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AFRICAN POLYGAMY: PAST AND PRESENT

JAMES FENSKE

ABSTRACT. I use DHS data to test nine hypotheses about the prevalence and decline of African polygamy. First, greater female involvement in agriculture does not increase polygamy. Second, past inequality better predicts polygamy today than does current inequality. Third, the slave trade only predicts polygamy across broad regions. Fourth, modern female education does not reduce polygamy. Colonial schooling does. Fifth, economic growth has eroded polygamy. Sixth and seventh, rainfall shocks and war increase polygamy, though their effects are small. Eighth, polygamy varies smoothly over borders, national bans notwithstanding. Finally, falling child mortality has reduced polygamy.

1. INTRODUCTION

Polygamy and poverty are both widespread in Africa.¹ Several mechanisms have been suggested linking polygamy to slow growth, including low savings rates (Tertilt, 2005), reduced investment in girls' human capital (Edlund and Lagerlöf, 2006), and diminished labor supply of unmarried men (Edlund and Lagerlöf, 2012). In the "polygamy belt" stretching from Senegal to Tanzania, it is common for more than one third of married women to be polygamous (Jacoby, 1995). Excepting Haiti, polygamy is less common in other developing countries. In all other Demographic and Health Surveys (DHS), at least 92% of married women are reported to be monogamous. This is despite a striking decline in the prevalence of polygamy in Africa over the last half century. In Benin, more than 60% of women in the sample used for this study who were married in 1970 are polygamists, while the figure for those married in 2000 is under 40%. This is also true of Burkina Faso, Guinea, and Senegal. Several other countries in the data have experienced similar erosions of polygamy. This is an evolution of marriage markets as dramatic as

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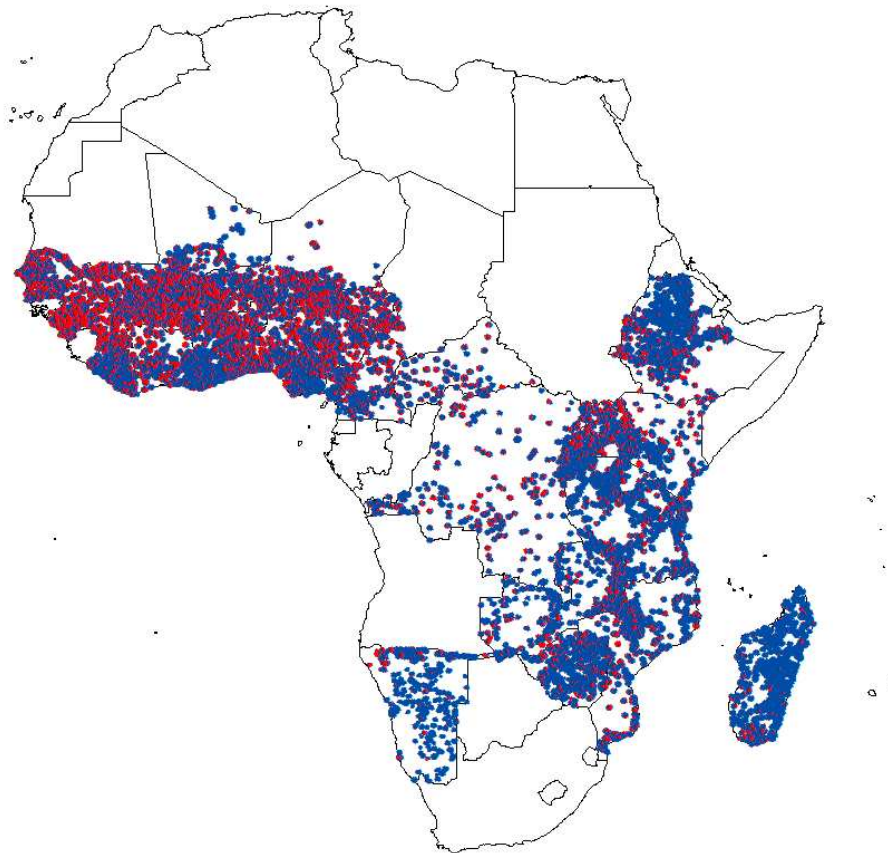
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¹I deal only with polygyny (multiple wives) in this paper, ignoring polyandry (multiple husbands). Non-specialists are typically unfamiliar with the term "polygyny."

FIGURE 1. Polygamy in Africa



This figure plots polygamy for the women in the sample that have latitude and longitude coordinates. A red dot indicates polygamy, and a blue dot indicates monogamy.

the rise in divorce in the United States or the decline of arranged marriage in Japan over the same period.

I use DHS data on 494,157 women from 34 countries to test nine hypotheses about the geographic distribution of polygamy in sub-Saharan Africa and its decline over time. These are motivated by a simple model, and by previous theories and findings from economics, anthropology, and African history. These hypotheses test whether polygamy responds to economic incentives, economic shocks, and the process of economic development.

I map African polygamy in Figure 1. Each point is a married woman for whom coordinates are available. Red dots indicate polygamists; blue dots are monogamists. Polygamy is concentrated in West Africa, though a high-intensity belt stretches through to Tanzania. Polygamy in the data is largely bigamy: 72% of respondents report that they are the only wife, 19% report that their husband has two wives, 7% report that he has three wives, and fewer than 2% report that he has 4 wives or more.

The geographic distribution of polygamy can be accounted for by geographic, historical and cultural variables that are slow to change. First, Jacoby (1995) has linked the demand for wives in the Ivory Coast to the productivity of women in agriculture. I find, by contrast, that polygamy is least common in those parts of Africa where women have historically been most important in agriculture. Second, economists since Becker (1974) have linked polygamy to inequality between men. I am not able to find any correlation between wealth inequality recorded in the DHS and the probability that a woman is polygamous. I find, however, that historical inequality predicts polygamy today. Similarly, geographic predictors of inequality that have been used in other studies also predict the existence of polygamy in the present. Third, I confirm the result of Dalton and Leung (2013); greater slave trade exposure does predict polygamy today. I show, however, that the result depends on a broad comparison of West Africa to the rest of the continent.²

I show the decline of polygamy over time in Figure 2. A raw correlation between year of birth and polygamy will confound time trends with age effects, since a young lone wife may later become a polygamist's senior wife. Thus, I estimate the time trend of polygamy for each country with more than one cross-section. I use the regression:

$$polygamous_i = f(age_i) + g(year\ of\ birth_i) + \epsilon_i.$$

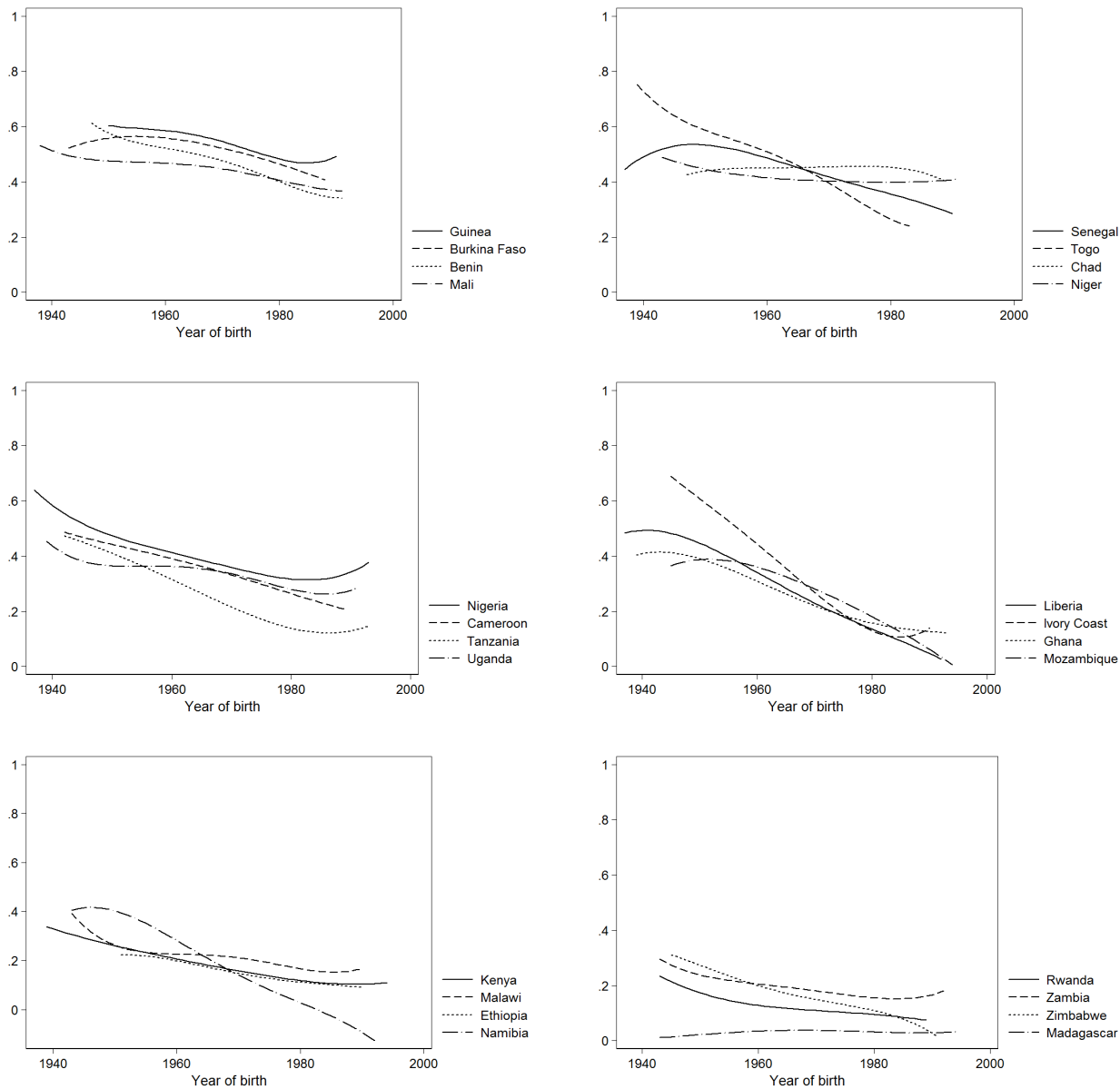
The functions f and g are quartic. I use the estimated coefficients and survey weights to calculate the predicted probability that a woman aged 30 is polygamous as a function of her year of birth. I present these in Figure 2. Though the speed of the decline has differed across countries, its presence has been almost universal. In the Web Appendix, I show raw plots of polygamy by age stratified by country and survey year: these tell a similar story. To my knowledge, this is not a trend that has been documented previously.³

Understanding the decline in African polygamy requires examining time-varying factors that may influence polygamy. First, I exploit two natural experiments that have increased female education in Nigeria (Osili and Long, 2008) and Zimbabwe (Agüero and Ramachandran, 2010), and find no causal effect of women's schooling on polygamy. By contrast, I use colonial data from Huillery (2009) and Nunn (2011) to show that schooling investments decades ago predict lower polygamy rates today. Second, I find an impact of greater levels income per capita on the decline in polygamy. I follow Miguel et al. (2004), and use country-level rainfall as an instrumental variable. Third, I find that local economic shocks predict polygamy; women within a survey cluster who received unfavorable rainfall draws in their prime marriageable years are more likely to marry a

²I became aware of their paper while working on this project. They were first, but replication is good for science.

³The data do not permit a similar exercise for men.

FIGURE 2. Predicted polygamy over time for women aged 30, by year of birth



polygamist. Fourth, war acts like a detrimental rainfall shock at the local level, increasing the prevalence of polygamy. Both of these effects, however, are small in magnitude. Fifth, I use a regression discontinuity design to test whether national bans and other country-level efforts have played any role in the decline of African polygamy. With a few notable exceptions, I find that they have not. Finally, I use national-level differences in differences and a natural experiment from Uganda to test for an effect of falling child mortality. The magnitudes I find are large enough to explain a meaningful decline in polygamy in several African countries.

To summarize: I find, first, that existing theories of polygamy face challenges in explaining Africa. Inequality is related to polygamy, but acts over the very long term. The distribution of polygamy in Africa does not fit an explanation rooted in the gender division of labor. Educating women in the present does not reduce polygamy. Second, I find that history matters. Pre-colonial inequality, the slave trade, and colonial education matter in the present. Third, African marriage markets have responded to economic growth and fluctuations, but the largest elasticities that I find are in response to changes in child health. These patterns are consistent with other findings that, while norms and culture respond to economic pressures, they are persistent.

1.1. Relevant literature. My results contribute to our knowledge of the determinants of ethnic institutions. Institutions such as pre-colonial states and land tenure matter for modern incomes (Goldstein and Udry, 2008; Michalopoulos and Papaioannou, 2013). Although an empirical literature has explained national institutions as products of influences such as settler mortality, population, trade, or suitability for specific crops, less is known about the origins of ethnic institutions. Like national institutions, these may have their basis in biogeographical endowments such as population pressure or ecologically-driven gains from trade (Fenske, 2013; Osafo-Kwaako and Robinson, 2012). I add to this literature by testing hypotheses about the origin of one specific ethnic institution, and by identifying variables that influence its persistence and evolution.

My results also add to our understanding of family structures. Several recent contributions have explained marriage patterns using the gender division of labor created by influences such as the plough (Alesina et al., 2012), animal husbandry (Voigtländer and Voth, 2012), natural resource wealth (Ross, 2008), or deep tillage (Carranza, 2012). Other views link marital rules to risk-sharing arrangements (Rosenzweig and Stark, 1989). A handful of papers model polygamy. In this paper, I reassess some of the most influential explanations of African polygamy, and propose new contributing factors. I uncover a dramatic transition in the continent's marriage markets, and assess some plausible explanations for this change.

In section 2, I outline the hypotheses that I test. I discuss the literature and simple model that motivate these. In section 3, I describe the tests that I apply to each of these hypotheses. I introduce the multiple data sources that I use in section 4. I report the results in section 5. In section 6, I conclude.

2. HYPOTHESES

In this section, I outline a simple model of polygamy that addresses the hypotheses that I test empirically. I relate its predictions to existing results in the economic, anthropological, and historical literatures.

2.1. Model Overview. In the Web Appendix, I present a simple model that motivates my empirical tests within a unified framework. Not every outcome is novel. For example,

the link between inequality and polygamy goes back to Becker (1974). This model cannot explain all stylized facts in the data. Increasing incomes predict greater polygamy in the model, but less polygamy in the data. The purpose of the model, then, is to demonstrate that the hypotheses I test are theoretically relevant in a simplified, static framework. Further, I derive predictions that differ from existing explanations of polygamy; this establishes that there is theoretical ambiguity that must be resolved empirically.

In the basic model, poor men and rich men trade sisters for wives at an endogenously-determined bride price. Wives work and bear children. Men face a trade-off between fertility and consumption, and select the costly human capital of their children. The parameters of the model are chosen to capture insights about the hypotheses I test. ρ measures female agricultural productivity. θ indicates the degree of inequality between men. s indicates the ratio of women to men. γ^L and γ^H are the costs of raising low-human-capital and high-human-capital children, respectively. y is the overall level of income.

Because the model does not allow for non-marriage of women or marital age gaps, the mean number of wives per man is determined mechanically by the female-male ratio, s . I use the ratio of wives of a rich man to the number of wives of a poor man as an index of polygamy. This endogenous outcome is denoted R . The fraction of women who are married to rich men is increasing in R .

2.2. The geographic distribution of polygamy.

2.2.1. *The gender division of labor.* Boserup (1970) suggests that accumulating wives is more profitable for men where women contribute more to agriculture. This is facilitated by African land tenure systems that allow growing households to expand their holdings of land. Empirically, Jacoby (1995) shows that the demand for wives is greatest in those parts of the Ivory Coast where female productivity in agriculture predicted by crop mixes is highest. White (1988) finds a positive correlation between polygamy and female importance in agriculture within the *Standard Cross-Cultural Sample*. Alternatively, women's economic roles shape their relative bargaining power, potentially improving their marital outcomes.

Although women are more important in agriculture where they are more productive (Alesina et al., 2012), the model does not predict that this will increase polygamy. Though greater productivity ρ increases the demand for women, supply is held constant. Increasing the productivity of women in agriculture *reduces* polygamy in the model ($\frac{\partial R}{\partial \rho} < 0$). The increase in ρ raises the purchasing power of both rich men and poor men, since their endowments of sisters have both increased in value. This reduces the disparity in purchasing power and, hence, polygamy.

2.2.2. *Inequality.* Becker (1974) argues that polygamy can raise total output when men are unequal. Similarly, Bergstrom (1994) models polygamy as a consequence of inequality in male endowments of both wealth and sisters. Empirically, Barber (2008) and

Kanazawa and Still (1999) both find that polygamy is more common in modern countries where inequality is greater. White (1988) finds a positive correlation between inequality and polygamy within the *Standard Cross-Cultural Sample*. The model predicts that inequality increases polygamy. $\frac{\partial R}{\partial \theta} > 0$.

Many perspectives stress that inequality will only permit polygamy under despotic political institutions; in democratic societies, poorer men will vote to impose monogamy (Anderson and Tollison, 1998; De la Croix and Mariani, 2012). Similarly, Lagerlöf (2010) suggests that a self-interested ruler may impose monogamy at later stages of development to prevent his own overthrow by lesser men deprived of wives. Across societies, Betzig (1982) finds a positive correlation between hierarchy and polygamy, arguing that men use positions of authority to increase access to women. Even where marriage has been monogamous, mating has been polygynous in despotic, unequal societies (Betzig, 1992, 1995).

2.2.3. *The slave trade.* That the slave trade may have increased polygamy is an old argument – see Thornton (1983). In addition to its effects on inequality and the female-male ratio, it created movable wealth that may have facilitated a transition from matrilineal to patrilineal marriage, allowing non-sororal polygamy to exist (Schneider, 1981). Persistence of polygamy after the end of the slave trade may be due, among other reasons, to cultural durability, survival of unequal political and economic structures, permanent changes in the economic role of women, or continuation of unequal sex ratios (Edlund and Ku, 2011).

Dalton and Leung (2013) test whether the slave trade predicts polygamy in DHS data. I confirm their result using different methods. I take women as the unit of observation, rather than men, and match women to slave exports by location in addition to matching by ethnicity. I show these results are robust to adding Angola, which exported more slaves than any other country, but has low polygamy rates today. I add the caveat that the slave trade can only predict polygamy across broad regions.

The slave trade can be thought of in at least two ways in the model. The first is as an increase in the female-male ratio, s . This will increase the number of wives for rich and poor men. However, $\frac{\partial R}{\partial s} < 0$. A larger endowment of sisters for both rich and poor men will reduce inequality in wives. I show in the Web Appendix that the female-male ratio helps explain polygamy today by showing that polygamy is more common in areas closer to mines, where labor is generally provided by migrant men. A second approach to the slave trade gives a different result. Because those who profited from the slave trade did so at the expense of others, it increased inequality (θ). This would increase R .

2.3. The decline of polygamy.

2.3.1. *Female education.* Empowering women through education may encourage them to avoid polygamous marriage. Gould et al. (2008) suggest that a rich man intent on increasing child quality will prefer one educated wife to several uneducated ones because

of her comparative advantage in producing high-quality children. If the returns to human capital rise, and women are heterogeneous in their levels of human capital, this can provoke a transition to monogamy.

Histories of missionary education exert persistent influence on attitudes towards democracy (Woodberry, 2012) and the position of women (Nunn, 2011); it is possible that these have had a similar effects on attitudes towards polygamy. These cultural influences are not captured by the model.

The model gives different predictions. If educating women makes it easier for them to raise educated children, reducing γ^H , it will have no effect on polygamy, though it may induce a switch from low-quality to high-quality children. This differs from the result in Gould et al. (2008). In their model, educated women have an advantage in producing educated children, and husbands prefer this benefit to greater fertility. Here, women are homogenous. The effects of mass education programs like the ones I exploit as natural experiments will differ from those that have unequal impacts.

2.3.2. *Economic growth.* The Gould et al. (2008) model is one in which the transition to monogamy is spurred by the increasing importance of human capital under modern economic growth. Gould et al. (2012) support this interpretation, correlating polygamy rates with income sources in the Ivory Coast. Similarly, Lagerlöf (2005) models the transition to greater reproductive equality not as the result of greater incomes *per se*, but of the transition to modern growth based on greater returns to human capital.

Contrary to the literature, the model reveals that other mechanisms may counter the tendency of polygamy to decline with income if there is no change in the returns to human capital. Here, an increase in y will increase the fraction of wives held by the rich: $\frac{\partial R}{\partial y} > 0$. The increase in y raises the importance of monetary wealth relative to wealth in sisters, increasing the advantage of rich men in the marriage market. The distribution and source of income gains, then, will matter.

2.3.3. *Economic shocks.* I test whether rainfall shocks at the survey cluster level predict whether a woman will marry polygamously. Since many African societies pay bride price, an adverse shock may encourage a girl's parents to marry her to a worse man in order to smooth consumption. Even without bride price, this may allow her parents to remove a dependant or gain ties with another household able to offer support. Since polygamist men tend be wealthier, they are better able to buy a wife in depressed conditions.

Although I do not include insurance explicitly, the model captures these intuitions. If poor men see their incomes fall more than richer men, this will act like an increase in θ , increasing R . If, instead, incomes fall generally, this decline in y will reduce the extent of polygamy.

2.3.4. *War.* Warfare might increase polygamy for several reasons. The sex ratio is an obvious channel; Becker (1974) cites a nineteenth-century war that killed much of the

male population of Paraguay and was followed by a rise in polygamy. The BBC has suggested that polygamy is a coping strategy for war widows in Iraq,⁴ while the OECD has made similar claims about Angola.⁵ Historically, warfare has existed as a means for capturing women from neighboring ethnic groups (White and Burton, 1988). In the model, war would be expected to operate through the same channels as a local economic shock, as well as by increasing s , the female-male ratio.

2.3.5. National policies. Polygamy was banned by law in the Ivory Coast in 1964, but remains widespread there. Despite the apparent failure of similar bans in other countries, it is possible that other policies that vary at the national level may have affected polygamy. These could include democratization, the legal status of women, or the provision of health and education.

I use a regression discontinuity design to test whether polygamy rates break at the borders in my sample. Other studies of Africa have found that government investments such as education and health have effects that change discontinuously across national borders. By contrast, indigenous institutions such as rights over land pass smoothly over national borders (Bubb, 2013).

The model suggests that only some policies will matter. For example, some countries might provide better education, lowering γ^H , but having no effect on polygamy. Alternatively, countries with national bans that increase the costs of polygamy could be seen as levying a fine on wives greater than s . This would have the effect of dampening demand for wives from richer men, reducing bride-price and relative polygamy R .

2.3.6. Child mortality. Most economic models of polygamy consider it as a means for men to achieve greater fertility. Empirically, Grossbard-Shechtman (1986) estimates that two thirds of the demand for wives in Maiduguri is, in fact, demand for children. Barber (2008) finds polygamy and pathogen stress are positively correlated across countries.

In the model, child mortality could be seen as an increase in γ^L and γ^H , the costs of children. In the baseline setup, child mortality will change fertility, but not the total number of wives. This follows from the assumptions on preferences; a simplified model with quasilinear utility gives the result that greater levels of child mortality increase polygamy if the extent of inequality is not too great. This follows a simple intuition; if polygamy is a mechanism for men to increase their fertility, a reduction in the probability that any one child will die reduces number of wives needed to achieve a target number of surviving children. Whether this occurs in practice will depend on the magnitudes of the income and substitution effects.

2.4. Other views. Space and data availability force me to ignore some plausible explanations of polygamy and its decline. These include exposure to pair-bonding hormones

⁴<http://www.bbc.co.uk/news/world-middle-east-12266986>

⁵<http://genderindex.org/country/angola>

through animal husbandry (Adshade and Kaiser, 2008), son-preference (Milazzo, 2012), abundance of land (Goody, 1973, 1976), and assortative matching (Siow, 2006). I discuss other possible determinants of polygamy, such as religion and urbanization, in Appendix A and in the Web Appendix. In the Web Appendix, I present the correlates of historic polygamy across the ethnic groups recorded in the Murdock (1967) *Ethnographic Atlas*.

3. TESTS

The econometric tests that I use to test these hypotheses vary according to whether the potential cause of polygamy is time-invariant, varies over time, can be tested with a regression discontinuity, or can be tested using a natural experiment.

3.1. The geographic distribution of polygamy. Several hypotheses suggest effects of time-invariant variables on polygamy. Historical inequality is one example. For hypotheses of this type, my basic specification is:

$$(1) \quad \text{polygamous}_i = z_i' \beta + x_i' \gamma + \delta_{CR} + \epsilon_i.$$

Here, polygamous_i is an indicator for whether woman i is in a polygamous marriage. z_i is the vector of controls of interest – for example her ethnic group’s gender division of labor, or her survey cluster’s suitabilities for growing certain crops. x_i is a vector of individual and geographic controls. δ_{CR} is a country-round fixed effect; this will absorb both country and survey-year fixed effects. ϵ_i is error. Standard errors are clustered at the level at which the variables of interest (z_i) vary. I use ordinary least squares (OLS) to estimate (1). Where I have instruments for z_i , I use instrumental variables (IV).

The variables that are available to include in x_i differ across the 90 DHS data sets that I compile, and so I use only a limited set of individual-level controls. These are: year of birth, year of birth squared, age, age squared, dummies for religion, and urban. I am able to include both year of birth and age because the DHS surveys were conducted in multiple years, though the linear term disappears with country-round fixed effects.

I include geographic controls in x_i to capture other determinants of polygamy that may be correlated with z_i . These are: absolute latitude; suitability for rain-fed agriculture; malaria endemism; ruggedness; elevation; distance to the coast, and dummies for ecological zone (woodland, forest, mosaic, cropland, intensive cropland, wetland, desert, water/coastal fringe, or urban).

3.1.1. The gender division of labor. I use two separate measures of the gender division of labor in z_i . The first is the historic degree of female participation in agriculture. The second is the suitability of the woman’s survey cluster for growing specific crops. I then use these suitability measures as instruments for the historic importance of women in agriculture. The exclusion restriction is that the relative productivity of different crops influences polygamy only through the gender division of labor and is not correlated with unobserved determinants of polygamy. Note that agricultural productivity in general is

included as a separate regressor, and is not excluded from the second stage. This is similar to the restriction in Jacoby (1995).

3.1.2. *Inequality.* When I test for the importance of contemporary inequality, I use the coefficient of variation of household wealth in z_i .⁶ I compute this within both survey clusters and sub-national regions. Because the wealth measures come normalized for each country-round, these results are only interpretable when country-round fixed effects are included. I also use historic class stratification, a measure of historical inequality, in z_i .

I also use geographic variables in z_i that have been treated by other studies as predictors of inequality. These are the log ratio of wheat to sugar suitability and heterogeneity in land quality. The mechanism behind the log ratio of wheat to sugar suitability was proposed by Engerman and Sokoloff (1997). Sugar production in the Americas was dependent on slave labor, while wheat production was amenable to family farms. The long-run result was more inequality in regions that grew sugar. Easterly (2007) finds the log suitability ratio predicts inequality even outside the Americas, which suggests that suitability for sugarcane predicts inequality-increasing agricultural practices even where it is not grown. Heterogeneity in land quality is more intuitive; when there is inequality in the ability to produce income, outcomes should be unequal. Michalopoulos et al. (2012) use this measure in explaining the rise of Islam. First-stage F statistics are too weak to permit using these geographic variables as instruments for inequality. I can, then, only offer a guarded interpretation; historical inequality or unobservable variables that are correlated with ethnic institutions shape polygamy today.⁷

3.1.3. *The slave trade.* I use measures of ethnicity-level slave exports in z_i , clustering standard errors by ethnicity. I instrument for slave exports using distance of the survey cluster from the closest slave port in the Americas. When country-round fixed effects are included, this instrument loses predictive power. Thus, I follow Nunn and Wantchekon (2011) and use distance from the coast as an alternative instrument. To demonstrate that the results depend on a broad comparison of West Africa and the rest of the continent, I show that including longitude in x_i eliminates the effect, as does re-estimating this regression on the sub-sample of West African countries.⁸ Because my main data source and that of Dalton and Leung (2013) both exclude Angola (the polygamy question was not asked), I assemble alternative data using the DHS “household recodes.” I code each household as polygamous if more than one woman is listed as a wife of the

⁶I show in the Web Appendix that the results are similar if a Gini coefficient is used.

⁷Other approaches to predicting inequality, such as unequal landholding (Dutt and Mitra, 2008), inequality in immigrants’ home countries (Putterman and Weil, 2010), or changes over time in relative prices of “plantation” and “smallholder” crops (Galor et al., 2009) cannot be applied to these data.

⁸Benin, Burkina Faso, Cameroon, Ghana, Guinea, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

household head. Individual controls are missing from these data, and so I only use geographic controls.

3.2. The decline of polygamy.

3.2.1. *Female education.* To test whether expanded access to education has reduced polygamy in Africa, I exploit two recent natural experiments and spatial variation in access to colonial education.

School-building in Nigeria. From 1976 to 1981, the Nigerian government engaged in a school-building program in certain states. Osili and Long (2008) use this to test whether female schooling reduces fertility. I follow their approach, and use OLS to estimate:

$$\begin{aligned} \text{polygamy}_i &= \beta \text{Born 1970-75} X \text{Intensity}_i \\ &+ \alpha \text{Intensity}_i + \lambda \text{Born 1970-75} + x_i' \gamma + \epsilon_i \end{aligned}$$

Intensity_i will, in different specifications, measure either whether the respondent's state was treated by the program, or spending per capita in the state. The controls in x_i match Osili and Long (2008). These are year of birth, dummies for the three largest Nigerian ethnic groups (Yoruba, Hausa, Igbo), and dummies for the major religions (Muslim, Catholic, Protestant, other Christian, and traditional). The sample includes only women born between 1956-61 and 1970-75. This tests whether the school-building program had a differential effect on the women young enough to be exposed to it as children in the affected states. β is the treatment effect. Standard errors are clustered by the states that existed in 1976.

The end of white rule in Zimbabwe. The end of white rule in Zimbabwe increased access to education for students who were 14 or younger in 1980. Agüero and Ramachandran (2010) test for intergenerational effects of this education shock. Agüero and Bharadwaj (2012) examine the impacts on knowledge of HIV. Following these, I use OLS to estimate:

$$\begin{aligned} \text{polygamy}_i &= \beta \text{Age 14 or below in 1980}_i + \alpha \text{Age in 1980}_i \\ &+ \lambda (14\text{-Age in 1980}) X \text{Age 14 or below in 1980} + \epsilon_i \end{aligned}$$

Like Agüero and Ramachandran (2010), I do not include additional controls and I use robust standard errors. The “full” sample includes women aged 6 to 22 in 1980, and the “short” sample includes women aged 10 to 20 in that year. β measures the effect of the change.

I show in the Web Appendix that a similar natural experiment from Sierra Leone (Canonier and Mocan, 2012) did not reduce polygamy. As with the colonial schooling investments, the data I use cover women, and so cannot be used to evaluate whether these modern schooling interventions altered the relative levels of schooling across genders.

Colonial education. First, I follow Huillery (2009) and include the average number of teachers per capita at the district (cercle) level in colonial French West Africa over the period 1910-1928 in z_i . I modify x_i so that it matches the controls used by Huillery (2009) as closely as possible. I always include the respondent's year of birth, year squared, age, age squared, dummies for religion and the urban dummy. In successive columns, I include measures of the attractiveness of the district to the French, conditions of its conquest, pre-colonial conditions, and geographic variables in x_i . Standard errors are clustered by 1925 district.

Second, I follow Nunn (2011) and include distance from a Catholic or Protestant mission in 1924 in z_i .⁹ Since much colonial education was conducted through missions, this captures the combined effects of schooling and evangelism. Standard errors are clustered by survey cluster.

The data I use cover women, and so do not reveal how colonial education affected the relative education levels of women and men. Because I do not have instruments for these historical variables, it is not possible to interpret these estimates as strictly causal. Indeed, geographic controls do predict the location of colonial missions (not reported). Supporting a causal interpretation, ethnicities recorded in the *Ethnographic Atlas* that practiced polygamy received more missions per unit area (not reported). The significant estimates I find are, however, consistent with the importance of history in explaining polygamy.

3.2.2. *Economic growth.* The data come as cross-sections of women born in different years. This allows me to use variation in the ages at which women were exposed to shocks such as drought, war, or economic growth to test for time-varying causes of polygamy. For hypotheses of this type, my basic specification is:

$$(2) \quad \text{polygamous}_i = z_i' \beta + x_i' \gamma + \delta_j + \eta_t + \epsilon_i.$$

The variables polygamous_i , x_i , and ϵ_i are the same as above. z_i now measures a woman's exposure to a shock around the time she is most marriageable. I measure shocks at the woman's age of marriage and, because this is potentially endogenous, averaged over her early adolescence (ages 12 to 16). δ_j is a fixed effect for the woman's survey cluster. η_t is a fixed effect for time – t is the year of marriage when z_t is measured at the age of marriage, and t is the year of birth when z_t is measured over the ages 12 to 16. I am comparing women across cohorts in the same survey cluster in order to identify β .

Because δ_j is collinear with geographic controls and the urban dummy, these controls are dropped. This prevents the use of (2) to test hypotheses such as the gender division of labor, inequality, and the slave trade in which geographic variables matter.

⁹Results are similar if dummy variables for whether a colonial mission exists within 5, 10, 15 or 20 km are used in z_i , although the correlation between polygamy and distance from a Protestant mission becomes more robust (not reported).

η_t is collinear with year of birth and the combination of η_t and δ_j are collinear with age when the shock is averaged over a woman's adolescence. Thus, x_i only contains dummies for religion in that specification. I use OLS or IV to estimate (2). Because the data are at the individual level, I am not able to include lagged polygamy. Standard errors are clustered at the level at which z_i varies.

To test for an impact of economic growth, I include log GDP per capita in z_t . Standard errors are clustered by country \times year of marriage (or year of birth). I instrument for country-level GDP per capita using the country-level rainfall estimates used by Miguel et al. (2004). Standard errors are clustered by country-round in the IV estimation.

3.2.3. *Economic shocks.* I include rainfall shocks in the woman's survey cluster in z_t . Standard errors are clustered by cluster \times year of marriage or cluster \times year of birth.

3.2.4. *War.* I include the number of battle deaths in a conflict whose radius includes a woman's survey cluster in z_t . I treat this as a proxy for conflict intensity. Standard errors are clustered by cluster \times year of marriage or year of birth.

3.2.5. *National policies.* For each neighboring set of countries in the data, I select all clusters that are within 100 km of the border and estimate:

$$(3) \quad \text{polygamy}_i = \beta_0 + \beta_1 \text{Country}_i + f(\text{Distance}_i) + \text{Country}_i \times f(\text{Distance}_i) + x_i' \gamma + \epsilon_i$$

I adopt the convention that Country_c is a dummy for the alphabetically prior country. $f(\text{Distance}_i)$ is a cubic in distance from the border. Because of the small sample size and inclusion of a spatial polynomial, I exclude the geographic controls from x_i . I cluster standard errors by survey cluster.

3.2.6. *Child mortality.* I include (separately) country-level and sub-national measures of under-5 mortality mortality in z_t . Standard errors are clustered by country \times year of marriage or year of birth. It is possible that polygamy increases child mortality (Strassmann, 1997). Here, however, child mortality is measured at or before the time these women are married and so precedes their fertility decisions.

The eradication of malaria in Kigezi. In 1960, a joint program between the WHO and the Government of Uganda eradicated malaria in the country's Kigezi region. Following Barofsky et al. (2011), I estimate the effect of this program with the regression:

$$\text{polygamy}_i = \beta \text{Post}_i \times \text{Kigezi}_i + x_i' \gamma + \delta_j + \eta_t + \epsilon_i$$

Here, Post_i measures whether the respondent was born in 1960 or later, Kigezi_i is a dummy for the treated region. δ_j is a district fixed effect, and η_t is a year-of-birth fixed effect. x_i includes dummies for religion, ethnicity and urban. Standard errors are clustered by district. I use this to test for an impact of child mortality on polygamy. There are two caveats. First, none of the women in the sample are old enough for treatment

to be measured relative to their year of marriage, rather than their year of birth. Second, malaria eradication had several effects; Barofsky et al. (2011), for example, find educational impacts. My results can only provide indirect support for the importance of a reduction in child mortality. This is, however, the only anti-malaria campaign I am aware of that overlaps with data on polygamy. The Kenyan anti-malaria efforts studied by Pathania (2011) began in 2004, and so it is still too early to evaluate that program's effects on marriage outcomes.

4. DATA

In this section, I introduce my sources of data. I provide additional details in the Web Appendix.

4.1. Dependent variables and controls. Data are taken from the “individual recode” sections of 90 DHS surveys conducted in 34 sub-Saharan countries between 1986 and 2009. These individual-level samples are nationally representative cross-sections of ever-married women of childbearing age. From these surveys, 494,157 observations are available in which a woman's polygamy status, year of birth, and urban residence are known. A woman is coded as polygamous if she reports that her husband has more than one wife. Latitude and longitude coordinates of the respondent's survey cluster are known for 301,183 of these observations.¹⁰ Year of birth, year of birth squared, age, age squared, dummies for religion, and urban are taken from these surveys.

Geographic controls are collected from several sources. For each of these, I assign a survey cluster the value of the nearest raster point. I obtain suitability for rain-fed agriculture and ecological zone from the Food and Agriculture Organization's Global Agro-Ecological Zones (FAO-GAEZ) project. The ecological zones are dummy variables, while the suitability measure ranges from 0 to 7. Elevation is an index that ranges from 0 to 255, taken from the North American Cartographic Information Society. Malaria endemicism is from the Malaria Atlas Project, and ranges from 0 to 1. Ruggedness is the Terrain Ruggedness Index used by Nunn and Puga (2012), which ranges from 0 to 1,368,318. Absolute latitude and distance from the coast are computed directly from the cluster's coordinates. The women for whom geographic coordinates are available differ from the full sample. They were generally born and married later, and are slightly more polygamous (see the Web Appendix). This will only influence the estimation results if there are heterogeneous treatment effects.

Other variables are specific to each hypothesis, and are described in greater detail in the Web Appendix. Summary statistics are in Table 1. Because these variables come from multiple sources, they are each available only for subsets of the data. Sample sizes, then, differ across columns in the regression tables.

¹⁰Recent DHS surveys add noise to these coordinates. Because this displaces 99% of clusters less than 5 km and keeps them within national boundaries, this adds only measurement error to the geographic controls.

4.2. The geographic distribution of polygamy.

4.2.1. *The gender division of labor.* The suitability measures for specific crops are scores between 0 and 7, published by the FAO. These vary by survey cluster. These are available for wheat, maize, cereals, roots/tubers, pulses, sugar, oil crops, and cotton. Though chosen for their availability, these crops are important in the countries in the data. For example, they accounted for 83% of the value of crop production in Zambia and 91% in Namibia in 2000 (faostat.fao.org).

Historic female participation in agriculture is taken from the *Ethnographic Atlas*. This source reports the ethnic institutions of 1,267 global societies, approximately at the time of European contact. I join these to the DHS data using respondents' ethnic groups. More than 40% of the sample could be assigned a level of "historic female agriculture" by this method. The polygyny rate for this sample is roughly 10 percentage points greater than for the unmatched sample. This sample differs along other observable dimensions, though these differences are small (see the Web Appendix). "Historic female agriculture" assigns each ethnic group a score between 1 and 5 indicating the degree to which women were important relative to men in agriculture.

4.2.2. *Inequality.* I use the wealth index from the DHS to measure inequality. This is a factor score computed separately for every survey round, based on household ownership of durable goods. I compute coefficients of variation and Gini coefficients from these data, measuring inequality across households within the survey cluster or sub-national region. Although it would be preferable to measure inequality across individuals, ownership of durable goods is only available by household. I do not have data on ownership of productive assets, such as land.

I take "historic class stratification" from the *Ethnographic Atlas*. This is a score between 1 and 5 describing the extent of class differences just prior to colonial rule. The sample for which this is non-missing is similar to the sample for which "historic female agriculture" is available.

The log ratio of wheat to sugar suitability is computed directly from the FAO data. Heterogeneity in land quality is the coefficient of variation of constraints on rain-fed agriculture for the survey clusters within each region. The constraints variable is an index between 1 and 7. It measures the combination of soil, climate, and terrain slope constraints. It also comes from the FAO. These measures have the additional advantage of being independent of household composition.

4.2.3. *The slave trade.* I match women in the sample to slave trade estimates from Nunn and Wantchekon (2011) using self-declared ethnicity. The estimates are reported on a map, allowing me to use respondents' geographic coordinates to create an alternative spatial measure of slave trade intensity. Since it is easier to measure slave exports across ports than across ethnicities, this will reduce measurement error. Further, the long-run effects of the slave trade may have worked through institutions that vary by location,

rather than by ethnicity. Following Dalton and Leung (2013), I use the log of (one plus) Atlantic slave trade exports normalized by area to measure slave trade exposure.

4.3. The decline of polygamy.

4.3.1. *Female education.* Years of schooling are reported in the DHS data. I use three measures of Nigeria's school building program from Osili and Long (2008): a dummy for a "high intensity" state, school-building funds in 1976 divided by the 1953 census population estimates, and school-building funds normalized by (unreliable) 1976 population projections. I match survey clusters to the old states using their coordinates. Since the 1999 Nigerian DHS do not report coordinates, I do not use this wave.

Teachers per capita and other controls from colonial French West Africa from Huillery (2009) are available on her website. Locations of colonial missions from Nunn (2011) (originally from Roome (1924)) are available on his website.

4.3.2. *Economic growth.* GDP per capita is from the World Development Indicators. Rainfall measures from the Miguel et al. (2004) data set average precipitation over geographic points in a country during a given year, measured by the Global Precipitation Climatology Project.

4.3.3. *Economic shocks.* Rainfall shocks taken from a University of Delaware series that reports annual rainfall on a latitude/longitude grid. Each cluster is joined to the nearest grid point. I measure shocks as the ratio of rainfall in year t to average rainfall for that cluster.

4.3.4. *War.* I take battle deaths from the Uppsala Conflict Data Program (UCDP) and International Peace Research Institute, Oslo (PRIO) Armed Conflict Dataset. Each conflict has a latitude/longitude coordinate, a radius, and a best estimate of the number of battle deaths during each year of fighting. If a war's radius overlaps a woman's survey cluster in her marriageable years, she is "treated" by these battle deaths.

4.3.5. *National policies.* Distance to each national border is computed by calculating the minimum distance between a survey cluster and a pixelated border map.

4.3.6. *Child mortality.* Child mortality (under 5) is taken from the World Development Indicators. Because it is only reported every five years, it is interpolated linearly by country. In the Web Appendix, I show that alternative measures taken from the Institute for Health Metrics and Evaluation or computed directly from DHS birth histories give similar results.

For Uganda, "Kigezi" is a dummy for whether the respondent's survey cluster is in Kabale, Kanungu, Kisoro or Rukungiri. In addition to the DHS sample, I use the 1991 Ugandan census, available through IPUMS. Because polygamy is only reported for household heads in the census, I limit my sample to wives of household heads when using IPUMS data.

5. RESULTS

In this section, I present the results of the tests outlined above. Additional robustness checks and supporting results are listed in Appendix A and are described in detail in the Web Appendix.

5.1. The geographic distribution of polygamy.

5.1.1. *The gender division of labor.* I show in Table 2 that the distribution of polygamy within Africa is inconsistent with Jacoby's (1995) results. The variables that predict female productivity in his sample do not predict polygamy here. Roots and tubers (the equivalent of yams and sweet potatoes) have a negative impact on polygamy (columns 1 and 2). His negative coefficient on maize is not found here.

Polygamy and the historical importance of women in agriculture are negatively correlated (columns 3 and 5). Polygamy is concentrated in the Sahel and Sudan regions where women have been less important in agriculture than in more tropical parts of Africa. Additional controls (in particular, religion), lead this result to become insignificant across countries, though it remains significant within countries (columns 4 and 6). The correlations are moderate; a one standard deviation increase in historic female agriculture reduces polygamy by roughly 3 percentage points in the most conservative specification (column 4). To test whether the correlation varies by land scarcity, I include population density and its interaction with historic female agriculture. The interaction is not significant (not reported). The result is not driven by the plough, as the estimates are nearly identical when the only African country with an indigenous plough – Ethiopia – is removed (not reported).

The IV results are larger than the OLS estimates (columns 9 and 10). More severe measurement error in the historic division of labor than in contemporary geographic conditions is one explanation. It is also possible that crop suitability cannot be excluded from the second stage. Indeed, conventional over-identification tests fail on these data. Still, the hypothesis that the gender division of labor in agriculture determines polygamy cannot explain why polygamy is most prevalent in those parts of Africa where female labor in agriculture has historically been least important, even when this is predicted by fixed geographic factors.¹¹

Why do my results differ from those of Jacoby (1995)? I show in the Web Appendix that my results hold even within the Ivory Coast. The hypothesis that a greater importance of women in agriculture leads to polygamy ignores general equilibrium effects captured by the model in section 2. In addition, a greater role for women may enhance their ability to negotiate improved marital outcomes.

¹¹The first-stage F-statistics are low because I treat all suitability measures as instruments. The first stage is reported in columns 7 and 8. If I select only those with the most predictive power, the first-stage F-statistics improve without qualitatively changing the results.

5.1.2. *Inequality.* In Table 3, I show that there is no large positive relationship between present-day wealth inequality and polygamy (columns 1 to 4). In the one specification where the correlation is statistically significant, the point estimate is very small. Historic class stratification, by contrast, predicts polygamy today (columns 5 to 7). The geographic predictors of inequality also predict polygamy, further suggesting that the long-term determinants of inequality matter. The wheat-sugar ratio is significant across specifications (columns 8 to 10). Greater intra-regional differences in land quality predict higher levels of polygamy, though this is not robust to the inclusion of other controls unless country-round fixed-effects are also included (columns 11 to 13).

The magnitudes of the effects vary. A one standard deviation reduction in historical class stratification would raise polygamy by a bit more than 2 percentage points. This is not negligible, but is not large enough to explain a substantial fraction of the variance in polygamy. A one standard deviation movement in the log wheat-sugar ratio is associated with a roughly 3 percentage point reduction in polygamy rates (column 9), while the comparable effect for unequal land quality is a bit larger than 1 percentage point with controls (column 13).

The data do not make it possible to identify the mechanisms that allow past inequality to better explain polygamy today than present-day inequality. I do not, for example, have data on hypergamy. There are at least two likely explanations. First, the basis of inequality in African societies has changed; current inequality and past class stratification have a correlation coefficient less than 0.01. Whereas inequality in the past was based largely on “wealth in people” (Guyer, 1993), inequality today depends more on factors such as human capital that are not complemented by polygamy. Supporting this interpretation, Lagerlöf (2010) argues that greater inequality leads to polygamy only in earlier stages of development. Second, institutions and culture are slow to evolve. Other results below confirm the importance of historical variables and the small elasticities of polygamy with respect to present-day shocks.

5.1.3. *The slave trade.* In Table 4, I find a positive correlation between the slave trade and current-day polygamy. This is true in both individual-level and household-level data. It is more robust when respondents are matched to treatment by location (columns 1, 2, 12, and 13) rather than by ethnic group (columns 6, 7, 17 and 18). In the individual-level OLS, a one standard deviation increase in slave exports predicts a 2 percentage point increase in polygamy (column 2). The IV results are more than 10 times as large (column 13). This is consistent with more severe measurement error in slave exports than in geographic location.

This effect depends, however, on the comparison of West Africa with the rest of the continent. I use Table 4 to show that country fixed effects (column 3), controlling for longitude (column 4), and separately estimating the effects using only the West African sub-sample (column 5) do not yield significant positive results. The hypothesis that the

slave trade increased polygamy in Africa is supported, but the fineness of the variation that can be used to identify the effect should not be overstated.

5.2. The decline of polygamy.

5.2.1. *Female education.* I show in Table 5 that the educational expansions in Nigeria and Zimbabwe do not predict discontinuous drops in polygamy. In the Web Appendix, I show that these results are consistent with the small (though statistically robust) correlation between years of education and polygamy in observational data. I do find a negative effect of schooling in colonial French West Africa on polygamy today in Table 6. A one standard deviation increase in colonial education reduces polygamy by roughly 1 percentage point (column 1).¹² While I find that proximity to a historical Catholic mission reduces polygamy today, the similar effect of distance from a protestant mission disappears once country-round or region-round fixed effects are added. A one standard deviation increase in access to a Catholic mission reduces polygamy by roughly 3 percentage points with the tightest fixed effects (column 9). I find no evidence that Catholic missions better predict polygamy in colonies of Catholic countries, or where Protestant missions are more distant (not reported).

The lack of an impact for modern education is similar to the finding in Friedman et al. (2011) that educating women does not create “modern” attitudes. The historical results are consistent with the findings in Nunn (2011) that Catholic missions imparted both education and ideologies about the role of women. These results suggest that education only reduces polygamy rates over the long term and in conjunction with other interventions. While colonial schooling was largely performed by missionaries, for whom the sanctity of Christian marriage was an overarching concern (e.g. Chanock (1985)), this is not true of modern education.

If historical schools proxy for parental education, it could explain these results. This information is not in the DHS data, and so I use other sources to test whether parental education predicts polygamy. I show in the Web Appendix that mother’s education does not predict polygamy in World Bank surveys from Nigeria, Ghana, and the Ivory Coast. Daughters of more educated fathers are less likely to be polygamous in Nigeria and the Ivory Coast, and the negative correlations between own education and polygamy are significant only in the Ivory Coast.

5.2.2. *Economic growth.* I show in Table 7 that higher levels of GDP per capita during a woman’s marriageable years predict that she is less likely to marry a polygamist (columns 1, 2, 6 and 7). The estimated coefficients are, however, small. A 100% increase in GDP per capita would reduce polygamy by roughly 2 percentage points in the unconditional OLS specifications (column 1). This rises to roughly 20 points in the IV (column 2), which is consistent with the overall poor quality of African national income

¹²There is a negative correlation between polygamy today and health workers in the past, but this is not robust to additional controls.

accounts (Jerven, 2010). If standard errors are clustered by country, the result remains significant at the 5% level in the IV specifications, but is no longer significant in the OLS (not reported). While economic growth has been uneven and halting, most countries in the sample have seen a steady decline in polygamy, even if this has been faster when growth has accelerated.

5.2.3. *Economic shocks.* In Table 7, a positive rainfall shock in a woman's marriageable years predicts that she is less likely to marry polygamously. These effects are small. Raising rainfall by 100% over its normal value would only have a roughly 3 percentage point effect on polygamy (Columns 3 and 8).¹³ If standard errors are clustered by survey cluster, the result remains significant at the 1% level in both specifications (not reported).

5.2.4. *War.* In Table 7, war increases polygamy. This is marginally insignificant when measured at the year of marriage (column 4), though it is robust when averaged over early adolescence (column 9), and becomes larger and more significant if rainfall shocks are also included (see the Web Appendix). If standard errors are clustered by survey cluster, the result remains significant at the 1% level in the ages-12-to-16 specification (not reported). Although I take war as a random shock, I am unable to rule out the possibility that war operates through intermediate channels or that unobserved shocks cause both war and polygamy. The effects are again small. A war with one million battle deaths would, depending on the specification, raise a woman's probability of marrying polygamously by between 25 and 100 percentage points. On average, a woman receives a much smaller shock closer to 7,000 battle deaths in her year of marriage in the event she is affected by a war.

5.2.5. *National borders.* I report regression discontinuities in Table 8. Most borders do not bring significant discontinuous changes in polygamy rates. Of the seven exceptions, two can be immediately discarded; too few clusters were surveyed near the Benin-Burkina Faso (Column 1) and CAR-DRC (column 11) borders for the polynomial to be estimated accurately. Similarly, the Cameroon-Nigeria (column 12) and Niger-Nigeria (column 36) discontinuities are driven by outliers near the border, and disappear with either a linear or quadratic distance polynomial.

The remaining three breaks are large. There is no obvious mechanism that explains the discontinuities at CAR-Cameroon (column 10), Ivory Coast-Liberia (column 24), and Malawi-Tanzania (column 29) borders. While Bubb (2013) finds discontinuities indicating higher levels of education and numeracy in Ghana than in the Ivory Coast, education cannot explain the outcomes. I add years of schooling as a control; this has only a modest effect on the magnitudes (not reported).

¹³Because rainfall may be mean-reverting, I also allow rainfall to enter separately for each year between ages 12 and 16 (not reported). The coefficients are negative, but significant only at age 16. Interacting these shocks with the gender division of labor shows their effect to be largest where women are most important in agriculture (not reported).

5.2.6. *Child mortality.* The difference-in-difference estimates in Table 7 suggest that the effect of child mortality on polygamy is sizable. These results suggest an elasticity of at least 0.7 (column 5). The magnitudes are similar if I use alternative estimates from the Institute for Health Metrics and Evaluation, and are roughly 40% as large if I use sub-national region-specific estimates computed from the raw DHS data (see the Web Appendix). Using these DHS-based estimates, the magnitudes are similar using the mortality of boys or girls (not reported). In a country such as Nigeria, where under-5 mortality has fallen from more than 28% in the early 1960s to roughly 14% today, this is enough to explain a roughly 4 to 10 percentage point drop in polygamy rates over the period. I show in the Web Appendix that this is robust to including GDP per capita as a control. Similarly, this result survives controlling for country-level fertility rates (not reported). If standard errors are clustered by country, the result remains significant at the 5% level in the age-of-marriage specification and the 1% level in the ages-12-to-16 specification (not reported).

The results for Uganda provide suggestive evidence of causation. The DHS data show that women born after the malaria eradication program in the treatment area were roughly 7 percentage points less likely to marry polygamously (column 1). The IPUMS data give a smaller effect, equal to less than 1 percentage point (column 2), reflecting the lower polygamy rate for wives of household heads in the IPUMS data (11%) than all ever-married women in the DHS (31%).

Several other facts support the interpretation that polygamy is a strategy for men to increase their fertility, which would explain this result. Marriage of older women is rare; 95% of polygamist women began their most recent marriage no later than age 27.¹⁴ Interacting child mortality with the wealth index suggests the effect is largest for wealthier households (not reported). In the Web Appendix, I show that first wives whose first child dies are more likely to become polygamists, though I do not find an effect of child gender or twinning. Similarly, Milazzo (2012) has found that desired fertility leads Nigerian men to seek additional wives if their first wives do not have children; see also Wagner and Rieger (2011). I also show in the Web Appendix that controlling for pathogen stress in a sample of pre-industrial societies substantially reduces the unexplained gap between polygamy in Sub-Saharan Africa and the rest of the world. Pathogen stress itself positively predicts polygamy.

6. CONCLUSION

I have tested several influential theories of polygamy, and none have passed cleanly. Polygamy rates in the present are more related to inequality and female education in the past than they are to these variables today. The relative distribution of polygamy in Africa cannot be explained by the traditional gender division of labor. The slave trade

¹⁴The duration of the respondent's current marriage is reported in bins such as "15-19 years." The maximum age at most recent marriage is current age minus the minimum value in this bin.

remains a plausible explanation. However, this is indistinguishable from the fact that polygamy rates are higher in West Africa. Similarly, national policies appear not to have mattered. While polygamy responds to rainfall shocks and war, the magnitude of these effects is too small to play an important role in polygamy's decline in Africa.

Because many variables I use are only available for non-overlapping sub-samples of the data and the econometric specifications that I use cannot be synthesized into a single regression or decomposition, the significant results that I do find are best compared using standardized coefficients. One standard deviation increases in historic inequality or its geographic predictors raise polygamy by 2 to 3 percentage points. Historical schools and missions have similar standardized effects between 1 and 3 percentage points. A one standard deviation reduction in child mortality has a larger effect, a bit over 5 percentage points. The effects of the slave trade and economic growth are less precisely measured; a one standard deviation decrease in slave exports or a 100% increase in economic growth is expected to reduce polygamy between 2 and 20 percentage points, depending on whether OLS or IV estimates are used. While I have uncovered some economically important determinants of polygamy, none of these can explain the bulk of polygamy's prevalence or disappearance.

REFERENCES

- Adshade, M. and Kaiser, B. (2008). The origins of the institutions of marriage. *Working Paper*.
- Agüero, J. and Bharadwaj, P. (2012). Do the educated know more about health? Evidence from schooling and HIV knowledge in Zimbabwe. *Forthcoming in Economic Development and Cultural Change*.
- Agüero, J. and Ramachandran, M. (2010). The intergenerational effects of increasing parental schooling: Evidence from Zimbabwe. *Working Paper*.
- Alesina, A., Giuliano, P., and Nunn, N. (2012). On the origins of gender roles: Women and the plough. *Forthcoming in the Quarterly Journal of Economics*.
- Anderson, G. M. and Tollison, R. D. (1998). Celestial marriage and earthly rents: Interests and the prohibition of polygamy. *Journal of Economic Behavior & Organization*, 37(2):169–181.
- Baker, M., Brunnschweiler, C., and Bulte, E. (2008). Did history breed inequality? Colonial factor endowments and modern income distribution. *CER-ETH Economics Working Paper series*.
- Barber, N. (2008). Explaining cross-national differences in polygyny intensity resource-defense, sex ratio, and infectious diseases. *Cross-Cultural Research*, 42(2):103–117.
- Barofsky, J., Chase, C., Anekwe, T., and Farzadfar, F. (2011). The economic effects of malaria eradication: Evidence from an intervention in Uganda. *Working Paper*.
- Becker, G. (1974). A theory of marriage: Part II. *Marriage, Family, Human Capital, and Fertility*. Edited by Schultz, Theodore W.

- Bergstrom, T. (1994). On the economics of polygyny. *Working Paper, University of Michigan*.
- Betzig, L. (1992). Roman polygyny. *Ethology and Sociobiology*, 13(5):309–349.
- Betzig, L. (1995). Medieval monogamy. *Journal of Family History*, 20:181–181.
- Betzig, L. L. (1982). Despotism and differential reproduction: A cross-cultural correlation of conflict asymmetry, hierarchy, and degree of polygyny. *Ethology and Sociobiology*, 3(4):209–221.
- Boserup, E. (1970). *Woman's role in economic development*. Martin's Press, New York.
- Bubb, R. (2013). The Evolution of Property Rights: State Law or Informal Norms? *Forthcoming in the Journal of Law and Economics*.
- Cannonier, C. and Mocan, N. (2012). Empowering Women Through Education: Evidence from Sierra Leone. *NBER Working Paper No. 18016*.
- Carranza, E. (2012). Soil endowments, production technologies and missing women in India. *Working Paper*.
- Chanock, M. (1985). *Law, custom, and social order: The colonial experience in Malawi and Zambia*. Cambridge University Press.
- Christiaensen, L., Gindelsky, M., and Jedwab, R. (2013). The Speed of Urbanization and Economic Development: A Comparison of Industrial Europe and Contemporary Africa. *Working Paper*.
- Dalton, J. and Leung, T. (2013). Why is polygyny more prevalent in Western Africa? An African slave trade perspective. *Forthcoming in Economic Development and Cultural Change*.
- De la Croix, D. and Mariani, F. (2012). From polygyny to serial monogamy: a unified theory of marriage institutions. *IZA Discussion Paper*.
- Dutt, P. and Mitra, D. (2008). Inequality and the instability of polity and policy. *The Economic Journal*, 118(531):1285–1314.
- Easterly, W. (2007). Inequality does cause underdevelopment: Insights from a new instrument. *Journal of Development Economics*, 84(2):755–776.
- Edlund, L. and Ku, H. (2011). The Slave Trade and Polygyny in Africa. *Working Paper*.
- Edlund, L. and Lagerlöf, N.-P. (2006). Individual versus parental consent in marriage: Implications for intra-household resource allocation and growth. *The American Economic Review*, 96(2):304–307.
- Edlund, L. and Lagerlöf, N.-P. (2012). Polygyny and Its Discontents: Paternal Age and Human Capital Accumulation. *Working Paper*.
- Engerman, S. L. and Sokoloff, K. L. (1997). *Factor endowments, institutions, and differential paths of growth among new world economies*, pages 260–304. How Latin America Fell Behind. *Essays on the Economic Histories of Brazil and Mexico, 1800-1914*. Stanford University Press.
- Fenske, J. (2013). Ecology, trade and states in pre-colonial Africa. *Forthcoming in the Journal of the European Economic Association*.

- Friedman, W., Kremer, M., Miguel, E., and Thornton, R. (2011). Education as liberation? *National Bureau of Economic Research Working Paper No. 16939*.
- Galor, O., Moav, O., and Vollrath, D. (2009). Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. *Review of Economic Studies*, 76(1):143–179.
- Goldstein, M. and Udry, C. (2008). The profits of power: Land rights and agricultural investment in Ghana. *The Journal of Political Economy*, 116(6):981–1022.
- Goody, J. (1973). Polygyny, economy, and the role of women. *The character of kinship*, pages 175–190.
- Goody, J. (1976). *Production and reproduction: A comparative study of the domestic domain*. Cambridge University Press Cambridge.
- Gould, E., Moav, O., and Simhon, A. (2008). The mystery of monogamy. *The American Economic Review*, 98(1):333–357.
- Gould, E. D., Moav, O., and Simhon, A. (2012). Lifestyles of the rich and polygynous in Cote d'Ivoire. *Economics Letters*, 115(3):404–407.
- Grossbard-Shechtman, A. (1986). Economic behavior, marriage and fertility: Two lessons from polygyny. *Journal of Economic Behavior & Organization*, 7(4):415–424.
- Guyer, J. (1993). Wealth in people and self-realization in Equatorial Africa. *Man*, 28(2):243–265.
- Huillery, E. (2009). History matters: The long-term impact of colonial public investments in French West Africa. *American Economic Journal: Applied Economics*, 1(2):176–215.
- Jacoby, H. (1995). The economics of polygyny in Sub-Saharan Africa: Female productivity and the demand for wives in Côte d'Ivoire. *Journal of Political Economy*, 103(5):938–971.
- Jerven, M. (2010). The relativity of poverty and income: How reliable are African economic statistics? *African Affairs*, 109(434):77–96.
- Kanazawa, S. and Still, M. C. (1999). Why monogamy? *Social Forces*, 78(1):25–50.
- Lagerlöf, N. (2010). Pacifying monogamy. *Journal of Economic Growth*, 15(3):1–28.
- Lagerlöf, N.-P. (2005). Sex, equality, and growth. *Canadian Journal of Economics/Revue canadienne d'économique*, 38(3):807–831.
- Michalopoulos, S., Naghavi, A., and Prarolo, G. (2012). Trade and geography in the economic origins of Islam: theory and evidence. *NBER Working Paper w18438*.
- Michalopoulos, S. and Papaioannou, E. (2013). Pre-colonial Ethnic Institutions and Contemporary African Development. *Econometrica*, 81(1):113–152.
- Miguel, E., Satyanath, S., and Sergenti, E. (2004). Economic shocks and civil conflict: An instrumental variables approach. *Journal of Political Economy*, 112(4):725–753.
- Milazzo, A. (2012). Son Preference, Fertility, and Family Structure. Evidence from Reproductive Behavior among Nigerian Women. *Working Paper, Bocconi University*.
- Murdock, G. (1967). Ethnographic Atlas: A summary. *Ethnology*, 6(2):109–236.

- Nunn, N. (2011). Gender and Missionary Influence in Colonial Africa. *African Poverty of the Longue Durée*.
- Nunn, N. and Puga, D. (2012). Ruggedness: The blessing of bad geography in Africa. *The Review of Economics and Statistics*, 94(1):20–36.
- Nunn, N. and Wantchekon, L. (2011). The slave trade and the origins of mistrust in Africa. *American Economic Review*, 101(7):3221–3252.
- Osafo-Kwaako, P. and Robinson, J. A. (2012). Political Centralization in Pre-Colonial Africa. *Working Paper*.
- Osili, U. and Long, B. (2008). Does female schooling reduce fertility? Evidence from Nigeria. *Journal of Development Economics*, 87(1):57–75.
- Pathania, V. (2011). The Impact of Malaria Control on Infant Mortality in Kenya. *Working Paper*.
- Putterman, L. and Weil, D. (2010). Post-1500 population flows and the long-run determinants of economic growth and inequality. *The Quarterly Journal of Economics*, 125(4):1627.
- Roome, W. R. (1924). *Ethnographic Survey of Africa: Showing the Tribes and Languages; Also the Stations of Missionary Societies*.
- Rosenzweig, M. and Stark, O. (1989). Consumption smoothing, migration, and marriage: evidence from rural India. *The Journal of Political Economy*, 97(4):905–926.
- Ross, M. (2008). Oil, Islam, and women. *American Political Science Review*, 102(1):107–123.
- Schneider, H. (1981). *The Africans: an ethnological account*. Prentice-Hall.
- Siow, A. (2006). Monogamy implies positive assortative matching. *Working Paper*.
- Strassmann, B. (1997). Polygyny as a risk factor for child mortality among the Dogon. *Current Anthropology*, 38(4):688–695.
- Tertilt, M. (2005). Polygyny, fertility, and savings. *Journal of Political Economy*, 113(6):1341–1374.
- Thornton, J. (1983). Sexual demography: The impact of the slave trade on family structure. in C. Robinson and M. Klein (eds.), *Women and slavery in Africa*, pages 39–48.
- Vanhanen, T. (2000). A new dataset for measuring democracy, 1810-1998. *Journal of Peace Research*, 37(2):251–265.
- Voigtländer, N. and Voth, H. (2012). How the west “invented” fertility restriction. *Forthcoming in the American Economic Review*.
- Wagner, N. and Rieger, M. (2011). Polygamy and Child Health. Do babies get sick if daddy has many wives? *Working Paper*.
- White, D. and Burton, M. (1988). Causes of polygyny: Ecology, economy, kinship, and warfare. *American Anthropologist*, 90(4):871–887.
- White, D. R. (1988). Rethinking polygyny: co-wives, codes, and cultural systems. *Current Anthropology*, 29(4):529–572.

Woodberry, R. (2012). The missionary roots of liberal democracy. *American Political Science Review*, 106(2):244–274.

APPENDIX A. ROBUSTNESS AND ADDITIONAL HYPOTHESES

The following robustness checks are detailed in the Web Appendix.

A.1. Additional summary statistics and observable characteristics by sub-sample. 1) Observable characteristics of the sample of polygamists differ from those of the sample of non-polygamists. 2) Observable characteristics of the sample for which the historic importance of women in agriculture is missing differ from those of the sample for which it is non-missing. I show similar comparisons for the sub-samples with non-missing historic class stratification and geographic coordinates. 3) I provide summary statistics on the distribution of respondents' husbands' total number of wives, and respondents' ranks as wives.

A.2. The gender division of labor. 1) Results are similar when the sample is restricted to societies that earn at least half their subsistence from agriculture. 2) Results are similar when dummies for ecological type are excluded. 3) Results are similar when estimated only on the Ivory Coast.

A.3. Inequality. 1) The correlation between country-level inequality in a woman's prime marriageable years and polygamy is small or nonexistent. 2) Results using cluster and region wealth Gini coefficients are similar to the baseline results. 3) A binary indicator of historical class stratification gives similar results to the baseline.

A.4. Female education. There is only a small (though robust) correlation between years of schooling and polygamy.

A.5. Economic growth. 1) Results are robust to including terms of trade as a control. 2) Results are similar when estimated on the sample of non-migrants.

A.6. Economic shocks. Results are similar when estimated on the sample of non-migrants.

A.7. War. 1) Results are stronger when rainfall shocks are included. 2) Results are similar when estimated on the sample of non-migrants.

A.8. Child mortality. 1) Results are similar when using an alternative measure of child mortality from the Institute for Health Metrics and Evaluation. 2) Results are similar when using an alternative measure of child mortality for sub-national regions computed using the birth histories section of the DHS. 3) Results are similar when estimated on the sample of non-migrants. 4) Results are robust to including log GDP per capita as a control.

A.9. Other hypotheses not discussed in the text. I include religion as a control, but do not attempt to explain whether it has a causal impact. I discuss the correlation of religion and polygamy in the Web Appendix. I have tested whether additional time-invariant variables predict polygamy using (1). Polygamy and bride price recorded in the *Ethnographic Atlas* both predict polygamy. A quadratic function of historic population density gives an inverse-U pattern. This is consistent with many hypotheses. Baker et al. (2008), for example, argue that inequality is highest at intermediate population densities. The ratio of people to land may also reflect the cost of allocating farms across wives (Goody, 1976).

I have tested whether additional time-varying variables predict polygamy using (2). I have found no impact of urbanization or life expectancy. The urbanization rate in Africa has risen some 25 percentage points over the past six decades (Christiaensen et al., 2013), and there is a gap in polygamy rates between rural and urban areas of roughly 8 percentage points. Were this causal, it would imply only a 2 percentage point drop in African polygamy. Further, polygamy is not declining fastest where urbanization is increasing most rapidly.

There is no significant correlation between the rate of population growth in a woman's year of marriage and the probability she is polygamous. Literacy rates are, surprisingly, positive predictors of polygamy. The Vanhanen (2000) index of democracy does not predict polygamy. Like GDP, the Human Development Index predicts less polygamy, though this recently-created index is missing for more than half the sample. The correlation between polygamy and women's labor force participation is negative, but not robust. I do not have data on wages or the value of time of mothers or fathers.

There is a negative correlation if population growth is measured over a woman's adolescence. Similarly, higher country-level fertility rates in a woman's year of marriage or averaged over her adolescence predict lower rates of polygamy. Although standard models (e.g. Tertilt (2005)) predict that population growth facilitates polygamy, these results are interpretable if wives and births per wife are substitutes in producing births. Further supporting this interpretation, both maternal mortality and adult female mortality predict greater rates of polygamy.

Table 1. Summary statistics

	Mean	s.d.	Min.	Max.	N		Mean	s.d.	Min.	Max.	N
<i>Main controls</i>						<i>The gender division of labor</i>					
Polygamous	0.28	0.45	0	1	494,157	Historic female agriculture	2.91	0.89	1	5	207,757
Age	30.8	8.70	10	64	494,157	<i>Inequality</i>					
Urban	0.30	0.46	0	1	494,157	Cluster c.v. of wealth index	2.95	39.2	0	3,721	241,709
Year of birth	1,970	10.5	1,937	1,994	494,157	Region c.v. of wealth index	15.1	148	0.22	3,199	240,656
Religion: Animist	0.0071	0.084	0	1	494,157	Historic class stratification	3.20	1.39	1	5	219,474
Religion: Catholic	0.17	0.37	0	1	494,157	Log wheat sugar ratio	-1.04	0.68	-2.08	1.61	297,936
Religion: Christian (Other)	0.025	0.16	0	1	494,157	Region c.v. of ag. constraints.	0.18	0.064	0	0.39	301,183
Religion: Missing	0.093	0.29	0	1	494,157	<i>The slave trade</i>					
Religion: None	0.044	0.21	0	1	494,157	ln(1+Atlantic slaves/Area), by name	0.62	0.99	0	3.66	259,012
Religion: Orthodox	0.016	0.12	0	1	494,157	Dist. Atlantic ST by name	5,818	1,531	3,694	9,258	259,012
Religion: Other	0.096	0.29	0	1	494,157	ln(1+Atlantic slaves/Area), by location	0.45	0.84	0	3.77	301,183
Religion: Protestant	0.19	0.39	0	1	494,157	Dist. Atlantic ST by location	6,143	1,719	3,702	9,534	301,183
Religion: Spiritual	0.0036	0.060	0	1	494,157	<i>Female education</i>					
Religion: Traditional	0.025	0.16	0	1	494,157	Resp. Education Years	3.27	4.06	0	26	493,829
Religion: Muslim (excluded)	0.34	0.47	0	1	494,157	High intensity	0.85	0.36	0	1	35,513
<i>Ecological zones</i>						<i>Economic growth</i>					
Woodland	0.22	0.42	0	1	301,183	Funds/capita (1953 pop.)	92.3	53.0	1.40	220	35,513
Forest	0.061	0.24	0	1	301,183	Funds/capita (1976 pop.)	1.77	1.32	0.15	6.19	35,513
Mosaics	0.15	0.35	0	1	301,183	Teachers/cap (1925)	0.00046	0.0022	4.3e-06	0.024	103,432
Cropland	0.12	0.33	0	1	301,183	Distance to Catholic Mission (000 km)	0.21	0.20	0.00015	1.17	301,183
Intensive cropland	0.0011	0.033	0	1	301,183	Distance to Protestant Mission (000 km)	0.17	0.19	0.00010	1.22	301,183
Wetland	0.0084	0.091	0	1	301,183	<i>Economic shocks</i>					
Desert/Bare	0.034	0.18	0	1	301,183	Rainfall shock: Age of marriage	0.95	0.19	0	8.06	252,079
Water/Coastal fringe	0.041	0.20	0	1	301,183	Rainfall shock: Ages 12-16	0.95	0.11	0	2.97	268,381
Urban	0.0070	0.083	0	1	301,183	<i>War</i>					
<i>Other GIS controls</i>						<i>War</i>					
Malaria	0.38	0.19	0	0.75	301,183	Battle deaths: Age of marriage (millions)	0.0011	0.0050	0	0.12	300,669
Elevation	165	10.3	140	195	301,183	Battle deaths Ages 12-16 (millions)	0.0012	0.0037	0	0.033	300,390
Ruggedness	64,300	102,512	0	1.37e+06	301,183	Battle deaths: Age of marriage (nonzero)	0.0072	0.011	0.000020	0.12	47,572
Distance to coast	463	358	0.013	1,771	301,183	Battle deaths Ages 12-16 (nonzero)	0.0044	0.0063	4.0e-06	0.033	78,118
Abs. latitude	10.7	5.18	0.0015	28.7	301,183	<i>Child mortality</i>					
<i>Crop suitability</i>						<i>Child mortality</i>					
Wheat suit.	0.42	1.05	0	7	298,017	Child mortality: Ages of marriage	0.19	0.059	0.054	0.42	474,759
Maize suit.	2.02	1.74	0	7	301,183	Child mortality: Ages 12-16	0.20	0.058	0.057	0.40	456,573
Cereals suit.	3.26	1.73	0	7	299,111						
Roots and tubers suit.	2.04	1.68	0	7	301,183						
Pulses suit.	2.43	1.61	0	7	299,111						
Sugar suit.	2.88	1.60	0	7	299,111						
Oil suit.	0.83	1.14	0	7	299,111						
Cotton suit.	1.64	1.70	0	7	299,127						
Rainfed ag. suit.	4.08	2.06	0	7	299,111						

Table 2. The gender division of labor

	<i>Dependent variable: Polygamous</i>						<i>Dependent variable: Historic female agriculture</i>		<i>Dependent variable: Polygamous</i>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Historic female agriculture			-0.065*** (0.021)	-0.032*** (0.011)	-0.091*** (0.017)	-0.035*** (0.012)			-0.145*** (0.031)	-0.200** (0.086)
Wheat suit.	-0.070*** (0.002)	-0.003** (0.001)	-0.064*** (0.014)	-0.005 (0.004)			0.287*** (0.063)	0.014 (0.021)		
Maize suit.	0.005** (0.002)	0.007*** (0.002)	0.019** (0.008)	0.008** (0.003)			-0.015 (0.038)	-0.010 (0.016)		
Cereals suit.	0.021*** (0.002)	-0.004** (0.002)	-0.006 (0.009)	-0.005* (0.003)			-0.100** (0.044)	0.016 (0.020)		
Roots and tubers suit.	-0.003* (0.002)	-0.005*** (0.002)	-0.013* (0.008)	-0.005 (0.003)			0.112*** (0.035)	0.020 (0.021)		
Pulses suit.	-0.009*** (0.003)	0.002 (0.002)	-0.002 (0.010)	0.004 (0.005)			0.038 (0.057)	-0.015 (0.015)		
Sugar suit.	0.014*** (0.002)	0.009*** (0.002)	0.015* (0.008)	0.009* (0.004)			0.002 (0.042)	-0.037** (0.018)		
Oil suit.	-0.030*** (0.002)	0.001 (0.002)	0.008 (0.012)	0.002 (0.005)			0.218*** (0.062)	0.047** (0.021)		
Cotton suit.	0.004* (0.002)	0.000 (0.002)	0.006 (0.006)	-0.002 (0.004)			0.043 (0.039)	0.010 (0.009)		
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	IV	IV
Observations	297,959	297,959	139,499	139,499	207,757	140,044	139,499	139,499	139,499	139,499
Other controls	None	Geo./Ind.	None	Geo./Ind.	None	Geo./Ind.	None	Geo./Ind.	None	Geo./Ind.
F.E.	None	Cntry-rnd	None	Cntry-rnd	None	Cntry-rnd	None	Cntry-rnd	None	Cntry-rnd
Clustering	Cluster	Cluster	E.A. Ethnic.	E.A. Ethnic.	E.A. Ethnic.	E.A. Ethnic.	E.A. Ethnic.	E.A. Ethnic.	E.A. Ethnic.	E.A. Ethnic.
F test									10.65	1.792
Excluded instrument(s)									Crop. Suit.	Crop. Suit.

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Geographic controls (Geo.) are absolute latitude, suitability for rain-fed agriculture, malaria endemism, ruggedness, elevation, distance to coast, and ecological zone. Individual controls (Ind.) are year of birth, year of birth squared, religious dummies, age, age squared, and urban.

Table 3. Inequality

<i>Dependent variable: Polygamous</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cluster wealth c.v.	0.000*** (0.000)	0.000 (0.000)					
Region wealth c.v.			-0.000 (0.000)	-0.000 (0.000)			
Historic class stratification					0.031*** (0.012)	0.019*** (0.007)	0.012** (0.005)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	241,709	168,348	240,656	168,363	219,474	148,789	148,789
Other controls	None	Geo./Ind.	None	Geo./Ind.	None	Geo./Ind.	Geo./Ind.
F.E.	Cntry-rnd	Cntry-rnd	Cntry-rnd	Cntry-rnd	None	None	Cntry-rnd
Clustering	Cluster	Cluster	Region	Region	E.A. Ethnic.	E.A. Ethnic.	E.A. Ethnic.
<i>Dependent variable: Polygamous</i>							
	(8)	(9)	(10)	(11)	(12)	(13)	
Log wheat sugar ratio	-0.116*** (0.002)	-0.045*** (0.003)	-0.017*** (0.003)				
Region c.v. of ag. constraints.				0.373*** (0.107)	0.002 (0.067)	0.200*** (0.064)	
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	
Observations	297,959	297,959	297,959	301,183	299,111	299,111	
Other controls	None	Geo./Ind.	Geo./Ind.	None	Geo./Ind.	Geo./Ind.	
F.E.	None	None	Cntry-rnd	None	None	Cntry-rnd	
Clustering	Cluster	Cluster	Cluster	Region	Region	Region	

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Geographic controls (Geo.) are absolute latitude, suitability for rain-fed agriculture, malaria endemism, ruggedness, elevation, distance to coast, and ecological zone. Individual controls (Ind.) are year of birth, year of birth squared, religious dummies, age, age squared, and urban.

Table 4. The slave trade

	<i>Dependent variable: Polygamous</i>										
	<i>Individual recode</i>								<i>Household recode</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ln(1+Atl. slaves/Area), by location	0.043*** (0.014)	0.024** (0.011)	-0.008 (0.007)	0.008 (0.011)	-0.005 (0.017)				0.028** (0.012)	0.019* (0.011)	-0.011* (0.005)
ln(1+Atl. slaves/Area), by name						0.025* (0.013)	0.006 (0.011)	-0.001 (0.007)			
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	301,183	299,111	299,111	299,111	170,674	259,012	169,262	169,262	291,060	288,871	288,871
Sample	Full	Full	Full	Full	W. Africa	Full	Full	Full	Full	Full	Full
Other controls	None	Geo./Ind.	Geo./Ind.	Longitude	None	None	Geo./Ind.	Geo./Ind.	None	Geo.	Geo.
F.E.	None	None	Cntry-rnd	None	None	None	None	Cntry-rnd	None	None	Cntry-rnd
Clustering	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by name)	Ethnicity (by name)	Ethnicity (by name)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)
	<i>Dependent variable: Polygamous</i>										
	<i>Individual recode</i>								<i>Household recode</i>		
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
ln(1+Atl. slaves/Area), by location	0.429*** (0.108)	0.360*** (0.102)	-0.068*** (0.024)	-0.107** (0.044)	-0.075* (0.044)				0.310*** (0.076)	0.415*** (0.135)	-0.041** (0.018)
ln(1+Atl. slaves/Area), by name						0.300*** (0.084)	0.373* (0.195)	-0.035 (0.029)			
Estimator	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Observations	301,183	299,111	299,111	301,183	170,674	259,012	169,262	169,262	291,060	288,871	288,871
Sample	Full	Full	Full	Full	W. Africa	Full	Full	Full	Full	Full	Full
Other controls	None	Geo./Ind.	Geo./Ind.	Longitude	None	None	Geo./Ind.	Geo./Ind.	None	Geo.	Geo.
F.E.	None	None	Cntry-rnd	None	None	None	None	Cntry-rnd	None	None	Cntry-rnd
Clustering	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by name)	Ethnicity (by name)	Ethnicity (by name)	Ethnicity (by loc.)	Ethnicity (by loc.)	Ethnicity (by loc.)
F test	17.87	16.27	18.18	13.50	9.891	15.35	5.513	13.88	18.90	11.52	17.97
Excluded instrument(s)	ST distance	ST distance	Coast dist.	ST distance	ST distance	ST distance	ST distance	Coast dist.	ST distance	ST distance	Coast dist.

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Geographic controls (Geo.) are absolute latitude, suitability for rain-fed agriculture, malaria endemism, ruggedness, elevation, distance to coast, and ecological zone. Individual controls (Ind.) are year of birth, year of birth squared, religious dummies, age, age squared, and urban.

Table 5. Modern education

	<i>Dep. Var.: Polygamous</i>				<i>Dep. Var.: Polygamous</i>	
	(1)	(2)	(3)		(4)	(5)
Born 1970-75 X Intensity	0.048*	0.000	-0.012	14 or below in 1980	-0.008	-0.001
	(0.025)	(0.000)	(0.008)		(0.020)	(0.025)
Born 1970-75	-0.108***	-0.095**	-0.043	Age in 1980	0.002	0.003
	(0.036)	(0.035)	(0.037)		(0.003)	(0.005)
Intensity	-0.004	0.000	-0.019***	(14-Age in 1980)	-0.002	-0.004
	(0.054)	(0.000)	(0.006)	X Below 14 in 1980	(0.004)	(0.008)
Estimator	OLS	OLS	OLS	Estimator	OLS	OLS
Sample	Nigerians b. 1970-75 and 1956-61.			Sample	Zimb. "Full"	Zimb. "Short"
	High / low	Dollars / 1953	Dollars / 1976			
Measure of intensity		pop.	pop.	Ages in 1980	6 to 22	10 to 20
Observations	9,668	9,668	9,668	Observations	6,367	3,901
Other controls	Osili/Long	Osili/Long	Osili/Long	Other controls	No	No
F.E.	None	None	None	F.E.	None	None
Clustering	1976 State	1976 State	1976 State	Clustering	Robust	Robust

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Osili/Long controls are year of birth, and dummies for the three largest Nigerian ethnic groups (Yoruba, Hausa, Igbo), and the major religions (Muslim, Catholic, Protestant, other Christian, and traditional).

Table 6. Colonial education

	<i>Dependent variable: Polygamous</i>				
	(1)	(2)	(3)	(4)	(5)
Teachers/capita, 1910-1928	-7.227*** (1.314)	-5.175*** (1.834)	-9.197*** (2.245)	-9.195*** (3.255)	-4.166** (1.974)
Estimator	OLS	OLS	OLS	OLS	OLS
Sample	French West Africa				
Observations	103,432	103,432	103,432	103,432	103,432
F.E.	None	None	None	None	None
Other controls	None	Attractiveness	Conquest	Precolonial	H-Geographic
Clustering	District 1925	District 1925	District 1925	District 1925	District 1925

	<i>Dependent variable: Polygamous</i>			
	(6)	(7)	(8)	(9)
Distance to Catholic mission	0.191*** (0.010)	0.064*** (0.009)	0.052*** (0.014)	0.156*** (0.025)
Estimator	OLS	OLS	OLS	OLS
Observations	301,183	299,111	299,111	299,111
Other controls	None	Geo./Ind.	Geo./Ind.	Ind.
F.E.	None	None	Cntry-rnd	Region
Clustering	Cluster	Cluster	Cluster	Cluster

	<i>Dependent variable: Polygamous</i>			
	(10)	(11)	(12)	(13)
Distance to Protestant mission	0.233*** (0.011)	-0.003 (0.010)	-0.087*** (0.012)	0.015 (0.025)
Estimator	OLS	OLS	OLS	OLS
Observations	301,183	299,111	299,111	299,111
Other controls	None	Geo./Ind.	Geo./Ind.	Ind.
F.E.	None	None	Cntry-rnd	Region
Clustering	Cluster	Cluster	Cluster	Cluster

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Geographic controls (Geo.) are absolute latitude, suitability for rain-fed agriculture, malaria endemism, ruggedness, elevation, distance to coast, and ecological zone. Individual controls (Ind.) are year of birth, year of birth squared, religious dummies, age, age squared, and urban. Attractiveness controls are trade taxes in 1914. Conquest controls are date of conquest, length of resistance and its square, and indemnities in 1910. Precolonial controls are the presence of an ancient state, the presence of a European trade counter, and 1925 population density. H-Geographic controls are latitude, longitude, altitude, dummies for the river and coast, and average rainfall from 1915 to 1975.

Table 7. Time-varying determinants of polygamy

<i>Shock</i>	<i>Dependent variable: Polygamous</i>				
	<i>Ln(GDP per capita)</i>		<i>Rainfall</i>	<i>Battle deaths</i>	<i>Child mort. (WDI)</i>
	(1)	(2)	(3)	(4)	(5)
Shock at age of marriage	-0.015*** (0.004)	-0.201*** (0.074)	-0.025*** (0.004)	0.238 (0.153)	0.736*** (0.074)
Estimator	OLS	IV	OLS	OLS	OLS
Observations	448,195	318,119	252,079	300,669	474,759
Other controls	Individual	Individual	Individual	Individual	Individual
FE	Y.O.M./Cluster	Y.O.M./Cluster	Y.O.M./Cluster	Y.O.M./Cluster	Y.O.M./Cluster
Clustering	Country x Y.O.M.	Country x Y.O.M.	Cluster x Y.O.M.	Cluster x Y.O.M.	Country x Y.O.M.
F test	8.855				
Excluded instrument(s)	GPCP Rainfall				
<i>Shock</i>	<i>Dependent variable: Polygamous</i>				
	<i>Ln(GDP per capita)</i>		<i>Rainfall</i>	<i>Battle deaths</i>	<i>Child mort. (WDI)</i>
	(6)	(7)	(8)	(9)	(10)
Shock over ages 12-16	-0.014*** (0.005)	-0.257** (0.119)	-0.040*** (0.008)	1.088*** (0.220)	0.987*** (0.083)
Estimator	OLS	IV	OLS	OLS	OLS
Observations	422,763	253,662	268,381	300,390	456,573
Other controls	Religion	Religion	Religion	Religion	Religion
FE	Y.O.B./Cluster	Y.O.B./Cluster	Y.O.B./Cluster	Y.O.B./Cluster	Y.O.B./Cluster
Clustering	Country x Y.O.M.	Country x Y.O.M.	Cluster x Y.O.M.	Cluster x Y.O.M.	Country x Y.O.M.
F test	6.265				
Excluded instrument(s)	GPCP Rainfall				

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Geographic controls (Geo.) are absolute latitude, suitability for rain-fed agriculture, malaria endemism, ruggedness, elevation, distance to coast, and ecological zone. Individual controls (Ind.) are year of birth, year of birth squared, religious dummies, age, age squared, and urban.

Table 8. National borders

	<i>Benin and Burkina Faso</i>	<i>Benin and Niger</i>	<i>Benin and Nigeria</i>	<i>Benin and Togo</i>	<i>Burkina Faso and Ghana</i>	<i>Burkina Faso and Ivory Coast</i>	<i>Burkina Faso and Niger</i>	<i>Burkina Faso and Mali</i>	<i>Burkina Faso and Togo</i>	<i>CAR and Cameroon</i>	<i>CAR and DRC</i>	<i>Cameroon and Nigeria</i>	<i>DRC and Rwanda</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Border	0.867*	0.092	0.051	0.029	0.067	0.089	0.082	-0.023	0.048	0.189*	-0.726*	-0.201**	0.000
	(0.444)	(0.086)	(0.148)	(0.053)	(0.075)	(0.143)	(0.115)	(0.076)	(0.116)	(0.095)	(0.396)	(0.095)	(0.000)
Obs	1,605	1,375	9,217	14,855	5,503	1,803	3,857	11,148	2,603	1,255	1,924	7,198	5,359
	<i>DRC and Tanzania</i>	<i>DRC and Uganda</i>	<i>DRC and Zambia</i>	<i>Ethiopia and Kenya</i>	<i>Ghana and Ivory Coast</i>	<i>Ghana and Togo</i>	<i>Guinea and Ivory Coast</i>	<i>Guinea and Liberia</i>	<i>Guinea and Mali</i>	<i>Guinea and Senegal</i>	<i>Ivory Coast and Liberia</i>	<i>Ivory Coast and Mali</i>	<i>Kenya and Tanzania</i>
	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
Border	-4.381	-0.134	-0.033	0.135	-0.049	-0.009	0.095	-0.006	0.144	-0.169	-0.130**	0.243	0.106
	(8.703)	(0.174)	(0.043)	(0.138)	(0.077)	(0.041)	(0.408)	(0.070)	(0.118)	(0.186)	(0.059)	(0.150)	(0.142)
Obs	887	3,210	1,665	470	3,957	11,518	2,145	4,458	4,628	2,126	4,000	3,380	4,639
	<i>Kenya and Uganda</i>	<i>Malawi and Mozambique</i>	<i>Malawi and Tanzania</i>	<i>Malawi and Zambia</i>	<i>Mali and Niger</i>	<i>Mali and Senegal</i>	<i>Mozambique and Tanzania</i>	<i>Mozambique and Zambia</i>	<i>Mozambique and Zimbabwe</i>	<i>Niger and Nigeria</i>	<i>Rwanda and Tanzania</i>	<i>Rwanda and Uganda</i>	<i>Zambia and Zimbabwe</i>
	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)
Border	-0.099	0.040	0.158***	-0.000	0.301	0.093	-4.497	0.000	-0.106	-0.125**	0.026	-0.043	0.049
	(0.085)	(0.061)	(0.060)	(0.064)	(0.213)	(0.096)	(2.932)	(0.000)	(0.210)	(0.061)	(0.066)	(0.043)	(0.110)
Obs	3,793	16,673	2,919	7,019	887	2,208	1,592	574	2,885	12,252	4,064	5,284	1,629

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. All regressions are OLS, with polygyny as the dependent variable and standard errors clustered at the survey cluster level. Other controls are a cubic in distance to the border, interacted with a country dummy, year of birth, year of birth squared, religious dummies, age, age squared, and urban. The coefficient reflects the jump from moving to the alphabetically prior country.

Table 9. Malaria eradication in Uganda

	<i>Dependent variable: Polygamous</i>	
	<i>DHS</i>	<i>IPUMS</i>
	(1)	(2)
Kigezi X Post (birth)	-0.074** (0.035)	-0.007** (0.003)
Estimator	OLS	OLS
Observations	8,740	182,553
Other controls	Rel/Urb/Eth	Rel/Urb/Eth
F.E.	Y.O.B./Dist.	Y.O.B./Dist.
Clustering	District	District

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Sample only includes Uganda. Rel/Urb/Eth signifies controls for religion, urban, and ethnicity.