key issues addressed in this paper are the origins of matrilineality in Sub-Saharan Africa and its long-term impacts on female education and labor and marriage market. Considering the fact that cultural norms persist over time, the idea is to explore the subsequent cause and effect relationship: *geoclimatic conditions* → *adoption of matrilineality* → *impacts on female education*. For this purpose, I first test two anthropological theories according to which matrilineal kinship systems (i) are associated with *extensive hoe agriculture*, as women tend to perform most of the labor tasks such as planting and harvesting while men are assigned to land clearing in a root-based agriculture (Ember, 1983) and (ii) are absent in environment beneficial to movable property that are handled by men like *large domesticated animals*, as opposed to land property (Murdock, 1949). I explain the presence of matrilineal systems in areas suitable for extensive agriculture in root crops without large domestic animals by the possibility for women to increase their production and property such as lands, which cannot be threatened by movable properties in the hands of men. Exploiting exogenous variations in crop and landuse suitability and controlling for a battery of historical and geoclimatic potential confounding factors, I find that the coincidence of land suitability for root crops and land unsuitability for animal husbandry predicted the prevalence of matrilineality in Sub-Saharan Africa. In a second part, I explore the impact of ancestral matrilineality on women's socioeconomic status and find that matrilineal-origin women are less likely to be educated compared to patrilineal women, suggesting a substitution between human capital (education) and physical capital (landed property) in parental investment's choices.

The historical data on preindustrial ethnic groups and cultural norms are based on information from the *Ethnographic Atlas* and the *Murdock Map of Ethnic Groups* which geolocalizes each ethnic group by its historically occupied territory. The *Ethnographic Atlas* is an anthropological database that captures preindustrial characteristics of 1267 ethnic groups, among which 408 are matrilineal and patrilineal ethnic groups from Sub-Saharan Africa. These data, gathered by George Peter Murdock (Murdock, 1967) contains information on various socioeconomic and cultural aspects such as historical subsistence economy, types of agriculture, types of main crop cultivated, sex division of labor, political integration, settlement patterns, marital norms or kinship structure. To construct the ecological index and geoclimatic control variables, I first use *FAO data* on suitability measures for low input farming and rainfed crops for different types of roots and on temperature, rainfall and elevation. I combine it with landuse suitability measures from Beck and Sieber (2010) that provides suitability indexes for nomadic pastoralism, animal husbandry and hunting-gathering. The hunting-and-gathering suitability exploits resources of the land. The pastoralism suitability uses domesticated animals as natural primary productivity. And the animal husbandry suitability uses domesticated animals as addition or alternative to agriculture, making use of primary productivity and/or agricultural products as food for livestock, and can be understood as more general definition of pastoralism. To explore the persistent effect of matrilineality on women's current status over time, I use the *Demographic and Health Survey*, a nationally representative survey conducted at the individual and household levels in different developing countries worldwide over several years. The *DHS* is focused on women empowerment and most of the respondents are women. It thus contains detailed information on a various set of variables such as occupation, education, literacy, marrital status, partner's occupation, possessions, fertility and health. It also provides information on ethnolinguistic

groups, allowing to merge these contemporary data with the historical ethnic groups and their characteristics from the *Ethnographic Atlas*. As African countries are populated by various ethnic groups from different cultural origins, I exploit both country and within-country region variation.

My empirical strategy consists in first exploiting geographical variation in crop and landuse suitability to find the environmental conditions beneficial to ancestral matrilineality. These ecological variations are objective measures exploiting climatic and soil characteristics and are thus supposed to be exogenous to cultural norms. Controlling for a set of historical and geoclimatic observables, I first test whether the coincidence of land suitability for *root crops* related to the practice of extensive hoe agriculture and the land unsuitability for *animal husbandry* predicted the prevalence of ancestral matrilineality in Sub-Saharan Africa. I use ethnolinguistic group fixed effects in order to compare ethnic groups within the same ethnolinguistic family among which vertically transmitted cultural traits are similar, allowing to correct for spatial autocorrelation. Second, I estimate the effect of matrilineality on contemporary outcome variables from the *DHS* performing an OLS regression and controlling for individual, historical and geoclimatic characteristics. To address causality, I implement a geographic regression discontinuity analysis using the distance from the ancestral matrilineal border of ethnic groups from the *Murdock Map of Ethnic Groups* to the current village location of the individual from the *DHS*, which is supposed to be exogenous. I control for geoclimatic conditions at the village location and individual and historical characteristics as well. Finally, to link past with present outcomes and lend further empirical support to the causal interpretation of the findings, I use the geoclimatic index created combining root crop suitability and animal husbandry unsuitability as instrument for ancestral matrilineality. Most IV coefficients corroborate OLS and RD results. However, IV findings have to be considered with a caveat since the exclusion-restriction assumption -implying that those specific ecological conditions do not affect contemporary female education and possessions through channels other than ancestral matrilineality- is hard to meet.

The analysis confirms two different theories on the origins of matrilineality prevailing in the anthropological literature. Ancestral matrilineality is more likely to be present in environments (i) suitable for extensive hoe agriculture and (ii) not beneficial to movable property like large domesticated animals. On the one hand, root crop suitability is associated with extensive hoe agriculture (since roots are mainly cultivated with a hoe or a digging stick) in which women tend to perform most of the tasks such as weeding, planting and harvesting while men are assigned to land clearing, which would have favored the occurence of matrilineality; on the other hand, environments unsuitable for animal husbandry are more detrimental to large domesticated animals that are potential movable property in the hand of men, then threatening and competing with land property that is transmitted by the mother in matrilineal systems. The index explains itself almost 10% of the variation in kinship systems (R-squared is equal to 7.34% without controls and fixed effects). Depending on regression specifications, I find that a 0.1 increase in the index (continuous values between 0 and 1) is associated with an increase of 15% points to 26% points in the likelihood of adopting a matrilineal kinship. The effect holds controlling for a various set of historical controls from the *Ethnographic Atlas* such as year of observation, levels of juridictions, settlement patterns (from nomadic or fully migratory to complex settlements as proxy

for population density), historical plow use; and other historical controls like Catholic and Protestant missions, explorers' routes, and for geoclimatic controls like average temperature, precipitation and elevation. As an external validity test, I assess whether this index has an impact on ancestral Asian and Australian societies and find a significant and positive impact.

Exploring the impacts of ancestral matrilineality today using country variation, I bring evidence that women from matrilineal societies are less educated compared to their patrilineal counterparts, suggesting a substitution between human capital (education) and physical capital (landed property) in parental investment's choices. To explain those results, I explore underlying mechanisms and find that matrilineal-origin women are more likely to own a land or a house alone in rural areas, bringing evidence of the persistence of this gender-biased social institutions over time. This difference in parental investment choices has repercussion on the labor and marriage markets. Since matrilineal women already have assets, they are less likely to get a "white-collar job", they do not seek for a rich or educated partner, and contribute the most to household expenditures. I exploit both country and within-country region variation with OLS regressions and find similar results. The causal interpretation of the findings is supported by both geographic regression discontinuity and instrumental variable analyses.

The contribution of this paper is twofold. First, this paper is, to the best of my knowledge, the first to test empirically how agricultural sources might affect kinship systems, testing two existing hypotheses prevailing in the anthropological literature on the origins of matrilineal inheritance. It investigates the causal impact of the combination of land suitability for root crop and land unsuitability for animal husbandry on the likelihood of adopting a matrilineal kinship systems, and studies the underlying explanatory mechanisms. This paper contributes to the litterature in economics and evolutionary anthropology and biology by shedding lights on how ecological conditions in which societies have lived historically have determined their biology and their cultures (Diamond (1999); Murdock, 1949; Henrich, 2017) or more broadly on how norms and beliefs are formed and on their causal effects on women outcomes (Bernhardt et al., 2018; Jayachandran, 2015). A number of papers have recently enlightened the historical origins of heterogeneity in gender norms and on their impacts on current gender outcomes such as female labor force participation (Boserup et al., 1970; Alesina et al., 2013; Demie, 2018); female education levels (Ashraf et al., 2019); and restrictions on women's sexuality (Becker, 2018). Finally, BenYishay et al. (2017) studies the influence of marine ecology on matrilineal inheritance and shows that subsistence on fishing instrumentalized by coral reef density predicts the prevalance of matrilineal societies in the Solomon Islands, but do not find significant long-term impacts on women.

Second, this paper investigates the long-term impacts of matrilineal kinships as gender-biased social institutions on female education, and contributes to the literature on human capital and gender norms and institutions. The striking and perhaps counterintuitive main insight of the paper is that, albeit matrilineal systems allow women to inherit and possess assets which increases their bargaining power within the household, they imply a substitution of human capital (mobile asset) from physical assets (immovable properties), with a persistent effect over generations. In the same vein, Becker et al. (2020) finds that forced migration led to a shift in preferences, away from material possessions and towards investment in human capital studying mass population movements in post-WWII Poland. In

addition, Ashraf et al. (2019) stresses the importance of cultural norms such as the practice of bride price on female education. The link between kinship systems and the status of women is still widely unexplored in the economic literature, although recent articles provide new evidence on the impacts of matrilineality on economic outcomes: matrilineality would increase women empowerment, women political participation and women's willingness to compete. Gneezy et al. (2009) shows that women from matrilineal society are more willing to compete either against men from their group or against men from partiarchal ethnic groups. Lowes (2017) shows that children are healthier and better educated and women experience less domestic violence in matrilineal societies. Additionnally, matrilineality would be associated with reducing the gender gap in political participation (Robinson and Gottlieb, 2019). Finally, Jayachandran (2015) states that cultural norms like patrilocality and concern for women's "purity" contribute to a lower female employment rate or a male-biased sex ratio in some developing countries like India and China.

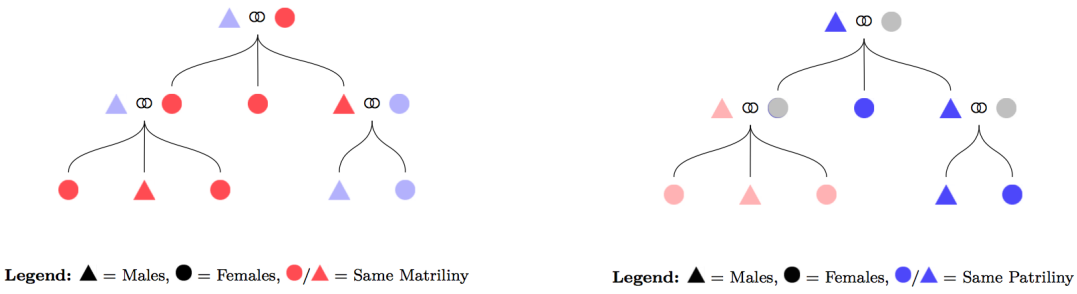
This paper also relates to the literature on the persistent effects of institutions, norms and beliefs (Nunn, 2008; Dell, 2010; Nunn and Wantchekon, 2011; Voigtländer and Voth, 2012; Michalopoulos and Papaioannou, 2016) and on the historical origins of current variation in culture (Nunn and Puga, 2012; Alsan, 2015; Enke, 2019; Grosjean and Khattar, 2019).

This paper proceeds as follows. Section 2 provides a background on matrilineal kinship systems. Section 3 describes matrilineal societies in Sub-Saharan Africa using the *Ethnographic Atlas* data and presents the hypotheses to test. Section 4 and 5 present the data and the empirical strategy. Section 6 shows that the variation in ancestral matrilineal societies is largely determined by ecological conditions. Section 7 presents the long-term impacts of matrilineality on women's current position. In section 8, I use the ecological index created combining root crops suitability and animal husbandry unsuitability as instrument for ancestral matrilineality.

2 Matrilineal Kinship Systems

Kinship systems, from which lineage and inheritance rules are defined, can be considered as a social institution that organizes human lives regarding the distribution of resources, the production management and the obligations among family members.

Kinship systems There exists different types of inheritance systems depending on the type of descent: in *bilineal* descent systems, the descent inherits through both male and female ancestors equally contrary to *unilineal* descent systems, in which kin is defined only through one of the two parents. In *matrilineal* kinship systems, inheritance and group affiliation are exclusively traced through the female line while a descent belongs to his father's kinship group in *patrilineal* kinship systems. Matrilineal and patrilineal systems are not symmetrically opposed: in matrilineal systems, husbands and wives keep strong allegiances with their own lineages, whereas a wife is integrated into the husband's group in patrilineal systems. Matrilineal inheritance systems are thus an institution in which inheritance of land and movable property is traced through the female line (see Figure 1). It is associated with *matrilocality*, the practice of living close to the wife's relatives, as opposed to patrilocality.



(a) Matrilineal Kinship

(b) Patrilineal Kinship

Figure 1: Kinships System Diagrams from Lowes (2017)

Types of matrilineal systems Fox (1983) depicts three types of matrilineal systems: the first one is the mother-daughter-sister system, a system related to matrilocality in which women hold more resources and have higher status, the second is the brother-sister-nephew system that often practices avunculocal (for which the transfer of the marital residence is in the house or the village of the wife's brother) which is associated with a lower women status, and finally, a mixed system between these relationships in which women's status would be neither too high nor too low.

The matrilineal puzzle The adoption of matrilineal system has long been debated in the evolutionary anthropology literature due to its contradictory aspects (Mattison, 2011). The *matrilineal puzzle* is the hypothesis that matrilineal inheritance system is puzzling since it decreases spousal cooperation: in fact, it splits an individual's allegiance between investment in his household and investment in his lineage, and both spouses keep strong ties with their own lineage. As matrilocality and exogamy structural

elements of matriliny, when a women gives birth to a child outside of her group, the husband will have to live with his wife's family. Therefore, matrilineal societies can undermine male authority and husband's control over his wife and children, compared to patrilineal societies, in which the children belong to the husband's group. Most kindship systems are patrilineal. However, preindustrial matrilineal societies are mainly gathered in Sub-Saharan Africa along a horizontal band called the *Matrilineal Belt* extending from current Angola to Mozambique (see Figure 6).

Subsistence Economies of Preindustrial Matrilineal Societies The Ethnographic Atlas, which provides information on 408 ethnic groups for which 74 are matrilineal and 334 patrilineal, allows to explore some historical and cultural characteristics of ancestral matrilineal ethnic groups. First, matrilineal societies are associated with a higher women's production and property (Murdock, 1949; Aberle, 1961; Ember, 1983). Because of biological constraints like physical strength and childbearing, rules of sex division of labor emerges, which in turn affects male and female production. An extensive root-based agriculture, as opposed to intensive plow agriculture, allows women to participate more into agricultural tasks, and hence to produce more (Alesina et al., 2013; Ember, 1983). In fact, this type of agriculture (using a hoe or a digging stick) does not require as much physical strength as intensive agricultural systems (using a plow with large animals). Besides, the growing season is longer and smooth all along the year without peaks requiring intense labor work during a short period of time as it is the case with cereal cultivation. Data from the Ethnographic Atlas depicting characteristics of preindustrial ethnic groups from Sub-Saharan Africa show that matrilineal societies were 15% points more likely to practice extensive hoe agriculture as subsistence economy with roots as main type of crops, and were not associated with intensive agriculture and the domestication of large animals (table 1).

	Dependent variable: Ancestral Matrilineality				
	(1)	(2)	(3)	(4)	(5)
Extensive Hoe Agriculture	0.149**				
	(0.062)				
Intensive Agriculture		−0.186***			
		(0.053)			
Cultivation of Root Crops			0.144**		
			(0.056)		
Cultivation of Cereals Crops				−0.072	
				(0.051)	
Domestication of Large Animals					−0.164***
					(0.049)
Year of obs. FE	Yes	Yes	Yes	Yes	Yes
Ethno-Linguistic Group FE	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes
Geoclimatic Controls	Yes	Yes	Yes	Yes	Yes
Observations	346	346	346	346	346
R-squared	0.26	0.27	0.26	0.25	0.27

Note: The unit of observation is the ethnic group. Robust standard errors are reported in parenthesis. Ethno-linguistic group fixed effects correct for spatial autocorrelation. Large domesticated animals includes cows, horses and pigs. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 1: Correlates of Ancestral Matrilineality: Means of Subsistence

Cultural Norms Related to Matrilineal Institutions Matrilineal kinship systems are also strongly correlated with other cultural norms. Those other cultural practices may vary with the practice of matrilineal kinship. However, I am not able to unbundle those practices with the matrilineal kinship practice and one can consider that matrilineality is capturing a bunch of other cultural norms, which might vary depending on the specificities of each ethnic group. Albeit it is tricky to disentangle whether a given cultural norm occured before the emergence of kinship systems or after or simultaneously, one can depict features of kinship systems in their sociocultural aspects, regarding both inheritance rules and marital norms. Table 2 shows that matrilineal kinship systems are strongly correlated with matrilineal inheritance rules either for landed or movable properties. Almost all the variation is explained by kinship systems (R-squared is higher than 80% without controls). Thus, matrilineal and patrilineal kinship systems define lineage and inheritance of properties along either the maternal or the paternal line. Matrilineality is also strongly correlated with matrilocality (R-squared is 0.75 without controls), which is, according to the anthropological literature, a corrollary of matrilineality. Matrilineal societies also practiced bride service, meaning that once married, the groom had to move to the bride's family and offer his services. Thus, most women from matrilineal societies were used to stay in their village, benefitting from kin support. This was not the case of patrilineal societies who were more willing to pratice bride price: after marriage, the bride had to move to the groom's family who offered large animals such as cows in exchange for the bride. The bride had to leave her relatives and move in the groom's village, impeding less support from her family and living in a totally new environment.

	Dependent variable: Ancestral Matrilineality				
	(1)	(2)	(3)	(4)	(5)
Matrilineal Inheritance Rule for Landed Property	0.890^{***}				
	(0.032)				
Matrilineal Inheritance Rule for Movable Property		0.877^{***}			
		(0.026)			
Marital Norm Bride Price			-0.176^{***}		
			(0.055)		
Marital Norm Bride Service				0.168^{**}	
				(0.080)	
Marital Norm Matrilocality					0.921^{***}
					(0.036)
Year of obs. FE	Yes	Yes	Yes	Yes	Yes
Ethno-Linguistic Group FE	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes
Geoclimatic Controls	Yes	Yes	Yes	Yes	Yes
Observations	269	284	345	345	330
R-squared w/o controls	0.83	0.87	0.07	0.06	0.75
R-squared	0.84	0.87	0.27	0.25	0.78

Note: The unit of observation is the ethnic group. Robust standard errors are reported in parenthesis. Ethno-linguistic group fixed effects correct for spatial autocorrelation. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 2: Correlates of Ancestral Matrilineality: Other Cultural Norms

3 Conceptual Framework

Geoclimatic Origins of Matrilineal Kinship Systems There exists no unique theory on the origins of matrilineal kinship systems. Early anthropological hypotheses posited that matrilineality was the most archaic inheritance system in the world (Morgan, 1907). George Peter Murdock was one of the firsts to seek to understand the origins and features of matrilineality. From an evolutionary anthropology point of view, the existence of matrilineality can be explained by the adaptation of a society in response to given social and ecological conditions. Three main factors which might have contributed to the adoption of matrilineal kinship systems emerge from the anthropological litterature: male absenteism, the presence of horticulture or extensive agriculture and the absence of large domesticated animals.

It might be more advantageous for a men to invest in his nieces relative to his own sons in environments with low paternity certainty. As maternity is easily observable contrary to paternity, if an environment leads to male absenteism, a kinship system in which wealth and property are inherited through the mother's line would be an adaptative social institution as a brother knows he is related to his sister but does not necessarily knows that his son is actually his offspring (Fortunato, 2012). Holden et al. (2003) creates a model combining wealth and paternity certainty and argues that a daughter-biased investment may be adaptative when the marginal benefit of investing in sons relative to daughters can be devalued by the paternity uncertainty of the son.

Appart from the paternity certainty issue, the benefit of inheritance/wealth to a daughter can be high with certain types of agricultural sources. Matrilineal societies were consistently found in environments suitable for extensive agriculture with low agricultural yields (Murdock, 1949; Aberle, 1961) and rarely associated with plow agriculture, i.e. intensive agriculture with high agricultural yields (Peoples and Bailey, 2011). More generally, Boserup et al. (1970) establish the pioneer hypothesis, tested in Alesina et al. (2013), according to which men have a comparative advantage over women in farmwork due to a higher physical strength. The theory states that in societies who traditionally practiced plow agriculture, women were confined to minor domestic activities since they could not participate more in field work. Plow agriculture is characterized by the use of the cow and can be practised only in areas suitable for plow-positive cereals such as wheat, barley and rye, as opposed to plow-negative cereals like sorghum or millet (Alesina et al., 2013) or roots and tubers (Demie, 2018).

The distinction between crop types influences the sex division of labor. While women tend to perform most of the agricultural tasks like planting, weeding and harvesting in a root-based agriculture, men are assigned to clearing and preparing lands for planting (Ember, 1983; Demie, 2018). Ember (1983) states that cereals, which are often dried, require more preparation and more labor input before being edible compared to roots. Cereal cultivation involves a shorter growing period contrary to roots, leading to intense field preparation and harvest work during peak season. They also require more secondary processing before being cooked such as drying and grinding, tasks that are mostly performed by women, leaving less time for them in production in farmwork. Thus, an environment suitable for root crops appears to be more beneficial to women as they can increase their production and consequently their landed property. A sex division of labor in field work biased towards women might increase their legitimacy to be the owner of the land they work on. Thereupon, the importance of women in a society

will increase if the means of subsistence depend primarily on their production. In a society practicing extensive hoe agriculture, women can produce more, can dispose of a more stable and abundant source of food supply, and increase their property (Murdock, 1949).

Matrilineal societies are absent with the domestication of large animals (Murdock, 1949; Aberle, 1961; Holden et al., 2003). Aberle, 1961 tests for ecological correlates of matrilineality in 565 cultures worldwide and brings evidence that evidence that 56% of matrilineal societies were horticulturalist while 23% were pastoralist. The adoption of pastoralism resulted in patrilocal residence (the wife lives with her husband's family) for most of world's cultures. Murdock (1949) argues that the increase in quantity of movable properties that can be found in the hands of men like domesticated animals might challenge the importance of landed property and threaten the transmission of land to daughters. Additionally, Holden et al. (2003) uses a phylogenetic approach and shows that the spread of cattle led to the loss of matrilineality in Sub-Saharan Africa among the Bantu ethno-linguistic group. Finally, in the economics literature, Becker (2018) tests the hypothesis that women from societies that historically practiced pastoralism had a lower status and were more subject to constraints on their sexuality.

The *Staples Thesis*, also known as geographic determinism, stipulates that the level of economic development or the creation of institutions of a given area depend on the geographic resources historically available. Social institutions such as kinship systems and inheritance rules emerge from parental investment choices. It might be more beneficial for a society to invest either in sons or daughters depending on the availability of agricultural and soil resources in a given environment.

- I posit that the combination of land suitability for root crop and land unsuitability for the domestication of large animals contributed to create a sex division of labor biased towards women and to garantee that they could keep on owning the land they work on for themselves. Extensive hoe agriculture is the main mean of subsistence and women are contributing to most of the food production of carbohydrate in those societies. Men's acitivity would steer towards hunting or fishing rather than agricultural production. Areas suitable for the cultivation of roots and unsuitable for animal husbandry allow women to work more on land relative to men, to produce more, and hence, to increase their property. At the same time, the transmission of landed property to daughters cannot be threatened by movable property handled by men such as large animals.

- Then, the establised male-female distribution of production and property based on agricultural and soil resources has implications towards parental investments' choices. Social institutions emerge: matrilineal kinship systems with a daughter-biased parental investment and patrilineal kinship systems with a son-biased parental investment.

Figure 2 depicts the comparative advantages of investing in daughters or sons depending on land suitabilities for root crops and animal husbandry. For a matrilineal system to emerge, there has to be a coincidence of both land suitability for root crops and land unsuitability for large domesticated animals, otherwise, if one factor is missing, it will not be more beneficial to invest in daughters compare to sons.

	Land suitability for root crop	*Land unsuitability for root crop*
Land unsuitability for animal husbandry	Women **participate more** in agricultural tasks, women's production increases and women's property increases. **No competition** between landed properties aquired by women and cows as movable properties handled by men. → Comparative advantage to invest in daughters.	Women **cannot participate** in agricultural tasks or work less than men, women's production is low or nul and women's property is low or nul. **No competition** between landed properties aquired by women and movable properties handled by men like large animals. → No comparative advantage to invest in daughters.
Land suitability for animal husbandry	Women **participate more** in agricultural tasks, women's production increases and women's property increases. **Competition** between movable and immovable properties: landed properties aquired by women are threatened by movable properties handled by men such as cows, considered as wealth transmitted to son, for bride price for example. → Comparative advantage to invest in sons.	Women **cannot participate** in agricultural tasks or work much less than men, women's production low or nul and women's property low or nul. **Competition** between landed properties and cows as movable properties handled by men, landed properties aquired by women threathened and movable properties transmitted to sons. → Comparative advantage to invest in sons.

Figure 2: Parental Investment in Son Versus Daughter Depending On Land Suitability

The *FAO* data allow to know the crop and landuse suitabilities of a given geographic area. We expect matrilineal kinship systems to have emerged in areas suitable for extensive hoe agriculture without animal husbandry.

Hypothesis 1 *Part of the variation in the occurence of matrilineal kinship systems in Sub-Saharan Africa is caused by land suitability for root crop combined with land unsuitability for animal husbandry.*

Long-Term Impacts of Matrilineal Kinship Systems Those variations in kinship systems in the distant past might have affected contemporary life. In matrilineal societies, daughters are more likely to inherit, in particular immovable properties such as lands, relative to sons. I posit that matrilineal societies do not value education for their daughters and that parental investment is more oriented towards physical capital (immovable property) compared to human capital (education). In fact, as patrilineal-origin daughters cannot inherit, patrilineal parents might be more willing to invest in the education of their daughters. This result can be striking as women would appear to have a higher status and to be more valued within matrilineal societies, because they are the main contributor to household's production and wealth. It is likely that those societies value more physical capital rather than human capital.

Hypothesis 2 *Matrilineal-origin parents are less likely to invest in the education of their daughters relative to patrilineal-origin parents.*

This main hypothesis would imply that, on the labor market, matrilineal women would be less likely to get a "white-collar job" and more intended to work in farming. On the marriage market, they would

also chose a partner with a lower level of education. As matrilineal women are more likely to already hold assets, they will be less willing to invest in education and to get an educated and rich partner.

Those insights can be explained by the fact that matrilineal women inherit immovable properties and that they are more willing to live in rural areas.

Hypothesis 3 *Women who are descendants from matrilineal ethnic groups are more likely to own their own house or land alone and to have a rural status.*

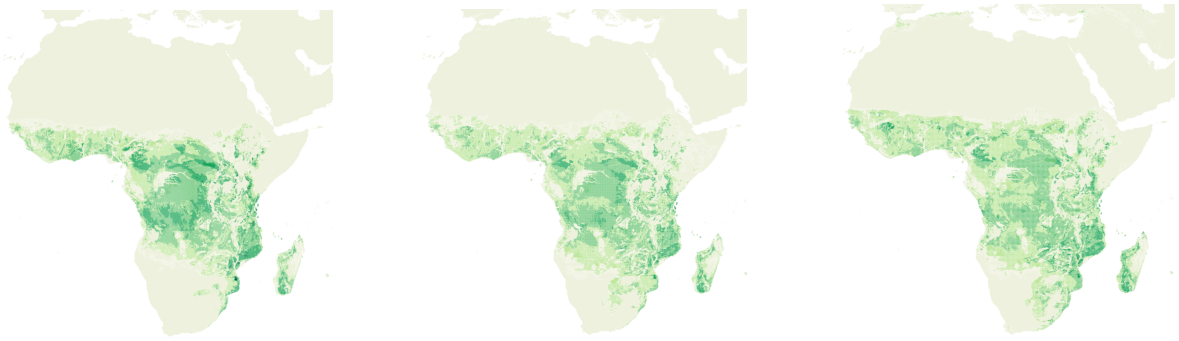
4 Data

Historical Ethnic Groups and Cultural Norms In this paper, I use the *Ethnographic Atlas*, an anthropological database that captures pre-industrial characteristics of 1,267 ethnic groups. These data, gathered by George Peter Murdock (Murdock, 1967) contain information on various socioeconomic and cultural aspects at the ethnic group level such as historical subsistence economy, type of agriculture, type of main crop cultivated, plow use, sex division of labor, political integration, settlement patterns, premarital and marital norms, polygyny and kinship structure. I combine these data with the *Murdock Map of Ethnic Groups* that contains the territorities historically occupied by the ethnic groups reported in the *Ethnographic Atlas* in Africa (see Figure 6). I also use additional historical data to have information on the routes of explorers and the Roome (1924) map of the location of Catholic and Protestant mission stations from Nunn (2010). In addition, in order to build a phylogenetic tree assigning each ethnic group to a specific ethnolinguistic family, I use data from the *Ethnologue*. Figure 8 shows the 3 main families of Sub-Saharan Africa: Afro-Asiatic, Niger-Congo and Nilo-Saharan, which are divided into 9 families which in turn are divided into 37 subfamilies containing the 408 ethnic groups under study, among which 73 are matrilineal and 334 are patrilineal. Historical data are depicted in Appendix A.

Geoclimatic Suitability Measures To construct the ecological index, I first use *FAO data* on land suitability for crops consisting in 10km by 10km grid cell measures. I use the crop suitability indexes in values for cultivated lands computed from the baseline period 1961-1990 for low input farming systems and rainfed crops, as preindustrial societies were not using off-farm inputs like fertilizers (see figure 3). I also use geoclimatic controls such as mean temperature, rainfall and elevation from the same dataset. Each variable or index from *FAO* are computed at the ethnicity level. Data are depicted in Appendix A.

As a first step, I examine the correlation between several root crops, such as cassava, yam and sweet potatoe (see table 9), which are cultivated with a digging stick in extensive agricultural systems, and find that the strongest correlations are observed with cassava and yam: matrilineal kinships are positively associated with the cultivation of root crops. Those first results also show that matrilineality is not associated with the cultivation of cereals. I create an intermediary index variable equal to the maximum value of cassava and yam index means, at the ethnic-group level. This first index is supposed to represent the land suitability for extensive agriculture in root crops (first anthropological theory).

Then, I combine this index with animal husbandry unsuitability measures from Beck and Sieber (2010). This paper provides suitability measures for several landuses: the agriculture index controls pri-



(1) cassava (2) yam (3) sweet-potato

Figure 3: Land Suitability for root crops from *FAO data*

mary productivity by growing domesticated plants considering geoclimatic characteristics; the hunting-gathering index exploits resources of the land; the nomadic pastoralism index uses domesticated animals as natural primary productivity; and the animal husbandry index is broad measure of pastoralism that uses domesticated animals as addition or alternative to agriculture, making use of primary productivity and/or agricultural products as food for livestock.

Since matrilineal societies are rarely found among pastoralist societies and with animal husbandry (Murdock, 1949; Holden and Mace, 2003), findings should show a negative correlation between animal husbandry and matrilineality (second anthropological theory). Indeed, I find a negative correlation between nomadic pastoralism and animal husbandry on the likelihood of adopting a matrilineal system (see table 9), while I find no association with hunting-gathering. I use the animal husbandry index (figure 4) as it is the most appropriate measure for the domestication of animals. As indexes are continuous values between 0 and 1, I compute one minus the mean land suitability for animal husbandry to have a measure of animal husbandry unsuitability for each ethnicity.

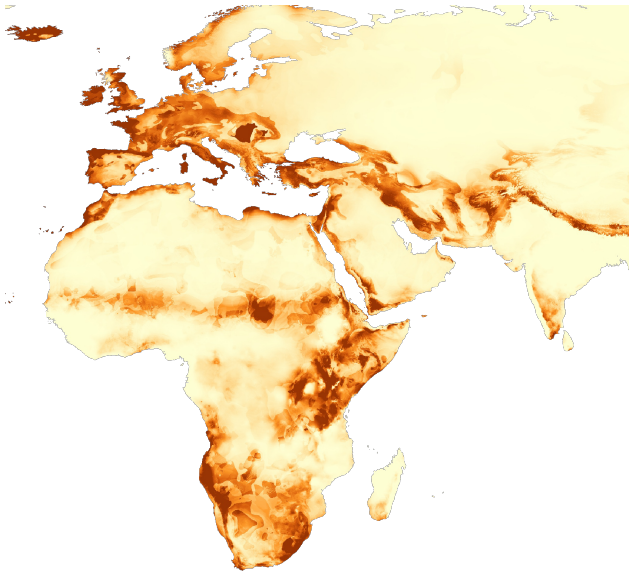


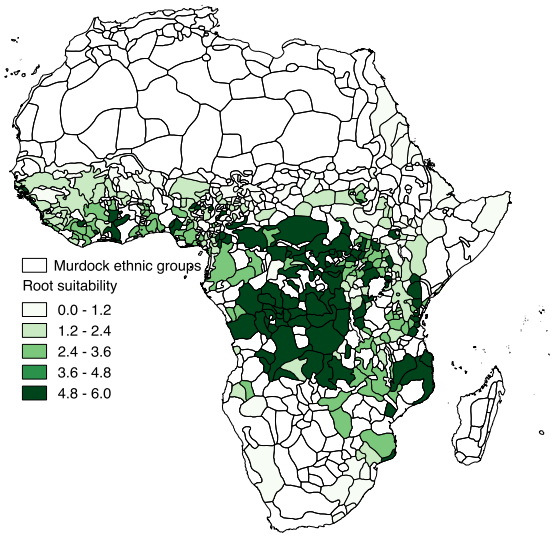
Figure 4: Land Suitability For Animal Husbandry From Beck and Sieber (2010)

As a final step, I construct a geoclimatic index which combines the land suitability for root crops (maximum index value for cassava and yam) with the land unsuitability for animal husbandry (one minus the animal husbandry suitability index). Figure 5 presents in (1) the ethnic group level means for the root crop suitability index, in (2) the animal husbandry unsuitability index, in (3) the final geoclimatic index that I created, predicting the prevalence of matrilineality, and in (4) the *Murdock Map of Ethnic Groups* depicting matrilineal and patrilineal ethnic groups in red and blue respectively. At first glance, the maps show a geographic correlation between the index and the location of matrilineal kinship systems: in particular, the index presents higher values along the matrilineal belt and nearby Ivory Coast in Western Africa.

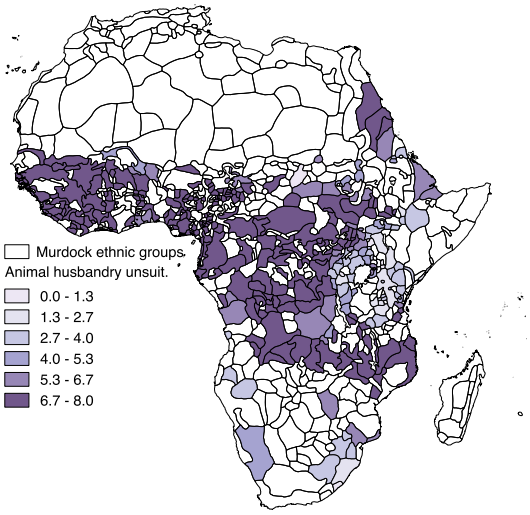
Figure 10 shows preliminary correlations between the geoclimatic index and other types of subsistence economies from the *Ethnographic Atlas*. Extensive agriculture as subsistence economy and roots as main crops were prevalent in areas where soil characteristics are simultaneously suitable for root crops and unsuitable for animal husbandry. The index is also strongly negatively correlated with large domesticated animals such as cows, horses and pigs as opposed to small domesticated animals like sheeps. In the literature, matrilineality is negatively associated with domesticated animals like cows and camels (Holden and Mace, 2003), no evidence has been found concerning small animals though. Figure 11 shows that the index is negatively correlated with the land suitability for nomadic pastoralism. It is also not correlated with agricultural suitability. The correlation between the geoclimatic index and the land suitability for hunting-gathering is slightly positive.

Contemporary Data To explore the persistent effect of matrilineality on female education, labor and marriage market outcomes, I use the *Demographic and Health Survey*, a representative database conducted at the individual and household levels in different developing countries worldwide over several years. The *DHS* provides detailed information on ethnolinguistic group, occupation, education, literacy, marrital status, partner's occupation, possessions, fertility and health.

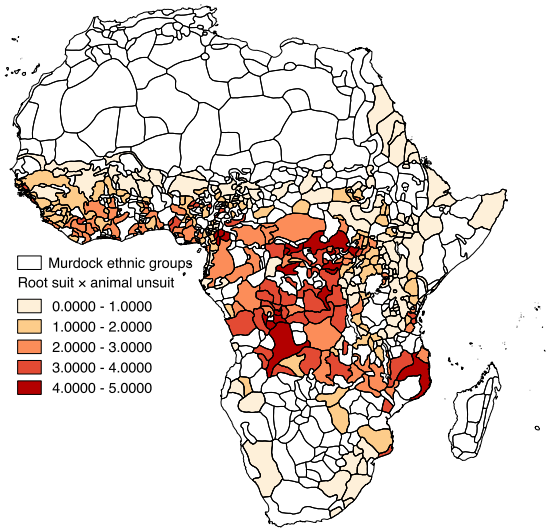
To link past to present data, I match each ethnic group of Sub-Saharan Africa from the *Ethnographic Atlas* with the ethno-linguistic group of each respondent of the *DHS*, using ethnolinguistic information on ethnic groups and world languages from the *Ethnologue* and following the method from Becker (2018). With this process, I am able to find 166 ethnic groups in the *DHS* over the 408 initial groups from the *EA*. All the variables that I use from the *DHS* are depicted in details in Appendix A.



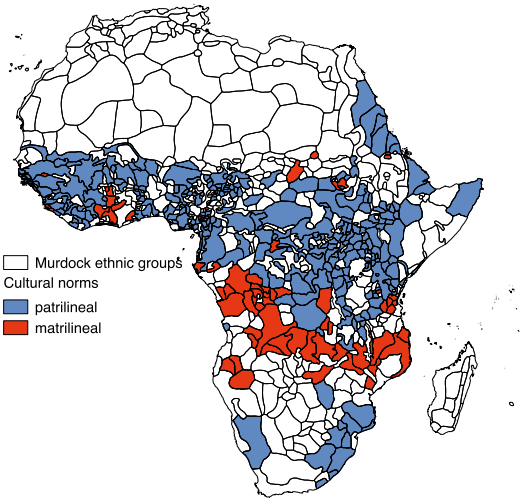
(1) Roots Suitability Index



(2) Animal Husbandry Unsuitability Index



(3) Roots×Animal Index



(4) Ancestral Matrilineal & Patrilineal Societies

Figure 5: Ancestral Matrilineality and Geoclimatic Index)

5 Empirical Strategy

In a first part, I exploit exogenous geoclimatic variations in Sub-Saharan Africa to find the ecological conditions beneficial to matrilineal kinship systems, testing two hypotheses from the anthropological literature. More precisely, I test whether the coincidence of land suitability for *root crops* related to the practice of extensive hoe agriculture and the land unsuitability for *animal husbandry* associated with the presence of large domesticated animals predicted the prevalence of ancestral matrilineality.

Then, to assess the long term impacts of ancestral matrilineality on the socioeconomic status of women, I use individual data from the *Demographic and Health Survey*. I perform an OLS regression controlling for various specifications on socioeconomic outcomes and gender norms and attitudes. To corroborate the results and bring further evidence on causality, I perform an IV regression and a geographic RD, using distance from the ancestral matrilineal border to the village location of the respondent as source of exogenous variation.

5.1 Ecological Determinants of Matrilineal Kinship Systems

I first exploit geographical variation in kinship system adoption in Sub-Saharan Africa from data from the *Ethnographic Atlas* and the *Murdock Map of Ethnic Groups*. I create a geoclimatic index from *FAO* suitability measures based on the two anthropological theories presented in section 3: the first explains matrilineality by the prevalence of extensive hoe agriculture in root crops, where women tend to perform most agricultural tasks and the second argues that matrilineality is less likely to emerge in environments favorable to movable property in the hands of men, such as domesticated animals which might challenge matrilineal rules of inheritance. The ecologicalindex_e is built at the ethnicity level, as follows:

$$\text{ecologicalindex}_e = \max\{\text{cassava}_e, \text{yam}_e\} \times \text{noanimalhusbandry}_e \tag{1}$$

where cassava_e and yam_e correspond to the land suitability for cassava and yam respectively; and $\text{noanimalhusbandry}_e$ is the land unsuitability for animal husbandry, which is equal to one minus the land suitability for animal husbandry ranging between 0 and 1. Figure 5 displays the value of the ecologicalindex_e at the ethnic group level.

I then regress the ecological index on ancestral matrilineality. This index, constructed from land suitability values which are objective measures based on temperature, elevation and soil characteristics, is supposed to be exogenous to the decision of adopting a matrilineal kinship system.

$$\text{matrilineality}_e = \alpha + \beta \text{ecologicalindex}_e + \gamma_t^{ea} + \gamma_g + \delta X_e^{histgeo} + \epsilon_e \tag{2}$$

where matrilineality_e takes value 1 if the ethnic group is a matrilineal kinship and 0 if it is a patrilineal kinship; $\text{ecologicalindex}_e^e$ is the geoclimatic index; γ_t^{ea} controls for the ethnic group's year of observation; γ_g are country fixed effects; and $X_e^{histgeo}$ controls for historical characteristics such as level of juridictions, settlement patterns, animal plow, polygyny, routes of explorers, religious missions, and geoclimatic factors (mean temperature, precipitation, elevation, terrain ruggedness).

5.2 Persistent Effects of Matrilineal Kinship Systems on the Contemporary Status of Women

OLS Regression The second part of the paper explores the contemporary impacts of matrilineal kinship systems on female education and labor and marriage market outcomes. I run the following OLS regression at the individual level i:

$$Y_{ie} = \alpha + \beta \text{matrilineality}_i + \gamma_t^{dhs} + \gamma_t^{ea} + \gamma_g + \delta X_e^{histgeo} + \eta X_i^{indiv} + \epsilon_{ie} \quad (3)$$

where matrilineality_i is equal to 1 if individual i belongs to a matrilineal-origin kinship ethnic group and 0 if she belongs to a patrilineal-origin kinship ethnic group; Y_{ie} is the outcome of interest from the *DHS* such as *woman's years of education*; γ_t^{ea} controls for the ethnic group's year of observation from the *Ethnographic Atlas*; γ_g are geographic fixed effects (country and within-country region fixed effects); $X_e^{histgeo}$ controls for historical characteristics such as local level of juridictions, settlement patterns, animal plow, polygyny, routes of explorers, religious missions, and geoclimatic factors such as mean temperature, precipitation, elevation, terrain ruggedness; X_i^{indiv} controls for individual characteristics such as age, religion fixed effects, and marital status and years of education when it is not the outcome variable. Standard errors are clustered at the ethnic group level.

Geographic Regression Discontinuity To address the potential identification issues that might be encountered with OLS, I use the distance from the ancestral matrilineal border to the village location of the respondent as exogenous variation. In fact, individuals today are not supposed to have chosen their location with respect to the distance to the ancestral matrilineal border. The matrilineal border is an arbitrary border and ethnic groups living close to it are supposed to be similar in several respects. My methodology is based on Lowes (2017). For RD results to hold, everything but the treatment (i.e. being in a matrilineal village) must vary smoothly at the border. I run the following regression discontinuity specification at the individual level i located in village v:

$$Y_{iev} = \alpha + \beta \text{matrilineal}_{iv} + f(\text{location}_v) + \gamma_t^{dhs} + \gamma_t^{ea} + \gamma_g + \delta X_e^{hist} + \eta X_i^{indiv} + \epsilon_{iev} \quad (4)$$

where Y_{iev} is the outcome of interest for individual i; matrilineal_{iv} is an indicator equal to 1 if the village v is on the matrilineal side and 0 if it is on the patrilineal side; $f(\text{location})_v$ is the RD polynomial which controls for smooth functions of geographic location for village v; and X_e^{hist} and X_e^{indiv} are vectors of covariates at the ethnic group e and individual i levels.

Instrumental Variation Approach Finally, to bring further support to the causal interpretation of the results, I instrument ancestral matrilineality with the geoclimatic index. The IV method requires to fulfill two conditions to rule out endogeneity issues: (1) relevance, the instrument ecologicalindex_e must be correlated with the endogenous variable matrilineality_e, and (2) the exclusion restriction assumption implies that those specific ecological conditions do not affect contemporary female education through channels other than ancestral matrilineality (the instrument itself does not cause Y_{iev}). Since this last condition is difficult to meet in this context, the IV results have to be considered with a caveat.

6 Ecological Determinants of Matrilineal Kinship Systems

Origins of Kinship Systems in Sub-Saharan Africa Anthropological theories and evidence suggest that matrilineal societies were associated with extensive hoe agriculture, relative to intensive plow agriculture, and were rarely pastoralist (Murdock, 1949; Aberle, 1961; Ember, 1983; Holden et al., 2003; Holden and Mace, 2003; Shenk et al., 2010). Aberle (1961) tests for ecological correlates of matrilineality in 565 cultures worldwide and finds that 56% of these societies were horticulturalist, practising extensive agriculture, while only 23% were pastoralist.

	Dependent variable: Ancestral Matrilineality					
	(1)	(2)	(3)	(4)	(5)	(6)
Land Suitability for Roots	−0.663	−0.597	−1.195*	−1.121	−1.569**	−1.926***
	(0.557)	(0.612)	(0.667)	(0.712)	(0.715)	(0.707)
Land Unsuitability for Animal Husb.	−0.236	−0.206	−0.056	−0.037	−0.217	−0.111
	(0.184)	(0.202)	(0.233)	(0.272)	(0.268)	(0.275)
Geoclimatic Index	**1.502****	**1.445****	**1.601****	**1.499****	**1.750****	**2.607*****
	(0.669)	(0.726)	(0.773)	(0.828)	(0.838)	(0.830)
Year of Obs. FE	No	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes
Ethno-Linguistic Group FE	No	No	No	Yes	Yes	Yes
Historical Controls	No	No	No	No	Yes	Yes
Geoclimatic Controls	No	No	No	No	No	Yes
R-squared	0.0734	0.11	0.35	0.37	0.48	0.54
Observations	408	406	406	384	346	346

Note: OLS estimates, impact of land suitability for roots and land unsuitability for animal husbandry on ancestral matrilineality. Suitability index ranges values from 0 to 1. Robust standard errors are reported in parenthesis. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 3: Impact of Geoclimatic Index on Ancestral Matrilineality: OLS Estimates

Using suitability measures from *FAO* and Beck and Sieber (2010), I test whether the land suitability for root crops such as cassava and yam and the land unsuitability for animal husbandry predict the prevalence of matrilineal kinship systems in Sub-Saharan Africa. Exploiting exogenous sources of geoclimatic variations, which are measured from objective indexes based on soil and geoclimatic characterisitcs, allows to claim for a causal impact of climate on the occurrence of cultural norms.

Column (1) of table 3 shows that the geoclimatic index combining land suitability for roots and land unsuitability for animal husbandry explains itself 7.34% of the variation in kinship systems in Sub-Saharan Africa (R-squared is 7.34% without controls). The effect remains significant whatever the specification, with year of observation, country and ethno-linguistic group fixed effects, that is, comparing matrilineal and patrilineal societies within a restricted geographic area and within a same ethno-linguistic group.

Ethno-linguistic group fixed effects correct for spatial autocorrelation. I am taking into account the fact that some ethnic groups for which occupied geographic areas are close together might have similar characteristics. Additionally, exploiting variation in kinship systems within the same ethno-linguistic

groups allows to compare matrilineal and patrilineal groups within the same family, in this case, 17 big families (see the ethno-linguistic tree of the sample under study in figure 8), removing the influence of vertically inherited norms. Thus, changes in kinship systems among the same ethno-linguistic families brings evidence that matrilineality has been created as an **adaptative process** in response to ecological conditions (BenYishay et al., 2017).

A striking result, stressed by table 13 showing the impact of the land suitablity for root index and the land unsuitability for animal husbandry index added separately, is that it is the very coincidence of both land suitability for roots and land unsuitability for animals that predicted the prevalence of matrilineal kinship systems. In fact, both indexes added separately have a slight if not insignificant impact on matrilineality, which disappears or appears with additional specifications. The impact is much stronger and consistent whatever the regression specifications with the interaction of both indexes.

Table 14 displays the contribution of many other potential contributing factors and controls. Regressions presented in columns (6) to (8) explains almost 55% of the variation in kinship systems. The *FAO* land suitability index for cereal crops does not have any impacts on matrilineality, as does the land suitability indexes for barley, millet, rye, sorghum or wheat, which are other types of cereals cultivated in Sub-Saharan Africa. Furthermore, the land suitability index for agriculture representing soil suitability for high agricultural yields from Beck and Sieber (2010) is significant at the 10% level and negative. These results consolidate the view that land suitability for cereals did not have an impact on matrilineality and that these societies did not evolve in environments suitable for intensive agricultue where potential yields are high. These results are in line with Ember (1983) and Demie (2018) that differenciate between extensive hoe agriculture, which allows for a higher sex division of labor ratio towards women as they can participate more in labor tasks in a root-based agriculture, and intensive agriculture which is associated with plow use and cereal cultivation.

The impact of the geoclimatic index on matrilineal kinship systems is strong and significant even controlling for a whole battery of control variables (see columns (7) and (8) of table 14) like other crop suitabilities, landuse suitabilities, malaria suitability and TseTsefly suitability from Alsan (2015).

As a consequence, it is likely that matrilineal kinship systems prevailed in areas where:

- women could increase their **agricultural production** thanks to the cultivation of root crops with a shifting agriculture, allowing them to hold more resources and to increase their **landed property**
- **movable properties** that can be handled by men such as large domesticated animals (which can be used as bride price) do not **compete** with landed property, meaning that it does not challenge matrilineal rules for landed property (Aberle, 1961; Holden and Mace, 2003).

External Validity In a second phase, the question of whether these results are specific to Sub-Saharan Africa or if they can also apply on other continents arises. As an external validity assessment of the findings, I test whether the index has an impact on ancestral Asian and Australian societies. I cannot extend the analysis to neither Europe, as there is no variation in kinship systems there according to the *Ethnographic Atlas*, nor America, as Beck and Sieber (2010) data on land suitability for animal husbandry are not available for this continent (see map 12).

Performing the same OLS regression controlling for identical historical controls (except religious missions and routes of explorers proper to Africa) and geoclimatic factors, I find that a similar pattern affected ancestral kinship systems orginated from Asia and Australia, albeit with a slightly less strong statistical power partly due to a lower number of observations (around 113 ethnic groups) and certainly less accurate data (I only have information on latitude and longitude for Asia and Australia ethnic groups and not the historically inhabited territories). Table 15 presents the results and shows that the impact of the geoclimatic index is positive and significant for all specifications, even using country fixed effects or ethno-linguistic group fixed effects, conferring external validity to the previous findings.

Explanatory Mechanisms After having shown that the geoclimatic index predicts almost 10% of the variation in kinship systems in Sub-Saharan Africa, this section explores the historical mecanisms underlying the results, in other words, why a society would have adopted a matrilineal kinship system.

	Dependent variables:							
	Sex Division of Agri. Labor		Type of Agriculture		Main Crop Cultivated		Domesticated Animals	
	Women participate more		Extensive Hoe	Intensive	Roots	Cereals	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land Suitability for Roots	−1.104	0.353	−0.870	−0.176	−1.603**	0.457	1.167	−1.167
	(1.476)	(1.649)	(0.616)	(0.733)	(0.691)	(0.772)	(0.769)	(0.769)
Land Unsuitability for Animal Husb.	−1.836***	−1.001	−0.727***	−0.059	−0.821***	0.686**	−0.098	0.098
	(0.502)	(0.621)	(0.240)	(0.286)	(0.269)	(0.301)	(0.300)	(0.300)
Geoclimatic Index	**3.862****	**0.554**	**1.665*****	**−0.202**	**2.421*****	**−0.803**	**−2.196*****	**2.196*****
	(1.682)	(1.998)	(0.640)	(1.033)	(0.772)	(0.984)	(0.805)	(0.805)
Year of Obs. FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethno-Linguistic Group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geoclimatic Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.19	0.40	0.26	0.3	0.24	0.32	0.43	0.43
Observations	244	237	346	346	346	346	346	346

Note: OLS estimates, impact of land suitability for roots and land unsuitability for animal husbandry on ancestral matrilineality. Suitability index ranges values from 0 to 1. Variable *Women Participate More* takes on integer values between 1 and 5 and increases in female parcipation. Robust standard errors are reported in parenthesis. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 4: Impact of Geoclimatic Index on Subsistence Economies: OLS Estimates

Table 4 depicts preliminary results on the impact of the geoclimatic index on the types of susbistence economies prevailing in matrilineal kinship systems from the *Ethnographic Atlas*. The indicator is positively correlated with the practice of extensive hoe agriculture as main mean of subsistence, the cultivation of root crops and the domestication of small animals. More importantly, the findinds show that the index is associated with an increase in female participation in agricultural work of 3.862, controlling for ethno-linguistic group fixed effects and historical factors. The effect remains positive but loses significance with additionnal controls such as year of observation dummies and geoclimatic controls. It appears that societies living in areas where geoclimatic conditions were favorable to the cultivation of roots without large domestic animals adopted an extensive hoe agriculture system as mean of subsistence with small animals, allowing women to participate more than men in agricultural tasks. Those societies might hence have a comparative advantage to invest in daughters relative to sons, as they are the ones who work on lands and who produce and bring carbohydrate to feed the household.

Columns (1) and (2) of table 5 show that the index has a positive impact of matrilineal inheritance rules for both landed and movable properties. A 0.1 increase in the index is associated with a 17.3% increase and a 20.8% increase in the likelihood of adopting a matrilineal inheritance rule for immovable property and movable property respectively. In addition, the index has a strong negative impact on bride price: in fact, without large domesticated animals, men cannot use them as bride wealth in exchange for the bride. In line with the previous result, the index has also a positive impact on bride service: in matrilineal societies, once married, the groom offers his service to his bride's family. However, the impact on matrilocality is positive but not significant, probably because of a poor sttaistical power (standard errors are very high compared to the coefficient value).

	Dependent variables:				
	Matrilineal Inheritance Rules		Marital Norms		
	Landed Property (1)	Movable Property (2)	Bride Price (3)	Bride Service (4)	Matri-locality (5)
Land Suitability for Roots	−0.624	−0.899	1.750**	−0.844*	0.0001
	(0.672)	(0.738)	(0.698)	(0.488)	(0.606)
Land Unsuitability for Animal Husb.	0.119	0.160	−0.020	0.085	0.349
	(0.267)	(0.296)	(0.272)	(0.190)	(0.246)
Geoclimatic Index	**1.732****	**2.078****	**−2.265*****	**1.098****	**0.720**
	(0.801)	(0.825)	(0.839)	(0.587)	(0.725)
Year of Obs. FE	Yes	Yes	Yes	Yes	Yes
Ethno-Linguistic Group FE	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes
Geoclimatic Controls	Yes	Yes	Yes	Yes	Yes
R-squared	0.36	0.34	0.21	0.17	0.34
Observations	269	284	345	345	330

Note: OLS estimates, impact of land suitability for roots and land unsuitability for animal husbandry on ancestral matrilineality. Suitability index ranges values from 0 to 1. Robust standard errors are reported in parenthesis. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 5: Impact of Geoclimatic Index on Other Cultural Norms: OLS Estimates

7 Long-Term Impacts of Ancestral Matrilineality

7.1 OLS Regressions

Female Education I examine first whether matrilineal-origin women are less educated compared to their patrilineal counterparts. The results confirm hypothesis 2: columns (1) and (2) show that matrilineality has a significant and negative impact on female years of education and levels of education (which is equal to 1 if she attained at least secondary or tertiary school, 0 otherwise). Being of matrilineal-origin decreases the years of education by almost one year. This result holds controlling for individual, historical and geoclimatic factors, and country and year of survey fixed effects. Matrilineal women are also less likely to be able to read (the outcome variable related to literacy indicates whether the respondent was able to read a passage during the survey). Results hold and have a stronger statistical power considering only variations at the within-country region level (see table 16).

	Dependent variable:		
	Education (year)	Education (level)	Literacy (reading)
	(1)	(2)	(3)
Matrilineal	-0.881^{**}	-0.047^{*}	-0.085^{***}
	(0.346)	(0.024)	(0.024)
Country & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	478,065	478,292	377,907
Cluster	166	166	158
R^2	0.383	0.241	0.303

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Levels of education is equal to 1 if she attained at least secondary or tertiary school, 0 otherwise. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 6: Impacts of Matrilineality On Female Education

Labor Market Then, I explore the implications of a lower education on labor market outcomes. Regressions of table 8 show that matrilineal women are more likely to work in agriculture, albeit the coefficient is not significant for the OLS regression. They seem to be less likely to be self-employed in agricultural job, meaning that they probably work for their family. Column (4) shows that matrilineal women are 3% point less likely to get a white-collar job. In addition, they seem to contribute the most to the household expenditures. Those results are aligned with hypothesis 2: as matrilineal-origin women are more likely to hold assets, they are less likely to be educated and, in that respect, to get a clerical or white-collar job. Most results hold using within-country region fixed effects (see table 17).

	Dependent variable:					
	Occupation Agriculture	Occupation Agriculture (Self)	Occupation Manual	Occupation White-Collar	Occupation Domestic	Household Expenditures Paid by Woman (0/1)
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	0.005	−0.032**	0.007	−0.032**	−0.006**	0.090
	(0.020)	(0.015)	(0.010)	(0.016)	(0.002)	(0.063)
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	445,879	117,015	439,727	280,590	445,879	28,694
Cluster	166	158	166	166	166	79
R^2	0.181	0.605	0.034	0.196	0.042	0.114

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 7: Impacts of Matrilineality On Women's Labor Market

Marriage Market Finally, the impact of being of matrilineal origin on education and labor market outcomes might affect marriage market outcomes as well. Results from table 8 show that matrilineal-origin women are more likely to have weaker marriage bonds: they are 1.4% points more likely to be divorced and 4.3% points more likely to have had more than one union in their life. The structure of matrilineal kinship systems, relative to patrilineal kinship systems, allow women to have greater support from their own kin groups, which allows them to have an outside option if they want to leave their husband. Furthermore, columns (4) and (6) show that, on average, partners of matrilineal women are less likely to be educated and to occupy a white-collar job. However, the statistical power of those regressions with country fixed effect does not seem to be high enough. Most results hold using within-country region fixed effects (see table 18), and the impact on partner's years of education is significant.

	Dependent variable:					
	Extensive Margin			*Intensive Margin*		
	Marital Status In Union	Marital Status Divorced	Had More Than One Union	Partner Edu. (Years)	Partner Occup. Agriculture	Partner Occup. White-Collar
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	−0.018	0.014***	0.043***	−0.254	0.032	0.005
	(0.013)	(0.003)	(0.009)	(0.164)	(0.022)	(0.011)
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	478,065	478,065	366,349	335,134	349,681	316,249
Cluster	166	166	165	164	165	164
R^2	0.216	0.032	0.075	0.549	0.214	0.131

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 8: Impacts of Matrilineality On Marriage Market

Explanatory Mechanisms What can explain the lower level of human capital in matrilineal systems? Matrilineal kinship systems are a gender-biased social institution strongly correlated with matrilineal rules of inheritance, meaning that lineage and inheritance are traced through the mother line. Those systems allow women to hold more assets: women are the ones who inherit immovable properties, such as land. Table 9 explores the mechanisms underlying the main results of the paper. Column (1) and (2) show that being of matrilineal origin increases the probability for a women of being the unique owner of a land or a house by 3.9% points and 3.3% points respectively. In addition, they are more likely to live in rural areas. Results hold controlling for individual, historical and geoclimatic factors, and country and year of survey fixed effects. Table 19 depicts the same regressions, using within-country fixed effects.

Those insights bring evidence of the persistence of cultural norms over time, in this case matrilineal kinships and rules of inheritance, corroborating hypothesis 3. In fact, as matrilineal-origin women inherit immovable properties, they are in a way bound to live in rural areas and to work on lands.

	Dependent variable:		
	Owns a Land Alone (0/1)	Owns a House Alone (0/1)	Has a Rural Status (0/1)
	(1)	(2)	(3)
Matrilineal	0.039***	0.032**	0.051**
	(0.015)	(0.015)	(0.021)
Country & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	203,561	203,632	478,065
Cluster	141	141	158
R^2	0.093	0.105	0.212

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 9: Impacts of Matrilineality On Female Possessions & Rural Status

7.2 Geographic Regression Discontinuity

To address the potential identification issues which might be encountered with OLS, I use the distance to ancestral matrilineal border as exogenous variation. In fact, individuals are not supposed to have chosen their distance to matrilineal border historically inhabited by preindustrial ethnic groups. For RD results to hold, everything but the treatment (i.e. being in a matrilineal village) must vary smoothly at the border. The matrilineal border is an arbitrary border and ethnic groups living close to it are supposed to be similar in several respects.

Results of table 21 show the impact on geoclimatic factors at both sides of the border in each village location (average values are computed at the village level). There is no significant difference in average temperature and elevation at the border. However, the impact on precipitations is slightly negative at the 10% level for three regression specifications over four. Overall, those findings bring evidence that there is no significant difference in geoclimatic conditions in each village location today.

Tables 10, 11, 12 show that most results hold with several RD specifications with a 100 km bandwidth, controlling for individual and historical, using year fixed effects and comparing individuals within the same country. I also control for geoclimatic conditions, including the mean temperature, elevation and precipitation of each village in the main regressions. Figures 13, 14, 15, and 16 depict the proportion of female respondents each 5km-bin from the matrilineal border (positive values on the matrilineal side, and negative values on the patrilineal side) for each variable. Even though those plots depict descriptive statistics without considering geographic fixed effects which can explain part of the variations, most of them show a clear cut-off at the border, bringing evidence, in addition to the RD coefficients, of a causal impact of ancestral matrilineal institutions on contemporary outcomes. The significant and negative impacts of matrilineality on years and levels of education are in line with the cut-off observed at the border. However, albeit I find a strong and negative impact on literacy based on reading passage in the regressions, I do not observe a discontinuity with a lower female literacy rate on the matrilineal side in the plots: this can be explained by country fixed effects, which are taken into account in the regression, comparing female respondents within the same country. Matrilineal-origin women seem to be less willing to get a "white-collar job" and to have a domestic occupation, they are also the ones who contribute the most to household expenditures, corroborating OLS findings. Although there seem to be no strong significant difference between matrilineal and patrilineal women in agricultural jobs, the sign of the coefficient is positive. Matrilineal-origin women seem to work in farming rather than in "white-collar" occupations. Table 12 stresses the lower education of matrilineal women's partners. Furthermore, those results support the idea that matrilineal-origin households are less "stable" than patrilineal ones: since matrilineal women hold asset, they have an outside option if they ask for a divorce, and hence, are more willing to end the mariage in case of strong disagreement with their husband. I find that matrilineal-origin women are more likely to be divorced and to have had more than one union. Finally, table 20 confirms the significant impacts of matrilineality on female possession (owning a land/house alone) and their rural status as explanatory mechanisms.

	Dependent variable:		
	Education (level)	Education (year)	Literacy (reading)
	(1)	(2)	(3)
	Panel A: Linear Polynomial in Distance		
Matrilineal	−0.946***	−0.049**	−0.086***
	(0.324)	(0.022)	(0.027)
	Panel B: Flexible Linear Polynomial in Distance		
Matrilineal	−1.066***	−0.062***	−0.097***
	(0.318)	(0.021)	(0.026)
	Panel C: Quadratic Polynomial in Distance		
Matrilineal	−1.061***	−0.061***	−0.096***
	(0.320)	(0.021)	(0.026)
	Panel D: Flexible Quadratic Polynomial in Distance		
Matrilineal	−1.080***	−0.060***	−0.107***
	(0.303)	(0.020)	(0.024)
Year & Country FE	Yes	Yes	Yes
Indiv. & Hist. Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	368,767	368,942	318,286
Cluster	162	162	155

Note: RDD estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 10: Impact on Female Education: RDD Estimates (100 km Bandwidth)

	Panel A: Linear Polynomial in Distance to Matrilineal Belt					
	Occupation Agriculture	Occupation Agriculture (Self)	Occupation Manual	Occupation White-Collar	Occupation Domestic	Household Expenditures Paid by Woman (0/1)
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Linear Polynomial in Distance					
Matrilineal	0.032	−0.012	−0.006	−0.059**	−0.006***	0.335***
	(0.025)	(0.014)	(0.011)	(0.029)	(0.002)	(0.056)
	Panel B: Flexible Linear Polynomial in Distance					
Matrilineal	0.028	−0.004	0.001	−0.064**	−0.006***	0.364***
	(0.023)	(0.012)	(0.010)	(0.028)	(0.002)	(0.050)
	Panel C: Quadratic Polynomial in Distance					
Matrilineal	0.035	−0.003	−0.001	−0.071***	−0.006**	0.356***
	(0.023)	(0.013)	(0.010)	(0.027)	(0.002)	(0.049)
	Panel D: Flexible Quadratic Polynomial in Distance					
Matrilineal	0.028	−0.006	0.006	−0.063*	−0.007***	0.280***
	(0.028)	(0.015)	(0.010)	(0.032)	(0.003)	(0.053)
Year & Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Indiv. & Hist. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	327,207	86,558	322,786	213,202	327,207	24,231
Cluster	161	152	161	161	162	62

Note: RDD estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 11: Impact on Labor Market: RDD Estimates (100 km Bandwidth)

	Dependent variable:					
	Extensive Margin			*Intensive Margin*		
	Marital Status In Union	Marital Status Divorced	Had More Than One Union	Partner Edu. (Years)	Partner Occup. Agriculture	Partner Occup. White-Collar
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Linear Polynomial in Distance					
Matrilineal	−0.006	0.005*	0.017***	−0.309**	0.022	−0.008
	(0.013)	(0.003)	(0.007)	(0.148)	(0.020)	(0.015)
	Panel B: Flexible Linear Polynomial in Distance					
Matrilineal	−0.009	0.005*	0.013**	−0.312**	0.025	−0.005
	(0.012)	(0.003)	(0.006)	(0.150)	(0.020)	(0.015)
	Panel C: Quadratic Polynomial in Distance					
Matrilineal	−0.008	0.005	0.013**	−0.339**	0.027	−0.007
	(0.012)	(0.003)	(0.007)	(0.150)	(0.022)	(0.016)
	Panel D: Flexible Quadratic Polynomial in Distance					
Matrilineal	−0.010	0.009***	0.011	−0.325**	0.005	0.007
	(0.013)	(0.003)	(0.007)	(0.159)	(0.022)	(0.016)
Year & Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Indiv. & Hist. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	343,979	343,979	264,706	244,581	252,559	236,087
Cluster	162	162	161	160	161	160

Note: RDD estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 12: Impact on Marriage Market: RDD Estimates (100 km Bandwidth)

8 Linking Present to the Past: Instrumental Variable Approach

To link the ecological conditions, which contributed to shape matrilineal kinship systems, to contemporary outcomes and to provide further empirical support to the causal interpretation of the findings, I instrument ancestral matrilineality with the geoclimatic index (land suitability for root crop interacted with land unsuitability for animal husbandry).

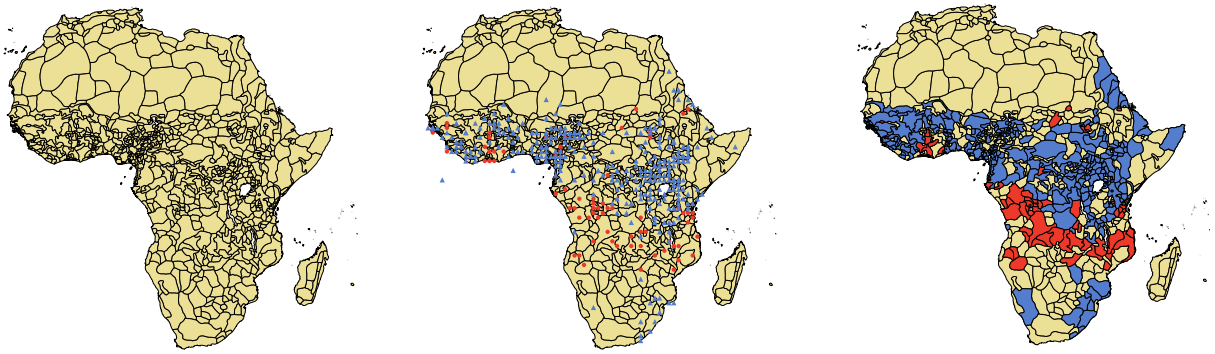
The exclusion restriction assumption implies that those specific ecological conditions do not affect contemporary female education and possessions through channels other than ancestral matrilineality. Since this condition is difficult to meet and test in this context, the results presented in this section have to be considered with a caveat. Table 22 shows the first stage regression results: with Africa region (see Figure 7) fixed effects, R-squared is 0.40 and *F*-statistic is 9.82, while with thinner fixed effects such as country fixed effects, R-squared is 0.72 and *F*-statistic is 87.05.

Tables 23, 24, 25, and 26 present the results, comparing women within the same African region. In this section, I first use wide geographic fixed effects in order to keep some variation in the geoclimatic index values. Most IV coefficients confirm the findings from the OLS regressions. Table 23 and 26 show that ancestral matrilineality instrumentalized by the land suitability for extensive agriculture in root crops without animal husbandry is associated with more immovable possessions owned by women, which implies a lower level of education.

IV coefficients have a similar if not slightly higher magnitude compared to OLS coefficients, in particular for female education outcomes. Explanatory mechanisms outcomes related to female possessions (woman owns a house/land alone) are of same magnitude, however, they became insignificant with country fixed effects, but remain of the same sign.

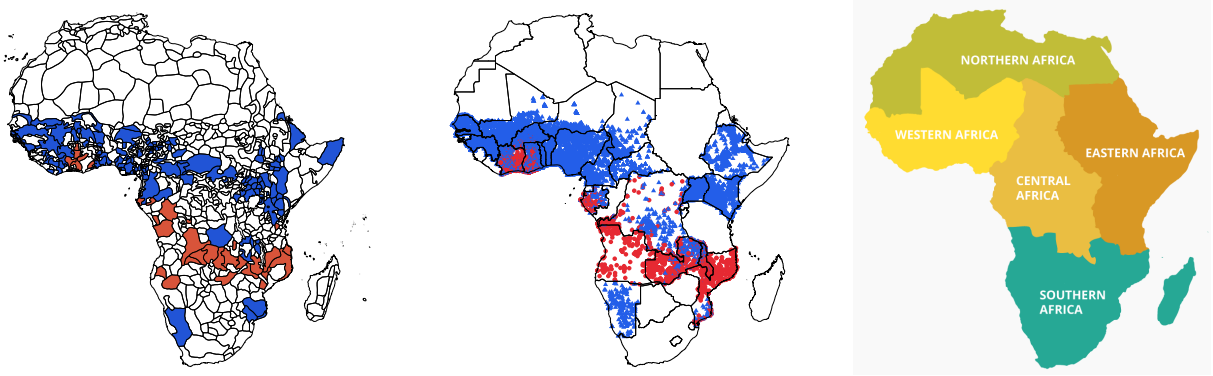
9 Conclusion

Figures



(1) Map of Ethnic Groups (2) *EA* Matrilineal Societies (3) *Murdock* Matrilineal Societies

Figure 6: *Murdock Map* of ethnic groups in (1), matrilineal and patrilineal sampling points from *Ethnographic Atlas* (2) and matrilineal and patrilineal ethnic group territories from *Murdock Map* (3)



(1) *DHS* Resp. Ancestral Ethnicity (2) *DHS* Respondents Location (3) African Subregions

Figure 7: *Murdock Map* of ethnic groups matched with *DHS* respondents' ethnicity in (1), *DHS* respondents location and ancestral matrilineal/patrilineal norms in (2) and map of African SubRegions (3)

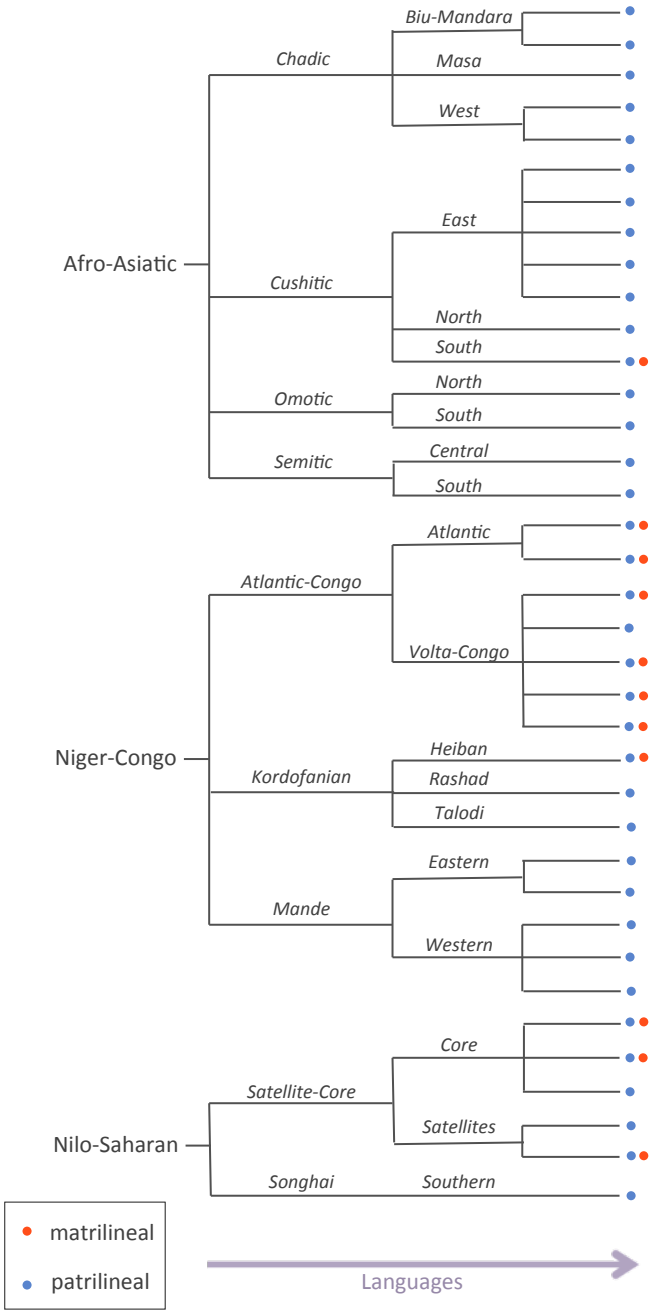
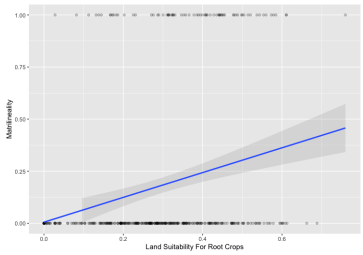
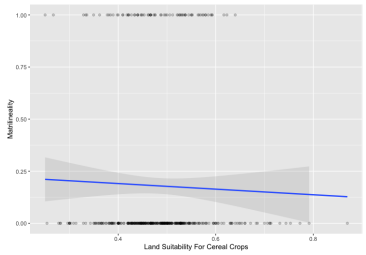


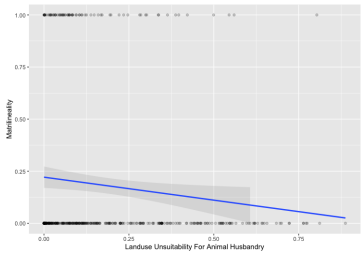
Figure 8: Ethno-linguistic Tree of Matrilineal and Patrilineal Socities from the *Ethnographic Atlas*



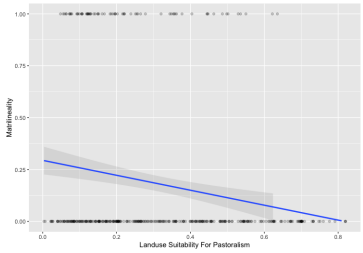
(1) root suitability



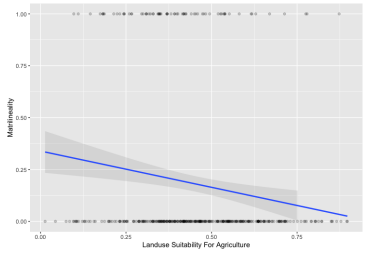
(2) cereal suitability



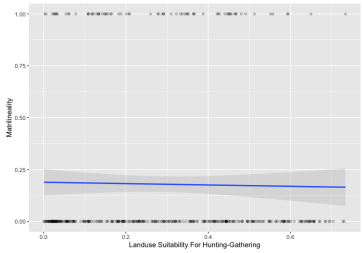
(3) animal husbandry suit.



(4) nomadic pastoralism suitability

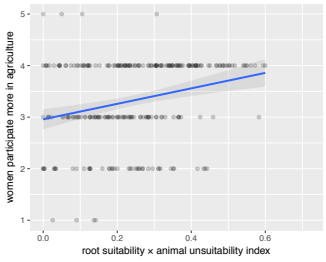


(5) agriculture suitability

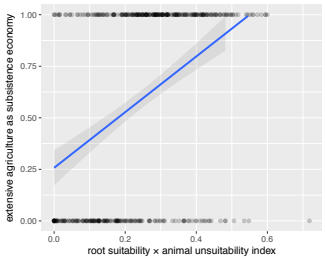


(6) hunting-gathering suitability

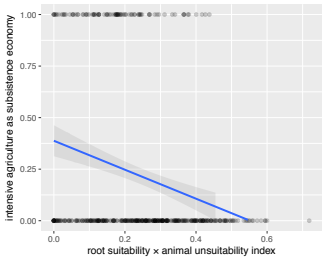
Figure 9: Correlations between Ancestral Matrilineality and Land Suitability Measures from *FAO*



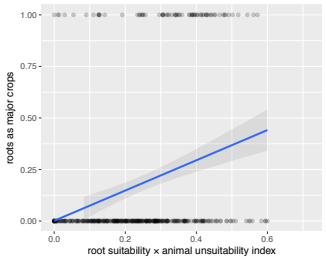
(1) women participate more



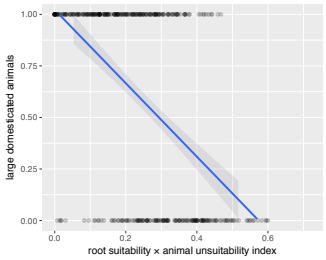
(2) extensive agriculture subs.



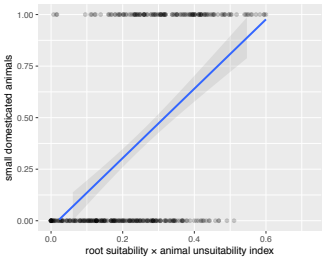
(3) intensive agriculture subs.



(4) roots as main crop

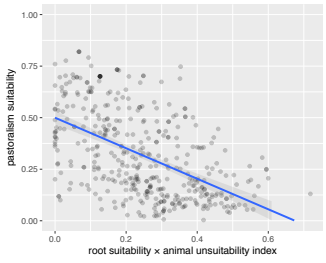


(5) large domesticated animals

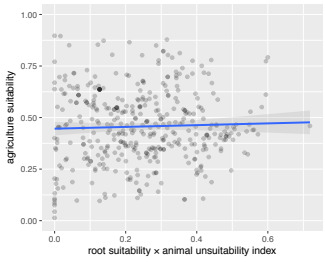


(6) small domesticated animals

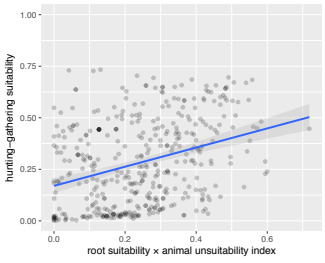
Figure 10: Correlations between Geoclimatic Index and Subsistence Economies from *Ethnographic Atlas*



(1) nomadic pastoralism suitability



(2) agriculture suitability



(3) hunting-gathering suitability

Figure 11: Correlations between Geoclimatic Index and Other Landuse Measures from Beck and Sieber (2010)

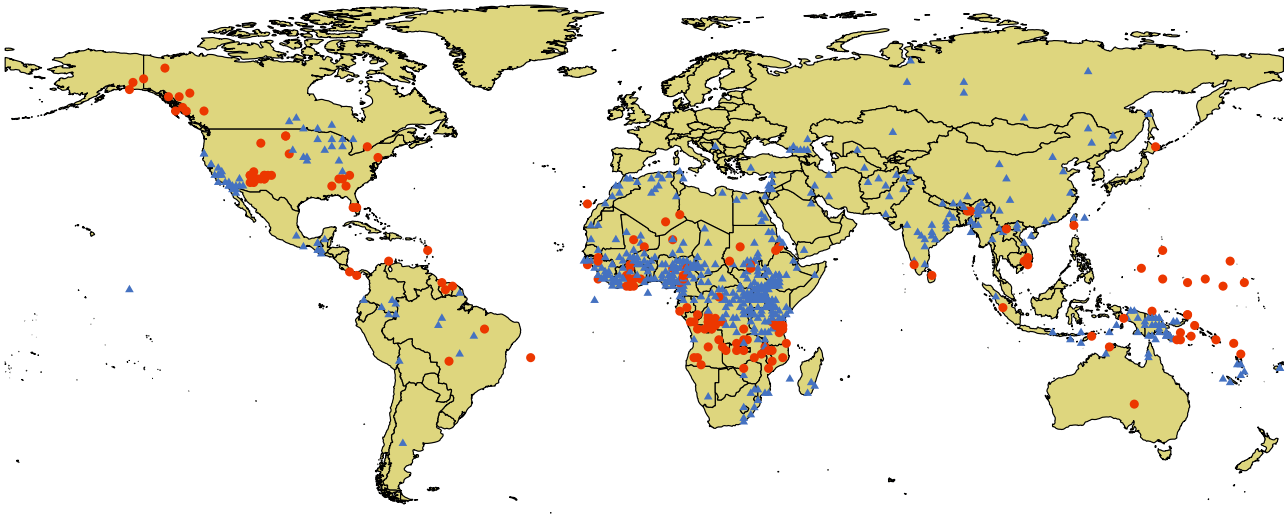
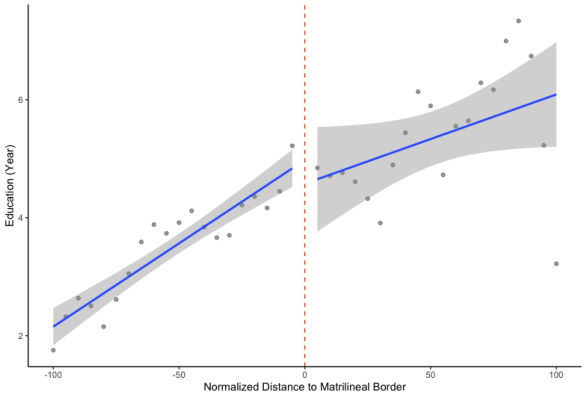
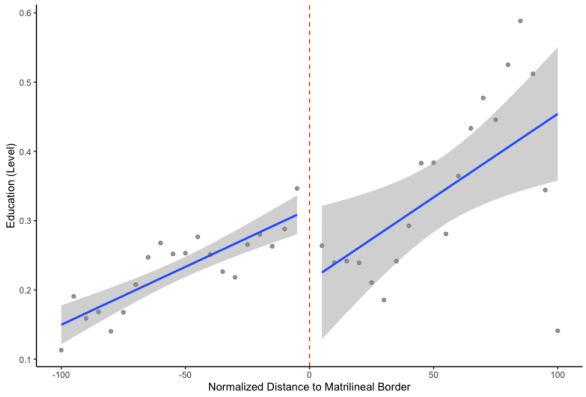


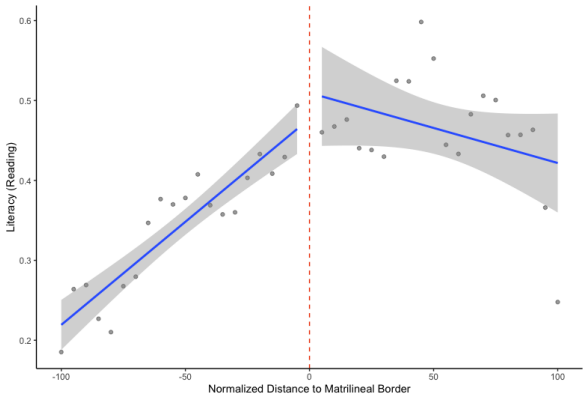
Figure 12: Ancestral Matrilineal and Patrilineal Kinship Societies Worldwide from *Ethnographic Atlas*



(1) Education (Years)

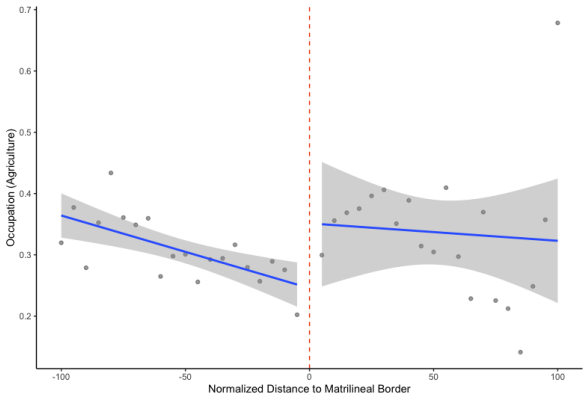


(2) Education (Levels)

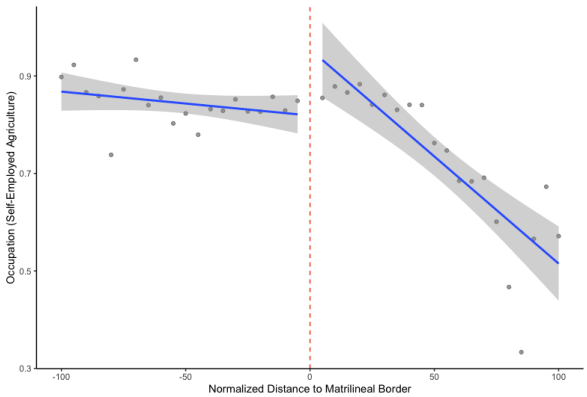


(3) Literacy (Reading)

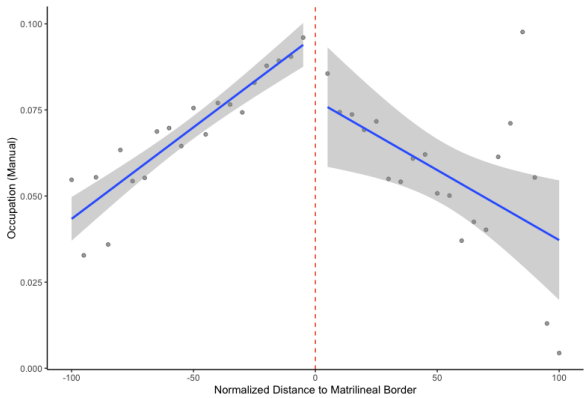
Figure 13: RDD Plots: Female Education



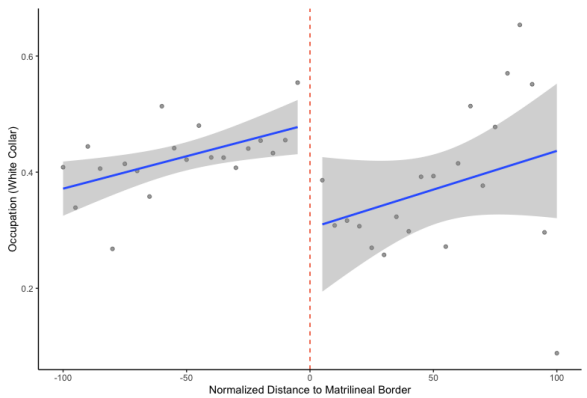
(1) Occup. Agri.



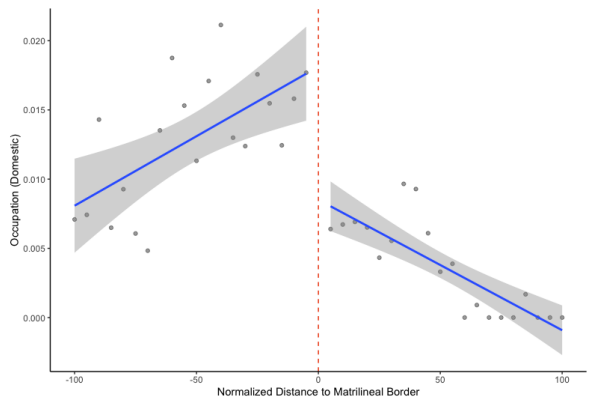
(2) Occup. Agri. (Self-Employed)



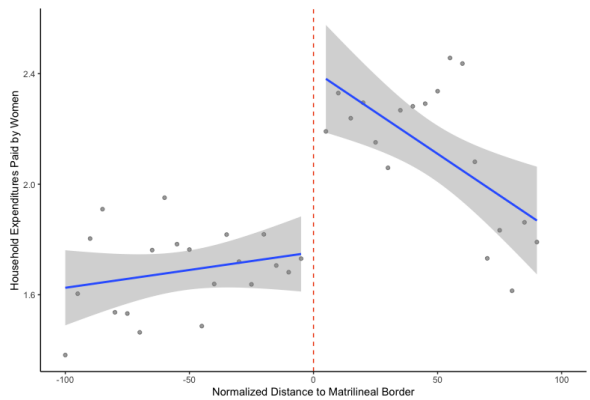
(3) Occup. Manual



(4) Occupation White-Collar

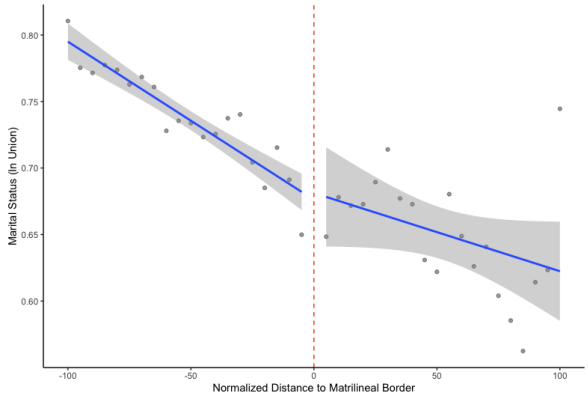


(5) Occupation Domestic

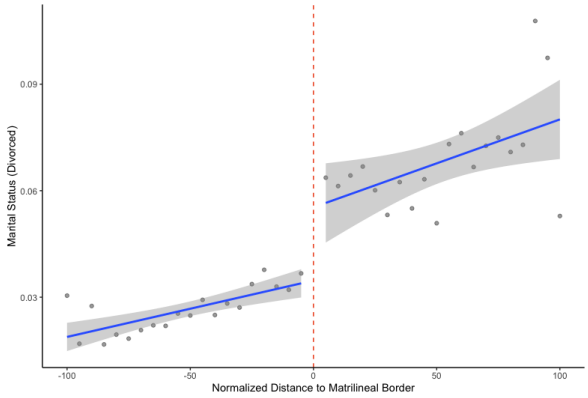


(5) Household Expenditures Paid By Woman

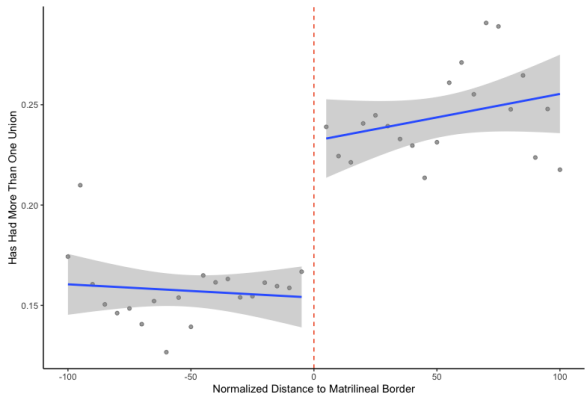
Figure 14: RDD Plots: Labor Market



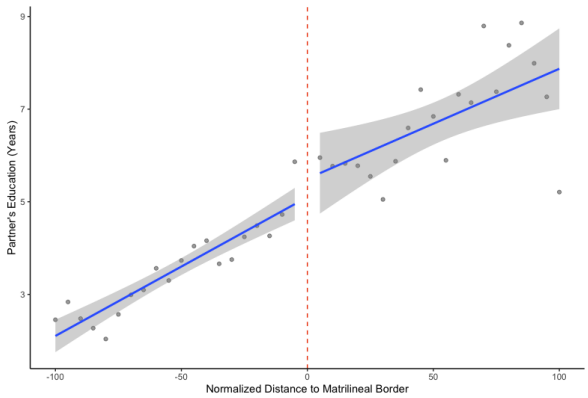
(1) Marital Status (In Union)



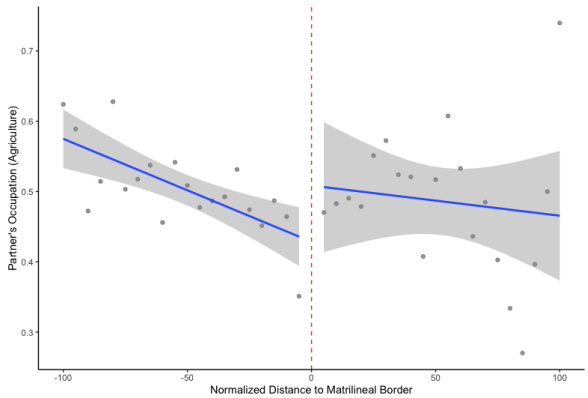
(2) Marital Status (Divorced)



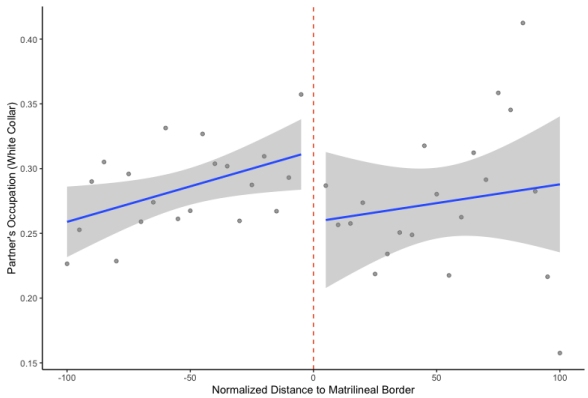
(3) Number Of Unions



(4) Partner Education

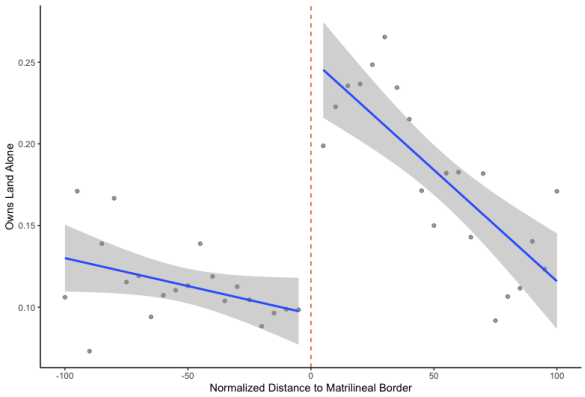


(5) Partner Occup. Agri.

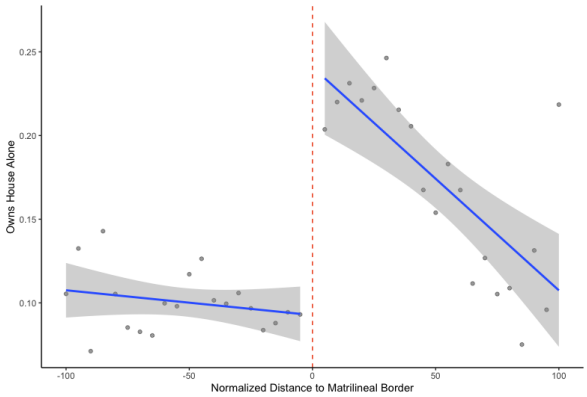


(6) Partner Occup. White-Collar

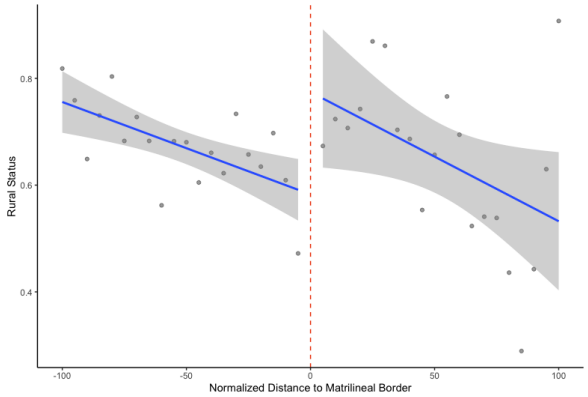
Figure 15: RDD Plots: Labor Market



(1) Owns Land Alone



(2) Owns House Alone



(3) Rural Status

Figure 16: RDD Plots: Labor Market

Tables

	Dependent variable: Ancestral Matrilineality					
	(1)	(2)	(3)	(4)	(5)	(6)
Land Suitability for Root Crops	0.559***	0.596***	0.148	0.129	0.165	0.033
	(0.122)	(0.126)	(0.157)	(0.176)	(0.184)	(0.213)
Land Unsuitability for Animal Husb.	0.120	0.146	0.298*	0.323*	0.281	0.468**
	(0.094)	(0.098)	(0.159)	(0.186)	(0.182)	(0.192)
Year of Obs. FE	No	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes
Ethno-Linguistic Group FE	No	No	No	Yes	Yes	Yes
Historical Controls	No	No	No	No	Yes	Yes
Geoclimatic Controls	No	No	No	No	No	Yes
R-squared	0.0734	0.11	0.35	0.37	0.48	0.54
Observations	408	406	406	384	346	346

Note: OLS estimates, impact of land suitability for roots and land unsuitability for animal husbandry on ancestral matrilineality. Unit of observation is the ethnic group. Suitability index ranges values from 0 to 1. Robust standard errors are reported in parenthesis. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 13: Impact of Indexes Added Separately on Ancestral Matrilineality: OLS Estimates

	Dependent variable: Ancestral Matrilineality							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land Suitability for Roots	−0.663	−0.597	−1.195*	−1.121	−1.569**	−1.926***	−1.574**	−1.825**
	(0.557)	(0.612)	(0.667)	(0.712)	(0.715)	(0.707)	(0.794)	(0.709)
Land Unsuitability for Animal Husb.	−0.236	−0.206	−0.056	−0.037	−0.217	−0.111	−0.048	−0.213
	(0.184)	(0.202)	(0.233)	(0.272)	(0.268)	(0.275)	(0.283)	(0.283)
Geoclimatic Index	**1.502****	**1.445****	**1.601****	**1.499****	**1.750****	**2.607*****	**2.079****	**2.563*****
	(0.669)	(0.726)	(0.773)	(0.828)	(0.838)	(0.830)	(0.909)	(0.826)
Land Suitability for Cereals						−0.568		
						(0.345)		
Land Suitability for Barley							−0.320	
							(2.871)	
Land Suitability for Millet							0.010	
							(0.349)	
Land Suitability for Rye							1.628	
							(2.762)	
Land Suitability for Sorghum							0.376	
							(0.323)	
Land Suitability for Wheat							0.980	
							(2.488)	
Land Suitability for Agriculture								−0.403*
								(0.217)
Land Suitability for Hunting-Gathering								−0.033
								(0.207)
Land Suitability for Pastoralism								0.281
								(0.190)
Malaria Suitability Index								−0.0003
								(0.006)
TseTse Fly Suitability Index								0.023
								(0.036)
Local Community Juridictions					0.084*	0.074	0.064	0.080*
					(0.049)	(0.046)	(0.046)	(0.047)
Settlement Patterns					−0.038*	−0.036*	−0.034*	−0.031
					(0.021)	(0.020)	(0.020)	(0.020)
Animal Plow					−0.056	−0.099	−0.097	−0.092
					(0.151)	(0.139)	(0.139)	(0.139)
Marital Composition Polygynous					0.247***	0.212***	0.211***	0.210***
					(0.066)	(0.062)	(0.061)	(0.062)
Explorers' routes					0.027	0.085*	0.092**	0.087*
					(0.049)	(0.046)	(0.046)	(0.047)
Mission Catholic					−0.023	−0.023	−0.030	−0.019
					(0.054)	(0.050)	(0.050)	(0.051)
Mission BFBS					−0.044	0.020	0.045	−0.011
					(0.122)	(0.115)	(0.115)	(0.114)
Mission Protestant					−0.069	−0.087*	−0.092*	−0.097*
					(0.053)	(0.049)	(0.048)	(0.051)
Distance to coast						−0.055***	−0.053***	−0.052***
						(0.010)	(0.011)	(0.011)
Temperature						0.065**	0.082**	0.038
						(0.033)	(0.037)	(0.035)
Elevation						0.0003	0.0003	0.0002
						(0.0002)	(0.0002)	(0.0002)
Precipitation						−0.0001	0.00002	−0.00000
						(0.0001)	(0.0001)	(0.0001)
Terrain Ruggedness						0.099***	0.100***	0.093***
						(0.025)	(0.025)	(0.024)
Year of Obs. FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Ethno-Linguistic Group FE	No	No	No	Yes	Yes	Yes	Yes	Yes
R-squared	0.073	0.12	0.35	0.37	0.48	0.54	0.55	0.54
Observations	408	406	406	384	346	346	346	346

Note: OLS estimates, impact of land suitability for roots and land unsuitability for animal husbandry on ancestral matrilineality. Unit of observation is the ethnic group. Suitability index ranges values from 0 to 1. Robust standard errors are reported in parenthesis. Significance levels are $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.10$.

Table 14: Impacts of Geoclimatic Index and Other Factors on Ancestral Matrilineality: OLS Estimates

	Dependent variable: Ancestral Matrilineality					
	(1)	(2)	(3)	(4)	(5)	(6)
Land Suitability for Roots	−1.145	−2.352	−2.501	−2.250	−8.812	−4.700**
	(1.521)	(1.523)	(1.625)	(1.637)	(5.454)	(1.897)
Land Unsuitability for Animal Husb.	0.087	−0.023	0.015	0.091	−0.298	0.067
	(0.219)	(0.224)	(0.248)	(0.270)	(0.354)	(0.351)
Geoclimatic Index	**1.479***	**2.740*****	**2.876****	**2.726****	**9.416***	**5.020*****
	(1.600)	(1.606)	(1.710)	(1.728)	(5.512)	(1.563)
Year of Obs. FE	No	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	Yes	No
Ethno-Linguistic Group FE	No	No	No	No	No	Yes
Historical Controls	No	No	Yes	Yes	Yes	Yes
Geoclimatic Controls	No	No	No	Yes	Yes	Yes
R-squared	0.032	0.25	0.31	0.35	0.61	0.58
Observations	128	126	113	113	113	97

Note: OLS estimates, impact of land suitability for roots and land unsuitability for animal husbandry on ancestral matrilineality. Suitability index ranges values from 0 to 1. Robust standard errors are reported in parenthesis. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 15: Impact of Geoclimatic Index on Ancestral Matrilineality in Asia and Australia: OLS Estimates

	Dependent variable:		
	Education (year)	Education (level)	Literacy (reading)
	(1)	(2)	(3)
Matrilineal	−0.809***	−0.076***	−0.064***
	(0.240)	(0.025)	(0.019)
Within-Country Region & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	173,907	162,213	122,962
R^2	0.380	0.286	0.240
Cluster	60	60	57

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 16: Impacts of Matrilineality On Female Education

	Dependent variable:					
	Occupation Agriculture	Occupation Agriculture (Self)	Occupation Manual	Occupation White-Collar	Occupation Domestic	Household Expenditures Paid by Woman (0/1)
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	0.008	−0.023	0.011	−0.042*	0.0005	0.033
	(0.016)	(0.017)	(0.008)	(0.023)	(0.002)	(0.063)
Within-Country Region & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	151,932	53,554	150,663	101,611	151,932	9,510
Cluster	60	56	60	60	60	31
R^2	0.231	0.607	0.049	0.264	0.028	0.159

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 17: Impacts of Matrilineality On Women's Labor Market

	Dependent variable:					
	Extensive Margin			*Intensive Margin*		
	Marital Status In Union	Marital Status Divorced	Had More Than One Union	Partner Edu. (Years)	Partner Occup. Agriculture	Partner Occup. White-Collar
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	-0.017^{**}	0.012^{***}	0.034^{***}	-0.338^{**}	0.030	-0.014
	(0.008)	(0.004)	(0.009)	(0.159)	(0.020)	(0.012)
Whitin-Country Region & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	162,146	124,799	124,134	111,625	114,628	109,986
Cluster	60	57	60	59	59	57
R^2	0.192	0.038	0.085	0.588	0.256	0.167

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 18: Impacts of Matrilineality On Marriage Market

	Dependent variable:		
	Owns a Land Alone (0/1)	Owns a House Alone (0/1)	Has a Rural Status (0/1)
	(1)	(2)	(3)
Matrilineal	0.041^{***}	0.032^{***}	0.071^{***}
	(0.013)	(0.011)	(0.022)
Within-Country Region & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	64,331	64,348	162,146
R^2	0.148	0.155	0.407
Cluster	56	56	60

Note: OLS estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 19: Impacts of Matrilineality On Female Possessions & Rural Status

	Dependent variable:		
	Owns a Land Alone (0/1)	Owns a House Alone (0/1)	Has a Rural Status (0/1)
	(1)	(2)	(3)
	Panel A: Linear Polynomial in Distance		
Matrilineal	0.026*	0.020*	0.062**
	(0.014)	(0.012)	(0.029)
	Panel B: Flexible Linear Polynomial in Distance		
Matrilineal	0.027**	0.028**	0.060**
	(0.013)	(0.011)	(0.026)
	Panel C: Quadratic Polynomial in Distance		
Matrilineal	0.027**	0.027**	0.068**
	(0.013)	(0.011)	(0.029)
	Panel D: Flexible Quadratic Polynomial in Distance		
Matrilineal	0.015	0.023*	0.044
	(0.014)	(0.012)	(0.030)
Year & Country FE	Yes	Yes	Yes
Indiv. & Hist. Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	150,620	150,688	343,979
Cluster	137	137	162

Note: RDD estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.10$.

Table 20: Impact on Female Possessions & Rural Status : RDD Estimates (100 km Bandwidth)

	Dependent variable:		
	Temperature	Elevation	Precipitation
	(1)	(2)	(3)
	Panel A: Linear Polynomial in Distance		
Matrilineal	−0.304	70.187*	−141.756**
	(0.228)	(36.715)	(63.859)
	Panel B: Flexible Linear Polynomial in Distance		
Matrilineal	−0.086	14.804	−106.003**
	(0.214)	(32.505)	(49.364)
	Panel C: Quadratic Polynomial in Distance		
Matrilineal	−0.214	44.851	−126.762**
	(0.218)	(34.587)	(56.108)
	Panel D: Flexible Quadratic Polynomial in Distance		
Matrilineal	−0.079	21.476	−89.912
	(0.236)	(37.120)	(57.676)
Year & Country FE	Yes	Yes	Yes
Indiv. & Hist. Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	368,767	368,942	318,286
Cluster	162	162	155

Note: RDD estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 21: Impact on Female Education: RDD Estimates (100 km Bandwidth)

	Dependent variable: Ancestral Matrilineality	
	(1)	(2)
Land Suitability for Roots	−1.128	−1.262**
	(1.267)	(0.633)
Land Unsuitability for Animal Husb.	−0.043	−0.323
	(0.440)	(0.229)
Geoclimatic Index	**2.516***	**2.223****
	(1.526)	(0.977)
Africa Region FE	Yes	No
Country FE	No	Yes
Observations	535,897	535,897
Cluster	166	166
R^2	0.40	0.72
F-Statistic	9.82	87.05

Note: IV first stage estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 22: Impacts of Matrilineality On Female Education

	Dependent variable:		
	Education (year)	Education (level)	Literacy (reading)
	(1)	(2)	(3)
Matrilineal	−2.400***	−0.138**	−0.176*
	(0.856)	(0.064)	(0.098)
Africa Region & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	506,305	478,292	377,907
Cluster	60	60	57
R^2	0.335	0.223	0.276

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Levels of education is equal to 1 if she attained at least secondary or tertiary school, 0 otherwise. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 23: Impacts of Matrilineality On Female Education

	Dependent variable:					
	Occupation Agriculture	Occupation Agriculture (Self)	Occupation Manual	Occupation White-Collar	Occupation Domestic	Household Expenditures Paid by Woman (0/1)
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	−0.063	0.139	0.013	0.071	−0.017*	0.225*
	(0.062)	(0.102)	(0.024)	(0.066)	(0.010)	(0.125)
Africa Region & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	445,879	117,015	439,727	280,590	445,879	28,694
Cluster	60	56	60	60	60	31
R^2	0.160	0.440	0.022	0.181	0.034	0.110

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 24: Impacts of Matrilineality On Women's Labor Market

	Dependent variable:					
	Extensive Margin			*Intensive Margin*		
	Marital Status In Union	Marital Status Divorced	Had More Than One Union	Partner Edu. (Years)	Partner Occup. Agriculture	Partner Occup. White-Collar
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	0.029	0.003	0.055*	0.206	0.086	0.016
	(0.033)	(0.009)	(0.030)	(0.409)	(0.062)	(0.035)
Africa Region & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	478,065	478,065	366,351	335,137	349,686	316,252
Cluster	166	166	165	164	165	164
R^2	0.213	0.030	0.063	0.543	0.196	0.125

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 25: Impacts of Matrilineality On Marriage Market

	Dependent variable:		
	Owns a Land Alone (0/1)	Owns a House Alone (0/1)	Has a Rural Status (0/1)
	(1)	(2)	(3)
Matrilineal	0.094***	0.077**	−0.052
	(0.035)	(0.034)	(0.068)
Africa Region & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	203,561	203,632	478,065
Cluster	141	141	158
R^2	0.087	0.099	0.202

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 26: Impacts of Matrilineality On Female Possessions & Rural Status

	Dependent variable:		
	Education (year)	Education (level)	Literacy (reading)
	(1)	(2)	(3)
Matrilineal	−1.593*	−0.083	−0.109
	(0.931)	(0.076)	(0.083)
Country & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	478,065	478,292	377,907
Cluster	166	166	158
R^2	0.383	0.241	0.303

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Levels of education is equal to 1 if she attained at least secondary or tertiary school, 0 otherwise. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 27: Impacts of Matrilineality On Female Education

	Dependent variable:					
	Occupation Agriculture	Occupation Agriculture (Self)	Occupation Manual	Occupation White-Collar	Occupation Domestic	Household Expenditures Paid by Woman (0/1)
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	−0.040	−0.018	0.045*	0.007	−0.005	0.239**
	(0.073)	(0.051)	(0.025)	(0.075)	(0.007)	(0.121)
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	445,879	117,015	439,727	280,590	445,879	28,694
Cluster	166	158	166	166	166	79
R^2	0.180	0.605	0.033	0.196	0.042	0.113

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 28: Impacts of Matrilineality On Women's Labor Market

	Dependent variable:					
	Extensive Margin			*Intensive Margin*		
	Marital Status In Union	Marital Status Divorced	Had More Than One Union	Partner Edu. (Years)	Partner Occup. Agriculture	Partner Occup. White-Collar
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	0.028	0.004	0.049	0.360	0.012	0.024
	(0.041)	(0.010)	(0.032)	(0.552)	(0.058)	(0.038)
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	478,065	478,065	366,349	335,134	349,681	316,249
Cluster	166	166	165	164	165	164
R^2	0.216	0.032	0.075	0.549	0.214	0.131

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 29: Impacts of Matrilineality On Marriage Market

	Dependent variable:		
	Owns a Land Alone (0/1)	Owns a House Alone (0/1)	Has a Rural Status (0/1)
	(1)	(2)	(3)
Matrilineal	0.055	0.065	−0.045
	(0.045)	(0.047)	(0.085)
Country & Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes
Add. Controls	Yes	Yes	Yes
Observations	203,561	203,632	478,065
Cluster	141	141	158
R^2	0.093	0.105	0.211

Note: IV estimates. Robust standard errors are clustered at the ethnic group level. Significance levels are $^{***}p < 0.01$,$^{**}p < 0.05$, $^{*}p < 0.10$. Individual controls include age, religion fixed effects, marital status. Additionnal controls include geoclimatic factors: average temperature, elevation and rainfall of the territory historically inhabited by each ethnic group.

Table 30: Impacts of Matrilineality On Female Possessions & Rural Status

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A Appendix A: List of Variables

A.1. Historical Variables: Ethnicity-Level Data from the Ethnographic Atlas

Ancestral matrilineality Based on v43: indicator that takes value 1 if matrilineal and 0 if patrilineal.

Settlements patterns Based on v30: indicator equal to 1 for nomadic or fully migratory, 2 for seminomadic, 3 for semisedentary, 4 for compact but impermenant settlements or neighborhoods of dispersed family homesteads, 5 for separated hamlets, forming a single community, 6 for compact and relatively permanent and 7 for complex settlements.

Levels of juridiction Based on v32: indicator equal to 1 if the juridictional hierarchy of local community has two levels, 2 if it has 3 levels and 3 if it has 4 levels.

Polygyny Based on v9 (marital composition of families): indicator equal to 1 if polygyny is common.

Root as main crop Based on v29: indicator that takes value 1 if the major crop type is roots.

Cereals as main crop Based on v29: indicator that takes value 1 if the major crop type is cereals.

Plow use Based on v39 indicator equal to 1 if presence of plow animals.

Large domesticated animals Based on v40: indicator equal to 1 if presence of bovine, equine or porcine animals.

Small domesticated animals Based on v40: indicator equal to 1 if absence or near absence of large domestic animals or presence of sheep and/or goats without larger domestic animals.

Bovine domesticated animals Based on v40: indicator equal to 1 if presence of bovine animals.

Equine domesticated animals Based on v40: indicator equal to 1 if presence of equine animals.

Porcine domesticated animals Based on v40: indicator equal to 1 if presence of porcine animals.

Routes of explorers Based on shapefile of precolonial explorers' routes: equal to 1 if the historical ethnic group territory contains at least one route, 0 otherwise (figure **??**).

Religious missions Based on Roome map (1924) of the historical location of Catholic and Protestant mission stations in Africa (see https://scholar.harvard.edu/nunn/pages/data-0). Dummy variables equal to 1 if at least one Catholic mission located in the historical ethnic group territory, equal to 1 if at least one Protestant mission located in the historical ethnic group territory, and equal to 1 if at least one BFBS mission located in the historical ethnic group territory.

A.2. Suitability Indexes and Geoclimate Data: Ethnicity-Level Data

Temperature Data from *FAO-GAEZ*: ethnic group level mean temperature. Mean temperature for each village location only for RD analysis.

Precipitation Data from *FAO-GAEZ*: ethnic group level mean precipitation. Mean precipitation for each village location only for RD analysis.

Elevation Data from *FAO-GAEZ*: ethnic group level mean elevation. Mean elevation for each village location only for RD analysis.

Crop suitability indexes Based on *FAO-GAEZ* and based on *Murdock Map of Ethnic Groups*: ethnic group level mean crop suitability by type of crop (cassava, yam, sweet potato, cereals, wheat, barley, rye, sorghum, millet).

Landuse suitability indexes Data from Beck and Sieber (2010) and based on *Murdock Map of Ethnic Groups*: ethnic group level mean landuse suitability indexes for sedentary pastoralism, animal husbandry, agriculture, hunting-gathering.

Malaria suitability index Malaria Suitability Index is the estimated malaria suitability measure from Alsan (2015) for each preindustrial ethnic group.

TseTse Fly suitability index TseTse Fly Suitability Index is the estimated TseTse fly suitability measure from Alsan (2015) for each preindustrial ethnic group.

A.3. Contemporary Variables: Individual-Level Data from the DHS

Rural status Based on v102: indicator equal to 1 if rural status, 0 if urban status.

Marital status Based on v501: woman's current marital status, equal to 1 if she is married.

Religion Based on v130: indicator equal to 1 for each type of religion.

Age Based on v012: age of female respondent at the time of interview.

Education (years) Based on v106: years of education.

Education (levels) Based on v106: indicator equal to 1 if respondent attended at least secondry school or a higher level, 0 if she has no education or if she only attented primary school.

Literacy (based on reading passage) Based on v155: indicator equal to 1 if respondent was able to read whole sentence during the survey, 0 if she cannot read at all or was able to read only parts of sentence.

Partner's education (years) Based on v715: partners' years of education.

Partner's education (levels) Based on v701: indicator equal to 1 if the respondent's partner attended at least secondry school or a higher level, 0 if he has no education or if he only attented primary school.

Occupation agriculture Based on v717: indicator equal to 1 if respondent is employed in agriculture, 0 otherwise (if she is employed in one of the following occupations: armed forces, security, clerical, management, sales, services, manual jobs ; or if she has a household/domestic occupation ; or if she is unemployed ; or if she does not know).

Occupation agriculture (self) Based on v717: indicator equal to 1 if respondent is self-employed in agriculture, 0 if she is only employed in agriculture.

Occupation manual Based on v717: indicator equal to 1 if respondent is employed in a manual job (skilled or unskilled), 0 otherwise (if she is employed in one of the following occupations: agriculture, armed forces, security, clerical, management, sales, services ; or if she has a household/domestic occupation ; or if she is unemployed ; or if she does not know).

Occupation "white-collar" Based on v717: indicator equal to 1 if respondent has a "white-collar" occupation such as clerical, management, sales, services ; 0 if she is employed in agriculture or manual (skilled or unskilled) jobs.

Occupation domestic Based on v717: indicator equal to 1 if respondent has a domestic/household occupation, 0 otherwise (if she is employed in one of the following occupations: agriculture, armed forces, security, clerical, management, sales, services, manual job (skilled or unskilled) ; or if she is unemployed ; or if she does not know).

Partner's occupation agriculture Based on v705: indicator equal to 1 if respondent is employed in agriculture, 0 otherwise (if he is employed in one of the following occupations: armed forces, security, clerical, management, sales, services, manual jobs ; or if he has a household/domestic occupation ; or if he is unemployed ; or if he does not know).

Partner's occupation "white-collar" Based on v705: indicator equal to 1 if respondent has a "white-collar" occupation such as clerical, management, sales, services ; 0 if he is employed in agriculture or manual (skilled or unskilled) jobs.

Househol expenditures paid by women Based on v742: indicator equal to 1 if she contributes less than half, 2 if she contributes about hald, 3 if she contributes more than half, 4 if she contributes to all household expenditures, and 0 otherwise (almost none).

Marital status (in union) Based on v501: indicator that takes value 1 if she is married or if she is living with her partner, 0 otherwise (never in union, separated, divorced, widowed).

Marital status (divorced) Based on v501: indicator that takes value 1 if she is divorced, 0 otherwise (married, living with partner, never in union, separated, divorced, widowed).

Woman had more than one union Based on v503: indicator that takes value 1 if woman had more than one union, 0 otherwise.

Woman owns land alone Based on v745a: indicator that takes value 1 if woman owns a house jointly or both alone and jointly, 0 if she owns alone or does not own.

Woman owns house alone Based on v745b: indicator that takes value 1 if woman owns a house jointly or both alone and jointly, 0 if she owns alone or does not own.

Appendix B. Main Sample

Country	Nb of Obs.	Ethnic Group from the DHS
Angola	14,379	Chokwe/Kioko, Kikongo/Ukongo, Nhaneca
Benin	62,031	Fon, Betamaribe, Yoruba
Burkina Faso	50,474	Bissa, Bobo, Dioula, Gourmantche/Gourmatche, Lob, Mossi, Samo
Cameroon	35,454	Fon, Bamilike-Central, Bamilike/Bamoun, Banen-Bandem, Banyang, Bassa-bakoko, Bata, Beti/Bassa/Mbam,Biu-Mandara, Fali, Gbaya, Mboum, Mousgoum
CAR	5,884	Banda, gbaya, Mandjia, Mboum, Ngbaka-Bantou, Sara, Zande-Nzakara
Chad	31,258	Sara, Baguirmien, Baguirmi/Barma, Fitri-Batha, Massa/Mousseye/Mousgoume, Peul (Laka Adawama)
Congo	30,283	Teke, Kongo, Kota
Ivory Coast	22,786	Abron, Agni, Alladian, Akan, Avikam/Brignan, Bakwe, Bambara, Baoule, Bete, Dioula, Gagou, Gouro, Guere, Koulango, Krou, Lobi, Senoufo, Teke, Toura
DRC	28,822	Lunda, Kasai, Katanga, Tanganika, Bakongo North and South
Ethiopia	61,635	Affar, Amharra/Amhara,anyiwak, Ari/Bako, Basketo, Bena, Burji, Guragie, Konso, Komo, Hamer, Mao, Yemsa/Yem, Sidama, Somalie, Tigraway/Tigre, Tigray (tigraway)
Gabon	14,605	Fang, Kota-Kele, Myene, Okande-Tsogho
Gambia	10,233	Bambara, Jola/Karoninka, Fula/Tukulur/Lorobo, Serahuleh
Ghana	29,408	Akan, Akwapim, Asante, Ewe, gurma, Dagarti, Fanti/Fante, Ga/Adangbe, Grusi, Grussi
Guinea	23,849	Guerze, Kissi, Malinke, Peulh, Sousou, Toma
Kenya	68,533	Boran/Borana, Kalenjin, Kamba, Kikuyu, Kisii, Luo, Maasai, Meru, Pokomo, Samburu, Somali, Taita/Tavate, Turkana
Malawi	82,163	Amanganja/Anyanja, Chewa, Nkonde, Sena, Tonga, Tumbuka, Yao
Mali	47,560	Dambara, Dobo, Dogon, Malinke, Senoufo/Minianka, Sarakole/Soninke, Sonrai, Peulh/Toucouleur
Mozambique	34,942	Bitonga, Cicewa, Chichopi, Cisena, Ciyao, Shimakonde, Emakua, Elomwe, Xitsonga, Xitswa
Namibia	31,998	Damara/Nama, Herero
Niger	34,463	Djerma/Songhai, Gourmanthe, Haoussa
Nigeria	103,112	Afo, Anaguta, Angas, Bassa, Bolawa/Bolew, Bura/Babur, Bini/Edo, Efik, Egba, Ebira/Igbira, Ekoi, Gede/Gude/Ga, Kurama, Ibibio, Igbo/Ibo, Idoma, Igala, Hausa, Isoko,Kadara, Kagoro, Kamuku, Karekare, Kurama, Mumuye, Nupe, Tera, Yoruba, Yungur
Senegal	105,456	Bambara, Diola, Balant, Mandingue, Soninke, Sarakole
Togo	26,083	Adja-Ewe, Ana-Ife, Kabje-Tem, Para-Gourma
Uganda	38,980	Acholi, Alur, Baganda, Bagisu, Bakonjo, Banyoro, Basoga, Batoro, Iteso, Jie, Karimojong, Kuku, Lango, Lugbara, Madi
Zambia	46,296	Ambo, Amwanga, Bisa, Chewa, Chokwe, Kaonde, Kunda, Lamba, Lunda, Luchazi, Lala, Luvale, Mambwe, Mbunda, Namwanga, Ngumbo, Nyanja, Tonga, Tumbuka, Yombe