Fertility in Sub-Saharan Africa: the role of inheritance[*]

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Abstract

Fertility in Sub-Saharan Africa is the highest in the world and it should continue boosting population growth for decades to come. In this paper, we showcase a new driver of fertility decisions that has been largely overlooked by demographers and economists: inheritance rules. In particular, we demonstrate that impartible inheritance (i.e. transmission of the deceased's property to a single heir) does not incentivize households to control their number of children. Our main empirical strategy links data from the past on deep-rooted inheritance customs for more than 800 ethnic groups with modern demographic surveys covering 24 countries in Sub-Saharan Africa. Our spatial Regression Discontinuity Design exploiting ancestral borders reveals that belonging to an ethnic group with impartible customs increases fertility by 0.85 children per woman. We also establish, both theoretically and empirically, that impartible inheritance rules play an even bigger role in flat lands that are less costly to farm and less labor intensive.

JEL classification: J10, O10, K11
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1 Introduction

At 4.6 children per woman in 2021, the fertility rate in Sub-Saharan Africa is the highest in the world (United Nations 2022). This high fertility is likely to hold in the coming decades, as illustrated by the repeated revisions of the population projections by the United Nations Population Division (UNPD) due lower-than-expected fertility decline (Ezeh, Kissling, and Singer 2020). Indeed, the projected population of Sub-Saharan Africa in 2050 is 1.5 billion according to UNPD's 1998 revision, 1.75 billion according to the 2008 revision, and 2.1 billion in the most recent revision(Ezeh, Kissling, and Singer 2020). The reasons behind this differential fertility are unclear. Even after accounting for well-known drivers of fertility decline across the globe, such as human capital (Baudin, de la Croix, and Gobbi 2020), technological progress (Guner, Delventhal, and Fernandez-Villaverde 2020), child mortality (Kalemli-Ozcan 2003), women empowerment (de la Croix and Brée 2019), and family planning (Bhattacharya and Chakraborty 2017; Strulik 2017; de Silva and Tenreyro 2020; Cavalcanti, Kocharkov, and Santos 2021), estimates suggest that the average woman in Sub-Saharan Africa will continue to give birth to 0.8 more children than women elsewhere in the developing world (Zipfel 2022).

This paper showcases a new legal factor behind Sub-Saharan Africa's high fertility, which has been largely overlooked by demographers and economists alike: inheritance rules. We show that the widespread incidence of inheritance rules where property is transmitted to a single heir does not incentivize Sub-Saharan African households to control their number of children. Across Sub-Saharan African, inheritance is often governed by a myriad of ancestral customary laws, a prerrogative recognized in many constitutions. As a result, areas where land is passed down to a single heir (henceforth, impartible inheritance) coexist in close proximity with areas where land is divided among several heirs (henceforth, partible inheritance). Using data on ancestral inheritance rules by Murdock (1967) and modern Demographic and Health Surveys (DHS), we examine how different inheritance rules affect the fertility of Sub-Saharan women. Our OLS and regression-discontinuity estimates reveal that impartible inheritance rules substantially increases fertility, by as much as 0.85 children per woman. We argue that these results have important policy implications since impartible inheritance remains the prevailing custom in many ethnic groups across the African continent and continues to rule the transmission of properties across generations.

To better understand the mechanisms through which inheritance rules can drive fertility decisions, we develop a conceptual framework of land production, inheritance and fertility. Our model characterizes subsistence farming in Sub-Saharan Africa with land indivisibility constraints over small plots of land, incorporates impartible and partible inheritance rules governing the transmission of land, and evaluates fertility decisions. Our model predicts that partible inheritance, by dividing land among several heirs, pushes individuals to limit their fertility to avoid fragmenting the land into "inefficiently small parcels" (Baker and Miceli 2005). In contrast, impartible inheritance, by transmitting all lands to a single heir, is associated with high fertility rates, as indivisibility constraints are not binding.

Our main goal is to assess the consequences of deep-rooted inheritance rules for today's fertility in Sub-Saharan Africa. To do so, we use pre-industrial data on 842 ethnic groups recorded by Murdock (1967). We link this historical data with modern Demographic and Health Surveys (DHS) covering a total of 24 countries. Our first empirical strategy compares the fertility of women from ethnic groups with partible and impartible customs, controlling for a large set of individual, geographical and historical covariates. We find that impartible inheritance is associated with higher fertility and that the magnitude of the effect is comparable to other ethnic characteristics that have received more attention in the literature, such as polygamous unions (Tertilt 2005; Rossi 2019) or matrilineality (BenYishay, Grosjean, and Vecci 2017). Our second empirical strategy exploits ancestral ethnic borders in a spatial Regression Discontinuity Design (RDD), similar to Moscona, Nunn, and Robinson (2020). Our spatial RDD allows to control for unobservable characteristics that vary smoothly across space and allows us to explore the causal link between past inheritance customs and current fertility levels. Comparing women who live in very close proximity, within 60 kilometers of an ancestral border, we find that belonging to an ethnic group with impartible inheritance customs increases fertility by 0.85 children per woman.

To explore the mechanisms behind these effects, we extend our theoretical and empirical analysis to account for different characteristics of the lands transmitted across generations. In detail, we establish both theoretically and empirically that inheritance rules play a bigger role in flat lands that are less costly to farm and less labor intensive (Food and Agriculture Organization 1993), and we demonstrate in our theoretical framework that is this is due to land indivisibilities.

Relative to previous literature, our main contribution is to show that inheritance rules are a key driver of fertility decisions. The role of legal factors in general and of inheritance rules in particular has been largely overlooked by both economists and sociologists, whose focus has been centred on human capital (Baudin, de la Croix, and Gobbi 2020), technological progress (Guner, Delventhal, and Fernandez-Villaverde 2020), child mortality (Kalemli-Ozcan 2003), women empowerment (de la Croix and Brée 2019), and family planning (Bhattacharya and Chakraborty 2017; Strulik 2017; de Silva and Tenreyro 2020; Cavalcanti, Kocharkov, and Santos 2021). Instead, our paper suggests that institutions can play a major role in accelerating fertility declines and allowing Sub-Saharan African countries to grasp the benefits of a "demographic dividend" (Bloom, Kuhn, and Prettner 2017).[1] By shifting the focus of fertility decisions towards inheritance rules, our paper bridges two separate strands of the literature: one exploring fertility decisions, another the role of inheritance and ancestral customs on current economic outcomes (Michalopoulos and Papaioannou 2020). We review these contributions in detail in the next section.

The remainder of the paper is organized as follows. Section 2 reviews the literature on fertility decisions and inheritance rules. Section 3 describes the rules governing inheritance in modern Sub-Saharan Africa and the legacy of the past. Section 4 develops the conceptual framework. Section 5 describes the data sources. Sections 6 and 7 provide estimates from OLS and spatial Regression Discontinuity Design across ancestral borders. Section 8 concludes.

2 Contribution to the literature

The role of inheritance rules has been largely overlooked in the literature that studies fertility in particular, and also in the literature studying the effect of norms on development in general. Our paper provides theoretical and empirical support for studying inheritance as a deep determinant of fertility decisions.

[1]The latter corresponds to the economic growth potential that results from a shift in a population's age structure. When this happens, the working age population surpasses the rest, which implies a lower dependency ratio, leading to more available resources to invest in the essential infrastructure needed by a country to develop. Our work makes the case that changes to inheritance laws and efficient implementation could be an important driver to the decline of fertility in Sub-Saharan Africa and, eventually, could help countries enjoy a demographic dividend.

A recent strand of the literature in development economics has looked at the effects of changes in inheritance laws in developing countries. These law changes are mainly aimed at providing more security to women and to the nuclear family. The main outcomes studied are parental decisions regarding boys and girls, marriage, or domestic violence. These studies examine law changes in a specific country and evaluate short-run outcomes. The question of how inheritance law reforms might change family structures has been largely overlooked.[2] Our contribution to this literature is to incorporate changes in inheritance laws as part of the development process itself, through a fertility channel.

Some recent studies have looked at how changes in inheritance laws affect the role of women in developing countries. Prior to these reforms, countries usually have used systems of inheritance that tended to favor sons over daughters. Hence, these studies look mainly at recent policy changes that have increased the rights of wives and daughters over inheritance. The 2005 Hindu Succession Act[3] is probably the reform that has received most attention. Deininger, Goyal, and Nagarajan (2013) show that the reform had a positive effect on daughters' education. Roy (2015) also finds positive effects on education, as well as on larger dowries. Mookerjee (2019) finds that the reform reshaped households from joint to nuclear types and that this change was beneficial for female's autonomy. Some findings are less positive. Anderson and Genicot (2015) show that the improved inheritance rights increased the incidence of suicide due to stronger intra-household conflict. Bhalotra, Brulé, and Roy (2020) find that the reform strengthened the preference for having boys relative to girls, increasing female foeticide. Bahrami-Rad (2019) shows that female's entitlement over inheritance can lead to higher rates of arranged "inmarriages" (marriage between cousins or within a small community) in order to prevent family estates from splitting. This also leads to a lower premarital sexual freedom. Another Indian law that has also been investigated is the Dowry Prohibition Rule in 1985. This law prohibited giving and taking dowries (reinforcing the Dowry Prohibition Act in 1961, which had not been strictly enforced). Alfano (2017) shows that this law made parents indifferent over the gender of their children and decreased the probability of having an extra child if the firstborn was a girl.

Apart from reforms in India, recent law changes in other developing countries

[2]Mookerjee (2019) is an exception.

[3]This was an amendment to the Hindu succession act 1956 and was enacted to remove gender discriminatory provisions regarding property rights in the Hindu Succession Act, 1956.

have also been analyzed. For Ghana, Aldashev et al. (2012) describe the Intestate Succession PNDC Law 111 of 1985 implemented by the Provisional National Defense Council (PNDC) government. The Akan ethnic group in Ghana is a matrilineal society. According to its customary law on inheritances, a deceased person's siblings have precedence over his widow and children. The 1985 law aimed at regulating practices of intestate succession in favor of the wives and children (the nuclear family). La Ferrara and Milazzo (2017) exploit this law change as a policy experiment and find that Akan males exposed to the reform experienced a decrease in the years of education. The authors do not find an effect on the education of girls. Harari (2019) looks at a reform in Kenya that gave equal inheritance rights to women compared to men. In particular, she finds that the reform had a positive effect on female education, decreased genital mutilation, and increased female bargaining power within households. Carranza (2012) studies the Koranic inheritance exclusion rule among the Muslim population in Indonesia. According to this rule, family wealth is transmitted through the male line: a surviving son has precedence over the deceased man's brothers and male agnates. Carranza (2012) finds that this rule strengthened parental preferences for boys over girls, and, hence, favored sex-differential fertility stopping and increasing fertility rates. For rural Philippines, Estudillo, Quisumbing, and Otsuka (2001) show that parents prefer bequeathing land to sons, while they invest more into the education of their daughters. Compared to the previous studies, our paper takes a wider geographical approach, exploiting the huge heterogeneity in inheritance customs of Sub-Saharan Africa's ethnicities (Michalopoulos and Papaioannou 2020).

3 Inheritance rules in Sub-Saharan Africa

Inheritance in Sub-Saharan Africa is in general regulated by customary law. In fact, most countries recognize customary land rights (Deininger et al. 2003) and land administration, including transfer following an inheritance, is effectively decentralized to traditional authorities (Byamugisha 2013).

Customs represent a set of long-established local rules emanating from traditional practices. They are not only a usage or a habit, but binding rules enforced by customary chiefs. For example, the constitution of Ghana says: "customary law means the rules of law which by custom are applicable to particular communities in Ghana" (article 11).

Customary law in Africa has its roots in the traditional laws in use prior to the colonial era. Although African colonies were ruled via imported common law or civil codes from the metropoles after the nineteenth century, customary law retained jurisdiction over African citizens under colonial supervision (Milner 1967). After independence, the resulting legal systems typically comprise a combination of pre-colonial customary law, civil or common law, and religious law. Appendix Figure A.1 shows that most of Sub-Saharan Africa have mixed legal systems with a customary law tradition.

Customary law is in general recognized in the constitution of most political entities, as shown in Table 1 for the countries in our analysis. The application of customary law is ensured by traditional and customary authorities. Constitutions also recognize the role of customary authority: "The institution of Chieftaincy as established by customary law and usage and its non-abolition by legislation is hereby guaranteed and preserved" (article 72 of the constitution of Sierra Leone).

Customary law plays a significant role in matters of family and personal status such as inheritance. This is recognized in the constitution of Sub-Saharan African countries, which defer to customary law to govern inheritance (Cooper 2010). For instance, article 162 of Chad's constitution says "The customary and traditional rules governing the matrimonial regimes and inheritance may only be applicable with the consent of the concerned parties. In default of consent, the national law alone is applicable." Moreover, in some Sub-Saharan African countries (such as Ghana, Kenya, Zambia, or Zimbabwe), family law is completely excluded from non-discrimination clauses (UN Habitat 2006). This implies that siblings can be treated differently depending of their birth order or gender. The primacy of customary law is further reinforced by courts' ruling. A seminal example is the 1999 Zimbabwean case of *Magaya v. Magaya*. The Supreme Court ruled in favor of Nakayi Shonhiwa—who inherited all his father's estates—against his older sister Veneria arguing that "customary law is a long-standing, fundamental, and central aspect of African society" (Ndulo 2011). In some other countries (such as Ethiopia, Mozambique, Namibia, Nigeria, or Senegal), the constitution explicitly prohibits discrimination. However, in practice inheritance remains regulated through the local customs and can be *d*e facto discriminatory across siblings. Some countries have tried to implement legal reforms to limit the impact of customary laws on inheritance. For instance, the Ghana Children's Act 560 of 1998 was meant to guarantee that "no person shall deprive a child of reasonable provision out of the

Table 1: Customary law recognition in the constitutions of Sub-Saharan African countries

Country ISO3	Year	Article	Text
BEN	1990	98	"[...] customary laws shall be recorded and brought into harmony with the fundamental principles of the Constitution."
BFA	1991	101	"The law establishes the rules concerning: [...] the procedure according to which custom may be asserted and harmonized with the fundamental principles of the Constitution."
CAF	2016	24	"[...] recognizes and protects the traditional values in accordance with the law and the Customary Authorities."
CIV	2016	24	"The State promotes and protects the cultural heritage as well as the habits and customs [...]."
CMR	1972	1, Part I	"The Republic of Cameroon [...] shall recognize and protect traditional values [...]."
COD	2005	204	"Without prejudice to the other provisions of this Constitution, the following matters are of the exclusive competence of the Provinces: [...] the execution of customary law;"
ETH	1994	9	"The Constitution is the supreme law of the land. Any law, customary practice or [...] which contravenes this Constitution shall be of no effect."
GAB	1991		No reference to customary law.
GHA	1992	11	"The common law of Ghana shall comprise the rules of law generally known as the common law, the rules generally known as the doctrines of equity and the rules of customary law [...]."
GIN	2010		No reference to customary law.
KEN	2010	2	"Any law, including customary law, that is inconsistent with this Constitution is void to the extent of the inconsistency, [...]"
LBR	1986	65	"The courts shall apply both statutory and customary laws in accordance with the standards enacted by the Legislature."
MLI	1992		No reference to customary law.
MOZ	2004	118	"The State shall recognise and esteem traditional authority that is legitimate according to the people and to customary law."
MWI	1994	200	"Except in so far as they are inconsistent with this Constitution, all Acts of Parliament, common law and customary law in force on the appointed day shall continue to have force of law, [...]"

Country ISO3	Year	Article	Text
NAM	1990	66	"Both the customary law and the common law of Namibia in force on the date of Independence shall remain valid to the extent to which such customary or common law does not conflict with this Constitution or any other statutory law."
NER	2010	99	"The law establishes the rules concerning: [...] the procedure according to which customs [coutumes] will be declared and brought into harmony with the fundamental principles of the Constitution;"
NGA	1999	245	"An appeal shall lie from decisions of a customary Court of Appeal to the Court of Appeal as of right in any civil proceedings before the customary Court of Appeal with respect to any question of Customary law [...]"
SEN	2001		No reference to customary law.
SLE	1991	170	"in this Constitution unless a contrary intention appears [...] 'law' includes [...] customary law and any other unwritten rules of law;"
TCD	2018	161	"[...] the customary and traditional rules are only applicable in the communities where they are recognized."
TGO	1992	143	"The Togolese State recognizes the traditional chiefdom, guardian of use and customs."
UGA	1995	Political Objectives	"Everything shall be done to promote a culture of cooperation. Understanding, appreciation, tolerance and respect for each other's customs, traditions and beliefs."
ZMB	1991	7	"The Laws of Zambia consist of [...] Zambian customary law which is consistent with this Constitution;"

estate of a parent." However, in practice, these reforms had only a very limited impact (Kutsoati and Morck 2014). The reason is the lack of measures to ensure "social legitimation, implementation and enforcement" (Cooper 2010). In many instances, hence, it is the customary judge who continues to administer inheritance conflicts.

4 Conceptual framework

Model Setup. Consider an economy populated by adults who make decisions for their household. Households differ with respect to the inheritance rule i that is customary with respect to their ethnicity. Adults care about household consumption, c, and the total endowments of their children. Their utility function is given by:

$$u(c_i, n_i) = \ln c_i + \beta \ln (n_i y_i'), \tag{1}$$

where $n \geq 1$ is the number of children of the household, and y', the children's income. $\beta > 0$ is the weight attached to utility derived by the next generation. We assume a "warm glow" type of altruism whereby households care directly about their children's endowments, as in the quantity-quality framework of human capital de la Croix and Doepke (2003).

Consumption depends on the (net) amount of children that a household decides to have and on the household's income:

$$c_i = (1 - \phi n_i) y_i, \tag{2}$$

where $\phi \in (0, 1)$ is a fixed cost of raising children and y is the household's income, which depends on household production.[4]

Total household production is determined by the size of the land, L, and labor, N. These two inputs are combined using a Stone-Geary production function f:

$$f(L, N_i) = \begin{cases} 0 & \text{for } L \leq \bar{L} \\ \left(L - \bar{L}\right)^{\alpha} N_i^{1-\alpha} & \text{otherwise,} \end{cases} \tag{3}$$

where $\alpha \in (0, 1)$ is the relative importance of productive land with respect to labor and $\bar{L} > 0$, a fixed amount of land required for the land to be productive. This threshold captures land indivisibilities behind our main hypothesis, i.e., that is unlikely that a positive level of agricultural output is obtained with only a minuscule amount of land input.[5] Stone-Geary technology is natural in agricultural economics, although underused (Beattie and Aradhyula 2015). [SEBASTIEN: REFERENCE THAT HOUSEHOLDS IN AFRICA LIVE UNDER SUBSISTENCE FARMING]

We now introduce the two types of inheritance rules: partible ($i = P$) and impartible ($i = I$) inheritance. The distinction between inheritance rules follows two assumptions. First, we assume that there is no functioning land market so that land can only be acquired by a bequest, denoted L_i'. [SEBASTIEN: EVIDENCE

[4] Assuming a budget constraint of the type $c_i = y_i - \phi n_i$, where children represent a direct cost in terms of consumption, leads to equivalent predictions.

[5] Decisions across inheritance rules are identical if $\bar{L} = 0$.

FOR THAT?] And second, we assume that inheritance and the structure of households go hand in hand. [EVIDENCE?] In detail, under partible inheritance, land is transmitted equally to each child who forms a new (neolocal) household. Each child is hence a laborer on its own plot of land. Income is equal to the output of the production. This implies that

$$L'_P = \frac{L}{n_p} \ , \qquad N_p = 1 \ , \quad \text{and} \qquad y'_P = f\left(\frac{L}{n_p}, 1\right) \ . \tag{4}$$

Under impartible inheritance, land is never divided and therefore remains constant across generations. The household consists of an extended family, which includes the heir as well as his siblings, n_I, who serve as laborers in the family farm, N'_I.[6] Total production is shared among all the adults of the extended family.[7] This implies that

$$L'_I = L \ , \qquad N'_I = n_I \ , \quad \text{and} \qquad y'_I = \frac{f(L, n_I)}{n_I} \ . \tag{5}$$

Before solving the model, we make the following assumption ensuring that fertility is above one in the interior case.

Assumption 1 *The cost of a child is relatively low:*

$$\phi < \frac{\beta(1-\alpha)}{\beta(1-\alpha)+1} \quad . \tag{6}$$

Assumption 1 is consistent with the fact that fertility is above replacement rates in Sub-Saharan Africa.

Equilibrium. The equilibrium fertility decisions under impartible and partible inheritance rules are given by n_I^* and n_P^*, respectively. These are the optimal fertility choices that maximize the utility function in Equation (1) subject to the budget constraint in Equation (2), the production function in Equation (3), the inheritance rules in Equations (4) and (5), and the condition $n \geq 1$.[8] In detail, n_I^* and n_P^* depend on the amount of land:

[6] Without loss of generality, we assume that all the offspring stay at the family farm. Assuming that a fraction of them leaves does not change the results.

[7] Note that we do not need to specify how the total production is shared as households care about total output and not its distribution (Equation 1).

[8] The details for solving the maximization problem are shown in Appendix A.3.

- If $L \leq \bar{L}$; $n_I^* = n_P^* = 1$.
- If $\bar{L} < L < \tilde{L}$; $n_I^* = \dfrac{(1-\alpha)\beta}{(1+(1-\alpha)\beta)\,\phi}$ and $n_P^* = 1$.
- If $L \geq \tilde{L}$; $n_I^* = \dfrac{(1-\alpha)\beta}{(1+(1-\alpha)\beta)\,\phi}$ and $n_P^* = \dfrac{\beta\bar{L} + (1+(1-\alpha)\beta)\phi L - \sqrt{\Delta}}{2(1+\beta)\phi\bar{L}}$

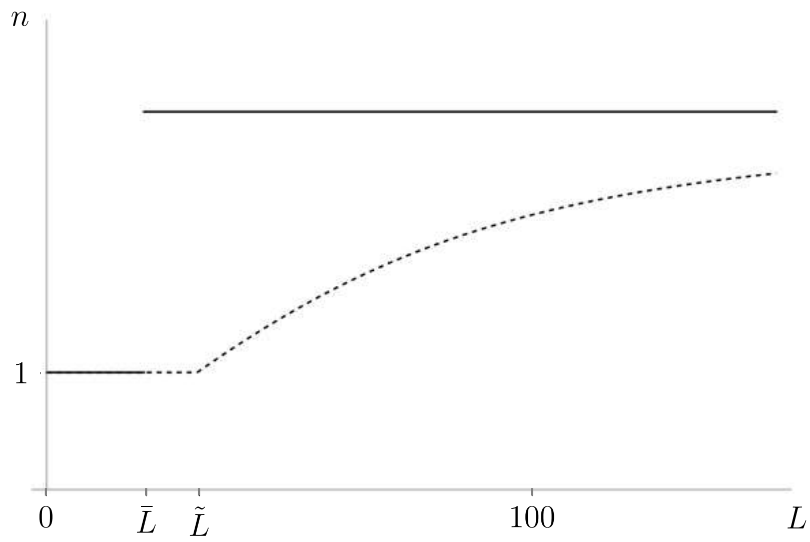
  where $\tilde{L} \equiv \dfrac{((1+\beta)\phi - \beta)\,\bar{L}}{\phi - (1-\alpha)\beta(1-\phi)}$;

  and $\Delta \equiv (\beta\bar{L} + (1+(1-\alpha)\beta)\phi L)^2 - 4(1-\alpha)\beta(1+\beta)\phi\bar{L}L$.

The model's equilibrium is illustrated in Figure 2. It shows the relationship between fertility and land under partible and impartible inheritance for certain parameter values. Intuitively, when the landholdings transmitted across generations is below $\bar{L}$, land is unproductive without resort of the labor input (i.e., number of children) or the inheritance regime (partible or impartible). Hence, the number of children is restricted to the minimum independently of the inheritance regime. For landholdings that are large enough to be productive, but small enough such that the indivisibility constraints are binding if land is further divided, i.e., when $\bar{L} < L < \tilde{L}$, fertility is higher under impartible than under partible inheritance and the fertility gap is at its maximum. The reason is that, under partible inheritance, further dividing such landholdings among several heirs can result in production falling below the subsistence level. This provides households under this inheritance regime a powerful incentive to limit their fertility. In contrast, under impartible inheritance, land is passed down unbroken, ensuring the maintenance of a productive land across generations even when fertility is high. The partible-impartible fertility gap gets smaller as the amount of land increases, i.e., in the $L \geq \tilde{L}$ region. This is because, as the size of the landholdings increase, the indivisibility constraint is less binding, in the sense that landholdings will remain above the productive threshold if they are split among few heir in partible inheritance regimes. That said, the incentive to limit fertility in order to avoid the fragmentation of land still exists, and the fertility gap between impartible and partible households remains positive.

Proposition 1 generalizes the equilibrium and derives our main testable implication for the empirical analysis.

Proposition 1 *Fertility is higher under impartible inheritance than under partible inheritance.*



Notes: Parameters values set to $\alpha = 0.3$, $\beta = 0.9$, $\phi = 0.12$, and $\bar{L} = 30$.

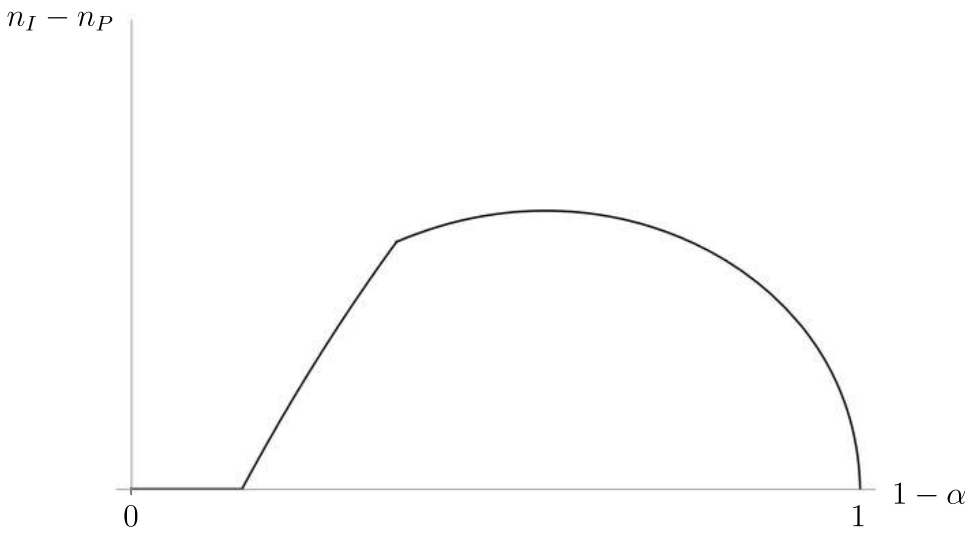
Figure 1: Relationship between fertility and land under partible (dotted line) and impartible inheritance (solid line).

Proof: When $L \leq \bar{L}$, $n_I^* = n_P^* = 1$. When $\bar{L} < L < \tilde{L}$ $n_P^* = 1$ and $n_I^* > 1$ by Assumption 1. When $L \geq \tilde{L}$, $n_I^* - n_P^* > 0$. ■

Proposition 1 follows directly from the Stone-Geary technology threshold that makes land unproductive when too little land inputs are used. Under partible inheritance, family landholdings are divided among all offspring. Hence, a high fertility decreases the amount of land available for the heirs and, eventually, can result in land inputs falling below the productive threshold and production below subsistence level. Under impartible inheritance, the transmission of land to a single heir prevents such land fragmentation, and the only factor limiting fertility is the cost of children in the budget constraint (Equation 2).[9] As a result, fertility is higher under impartible inheritance than under partible inheritance.

Differences in fertility across inheritance rules with varying labor-output elasticity.

[9]We can check that the maximum fertility from the time constraint $1 - \phi n$ is never optimal; $1/\phi > n_I^* > n_P^*$ from Proposition 1.



Notes: Parameters values set to $L = 120$, $\beta = 0.9$, $\phi = 0.12$, and $\bar{L} = 30$.

Figure 2: Relationship between the fertility difference in impartible inheritance and partible inheritance and labor-output elasticity.

5 Data and sampling

This section provides an overview of the data sources used for the analysis. We distinguish between contemporary sources on fertility across Sub-Saharan countries and historical records on ancestral ethnic characteristics, namely deep-rooted inheritance customs. We conclude this section with some graphical explorations of the impact of inheritance rules on fertility decisions during women's reproductive lifespan.

5.1 Ancestral ethnic characteristics

The most compelling source for ancestral ethnic characteristics is the Ethnographic Atlas (EA) coded by Murdock (1967). Over the last decade, several researchers have relied on this anthropological database to study the influence of ancestral characteristics on modern outcomes.[10] The EA compiles information on societal characteristics, economic activities, and political organization of ethnic groups in the nineteenth and early twentieth centuries (i.e. in the pre-industrial period).

[10] See for example Michalopoulos, Putterman, and Weil (2019), Moscona, Nunn, and Robinson (2020), Nunn and Wantchekon (2011), and Teso (2019). See also Lowes (2021) for a review and a discussion on the limitations of the database.

For Sub-Saharan Africa, the database offers detailed information on pre-industrial characteristics for 842 different ethnic groups. Among many other things, it reports the type of subsistence economy (hunting, fishing, animal husbandry or agriculture), the kinship systems (matrilineal or patrilineal), the domestic organization (nuclear, polygynous or extended family forms), and, most importantly, the inheritance rules.

We construct our main explanatory variable on inheritance customs from the variable "Inheritance distribution for real property (land)" of the EA (variable EA075). We build an indicator distinguishing between ethnic groups with partible and impartible inheritance. Partible inheritance corresponds to "Equal or relatively equal distribution among all members of the category."[11] Impartible inheritance includes (i) "Exclusive or predominant inheritance by the member of the category adjudged best qualified, either by the deceased or by his surviving relatives;" (ii) "Ultimogeniture, i.e., predominant inheritance by the junior member of the category;" and (iii) "Primogeniture, i.e., predominant inheritance by the senior member of the category."

We map the different inheritance rules across ethnic groups in the African continent using earlier work by Murdock (1959) drawing historical ethnic boundaries. Figure 3 shows that there is ample variation in inheritance customs across Africa, but also within the borders of modern countries. The figure illustrates the wide variation in inheritance rules across space and within countries.

5.2 Contemporaneous survey data

We use the Demographic and Health Surveys (DHS) conducted in Sub-Saharan African countries over the last decades to highlight fertility decisions in modern times. The main advantages of the DHS is that it interviews a nationally representative sample of households and that it has the best coverage for Sub-Saharan Africa, both in terms of time and space. Indeed, we were able to include all survey

[11] We classify ethnic groups where the EA reports an "absence of private property' ' as having partible inheritance. This concerns only 2 percent of our sample and our results are robust to excluding these ethnic groups from the analysis (see Section 7.3). The reason we classify absence of private property as partible inheritance is that, under this regime, everyone can access the land but none can sell it for their own benefit. For example, in the Bakuba ethnic group in the Democratic Republic of Congo, all the land belongs to the chief (the tribe's representative) and cannot be sold; the product of the land, in contrast, belongs to those who have sown it Torday and Joyce (1910).

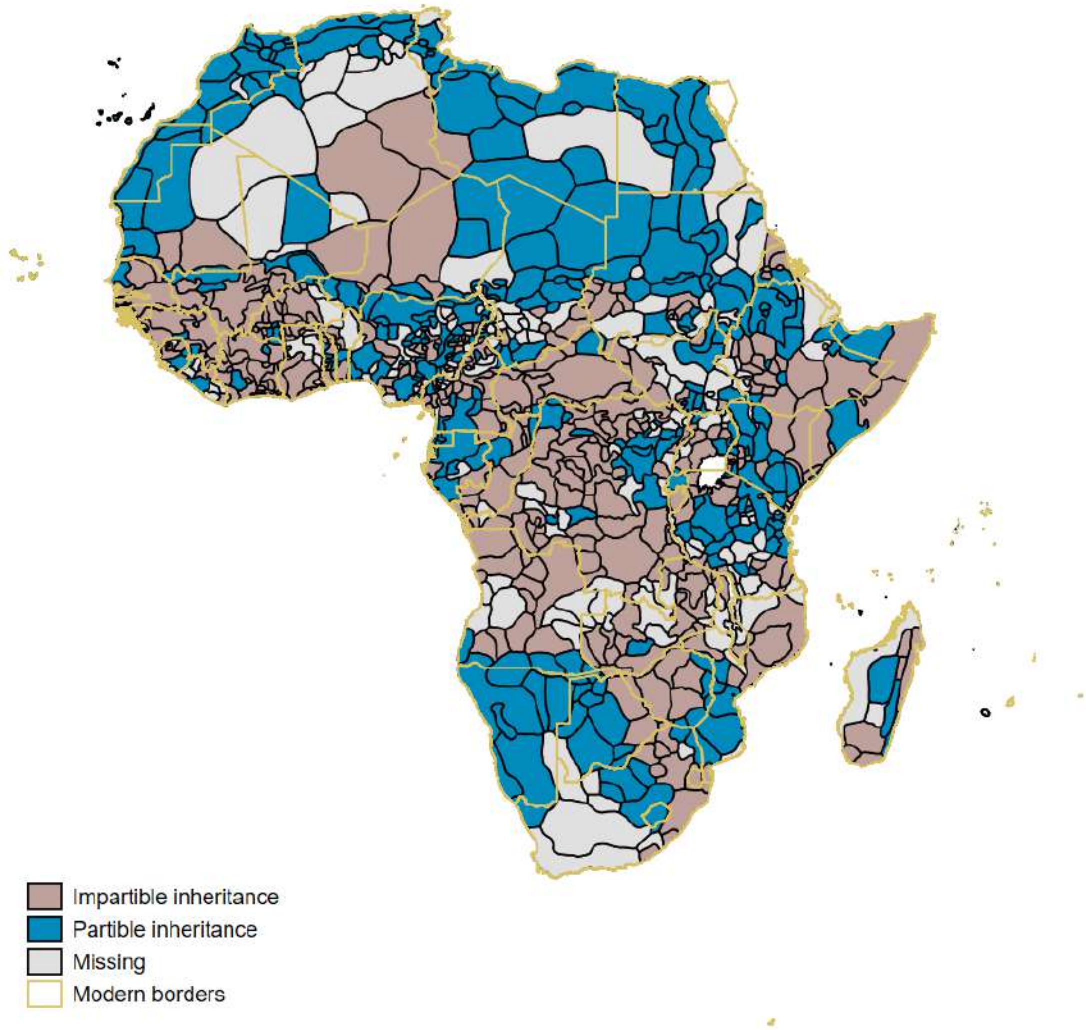


Figure 3: Map of the African continent showing ancestral inheritance customs recorded in the Ethnographic Atlas, as well as modern countries' borders.

waves conducted in the period 1986-2019 for which individuals' ethnicity and GPS coordinates were available. In total, we can observe fertility decisions in 24 countries covering a large part of Sub-Saharan Africa. Appendix Figure A.2 illustrates the geographical coverage of the data by mapping the coordinates of the DHS clusters. We pool together data from the different survey phases in each country. The sample size by phase ranges from about 4,500 respondents in Ghana surveyed during phase 2 (1993-1994) to more than 60,000 respondents in Senegal surveyed during phase 6 (2010-2016). A description of the surveys available in each country is reported in Appendix Table A.1.

To link contemporaneous data on fertility with past inheritance customs, we match the respondents' self-reported ethnicity recorded in DHS (variable v131) with their ancestors' pre-industrial characteristics from the EA.[12] In many cases, the matching is straightforward, since the ethnic group's name in the two sources is the same or a close variation (e.g. the Wolof people in the coast of Senegal can easily be merged with the "Wolof" ethnic group reported in Murdock's EA). When an exact match cannot be found, we rely the correspondence tables built by Teso (2019) and Michalopoulos, Putterman, and Weil (2019). In detail, these correspondence tables rely on several strategies to match past and present ethnic groups, such as using ethnolinguistic information[13] or the alternative ethnic groups' names from the Joshua project.[14] Relying on these methods, we are able to match 83% of our sample with their ancestral ethnic group recorded in the EA.

5.3 Sample description

Our sample comprises 651,148 women, whose residence can be precisely located and whose ethnicity can be matched with ancestral characteristics. Because deeply-rooted inheritance rules are less binding for migrants than for those living in the same place as their ancestors, we identify individuals who are born and raised in the same place they currently reside. Specifically, the DHS questionnaire asks respondents whether they have always resided in the same place and, if not, how long ago they moved. We use this variable to distinguish non-movers (184,270 women) from movers (208,479 women).[15] Our main analysis is based on the sample of non-movers. In the Appendix, we provide results using both non/movers and movers.

Table 2 shows descriptive statistics on our main sample of women born and raised where they currently reside (column "Full sample"), of which 110,748 identify as a member of an ethnic group with impartible inheritance (63 percent) and 65,993 identify as a member of an ethnic group with partible inheritance (37 percent). Women who participate in the DHS survey are from all ages between 15 and 49 years old. In our sample, the average age is 27.7 years old. In addition, 57

[12] For a limited number of surveys in Liberia, Namibia and Nigeria, ethnic groups were recorded based on their language (variables s119 for Liberia in 2006, s119 for Namibia in 2006, s114 for Namibia in 2013 and s118 for Nigeria in 2003).

[13] Ethnic groups are matched based on the lexicographic similarities of their language referenced in the Ethnologue database.

[14] Variations in ethnic groups' names are common and the Joshua project is a useful resource to find them. See www.joshuaproject.net.

[15] This information (variable v104 in the DHS questionnaire) is missing for 258,399 women in our sample.

percent of women are married, suggesting that younger women in this sample may have not found a reproductive partner yet. In our analysis, we account for this by showing the robustness of our results for a sub-group of women aged 40 and above. That is, for women who are closer to the end of their reproductive lifespan. About 50 percent of women in our sample have received no formal education and 56 percent were working at the moment of the survey.

Interestingly, age, formal education, and the probability of being married or working are similar for women in impartible- and partible-inheritance ethnic groups. In contrast, religion varies systematically across groups. Sixty percent of women in partible- and 45.5 percent of women in impartible-inheritance ethnic groups are Muslim. In turn, christianity is less common in our impartible (40 percent) than in our partible (48 percent) sub-samples. In addition, we observe differences across groups in the information on place of residence provided by the DHS questionnaire. Respondents from ethnic groups with partible inheritance are slightly more likely to come from rural areas (71 vs. 64 percent) and less likely to have access to electricity (23 vs. 34 percent) than respondents from ethnic groups with impartible inheritance. To account for these differences, our estimates include individual-level controls on religion, living in rural areas, and having access to electricity, as well as all the other individual-level characteristics described above.

5.4 Descriptives on fertility rates by inheritance rules

Before turning to our main empirical analysis, we explore how fertility rates differ between women from ethnic groups with different inheritance rules. Figure 4 displays the age-specific fertility rates across all countries in Sub-Saharan Africa and for all DHS surveys available. In Panel A, we distinguish between women who belong to an ethnic group with partible (solid line) and impartible (dashed line) inheritance rules. In Panel B, we report the impartible-partible fertility differential for each each groups, along with confidence intervals. To compute age-specific fertility rates, we consider a sub-sample of women aged more than 35 years old. That is, women who completed or are nearing the end of their reproductive lifespan. We reconstruct their complete birth history using the birth date of each child reported in the DHS survey. This allows us to observe the average number of births of women in different five-year periods since she turned 15.

Table 2: Descriptive statistics from DHS surveys

		Full sample Mean (SD) Nb. Obs.	**Impartible** Mean (SD) Nb. Obs.	**Partible** Mean (SD) Nb. Obs.
Women	Age	27.6 (9.8) 184,270	27.7 (9.8) 114,532	27.6 (9.8) 69,738
	No education (0/1)	0.493 (0.500) 184,269	0.495 (0.500) 114,531	0.490 (0.500) 69,738
	Married (0/1)	0.567 (0.495) 184,268	0.568 (0.495) 114,532	0.566 (0.496) 69,736
	Working (0/1)	0.558 (0.497) 184,011	0.586 (0.493) 114,418	0.513 (0.500) 69,593
	Christian (0/1)	0.447 (0.497) 177,643	0.480 (0.500) 111,424	0.392 (0.488) 66,219
	Muslim (0/1)	0.505 (0.500) 177,643	0.454 (0.498) 111,424	0.590 (0.492) 66,219
Household	Electricity (0/1)	0.274 (0.446) 183,537	0.232 (0.422) 113,920	0.344 (0.475) 69,617
	Rural area (0/1)	0.679 (0.467) 184,270	0.706 (0.456) 114,532	0.636 (0.481) 69,738

Notes: The first column "full sample" reports the mean, standard deviation (in parentheses), and number of observations, for the complete sample of women who were born and raised in the place where they currently live. The second and third columns report statistics for the sub-samples of women belonging to an ethnic group with impartible and partible inheritance customs, respectively. The first panel "Mother" are individual-level outcomes. The second panel "Place of residence" are outcomes at the household level.

The figure suggests that women from ethnic groups with impartible inheritance tend to have a higher fertility rate than those with partible inheritance. Differences are largest in the peak reproductive years, that is, between ages 20 and 29. This graphical exploration of the raw data provides some preliminary evidence that impartible inheritance rules play a role in fertility decisions. In addition, Appendix

Figure A.3 shows age-specific fertility rates separating women who live in flat and steep terrains. In line with the predictions of our theoretical framework, the partible-impartible gap in fertility rates is larger for those who live in flat terrains (i.e. slope below median; black lines) relative to those who live in steep terrains (i.e. slope above median; gray lines).

6 OLS estimates

Our main goal is to examine the hypothesis that fertility rates in Sub-saharan Africa are higher among women in ethnic groups with impartible inheritance rules. We start our empirical analysis by presenting the results from a linear regression that controls for a large set of observable individual, geographic, and historical characteristics. In the next section, we turn to a spatial regression discontinuity design that allows us to account for unobservable factors that vary smoothly across space.

6.1 Main OLS estimates

We begin by estimating the link between impartible inheritance rules and modern fertility. Our OLS estimates are derived from a regression of the form:

$$y_{ict} = \alpha + \beta Impartible_i + \gamma X_i + \delta_c + \zeta_t + \epsilon_{ict} \tag{7}$$

where y_{ict} denotes the number of children ever born to woman i in country c, as reported in the DHS survey year t. The number of children are based on the variable v201 in the DHS. We include fixed effects for countries, δ_c, and DHS survey years, ζ_t. The main variable of interest is $Impartible_i$, an indicator variable equal to one if woman i belongs to an ethnic group with impartible inheritance rules. Hence, the coefficient β measures the effect of belonging to an ethnic group with impartible inheritance rules on fertility. In detail, a positive (negative) β coefficient indicates that the women who identify as a member of an impartible ethnic group have more (less) children on average at the time of the DHS interview.

The vector X_i includes a large set of covariates that are potentially associated

Panel A: Age-specific fertility rates

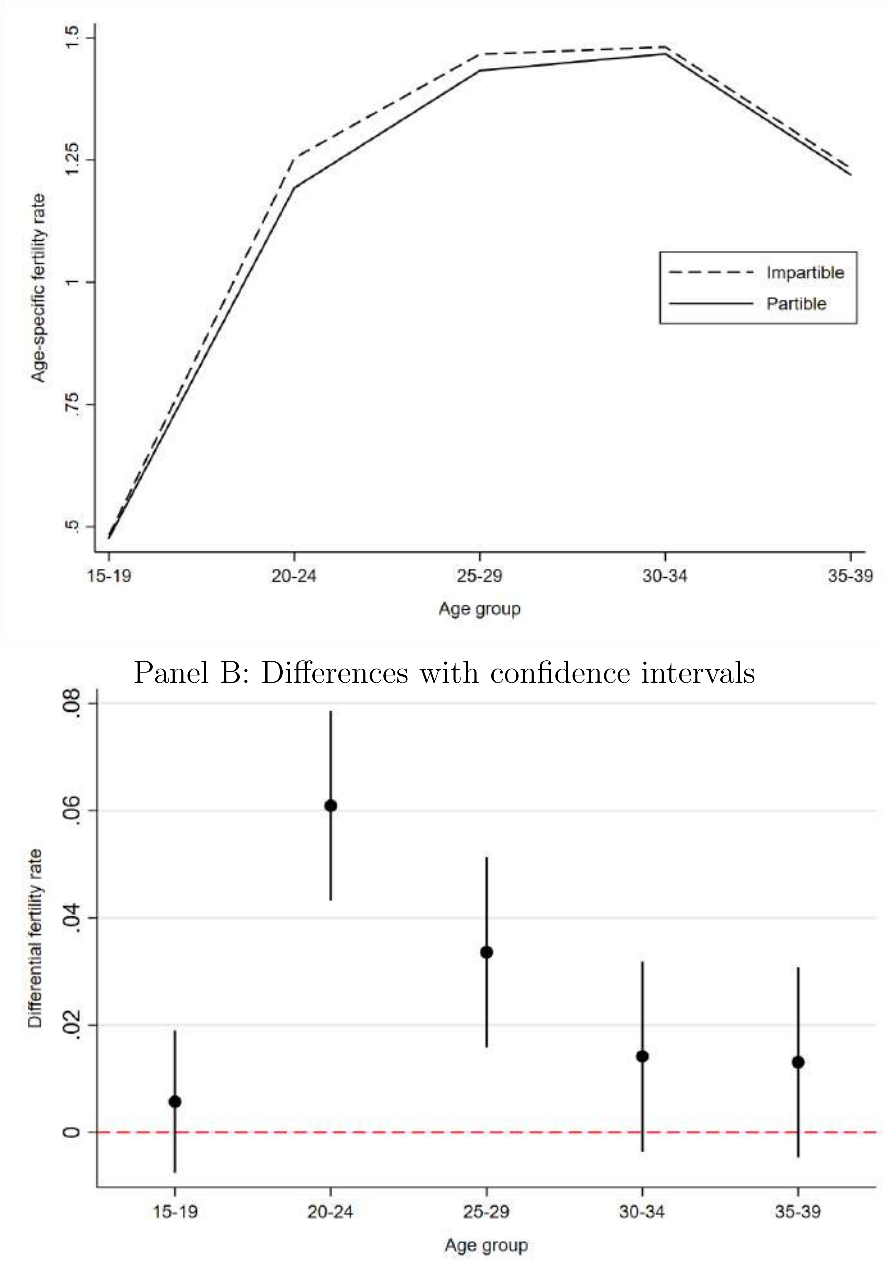


Figure 4: Age-specific fertility rates for women with different inheritance customs.

Notes: The age-specific fertility rates measure how many births a woman had on average during five-year periods from the moment she turned 15. In Panel A, the solid line plots the age-specific fertility rates (y-axis) for women who belong to an ethnic group with partible inheritance customs, while the dashed line plots the fertility rates of those with impartible customs. Panel B reveals the difference, with confidence intervals, between the two groups. The sample is composed of women aged more than 35 years old at the time of the DHS interview and for which we have reconstructed their complete birth history.

with fertility, such as individual-level socio-economic charateristics, geographical factors, and historical characteristics of ethnic groups and colonial influence. The individual-level socio-economic controls include age, indicator variables for religion,[16] and a set of indicator variables that equal 1 if a woman has received no formal education, if she is working or if she is married. Geographic controls are measured both at the individual and at the DHS-cluster level. We include one indicator variables for whether a woman lives in a rural area, and another for whether her household reports having access to electricity. We also consider the absolute value of latitude and longitude of the DHS cluster, as well as the population density from the CIESIN's algorithm (2004), light intensity from satellite data (Ghosh et al. 2010), and terrain's characteristics (ruggedness index and slope) from Nunn and Puga 2012 in the 1-km cell where the DHS cluster is located. Finally, we include two historical characteristics of ethnic groups that are usually associated with higher fertility: being part of a patrilineal ethnic group, and of an ethnic group that authorizes polygynous unions. We also control for colonial influence by including the distance to missionary settlements (Nunn 2010), colonial railway lines, and explorers' routes (Nunn and Wantchekon 2011).

Table 3 reports estimates of Equation (7). Across all specifications, we find that being a member of an ethnic group with impartible inheritance rules is associated with higher fertility. Column (1) reports estimates from the most parsimonious specification that only controls for country and year fixed effects. Column (2) adds individual-level socio-economic characteristics, Column (3) geographic controls, and Column (4) historical characteristics of ethnic groups and colonial influence. Our main estimate is unchanged after inclusion of these covariates. Women from impartible-inheritance ethnic groups have 0.11 more children on average than women from partible-inheritance ethnic groups. Compared to an average fertility of 2.86 children per woman, this implies a 4-percent increase in fertility. In terms of magnitude, this estimate is similar to that of belonging to an ethnic group that allows polygynous unions, a factor that has received substantial attention in the literature (Tertilt 2005; Rossi 2019).

Some of the estimates on the additional controls are interesting in its own right. Consistent with previous research, we find that being a member of a patrilineal ethnic group is associated with higher fertility (BenYishay, Grosjean, and Vecci 2017). This estimate is similar in magnitude to that of impartible inheritance. In contrast, we do not observe a statistically significant association between history of plow agriculture and fertility today (Alesina, Giuliano, and Nunn 2011).

[16] We distinguish between respondants' reporting her religion to be Islam, Christianity, another religion, or no religion.

Table 3: Effects of impartible inheritance rules on fertility - OLS estimates

	Number of children ever born				
	All ages				Over 40 years
	(1)	(2)	(3)	(4)	(5)
Impartible inheritance (0/1)	0.109 ***	0.122 ***	0.116 ***	0.108 ***	0.238 ***
	(0.026)	(0.017)	(0.017)	(0.016)	(0.056)
Patrilineal (0/1)				0.117 ***	0.283 ***
				(0.019)	(0.062)
Polygynous (0/1)				0.112 ***	0.305 ***
				(0.016)	(0.057)
Plow use (0/1)				-0.005	-0.035
				(0.043)	(0.139)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Individual controls	No	Yes	Yes	Yes	Yes
Geographical controls	No	No	Yes	Yes	Yes
Colonial controls	No	No	No	Yes	Yes
Mean Dep. Var.	2.85	2.86	2.86	2.86	6.36
R-squared	0.02	0.65	0.66	0.66	0.16
Observations	184,270	177,424	174,812	174,812	28,286

*Notes: The unit of observation is a woman interviewed for the DHS survey. The sample includes all women who were born and raised in the place where they currently live. Estimates for "Impartible inheritance (0/1)" correspond to coefficient β from Equation (7) and capture the effect of being from an ethnic group with impartible inheritance customs. The first column controls for country and time fixed effects. The second column adds "individual controls," including the respondent's age, as well as dummies for education, marital and employment status. The third column adds a set of "geographical controls," including dummies for living in a rural area, access to electricity, the absolute values of latitude and longitude, population density, light intensity from satellite data, ruggedness index and slope of terrain. Column four corresponds to the complete specification, adding also pre-industrial characteristics of the ethnic group where the woman belongs, such as patrilineality, polygyny, as well as controls for "colonial influence," including distance to missionary settlements, colonial railway lines and explorers' routes. Column five restricts the sample to women over 40 years, who are closer to the end of their fertile window. Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

As explained above, DHS surveys recruits participants aged between 15 and 49 years old. Because of the survey design, many women in our main sample have not yet completed their reproductive lifespan, and some might not have started having children yet. To show that our estimates are not driven by this composition effect, we reproduce our analysis on a sub-sample of women aged 40 years old or older. That is, on women who have completed or are close to completing their reproductive lifespan. As expected, the average number of children is larger, around 6.4 children per woman. Column (5) of Table 3 reports estimates of Equation (7) on this sub-sample. Our OLS estimates for the effect of impartible inheritance on fertility are positive and statistically significant, even if the sample size is substantially smaller. In terms of magnitude, our estimates are similar as before. We find that, among women who completed or are close to completing their reproductive lifespan, belonging to impartible inheritance groups increases fertility by 0.24 children. Relative to the sample mean, this corresponds, as before, to a 4-percent increase in fertility.

6.2 The moderating role of terrain's steepness

In this subsection we explore the mechanisms behind our OLS estimates. Our theoretical framework argues that partible inheritance, by dividing the lands among several heirs, incentivizes families to limit fertility to prevent land from fragmenting into inefficiently small parcels. This incentive is not present under impartible inheritance, and thereby, the latter is associated with higher fertility rates. A testable prediction of this mechanism is that if the land passed on to the heirs is more labor intensive, then the incentives to limit fertility under partible inheritance are closer to the corresponding incentives under impartible inheritance, therefore reducing the partible-impartible fertility differential.

Here we empirically test this prediction, that is, whether the quality of the land moderates the influence of inheritance rules on fertility decisions. In particular, we explore the role of terrain's steepness, as sloppy terrains are more labor intensive and costly to farm (Food and Agriculture Organization 1993) or build on (Nogales, Archondo-Callao, and Bhandari 2002). To measure the irregularity of the terrain, we follow Nunn and Puga (2012). Specifically, we measure the average slope of the earth within 30 by 30 arc-second cells (about one-kilometer squares) using data from GTOPO30 (US Geological Survey 1996). Figure 5 illustrates the geographic dristribution of this measure across Africa, with darker colors marking steeper terrain. The figure illustrates the large amount of spatial variation across the continent, as well as within countries and smaller geographical units.

To account for the moderating effect of different types of land, we augment Equation (7) by adding an interaction between impartible inheritance rules and terrain's steepness:

$$y_{ict} = \alpha + \beta Impartible_i + \lambda Impartible_i \times Steep_c + \rho Steep_c + \gamma X_i + \delta_c + \zeta_t + \epsilon_{ict}\ . \quad (8)$$

The coefficient of interest is now λ, which measures the moderating role of terrain's

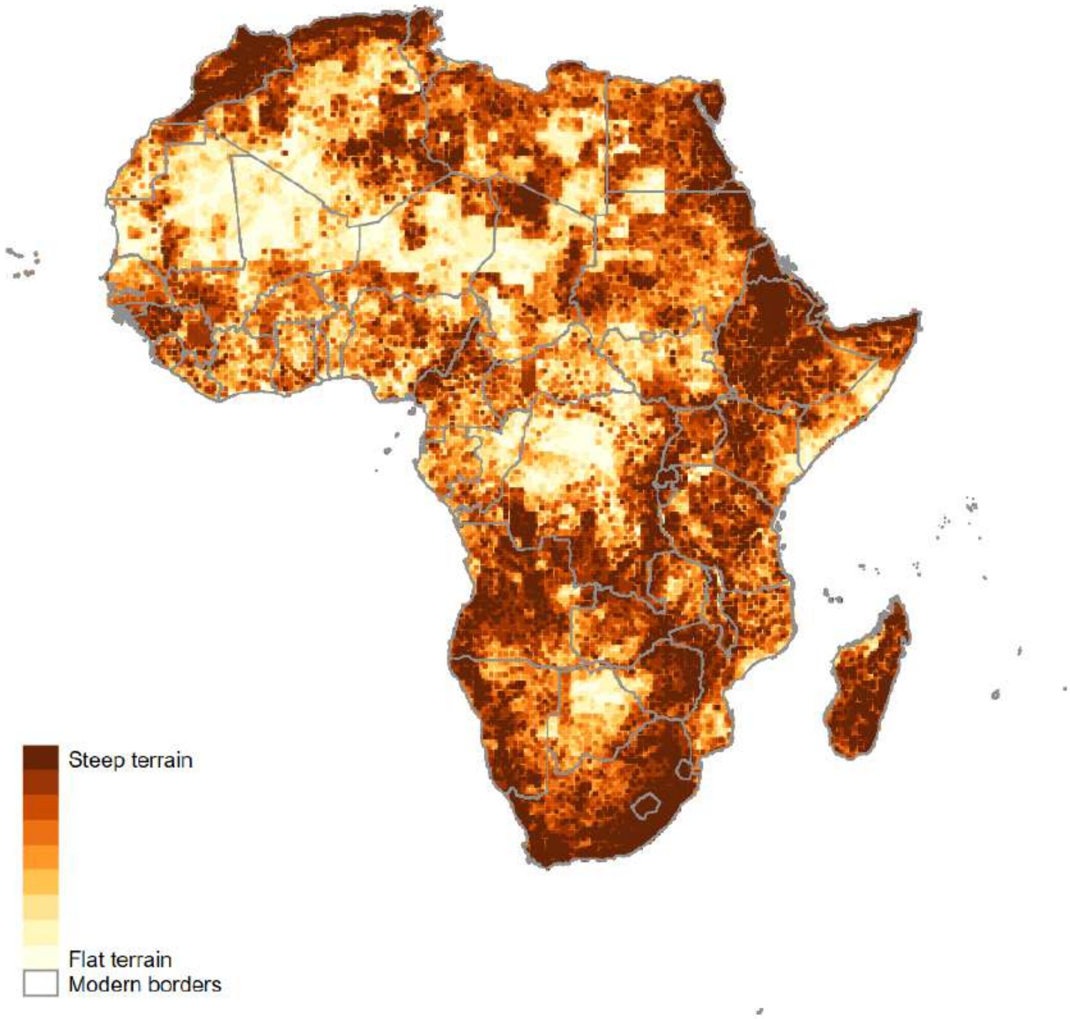


Figure 5: Map showing the extend of terrain's steepness across the African continent.

Notes: The average terrain's steepness was computed by Nunn and Puga (2012) using elevation data from GTOPO30 (US Geological Survey 1996).

steepness when interacted with the indicator variable of belonging to an ethnic group with impartible inheritance customs.

Tables 4 reports the estimated coefficients of Equation (8) for our complete sample of women who were born and raised in the place where they currently live. The interaction term λ is negative and statistically significant, which implies that a steeper terrain reduces the impact of impartible inheritance rules on fertility, as predicted by our model in Section 4. Our estimates suggest that going from the flat lands in the west coast of Senegal where the Wolof people resides (the log of the steepness measure is about 4 there, corresponding to the 10^{th} percentile) to the steep slopes of Ethiopian highlands where the Konso people lives and has been building stone walled terraces to prevent land erosion since four centuries (the log of the steepness measure is about 8 there, corresponding to the 90^{th} percentile) reduces the impact of impartible inheritance on fertility by 40 percent.[17]

Table 4: Moderating role of terrain's steepness - OLS estimates

	Number of children ever born
Impartible inheritance (0/1)	0.296 ***
	(0.053)
Terrain's steepness (ln)	0.024 ***
	(0.007)
Impartible * steepness	-0.030 ***
	(0.008)
Country FE	Yes
Year FE	Yes
Individual controls	Yes
Geographical controls	Yes
Colonial controls	Yes
Mean Dep. Var.	2.86
R-squared	0.66
Observations	174,812

*Notes: The unit of observation is a woman interviewed for the DHS survey. The sample includes all women who were born and raised in the place where they currently live. The estimate for the interaction "impartible * steepness" corresponds to coefficient λ from Equation (8) and captures the moderating role of terrain's steepness (higher value equals steeper terrain) for the effect of being from an ethnic group with impartible inheritance customs on fertility decisions. Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

7 Spatial Regression Discontinuity Design across ancestral borders

Our previous OLS estimates control for a wide range of observable characteristics, in addition to modern countries' fixed effects, but we cannot fully rule out that unobservable characteristics might be biasing our results. It could be the case, for instance, that some ethnic groups have unobservable characteristics that

[17] Since our model is linear, when the terrain's steepness increases from 4 to 8, the interaction coefficient is multiplied by four, that is 0.12 (-0.030*4). When comparing to a base effect of impartible inheritance of 0.296 children, this implies that going from relatively flat land to very steep ones, reduces the impact of impartible inheritance by 0.12/0.296, that is 40 percent.

have affected both their propensity to adopt impartible inheritance customs and their fertility decisions. One can think of geographic constrains that might push some ethnic groups to adopt impartible inheritance because of land indivisibilities constraints (Bertocchi 2006). Contemporary factors might also play a role, such as the propensity of governments to reach remote locations for enforcing the rule of law or providing infrastructures and services (Moscona, Nunn, and Robinson 2020). If these unobserved characteristics are also linked to fertility decisions, our estimates would suffer from omitted variable bias.

To strengthen our previous findings and be able to make a causal claim on the link between inheritance customs and fertility, we now turn to a new estimation strategy that exploits variation across ancestral borders within modern Sub-Saharan African countries. More specifically, we compare women who live in DHS clusters that are geographically close, but where one is located within the ancestral homeland of an ethnic group with impartible customs while the other is located is within the ancestral homeland of an ethnic group with partible customs.

7.1 Main estimates

We first identify pairs of contiguous ethnic groups where one ethnic group has impartible inheritance customs according to the EA, and the other partible inheritance customs. We then compute for each DHS cluster the distance in kilometers to the ancestral border that separates both ethnic groups. Our strategy is similar to that of Moscona et al. (2020) who use discontinuities in ancestral characteristics, in their case segmentary lineage organization, across historical boundaries.

Figure 6 illustrates this strategy in the case of Senegal. We can observe the ancestral boundaries of three ethnic groups located in the northern part of Senegal, above Gambia: the Wolof, Toucouleur and Serer peoples. The Wolof people historically lived in the west of the country by the Atlantic ocean, closer to the capital Dakar, and according to the EA their customs were to divide the inheritance of the defunct among all surviving children and spouses, although with a smaller share for women (Murdock 1967). Eastern from the Wolof people, lives the Toucouleur people, in the Senegal river valley. Despite having been islamized in the 11th century, their ancestral customs in terms of inheritance favor the first male born in the family (Lafont. 1939; Kane 1939). The Serer people, living above modern Gambia, are traditionally matrilineal and have long resisted the expansion of Islam in the region. Their inheritance custom is to select the heir as the first born in the mother's line (Aujas 1931; Bourgeau 1933; Dulphy 1939; Fayet 1939).

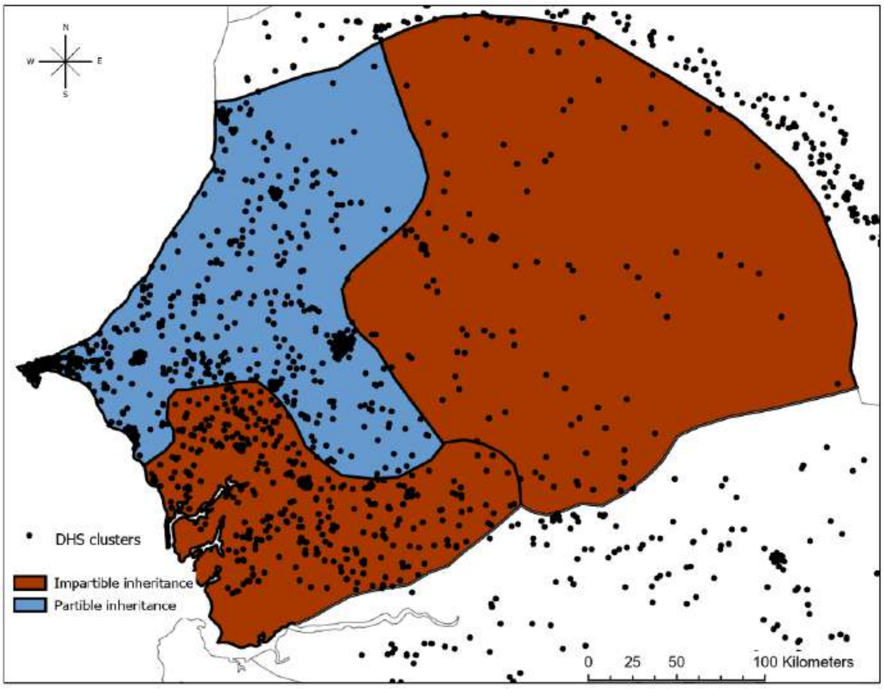


Figure 6: Illustration of the spatial RDD setting in the case of Senegal.

Notes: Three ethnic groups are highlighted: the Wolof on the West who have partible inheritance customs, the Toucouleur on the East, who like the Serer in the South, have impartible inheritance customs. Dots represent DHS clusters where women have been interviewed. Dark lines delimit the ancestral ethnic boundaries.

Despite the large set of variables that we control for in the OLS estimation, there might be unobservable characteristics between these ethnic groups that have affected their inheritance customs and continue to affect their fertility today. By using a smaller sample of DHS clusters located only a few kilometers across each side of the ancestral borders, we will account for these unobservables that vary smoothly across space. To do so, we will estimate the following RDD equation:

$$y_{ivpc} = \alpha + \beta I_v + f_l(dist_v, \gamma_l) \cdot [I_v = 0] + f_r(dist_v, \gamma_r) \cdot [I_v = 1] + \delta C + \zeta P + \epsilon_{ivpc} \quad (9)$$

where the unit of analysis is still a woman i aged between 15 and 49 and randomly selected from a DHS cluster. The variable of interest y is again the number of children ever born from this woman. We use ethnic pairs fixed effects (P) for contiguous ethnic groups, where one ethnic group has impartible inheritance customs, and the other partible inheritance customs. For instance, in the case of Senegal, the Wolof (West) and the Toucouleur (East) form one pair, while the Wolof and the Serer (South) form another pair. Even though the Toucouleur and the Serer share a border, they do not form a pair since they share the same inheritance customs. As before, we also use fixed effects for modern countries' borders denoted by C. The indicator variable I takes the value 1 if a DHS cluster v is located within the ancestral borders of an ethnic group with impartible inheritance, and 0 otherwise. f_l and f_r are unknown functions with parameter vectors γ_l and γ_r, controlling for the distance of the DHS cluster to both sides of the ancestral border (i.e. the running variable). In our baseline estimates, we use linear functions of the distance in kilometers. Robustness checks provide additional estimates using quadratic polynomials.

Our coefficient of interest is again β and it corresponds to the estimated discontinuity at the ancestral border in the average fertility rate. If we assume that the only difference at the ancestral border is the inheritance custom, while unobservable characteristics vary smoothly, we can interpret the estimated discontinuity as the causal effect of impartible inheritance rules on fertility decisions.

The starting point of our identification strategy is to show that ancestral ethnic boundaries reported in the seminal work of Murdock (1959) still coincide with ethnic affiliation today (Moscona, Nunn, and Robinson 2020). To do so, we plot in Panel A of Figure 7 the relationship between ethnic affiliation and the distance to the ancestral border. More precisely, the y-axis shows the share of women who identify as a member of an ethnic group with impartible inheritance customs. The x-axis is the distance in kilometers from the ancestral border, with positive values indicating distances inside an impartible ethnic group homeland and negative values outside of it. We observe a sharp discontinuity at the ancestral border. Indeed, the women who live in the ancestral homeland of an ethnic group with impartible inheritance customs are about 20 percentage points more likely to be themselves member of an ethnic group with impartible inheritance customs (Table 5). In other words, even though individuals are entirely free to move within the modern borders of their country, there is a strong persistence in the probability to live within the ancestral homeland of one's ethnic group. This translates into a sharp discontinuity at the ancestral boundary of our ethnic pairs in the probability that women identify as a member of an impartible ethnic group. We can use this discontinuity, which is driven by a non-negligible share of the population, as the first stage in our fuzzy RDD to measure the causal effect of inheritance rules on fertility today.

Table 5: Spatial RDD - Balance checks

Dep. Variable	Sample mean	Coef. (SE)
Impartible inheritance (0/1)	0.479	0.189 *** (0.014)
Polygyny (0/1)	0.840	0.013 (0.010)
Patrilineal (0/1)	0.784	-0.007 (0.011)
Patrilocal (0/1)	0.956	-0.007 (0.007)
Christian (0/1)	0.525	-0.013 (0.009)
Plow use (0/1)	0.053	0.007 (0.004)
Pastoralism (0/1)	0.087	0.013 (0.008)
Distance to missionary settlement (km)	116.7	-0.634 (1.608)
Distance to colonial railway (km)	269.0	-1.027 (1.856)
Distance to explorers' routes (km)	242.4	-1.341 (1.792)
Terrain ruggedness (standardized index)	-0.282	-0.015 (0.018)
Terrain slope (standardized index)	-0.275	-0.016 (0.018)

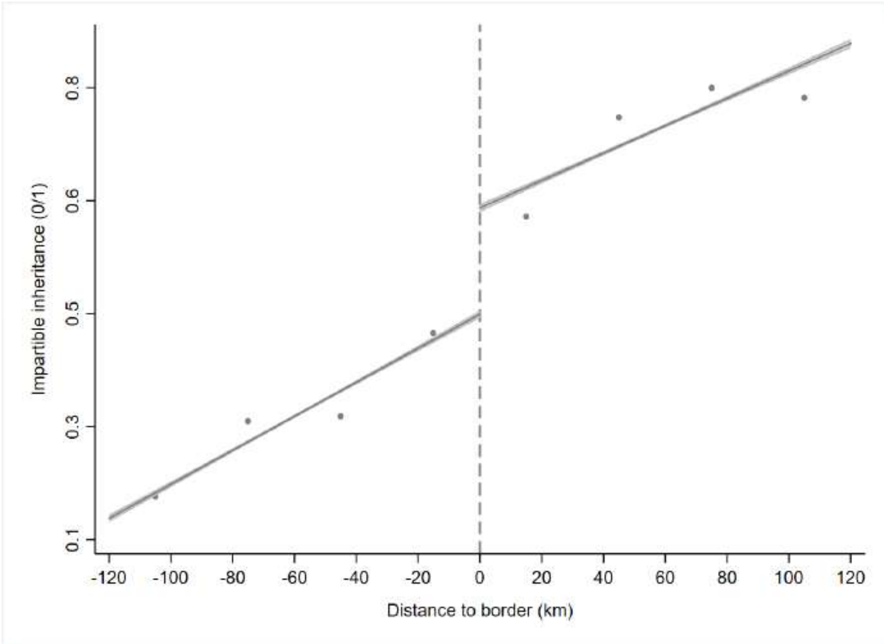
*Notes: The unit of observation is a woman interviewed for the DHS survey. Estimates are from separate regressions using as dependent variable the outcome mentioned in the first column. The second column reports the mean in the sample of women who were born and raised in the place where they currently live. The third column reports the coefficient β estimated using Equation (9). It captures the discontinuity estimated at the ethnic border, after controlling for a linear polynomial in distance, as well as for ethnic pairs and country fixed effects. For instance, the coefficient for "polygyny" shows what is the probability that women living in an impartible homeland are from an ethnic group that accepts polygamous unions, compared to those living in a partible homeland. The bandwidth used is 120 kilometers on each side of the ethnic border. The results suggest that the only discontinuity at the ethnic border is the likelihood to belong to an ethnic group with impartible inheritance customs, all other characteristics are perfectly "smooth." Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

Importantly, we also need to check whether impartible inheritance is the only historical trait that is discontinuous across the ancestral borders of our ethnic pairs. Table 5 reports the estimates of coefficient β of Equation (9) for a set of ancestral characteristics. We can observe that all other historical traits, including polygyny, patrilineality or religion, vary smoothly at the boundary of our ethnic pairs. We also verify that there is no difference in the European influence during the colonial period by checking for discontinuity in the distance to missionary settlements (Nunn 2010), colonial railway lines and explorers' routes (Nunn and Wantchekon 2011). All estimates for these three dependent variables are very small in magnitude and statistically indistinguishable from zero. Finally, we check for terrain's characteristics that have been found to be important factors for the economic development over the last centuries in Africa. More precisely, we look for discontinuity in terrain's ruggedness and slope, which, as revealed by Nunn and Puga (2012), has affected exposure to slave trades since the 15th century. Again, we do not see any discontinuity at the ethnic pairs' boundary on terrain's characteristics.

Now, we can turn to the analysis of the effects of impartible inheritance rules on fertility decisions, by exploiting the discontinuity at the border of our ethnic pairs. We start with a graph that plots the unconditional relationship between the number of children and the distance from the ancestral border in 10-kilometers bins. On Panel B of Figure 7, we can observe that in the raw data the women born and raised within the territory of impartible ethnic groups (positive values on x-axis) have on average more children than those born and raised within the territory of partible ethnic groups (negative values on x-axis). In fact, we notice a clear discontinuity precisely at the ethnic pairs boundary.

We next examine the RDD estimates of the discontinuity at the ethnic border, using Equation (9) with ethnic pairs and country fixed effects. The sample includes all women who live in DHS clusters that are located within ethnic pairs where one ethnic group has impartible inheritance customs, while the other has partible inheritance customs. It should be noted that some DHS clusters might be used more than once if an ethnic group shares more than one border with other ethnic groups that have different inheritance customs. For instance, in the case of Senegal in Figure 6, some DHS clusters within the Wolof homeland (West) are only a few kilometers apart from the border with the Toucouleur homeland (East), as well as from with the Serer homeland (South). Those DHS clusters will appear twice

Panel A: Likelihood to identify as a member of an impartible ethnic group



Panel B: Consequences on fertility

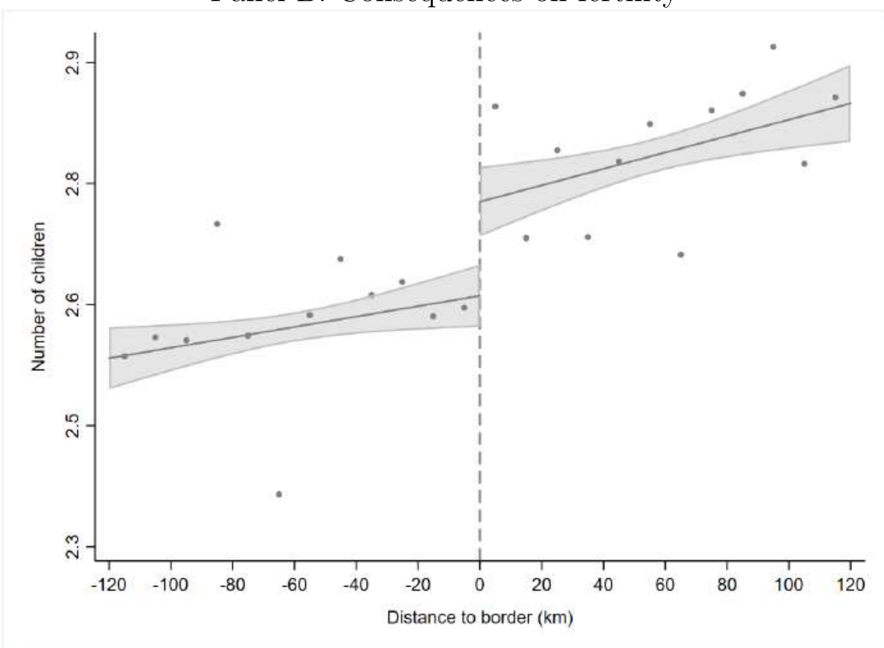


Figure 7: Unconditional relationship between outcome variables and distance to the ancestral boundaries.

Notes: We use 37.5-kilometers bins in Panel A and 10-kilometers bins in Panel B. Positive values on the x-axis imply distance into the homeland of an ethnic group with impartible inheritance customs and negative values distance into the homeland of an ethnic group with partible inheritance customs. The sample includes all women who were born and raised in the place where they currently live.

in the sample, each time within a different ethnic pair.

In Table 6, we provide estimates for women who live in DHS clusters that are within 60, 90 or 120 kilometers from the ancestral boundary. In all the three specifications, we find a positive coefficient for the link between impartible inheritance and fertility. The coefficients measured with the different bandwidths are relatively stable and always statistically significant.

Table 6: Spatial RDD - Reduced form estimates

	Number of children ever born		
	60 km	90 km	120 km
Impartible inheritance	0.163 ***	0.184 ***	0.161 ***
	(0.062)	(0.050)	(0.043)
Ethnic pairs FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Mean Dep. Var.	2.68	2.66	2.66
Nb. of pairs	270	286	294
Observations	89,361	138,819	173,883

*Notes: The unit of observation is a woman interviewed for the DHS survey. The dependent variable is the number of children ever born from this woman. The sample includes all women who were born and raised in the place where they currently live. Estimates are from regressions that include a linear polynomial in distance to the border, ethnic pairs and country fixed effects ("Nb. of pairs" is reported in the bottom panel). The main coefficient of interest corresponds to β in Equation (9). It captures the discontinuity at the ethnic border in the number of children born from women living in the homeland of an impartible ethnic group, compared to those living in the homeland of a partible ethnic group. The bandwidth goes from 60 kilometers in the first column to 120 kilometers in the third column, in 30 kilometers increments. Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

However, to measure the Average Treatment Effect (ATE) of impartible inheritance, we need to account for the fact that the discontinuity at the ancestral boundary is not 100 percent, that is not all the women living in the homeland of an impartible ethnic group belong to this ethnic group or share the same customs. In fact, we showed in Figure 7 (Panel A) that the estimated discontinuity was about 20 percent. To account for this, we now turn to estimating a "fuzzy" RDD.

First stage:

$$I_{ivpc} = \mu + \theta I_v + f_l(dist_v, \gamma_l) \cdot [I_v = 0] + f_r(dist_v, \gamma_r) \cdot [I_v = 1] + \delta C + \zeta P + \eta_{ivpc} \quad (10)$$

In the so-called "first stage" equation (10), the probability that a woman i belongs to an ethnic group with impartible inheritance customs is instrumented with the indicator variable I_v, which takes on the value 1 if her DHS cluster is located within the homeland of an ethnic group with impartible inheritance customs, and 0 otherwise. θ in Equation (10) will therefore measure the discontinuity at the border in the share of the population with impartible inheritance customs.

Second stage:

$$y_{ivpc} = \alpha + \beta \hat{I}_i + f_l(dist_v, \gamma_l) \cdot [I_v = 0] + f_r(dist_v, \gamma_r) \cdot [I_v = 1] + \delta C + \zeta P + \epsilon_{ivpc} \quad (11)$$

In the "second stage" equation (11), we now use $\hat{I}$ which corresponds to the probability that a woman identifies as a member of an impartible ethnic group instrumented by the location of her DHS cluster. As before, we control for the distance to the ethnic borders, as well as for country and ethnic pairs fixed effects. Our coefficient of interest is still β, which now measures the ATE of belonging to an impartible ethnic group.

Table 7: Fuzzy Spatial RDD - Average Treatment Effects

	Bandwith = 120 km
	First stage: Impartible
Impartible cluster	0.189 ***
	(0.014)
	ATE: Number of children
Impartible cluster	0.851 ***
	(0.237)
Ethnic pairs FE	Yes
Country FE	Yes
Mean Dep. Var.	2.66
Nb. of pairs	293
Observations	173,883

*Notes: The unit of observation is a woman interviewed for the DHS survey. The dependent variable is the number of children ever born from this woman. The sample includes all women who were born and raised in the place where they currently live. The bandwidth used is 120 kilometers on each side of the ethnic border. The "first stage" estimate corresponds to the coefficient θ in Equation (10). It captures the discontinuity at the border in the fraction of women who identify as a member of an impartible ethnic group, after controlling for a linear polynomial in distance, as well as ethnic pairs and country fixed effects. The Average Treatment Effect ("ATE") is from an instrumental variable estimation (using two-stage least-squares regression) in which the endogeneous variable is the fraction of women who belong to an impartible ethnic group, instrumented with the indicator variable that equals one if they live inside the homeland of an impartible ethnic group, and zero otherwise (coefficient β in Equation (11)). Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

The results of this two-stage least-squares fuzzy RDD are reported in Table 7. We find that women who identify as a member of an impartible ethnic group have on average 0.85 more children (second panel).[18] This effect is larger in size than our previous OLS estimates, which is likely explained by the fact that the fuzzy RDD provides a local treatment effect, estimated on a sample of women close to the ancestral borders. The effect of impartible inheritance might be more diffused among those who have moved from their ancestral homeland. To explore this possibility, we estimate again our fuzzy RDD model on the complete sample of women, including those who were born in a different place than the one where they currently live. The results reported in Table A.3 in Appendix reveal indeed an ATE of 0.25 children, about three times smaller than on the restricted sample of "non-movers." Of course, women who are "movers" or "non-movers" might have different preferences in terms of fertility, especially those that move from rural areas to cities, and are therefore selected samples. But, this might also be suggestive evidence that internal migrations might reduce the influence of impartible inheritance practices.

7.2 Heterogeneity analysis based on terrain's steepness

In this sub-section, we continue our analysis of the moderating role of terrain's steepness. In particular, we divide our sample between women living in flatter or steeper lands and perform heterogeneity analysis.

Table 8 reports estimates of Equation (9) for our different sub-samples. The first two columns divide the sample according to whether the women live in areas where our measure of terrain's steepness is below of above the median. The third and fourth columns divide the sample below or above the third quartile of our measure of terrain's steepness, resulting in two sub-samples that represent respectively 75 and 25 percents of our initial sample. The objective of this second panel is to highlight the effects of living in more extreme terrains.

Interestingly, we observe that in both panels the effect of impartible inheritance customs is positive and highly statistically significant only on the samples of women living in flatter lands. For those living in very steep lands, above the third quartile, the coefficient is almost zero. We also report two-sided z-tests in Table 8 confirming that the coefficients for women living in flat lands is higher

[18] The ATE corresponds to the estimate from Table 6 (column "120 kilometers") divided by the discontinuity in the fraction of the population that identifies as a member of an impartible ethnic group (so called "first-stage").

than for women living in steeper lands.

We conclude from this heterogeneity analysis that, as predicted by our model in Section 4, the effect of inheritance rules on fertility tends to vanish if the land to be transferred to the heirs is more costly to farm or build on. Together with results in Sub-section 6.2, this is more suggestive evidence for the moderating role of terrain's quality.

Table 8: Spatial RDD - Heterogeneity analysis

	Number of children ever born			
	Flat terrain β_f (below med.)	Steep terrain β_s (above med.)	Flat terrain β_f (below Q3)	Steep terrain β_s (above Q3)
Impartible inheritance	0.260 ***	0.062	0.221 ***	0.013
	(0.065)	(0.083)	(0.052)	(0.053)
$\beta_f \neq \beta_s$ (z-stat)	2.264		2.130	
(p-value)	0.024		0.033	
Ethnic pairs FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Mean Dep. Var.	2.71	2.61	2.69	2.57
Nb. of pairs	271	263	285	246
Observations	87,182	86,701	130,431	43,452

*Notes: The unit of observation is a woman interviewed for the DHS survey. The dependent variable is the number of children ever born from this woman. The sample includes all women who were born and raised in the place where they currently live. Estimates are from regressions that include a linear polynomial in distance to the border, ethnic pairs and country fixed effects ("Nb. of pairs" is reported in the bottom panel). The main coefficient of interest corresponds to β in Equation (9). It captures the discontinuity at the ethnic border in the number of children born from women living in the homeland of an impartible ethnic group, compared to those living in the homeland of a partible ethnic group. The bandwidth is 120 kilometers on each side of the ethnic border. The z-statistic and corresponding p-value are from a two-sided z-test for the difference between the coefficient estimated on the sub-sample of women living in "flat terrain" and the coefficient estimated on the sub-sample of women living in "steep terrain." Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

7.3 Robustness checks

In this sub-section, we test the sensitivity of our RDD setting to alternative specifications, including different bandwidths around the ancestral boundaries and different functional forms for the running variable. We also test the potential influence of outliers, as well as the sensitivity to different definitions of our main explanatory variable.

Bandwidth sensitivity: We start by showing that our results are robust to different bandwidth definitions. In Figure A.4 in Appendix, we report reduced form estimates from Equation (9) with bandwidth varying from 20 to 150 kilometers on each side of the ancestral ethnic boundaries, in 5-kilometer increments. We observe that results are rather stable and the 95 percent confidence intervals exclude 0 for all bandwidths above 50 kilometers. Furthermore, because the ancestral ethnic boundaries reported in the the seminal work of Murdock (1959) might suffer from measurement errors due to the fact that many of the sources compiled are from the early twentieth century, we also perform a "donut hole" test excluding those DHS clusters that are located within 10 kilometers of the ancestral borders. In addition, this will account for the fact that the exact location of DHS clusters is offset by a random number of kilometers from their true location in order to preserve the anonymity of respondents (random offsetting can be up to 5 kilometers in rural areas). The estimates reported in the last column of Table A.4 in Appendix reveal highly similar results compared to the 120-kilometer bandwidth using all observations.

Functional form: We now test the sensitivity of our empirical strategy to different functional forms for the running variable. Table A.4 in Appendix shows results for both linear and quadratic polynomials of the running variable. While standard errors tend to increase with the quadratic polynomial, the coefficients remain highly similar across bandwidths. Only for the small 60-kilometer bandwidth, the estimated effect with a quadratic polynomial of the distance is not statistically significant, but it remains relatively close in magnitude to other estimates.

Outliers: We check the robustness of our estimates to outliers. More specifically, we re-estimate Equation (9) for a total of 294 times, leaving one pair of ethnic groups out each time. This type of "Leave-one-out" procedure ensures that our results are not driven by a specific pair of ethnic groups, and therefore that there are robust to outliers. Figure A.5 in Appendix shows the distribution of the 294 point estimates following this procedure. We can observe that all estimates are positive (min. = 0.132, max. = 0.196) and centered around our baseline estimate of 0.161, with very little dispersion. We therefore conclude that our results are not driven by some specific ethnic groups in a particular country.

Private property: Finally, we investigate the sensitivity of our results to alternative definition of our main explanatory variable. In particular, we explained in sub-section 5.1 that we added ethnic groups for which the EA reports an absence of private property to the partible inheritance category since, in many cases, all members have equal access to the land. Even though this concerns only a small share of our sample (less than 2 percent), we test the sensitivity of our results to the exclusion of these women. Tables A.5 and A.6 in Appendix show that the results are highly similar for both the OLS and RDD settings, respectively.

8 Conclusion

Between now and 2050, the population of Sub-Saharan Africa is expected to almost double, surpassing 2 billion inhabitants. Among the major contributors to the population growth are the high fertility levels found in countries across the continent, which should remain close to 3 births per woman on average in 2050 (United Nations 2022).

This paper explores a new contributor to the high fertility in Sub-Saharan Africa: inheritance rules. The latter have been largely overlooked by previous research, which focused on well-known drivers of fertility decisions, such as human capital, technological progress, child mortality, women empowerment or family planning. We argue that inheritance rules, and especially impartible inheritance (i.e. transmission of the deceased's property to a single heir), are playing a major role in boosting the number of births in Sub-Saharan Africa.

We develop a theoretical model showing that, while partible inheritance (i.e. division among heirs) pushes individuals to limit their fertility to avoid fragmenting the land into "inefficiently small parcels" (Baker and Miceli 2005), impartible inheritance rules do not incentivize households to control their number of children. We test the model's predictions using pre-colonial data for 842 ethnic groups recorded by Murdock (1967) and modern demographic surveys covering 24 countries. Our first empirical strategy compares the fertility of women from ethnic groups with partible and impartible customs, controlling for a large set of individual, geographical and historical covariates. We confirm our model's predictions that impartible inheritance is associated with higher fertility. Our second empirical strategy exploits ancestral ethnic borders in a spatial Regression Discontinuity Design (RDD), which allows controling for unobservable characteristics that vary smoothly across space. Comparing women who live within 60 kilometers of an ancestral border, we find that belonging to an ethnic group with impartible inheritance customs increases fertility by 0.85 children per woman.

We also establish, both theoretically and empirically, that impartible inheritance rules play an even bigger role when the land's quality is higher. We proxy the land's quality with a measure of steepness from Nunn and Puga (2012), which averages the slope of the earth within 30 by 30 arc-second cells (about one-kilometer squares) using data from GTOPO30 (US Geological Survey 1996). We confirm our model's predictions that the effect of impartible inheritance on fertility is much stronger on flat lands that are less costly to farm (Food and Agriculture Organization 1993).

We believe that our study has important policy implications since impartible inheritance remains the prevailing custom in many ethnic groups across the African continent. Because many Sub-Saharan African countries' constitution defer to customary law to govern inheritance, rules such as primogeniture continue to rule the transmission of properties across generations. Our results suggest that reforming succession rules could play a major role in accelerating the fertility transition in Sub-Saharan African countries. This would allow them to grasp the benefits of a "demographic dividend," that is a shift in a population's age structure that can provide opportunities for rapid economic growth. However, because some legal reforms have been less than successful in the past (e.g. the Ghana Children's Act 560 passed in 1998), there should also be accompanied by measures to ensure social legitimation and enforcement (Cooper 2010).

References

Aldashev, Gani, Imane Chaara, Jean-Philippe Platteau, and Zaki Wahhaj. 2012. "Formal Law as a Magnet to Reform Custom." *Economic Development and Cultural Change* 60 (4): 795–828.

Alesina, Alberto, Paola Giuliano, and Nathan Nunn. 2011. "Fertility and the Plough." *American Economic Review* 101 (3): 499–503.

Alfano, Marco. 2017. "Daughters, dowries, deliveries: The effect of marital payments on fertility choices in India." *Journal of Development Economics* 125:89–104.

Anderson, Siwan, and Garance Genicot. 2015. "Suicide and property rights in India." *Journal of Development Economics* 114:64–78.

Aujas, L. 1931. "Les Sereres du Senegal." *Bull. Com. Et. Hist. Scient. Afr. Occ. Franc.* 14:293–333.

Bahrami-Rad, Duman. 2019. "Keeping it in the family: Female inheritance, Inmarriage, and the Status of Women." Unpublished.

Baker, Matthew, and Thomas J Miceli. 2005. "Land inheritance rules: theory and cross-cultural analysis." *Journal of Economic Behavior & Organization* 56 (1): 77–102.

Baudin, T., D. de la Croix, and P. Gobbi. 2020. "Endogenous Childlessness and Stages of Development." *Journal of the European Economic Association* 18 (1): 83–133.

Beattie, Bruce R., and Satheesh Aradhyula. 2015. "A Note on Threshold Factor Level(s) and Stone-Geary Technology." *Journal of Agricultural and Applied Economics* 47 (4): 482–493.

BenYishay, Ariel, Pauline Grosjean, and Joe Vecci. 2017. "The fish is the friend of matriliny: Reef density and matrilineal inheritance." *Journal of Development Economics* 127:234–249.

Bertocchi, Graziella. 2006. "The Law of Primogeniture and the Transition from Landed Aristocracy to Industrial Democracy." *Journal of Economic Growth* 11 (1): 43–70.

Bhalotra, Sonia, Rachel Brulé, and Sanchari Roy. 2020. "Women's inheritance rights reform and the preference for sons in India." *Journal of Development Economics* 146 (sep): 102275.

Bhattacharya, J., and S. Chakraborty. 2017. "Contraception and the Demographic Transition." *Economic Journal* 127 (606): 2263–2301.

Bloom, David E., Michael Kuhn, and Klaus Prettner. 2017. "Africa's prospects for enjoying a demographic dividend." *Journal of Demographic Economics* 83 (1): 63–76.

Bourgeau, J. 1933. "Notes sur la coutume des Sereres du Sine et du Saloum." *Bull. Com. Et. Hist. Scient. Afr. Occ.* 16:1–65.

Byamugisha, Frank FK. 2013. *Securing Africa's land for shared prosperity: A program to scale up reforms and investments.* World Bank Publications.

Carranza, Eliana. 2012. "Islamic Inheritance Law, Son Preference and Fertility Behavior of Muslim Couples in Indonesia." World Bank Policy Research Working Paper, (5972).

Cavalcanti, T., G. Kocharkov, and Cezar Santos. 2021. "Family Planning and Development: Aggregate Effects of Contraceptive Use." *Economic Journal* 131 (634): 624–657.

Cooper, Elizabeth. 2010. "Inheritance and the intergenerational transmission of poverty in Sub-Saharan Africa: policy considerations." *Chronic Poverty Research Centre Working Paper*, no. 159.

Deininger, Klaus, Aparajita Goyal, and Hari Nagarajan. 2013. "Women' s Inheritance Rights and Intergenerational Transmission of Resources in India." *Journal of Human Resources* 48 (1): 114–141.

Deininger, Klaus W, et al. 2003. *Land policies for growth and poverty reduction.* World Bank Publications.

de la Croix, D., and S. Brée. 2019. "Key forces behind the decline of fertility: lessons from childlessness in Rouen before the industrial revolution." *Cliometrica* 13:25–54.

de la Croix, David, and Matthias Doepke. 2003. "Inequality and Growth: Why Differential Fertility Matters." *American Economic Review* 93 (4): 1091–1113.

de Silva, T., and S. Tenreyro. 2020. "The Fall in Global Fertility: A Quantitative Model." *American Economic Journal: Macroeconomics* 12 (3): 77–109.

Dulphy, M. 1939. "Coutume serere de la Petite-Cote." *Publ. Com. Et. Hist. Scient. Afr. Occ. Franc., ser. A* 8:237–321.

Estudillo, J., A. Quisumbing, and K. Otsuka. 2001. "Gender Differences in Land Inheritance, Schooling and Lifetime Income: Evidence from the Rural Philippines." *Journal of Development Studies* 37 (4): 23–48.

Ezeh, Alex, Frances Kissling, and Peter Singer. 2020. "Why sub-Saharan Africa might exceed its projected population size by 2100." *The Lancet* 396 (10258): 1131–1133.

Fayet, J. C. 1939. "Coutumes des Sereres N'Doute." *Publ. Com. Et. Hist. Scient. Afr. Occ. Franc., ser. A* 8:195–212.

Food and Agriculture Organization. 1993. *Guidelines for land-use planning.* Volume 1. Food and Agriculture Organization of the United Nations.

for International Earth Science Information Network (CIESIN), Center, and Centro Internacional de Agricultura Tropical (CIAT). 2004. "Gridded population of the world, version 3 (GPWv3) and the global rural-urban mapping project, version 1 (GRUMPv1)." *Columbia University, Palisades.*

Ghosh, Tilottama, Rebecca L Powell, Christopher D Elvidge, Kimberly E Baugh, Paul C Sutton, and Sharolyn Anderson. 2010. "Shedding light on the global distribution of economic activity." *The Open Geography Journal* 3, no. 1.

Guner, N., M. J. Delventhal, and J. Fernandez-Villaverde. 2020. "Demographic Transitions Across Time and Space." Unpublished.

Harari, Mariaflavia. 2019. "Women's Inheritance Rights and Bargaining Power: Evidence from Kenya." *Economic Development and Cultural Change* 68 (1): 189–238.

Kalemli-Ozcan, S. 2003. "A stochastic model of mortality, fertility, and human capital investment." *Journal of Development Economics* 70:103–118.

Kane, A. S. 1939. "Coutume civile et penale toucouleur." *Publ. Com. Et. Hist. Scient. Afr. Occ. Franc., ser. A* 8:55–115.

Kutsoati, Edward, and Randall Morck. 2014. "Family ties, inheritance rights, and successful poverty alleviation: Evidence from Ghana." In *African Successes, Volume II: Human Capital*, 215–252. University of Chicago Press.

La Ferrara, Eliana, and Annamaria Milazzo. 2017. "Customary Norms, Inheritance, and Human Capital: Evidence from a Reform of the Matrilineal System in Ghana." *American Economic Journal: Applied Economics* 9 (4): 166–185.

Lafont. 1939. "Coutume toucouleur." *Publ. Com. Et. Hist. Scient. Afr. Occ. Franc., ser. A,* 9:247–301.

Lowes, Sara. 2021. "Ethnographic and field data in historical economics." In *The Handbook of Historical Economics*, edited by Alberto Bisin and Giovanni Federico, 147–177. Academic Press.

Michalopoulos, Stelios, and Elias Papaioannou. 2020. "Historical legacies and African development." *Journal of Economic Literature* 58 (1): 53–128.

Michalopoulos, Stelios, Louis Putterman, and David N. Weil. 2019. "The influence of ancestral lifeways on individual economic outcomes in Sub-Saharan Africa." *Journal of the European Economic Association* 17 (4): 1186–1231.

Milner, Alan. 1967. "The Development of African Law." *The International Lawyer* 1 (2): 192–201.

Mookerjee, Sulagna. 2019. "Gender-Neutral Inheritance Laws, Family Structure, and Women's Status in India." *The World Bank Economic Review* 33 (2): 498–515.

Moscona, Jacob, Nathan Nunn, and James A. Robinson. 2020. "Segmentary lineage organization and conflict in Sub-Saharan Africa." *Econometrica* 88 (5): 1999–2036.

Murdock, G. P. 1959. *Africa. It's people and their culture history.* McGraw-Hill.

Murdock, George P. 1967. *Ethnographic Atlas.* University of Pittsburgh Press, Pittsburgh.

Ndulo, Muna. 2011. "African customary law, customs, and women's rights." *Indiana Journal of Global Legal Studies* 18 (1): 87–120.

Nogales, Alberto, Rodrigo Archondo-Callao, and Anil Bhandari. 2002. "Road Cost Knowledge System." *Washington, DC: World Bank.*

Nunn, Nathan. 2010. "Religious conversion in colonial Africa." *American Economic Review* 100 (2): 147–52.

Nunn, Nathan, and Diego Puga. 2012. "Ruggedness: The blessing of bad geography in Africa." *Review of Economics and Statistics* 94 (1): 20–36.

Nunn, Nathan, and Leonard Wantchekon. 2011. "The slave trade and the origins of mistrust in Africa." *American Economic Review* 101 (7): 3221–3252.

Rossi, Pauline. 2019. "Strategic choices in polygamous households: Theory and evidence from Senegal." *The Review of Economic Studies* 86 (3): 1332–1370.

Roy, Sanchari. 2015. "Empowering women? Inheritance rights, female education and dowry payments in India." *Journal of Development Economics* 114:233–251.

Strulik, H. 2017. "Contraception and Development: A Unified Growth Theory." *International Economic Review* 58 (2): 561–584.

Tertilt, Michele. 2005. "Polygyny, fertility, and savings." *Journal of Political Economy* 113 (6): 1341–1371.

Teso, Edoardo. 2019. "The long-term effect of demographic dhocks on the evolution of gender roles: Evidence from the transatlantic slave trade." *Journal of the European Economic Association* 17 (2): 497–534.

Torday, Emil, and Thomas Athol Joyce. 1910. *Notes ethnographiques sur les peuples communément appelés Bakuba, ainsi que sur les peuplades apparentées, les Bushongo.* Volume 2. Ministère des colonies: en vente chez Falk fils.

UN Habitat. 2006. "Progress Report on Removing Discrimination Against Women in Respect of Property and Inheritance Rights." *Nairobi: United Nations Centre for Human Settlements.*

United Nations, Population Division. 2022. "World Population Prospects: The 2022 Revision."

US Geological Survey. 1996. "Gtopo30." *Land Processes Distributed Active Archive Center, US Geological Survey.*

Zipfel, Céline. 2022. "The Demand Side of Africa's Demographic Transition: Desired Fertility, Wealth, and Jobs." *STICERD Working Paper*, no. EOPP71.

A Appendix

A.1 Tables

Table A.1: DHS surveys used for each country

Country ISO3	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7
BEN			1996	2001		2011-2012	2017-2018
BFA		1992-1993	1998-1999	2003		2010	
CAF			1994-1995				
CIV			1994;1998-1999			2011-2012	
CMR				2004		2011	2018-2019
COD					2007	2013-2014	
ETH				2000	2005	2011	2016
GAB						2012	
GHA		1993-1994	1998-1999	2003	2008	2014	
GIN			1999	2005		2012	2018
KEN				2003	2008-2009	2014	
LBR	1986				2006-2007	2013	
MLI			1995-1996	2001	2006	2012-2013	2018
MOZ						2011	
MWI				2000;2004-2005	2010		2015-2016
NAM				2000	2006-2007	2013	
NER		1992	1998				
NGA				2003	2008	2013	2018
SEN		1992-1993;1997		2005		2010-2011;2012-2013;2014;2015;2016	2019
SLE					2008	2013	2019
TCD						2014-2015	
TGO	1988		1998			2013-2014	
UGA						2011	2016
ZMB					2007	2013-2014	

Table A.2: Effects of impartible inheritance rules on fertility - OLS estimates (Full sample - movers & non-movers)

	Number of children ever born				
	All ages				Over 40 years
	(1)	(2)	(3)	(4)	(5)
Impartible inheritance (0/1)	0.076 ***	0.099 ***	0.063 ***	0.054 ***	0.096 ***
	(0.013)	(0.009)	(0.009)	(0.009)	(0.028)
Patrilineal (0/1)				0.096 ***	0.280 ***
				(0.012)	(0.037)
Polygynous (0/1)				0.089 ***	0.159 ***
				(0.009)	(0.028)
Plow use (0/1)				-0.000	-0.095
				(0.029)	(0.089)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Individual controls	No	Yes	Yes	Yes	Yes
Geographical controls	No	No	Yes	Yes	Yes
Colonial controls	No	No	No	Yes	Yes
Mean Dep. Var.	2.96	2.96	2.96	2.96	6.16
R-squared	0.02	0.61	0.63	0.63	0.17
Observations	651,148	616,370	607,179	607,179	100,563

*Notes: The unit of observation is a woman interviewed for the DHS survey. The sample includes all women, that is those who currently live in the place where they were born, as well as those who moved out. Estimates for "Impartible inheritance (0/1)" correspond to coefficient β from Equation (7) and capture the effect of being from an ethnic group with impartible inheritance customs. The first column controls for country and time fixed effects. The second column adds "individual controls," including the respondent's age, as well as dummies for education, marital and employment status. The third column adds a set of "geographical controls," including dummies for living in a rural area, access to electricity, the absolute values of latitude and longitude, population density, light intensity from satellite data, ruggedness index and slope of terrain. Column four corresponds to the complete specification, adding also pre-industrial characteristics of the ethnic group where the woman belongs, such as patrilineality, polygyny, as well as controls for "colonial influence," including distance to missionary settlements, colonial railway lines and explorers' routes. Column five restricts the sample to women over 40 years, who are closer to the end of their fertile window. Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

Table A.3: Fuzzy Spatial RDD - Average Treatment Effects (Full sample - movers & non-movers)

	BW=120 km
	First stage: Impartible
Impartible cluster	0.180 ***
	(0.009)
	ATE: Number of children
Impartible cluster	0.245 *
	(0.133)
Ethnic pairs FE	Yes
Country FE	Yes
Mean Dep. Var.	2.85
Nb. of pairs	321
Observations	665,472

*Notes: The unit of observation is a woman interviewed for the DHS survey. The dependent variable is the number of children ever born from this woman. The sample includes all women, that is those who currently live in the place where they were born, as well as those who moved out. The bandwidth used is 120 kilometers on each side of the ethnic border. The "first stage" estimate corresponds to the coefficient θ in Equation (10). It captures the discontinuity at the border in the fraction of women who identify as a member of an impartible ethnic group, after controlling for a linear polynomial in distance, as well as ethnic pairs and country fixed effects. The Average Treatment Effect ("ATE") is from an instrumental variable estimation (using two-stage least-squares regression) in which the endogeneous variable is the fraction of women who belong to an impartible ethnic group, instrumented with the indicator variable that equals one if they live inside the homeland of an impartible ethnic group, and zero otherwise (coefficient β in Equation (11)). Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.*

Table A.4: Spatial RDD - Reduced form estimates - Robustness checks

	Number of children ever born			
	60 km	90 km	120 km	Donut hole
	Linear			
Impartible inheritance	0.163 ***	0.184 ***	0.161 ***	0.168 ***
	(0.062)	(0.050)	(0.043)	(0.049)
	Quadratic			
Impartible inheritance	0.119	0.166 **	0.163 **	0.176 **
	(0.102)	(0.080)	(0.068)	(0.087)
Ethnic pairs FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Mean Dep. Var.	2.68	2.66	2.66	2.66
Nb. of pairs	270	286	294	294
Observations	89,361	138,819	173,883	162,679

*Notes: The unit of observation is a woman interviewed for the DHS survey. The dependent variable is the number of children ever born from this woman. The sample includes all women who were born and raised in the place where they currently live. Estimates are from regressions that control for ethnic pairs and country fixed effects ("Nb. of pairs" is reported in the bottom panel). The first panel "Linear" includes linear polynomial in distance to the ethnic border, the second panel "Quadractic" includes quadractic polynomials in distance to the ethnic border. The main coefficient of interest corresponds to β in Equation (9). It captures the discontinuity at the ethnic border in the number of children born from women living in the homeland of an impartible ethnic group, compared to those living in the homeland of a partible ethnic group. The bandwidth goes from 60 kilometers in the first column to 120 kilometers in the third column, in 30 kilometers increments. The last column reports a "Donut hole" specification where women who live within 10 kilometers of the ethnic border are excluded. Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

Table A.5: Effects of impartible inheritance rules on fertility - OLS estimates (Sample excluding women from ethnic groups with no private property)

	Number of children ever born				
	All ages				Over 40 years
	(1)	(2)	(3)	(4)	(5)
Impartible inheritance (0/1)	0.112 ***	0.126 ***	0.126 ***	0.114 ***	0.242 ***
	(0.026)	(0.017)	(0.017)	(0.017)	(0.058)
Patrilineal (0/1)				0.132 ***	0.270 ***
				(0.021)	(0.068)
Polygynous (0/1)				0.096 ***	0.318 ***
				(0.018)	(0.063)
Plow use (0/1)				0.006	0.010
				(0.043)	(0.142)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Individual controls	No	Yes	Yes	Yes	Yes
Geographical controls	No	No	Yes	Yes	Yes
Colonial controls	No	No	No	Yes	Yes
Mean Dep. Var.	2.88	2.89	2.90	2.90	6.40
R-squared	0.02	0.65	0.66	0.66	0.15
Observations	177,463	170,679	168,116	168,116	27,230

*Notes: The unit of observation is a woman interviewed for the DHS survey. The sample includes all women who were born and raised in the place where they currently live, but excludes those who live within the borders of an ethnic group for which the EA reports an "absence of private property." Estimates for "Impartible inheritance (0/1)" correspond to coefficient β from Equation (7) and capture the effect of being from an ethnic group with impartible inheritance customs. The first column controls for country and time fixed effects. The second column adds "individual controls," including the respondent's age, as well as dummies for education, marital and employment status. The third column adds a set of "geographical controls," including dummies for living in a rural area, access to electricity, the absolute values of latitude and longitude, population density, light intensity from satellite data, ruggedness index and slope of terrain. Column four corresponds to the complete specification, adding also pre-industrial characteristics of the ethnic group where the woman belongs, such as patrilineality, polygyny, as well as controls for "colonial influence," including distance to missionary settlements, colonial railway lines and explorers' routes. Column five restricts the sample to women over 40 years, who are closer to the end of their fertile window. Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.*

Table A.6: Spatial RDD - Reduced form estimates
(Sample excluding women from ethnic groups with no private property)

	Number of children ever born		
	60 km	90 km	120 km
Impartible inheritance	0.163 ***	0.184 ***	0.161 ***
	(0.062)	(0.050)	(0.044)
Ethnic pairs FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Mean Dep. Var.	2.68	2.67	2.68
Nb. of pairs	269	284	293
Observations	88,413	136,629	170,056

*Notes: The unit of observation is a woman interviewed for the DHS survey. The dependent variable is the number of children ever born from this woman. The sample includes all women who were born and raised in the place where they currently live, but excludes those who live within the borders of an ethnic group for which the EA reports an "absence of private property." Estimates are from regressions that include a linear polynomial in distance to the border, ethnic pairs and country fixed effects ("Nb. of pairs" is reported in the bottom panel). The main coefficient of interest corresponds to β in Equation (9). It captures the discontinuity at the ethnic border in the number of children born from women living in the homeland of an impartible ethnic group, compared to those living in the homeland of a partible ethnic group. The bandwidth goes from 60 kilometers in the first column to 120 kilometers in the third column, in 30 kilometers increments. Robust standard errors, clustered by DHS sampling units, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

A.2 Figures

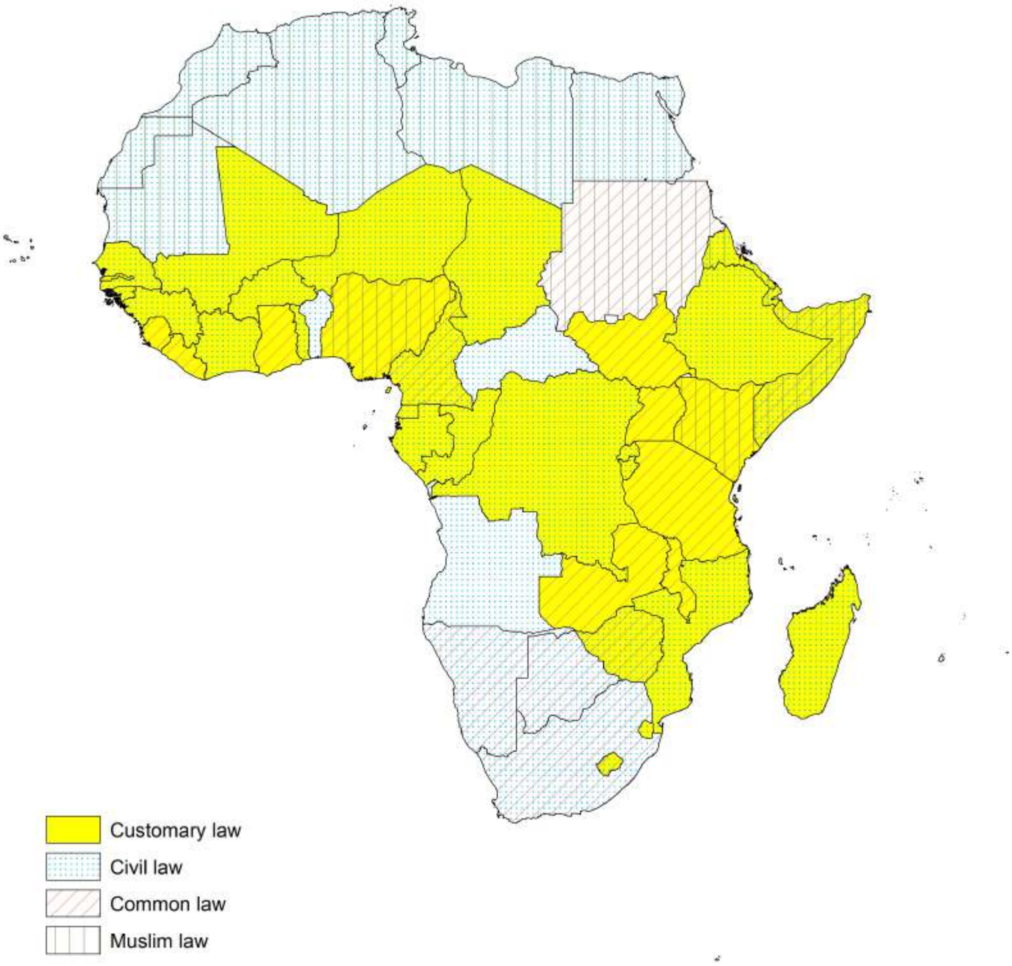


Figure A.1: Legal systems in Africa

Sources: JuriGlobe - World Legal Systems Research Group, University of Ottawa; Logo (2014)

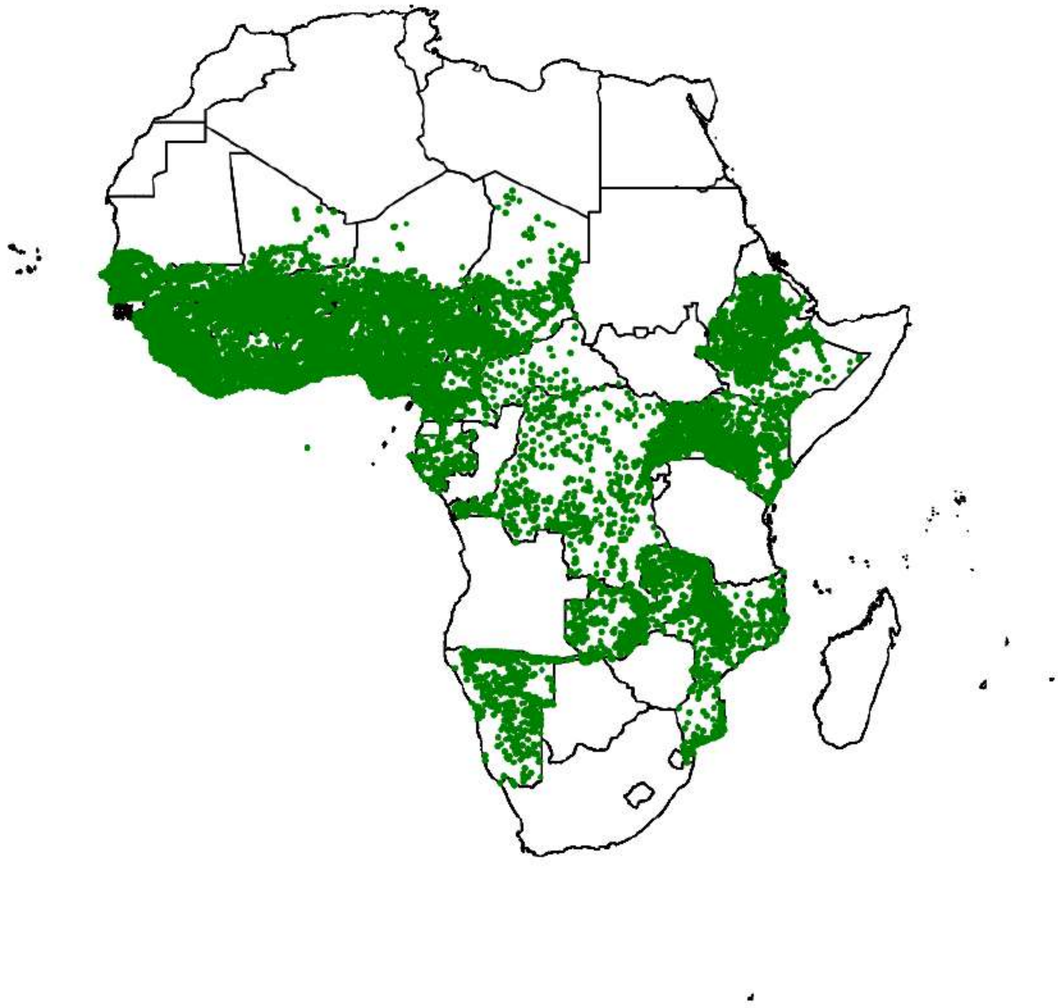


Figure A.2: Location of DHS clusters in Sub-Saharan African Countries

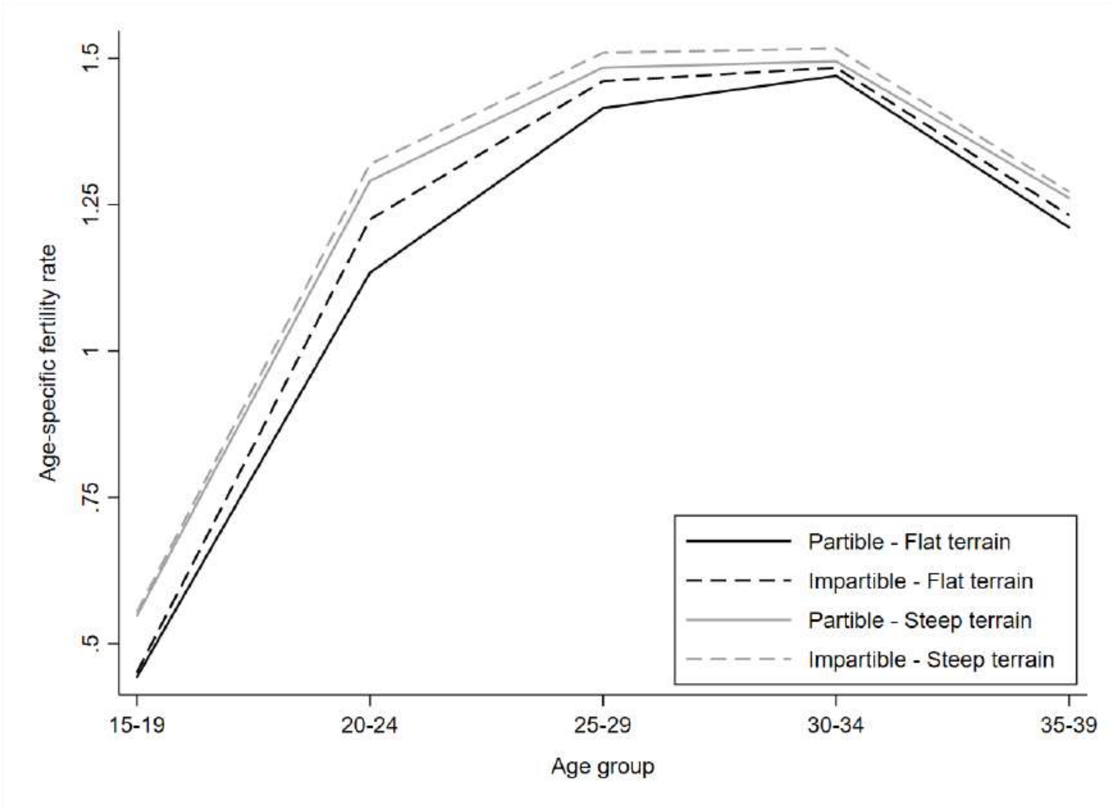


Figure A.3: Age-specific fertility, heterogeneity analysis by terrain's steepness.

Notes: The age-specific fertility rates (y-axis) measure how many births a woman had on average during five-year periods from the moment she turned 15 (x-axis). The sample is composed of women aged more than 35 years old at the time of the DHS interview and for which we have reconstructed their complete birth history. The solid lines plot the age-specific fertility rates for women who belong to an ethnic group with partible inheritance customs, while the dashed lines plot the fertility rates of those with impartible customs. The black lines are for women who live in flat terrains (i.e. slope below median), while the gray lines are for those who live in steep terrains (i.e. slope above median).

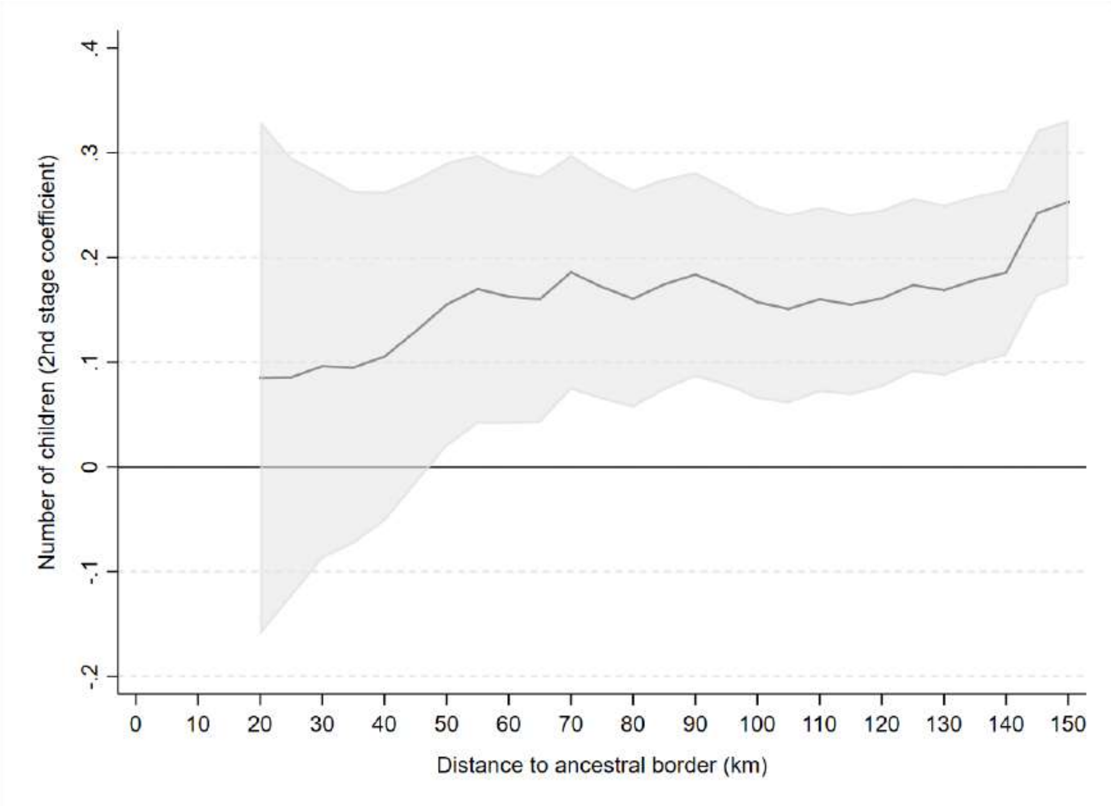


Figure A.4: Bandwidth sensitivity

Notes: The solid line plots reduced form estimates of the fertility effects (β in Equation (9)) from separate regressions with varying bandwidth around the ancestral border, from 20 to 150 kilometers in 5-kilometer increments. Regressions include a linear polynomial in distance to the border, ethnic pairs and country fixed effects. The sample includes all women who were born and raised in the place where they currently live. The shaded area represents 95 percent confidence intervals.

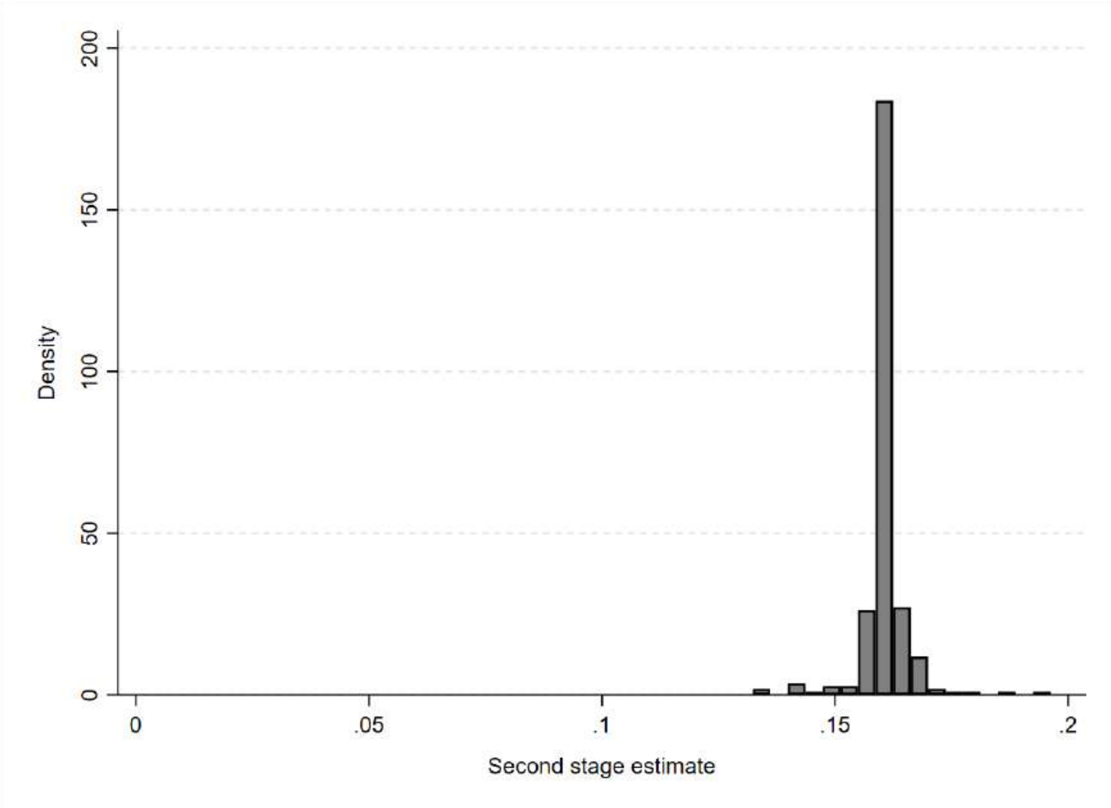


Figure A.5: Testing for outliers sensitivity using "Leave-one-out" procedure

Notes: Distribution of 294 point estimates (β in Equation (9)) from separate regressions, leaving one pair of ethnic groups out each time. Regressions include a linear polynomial in distance to the border, ethnic pairs and country fixed effects. Bandwidth is 120 kilometers and the sample includes all women who were born and raised in the place where they currently live. We observe that all estimates are centered around our baseline estimate of 0.16 (Table 6).

A.3 Maximization problems

Maximization problem under impartible inheritance. The maximization problem under impartible inheritance writes as follows

$$\max_{n_I} \quad \ln\left((1-\phi n_I)y_I\right) + \beta \ln\left(\left(L-\bar{L}\right)^{\alpha} n_I^{1-\alpha}\right) \ ,$$

which can be rearranged as

$$\max_{n_I} \quad \ln\left(1-\phi n_I\right) + \ln\left(y_I\right) + (1-\alpha)\beta\ln\left(n_I\right) + \alpha\beta\ln\left(L-\bar{L}\right) \ ,$$

and is only defined for $0 < n_P < \frac{1}{\phi}$.

The first order condition writes as follows,

$$-\frac{\phi}{1-\phi n_I}+\frac{(1-\alpha)\beta}{n_I}=0 \tag{12}$$

$$\iff n_I^*=\frac{(1-\alpha)\beta}{(1+(1-\alpha)\beta)\,\phi}\ ,$$

where n_I^*, is the solution to the maximization problem with impartible inheritance. Taking the derivative of Equation (12) with respect to n_I, we have

$$-\frac{\phi^2}{(1-\phi n_I)^2}-\frac{(1-\alpha)\beta}{n_I^2}<0\ ,$$

which satisfies the second order condition for a maximum.

Maximization problem under partible inheritance. The maximization problem under partible inheritance writes as follows

$$\max_{n_P}\ \ \ln\left((1-\phi n_P)y_P\right)+\beta\ln\left(n_P\left(\frac{L}{n_P}-\bar{L}\right)^{\alpha}\right)\ ,$$

which can be rearranged as

$$\max_{n_P}\ \ \ln\left(1-\phi n_P\right)+\ln\left(y_P\right)+(1-\alpha)\beta\ln\left(n_P\right)+\alpha\beta\ln\left(L-\bar{L}n_P\right)\ ,$$

and is only defined for $0<n_P<\min\left\{\frac{1}{\phi},\frac{L}{\bar{L}}\right\}$.

The first order condition writes as follows,

$$-\frac{\phi}{1-\phi n_P}+\frac{(1-\alpha)\beta}{n_P}-\frac{\alpha\beta\bar{L}}{L-\bar{L}n_p}=0 \tag{13}$$

$$\iff \frac{(1-\alpha)\beta}{n_P}-\left(\frac{\phi}{1-\phi n_P}+\frac{\alpha\beta\bar{L}}{L-\bar{L}n_p}\right)=0$$

$$\iff (1-\alpha)\beta(1-\phi n_P)(L-\bar{L}n_p)-n_P\left[\phi(L-\bar{L}n_p)+\alpha\beta\bar{L}(1-\phi n_P)\right]=0\ .$$

Where the left hand side of the first order condition is a second order polynomial and is negative for $n_P=\min\left\{\frac{1}{\phi},\frac{L}{\bar{L}}\right\}$. This implies that out of the two solutions to Equation (13) (respectively below and above $\min\left\{\frac{1}{\phi},\frac{L}{\bar{L}}\right\}$), only the one below, denoted n_P^*, is a solution to the maximization problem and equal to

$$n_P^* = \frac{\beta\bar{L} + (1+(1-\alpha)\beta)\phi L - \sqrt{(\beta\bar{L} + (1+(1-\alpha)\beta)\phi L)^2 - 4(1-\alpha)\beta(1+\beta)\phi\bar{L}L}}{2(1+\beta)\phi\bar{L}} .$$

Taking the derivative of Equation (13) with respect to n_P, we have

$$-\frac{\phi^2}{(1-\phi n_P)^2} - \frac{(1-\alpha)\beta}{n_P^2} - \frac{\alpha\beta\bar{L}^2}{(L-\bar{L}n_p)^2} < 0 ,$$

which satisfies the second order condition for a maximum.