Why is Polygyny More Prevalent in Western Africa?: An African Slave Trade Perspective

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Abstract

Polygyny rates are higher in Western Africa than in Eastern Africa. The African slave trades explain this difference. More male slaves were exported in the trans-Atlantic slave trades from Western Africa, while more female slaves were exported in the Indian Ocean and Red Sea slave trades from Eastern Africa. The slave trades led to prolonged periods of abnormal sex ratios, which impacted the rates of polygyny across Africa. In order to assess these claims, we construct a unique ethnicity-level data set linking current rates of polygyny with historical trade flow data from the African slave trades. Our OLS estimates show a positive correlation between the trans-Atlantic slave trades and polygyny. An IV approach shows the relationship is causal and statistically significant. We also provide cross-country evidence corroborating our findings.

JEL Classification: F14, J12, N17, O55
Keywords: slave trades, polygyny, Africa, development

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1 Introduction

Polygyny is a historical feature of many societies that has been shown to be detrimental to economic growth. While most people in these societies today rarely participate in polygynous marriages, one prominent exception is societies in the African continent. Within Africa, an additional stylized fact emerges: societies in Western Africa tend to have more polygynous marriages than those in Eastern Africa. In order to understand polygyny in Africa, we argue a defining episode in the continent's history, the African slave trades, must be taken into account.

The testable idea of this paper is simple. The African slave trades cause lengthy periods, in many cases more than a century, of abnormal sex ratios for societies in Africa, creating an environment in which polygyny either emerges or is strengthened as an institution. Polygyny, as a part of a society's culture, persists to the present since cultural change occurs slowly. Polygyny remains more prevalent in Western Africa due to a higher percentage of male slave exports in the trans-Atlantic trade. Eastern Africa experiences less polygyny due to a higher percentage of female slave exports in the Indian Ocean and Red Sea trades.

To the best of our knowledge, this paper represents the largest empirical study focusing on the link between the slave trades and current levels of polygyny in Africa. Our unique data set merges ethnicity-level slave exports data from Nunn and Wantchekon (2010) with ethnicity-level polygyny data from the male Demographic and Health Surveys (DHS) by the Measure DHS Project. We document the stylized fact regarding the prevalence of polygyny in Western and Eastern Africa. For instance, the percentage of men in polygynous marriages in Western African countries like Guinea, Togo, and Benin is 35.037, 29.793, and 29.679, whereas in Eastern African countries like Ethiopia, Kenya, and Malawi the percentage is 6.131, 9.206, and 10.101. Our OLS estimates show a positive correlation between the trans-Atlantic slave trades and polygyny. In order to address the problem of omitted variables, we employ an IV approach. Our results show a causal relationship between the trans-Atlantic slave trades and polygyny. The estimated impact is both statistically and economically significant.

To further support our results, we analyze the effects of the slave trades on polygyny rates using country-level data. Our country-level data set combines slave exports from Nunn (2008) with polygyny data from Tertilt (2005). Again, we find the OLS estimates show a positive

correlation between the trans-Atlantic slave trades and polygyny. Our coefficient estimate is significant and remains so across a number of specifications. An IV approach shows the relationship between the trans-Atlantic slave trades and polygyny is causal. Other African slave trades show no consistent relationship with polygyny rates.

The African slave trades have long been a topic of research for economic historians. Recent contributions include the following: Eltis and Engerman (2000), Eltis, Lewis, and McIntyre (2010), Eltis, Lewis, and Richardson (2005), Eltis and Richardson (1995), Hogerzeil and Richardson (2007), Nunn (2008), and Nunn and Wantchekon (2010). The availability of historical slave trade data, particularly the *Trans-Atlantic Slave Trade Database*, fuels much of the renewed research interest.[1] Eltis and Richardson (2010) provides a summary of the data.

Two papers closely relate to ours in their focus on the long-term impact of the slave trades. First, Nunn (2008) examines the impact of the African slave trades on subsequent African economic development. Nunn (2008) shows the poorest African countries today are those from which the most slaves were exported, suggesting the long-term effect of the slave trades is significant and relevant for understanding current African development performance. Second, Nunn and Wantchekon (2010) examines a particular channel through which the slave trades impact current African economic performances, namely the levels of trust across individuals within Africa. Trust supports economic exchange in well-functioning markets and would have plausibly been affected within groups living in the capture and export economies participating in the slave trades. Nunn and Wantchekon (2010) shows those individuals whose ancestral groups experienced higher slave exports exhibit lower levels of trust even to this day. Our paper contributes to these findings by suggesting an additional channel through which the slave trades have had a long-term impact on current African society.

Our paper also relates to the literature on determinants of polygyny and the economic impact of polygyny. Different theories exist about why polygyny emerges in societies. White and Burton (1988) provides a useful overview from the anthropology literature of these alternative theories. Possible explanations of polygyny range from the economic, including income inequality across males, to the demographic, including skewed sex ratios from higher male mortality rates due to dangerous occupations, to the political, including warfare. See Clignet (1970) and Dorjahn

[1]The *Trans-Atlantic Slave Trade Database* appears online at `http://www.slavevoyages.org`.

(1954) for further sources in anthropology on the determinants of polygyny. Early work in economics on polygyny includes Becker (1974) and Grossbard (1978). These papers focus on male income inequality and the marginal contribution of wives as determinants of polygyny. For more recent work see Jacoby (1995) and Gould, Moav, and Simhon (2008).

Recent literature establishes a link between polygyny and economic development. Tertilt (2005) shows polygyny can have significant quantitative effects on development outcomes. Among similar countries, polygynous countries are poorer than nonpolygynous countries. Polygynous countries have higher fertility and lower savings. The calibrated model in Tertilt (2005) suggests banning polygyny decreases fertility by 40 percent, increases savings by 70 percent, and increases GDP per capita by 170 percent. Tertilt (2006) documents gender inequality as being more severe in polygynous countries. Women living in polygynous countries face larger literacy gaps, live under more restrictive abortion laws, and have less power in national politics. Tertilt (2006) finds granting women more control over their marriage decisions has a similar impact on economic outcomes, like GDP per capita, as banning polygyny outright. Such policy changes may be difficult to enforce. Schoellman and Tertilt (2006), an extension of Tertilt (2005), finds banning polygyny in an infinite horizon, overlapping-generations model creates winners and losers, which provides a theoretical basis for why banning polygyny may be difficult to enforce. The findings of this literature suggest the slave trades could have affected current economic performance in Africa through the additional channel of polygyny, that is, in addition to the trust channel found in Nunn and Wantchekon (2010).

The rest of the paper is organized as follows: Section 2 provides historical background on the slave trades and how they affected marriage arrangements. Section 3 describes the data used in our quantitative exercises. Section 4 presents our empirical findings. Section 5 provides additional cross-country evidence. Section 6 concludes.

2 Historical Background

Slave exporting existed as an industry for hundreds of years in Africa. The African slave trade comprised four main slave trades: the trans-Atlantic, Indian Ocean, Red Sea, and trans-Saharan. Of these four slave trades, Nunn (2008) documents the trans-Atlantic as having by far the largest

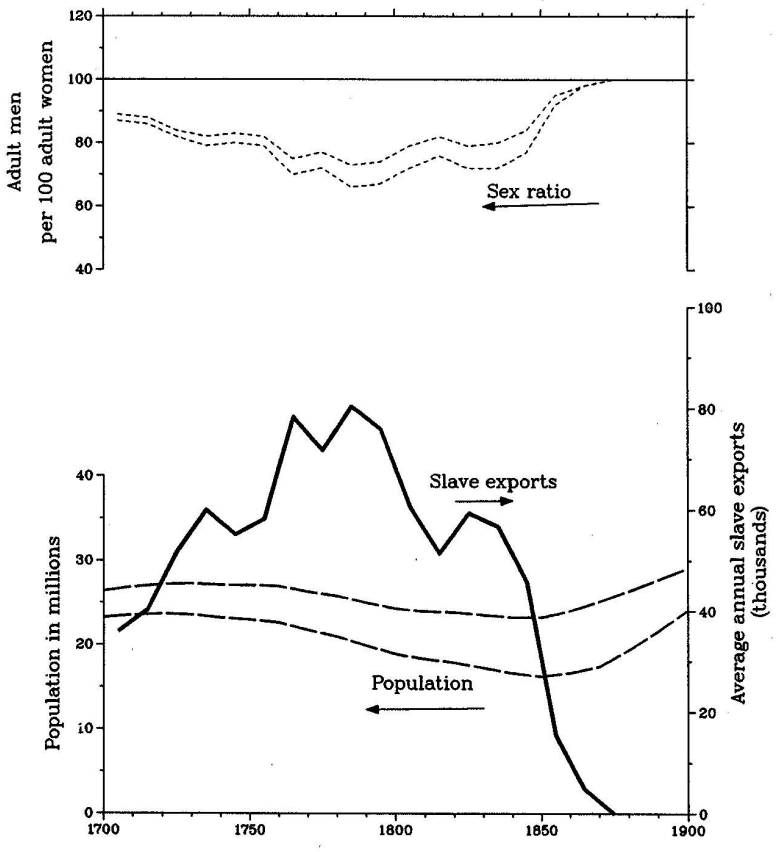
total volume of slaves over the period 1400-1900. Slaves were primarily produced by raiding and capturing between groups in the continent who then sold slaves to traders in exchange for imported goods, often times for weapons used for the further production of slaves, the so-called *gun-slave cycle*.

The impact of the African slave trades on African societies was substantial. According to Manning (1990), the slave trades dramatically impacted the population trajectory of the continent. By 1850, Africa's population was half of the level expected had the slave trades not taken place. The volume of exported slaves led to a significant drain in labor and human capital. For those Africans remaining on the continent, life became more uncertain and insecure. Nunn (2008) and Nunn and Wantchekon (2010) provide useful historical summaries of the consequences of the slave trades on African political life. The *gun-slave cycle* contributed to political instability and undermined existing institutions. Ethnic fractionalization deepened.

Figures 1 and 2 show a further effect of the slave trades, namely on African demographics as measured by the sex ratio. For space considerations, we only show the aggregate regions of the Western and Eastern coasts, but Manning (1990) provides similar information for smaller regions. The sex ratio series in Figures 1 and 2 are simulations constructed from available demographic data. The two lines represent low and high estimates based on low and high estimates of population growth. The figures show a skewed sex ratio on the Western and Eastern coasts of African during the periods of the slave trades. Figures 1 and 2 are easy to understand given the historical record. The sex ratio of exported slaves depended not only on the available supply from the African continent but also on the demand for slaves in the importing destination. If one gender was persistently demanded more than the other, this would lead to a skewed sex ratio in the remaining population.

Demand considerations explain not only why a skewed sex ratio can emerge but also why the effect of the slave trades on the sex ratio differs in Figures 1 and 2. Figure 1 shows the impact on the Western Coast. The main source of trans-Atlantic exports were from the Western Coast due to its close proximity to the New World. Eltis and Richardson (2010) shows the main destinations for these slave exports were the Caribbean and Brazil. Slaves exported to the Caribbean and Brazil were destined to perform tasks in places such as sugar plantations. Male slaves were viewed as being able to perform a variety of tasks. A Jamaican planter recalled the

Figure 1: Western Coast: Impact of Slave Exports



Source: Manning (1990)

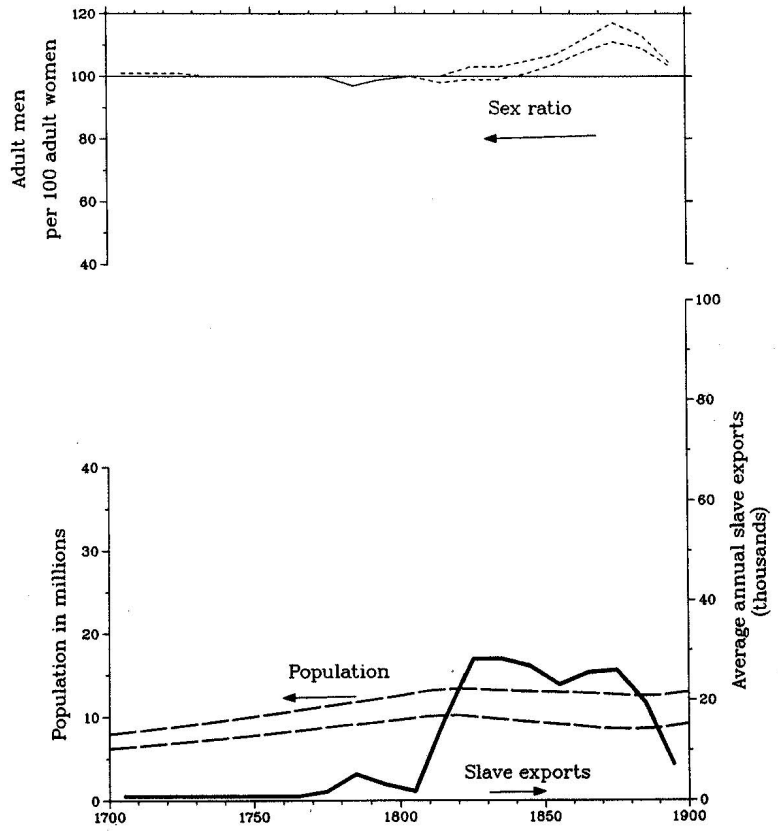
differences in tasks by gender (Beckford (1788, p. 13)):

> A negro man is purchased either for a trade, or the cultivation and different process of the cane–the occupations of the women are only two, the house, with its several departments and supposed indulgences, or the field with its exaggerated labours.

A British politician of the time expressed the preference for male slaves (Edwards (1801, p. 118)):

> I have to observe, that though it is impossible to conduct the business, either of a house or of a plantation without a number of females...the nature of the slave-service in the West Indies (being chiefly field labor) requires, for the immediate interest of the planter, a greater number of males.

Figure 2: Eastern Coast: Impact of Slave Exports

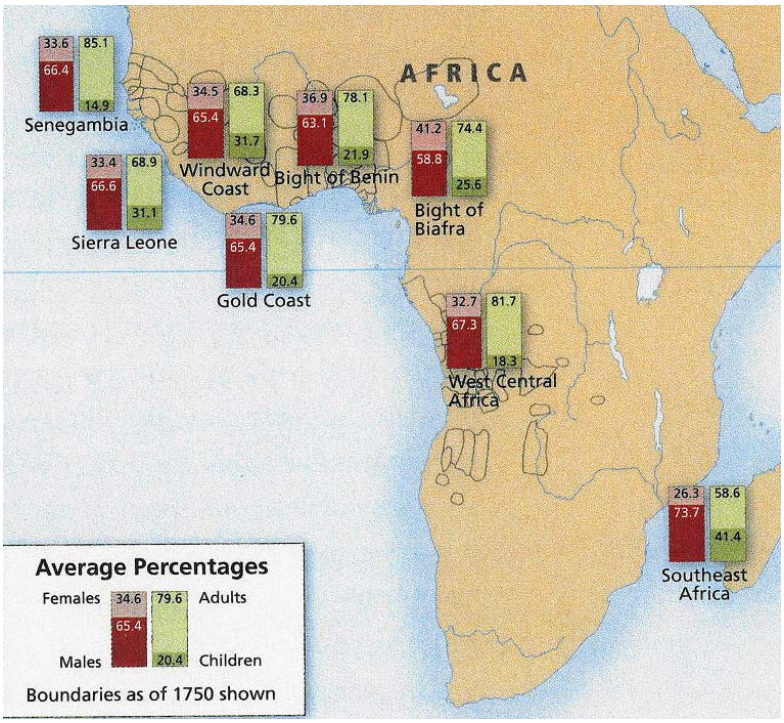


Source: Manning (1990)

As a result of this preference, traders exported disproportionally more males from the Western Coast. This fact is supported by the average percentages of males exported from various Western Coast regions to mainland North America and the Caribbean over the period 1545-1864 appearing in Figure 3. Figure 3 is extracted from Eltis and Richardson (2010). For example, 66.4 percent and 63.1 percent of the slaves exported from Senegambia and the Bight of Benin were males.

The impact of the slave trades on the sex ratio differs for the Eastern Coast appearing in Figure 2. Populations of this region of Africa were less likely to serve as a supply of slaves for trans-Atlantic exports. Instead, the Eastern Coast long served as a source of slaves for importing destinations in the Middle East and India. The Eastern Coast was, thus, affected primarily by the Indian Ocean and Red Sea slave trades, both of which existed for hundreds of years before the trans-Atlantic slave trades (see, for instance, Lovejoy (1983)). The export flows were dominated by Islamic traders. Middle Eastern and Indian buyers demanded African slaves

Figure 3: Gender and Age of Slave Exports to Mainland North America and the Caribbean, 1545-1864



Source: Eltis and Richardson (2010)

for use in a variety of roles, but, as Harris (1971), Lewis (1990), and Phillips (1985) all argue, the demand was especially strong for female slaves to use as domestic servants and even concubines. Manning (1990) documents the slave exports from the Eastern Coast were disproportionally female. The ratio of female to male slave exports from the Horn of Africa was exceptionally high. The impact of the loss of females appears in the Eastern Coast sex ratio in Figure 2.

The skewed sex ratios point to a further possible consequence of the slave trades: polygyny. Dorjahn (1954) argues the sex ratio is an important determinant of polygyny. The slave trades existed for hundreds of years, and, as a result, Africa experienced abnormal sex ratios for long periods of time. Polygyny could have emerged or been strengthened during the long period of abnormal sex ratios. Figures 1 and 2 suggest the Western Coast should have contained more polygnyous marriages, whereas the Eastern Coast should have contained fewer.

Why the slave trades' effect on marriage arrangements persists to this day remains an important point to address. Examination of Figures 1 and 2 shows the sex ratio returns to its natural rate shortly after the end of the slave trades. Nunn and Wantchekon (2010) faces a

similar challenge in explaining the long-term impact of the slave trades on current trust levels. One explanation recognizes cultural change occurs slowly. Bisin and Verdier (2000) and Bisin and Verdier (2001) represent two examples of this view. For instance, cultural traits existing within polygynous households might be passed along to children. In describing the *Abouré* ethnic group of the Ivory Coast, Clignet (1970, p. 76) writes "...polygyny is a mark of prestige about which many males are sensitive."[2] Once these cultural traits are established, polygyny can become self-sustaining. Again, describing the *Abouré*, Clignet (1970, p. 76) writes "...males are not entitled to resume sexual relations with a wife before the end of a three-year period following her last childbirth." This type of cultural trait provides an incentive for men to marry more women. Given the slave trades, and their resultant skewed sex ratios, occurred over such long periods of time, their effects on institutions, such as marriage, might not have dissipated even to this day.

3 Data

Because we are interested in examining the effects of the slave trades on the persistence of polygyny across different ethnic groups, we use two types of data for our analysis. The first report the total number of slaves exported at the ethnic group level. The second report the prevalence of polygyny at the ethnic group level. Table 1 reports summary statistics.

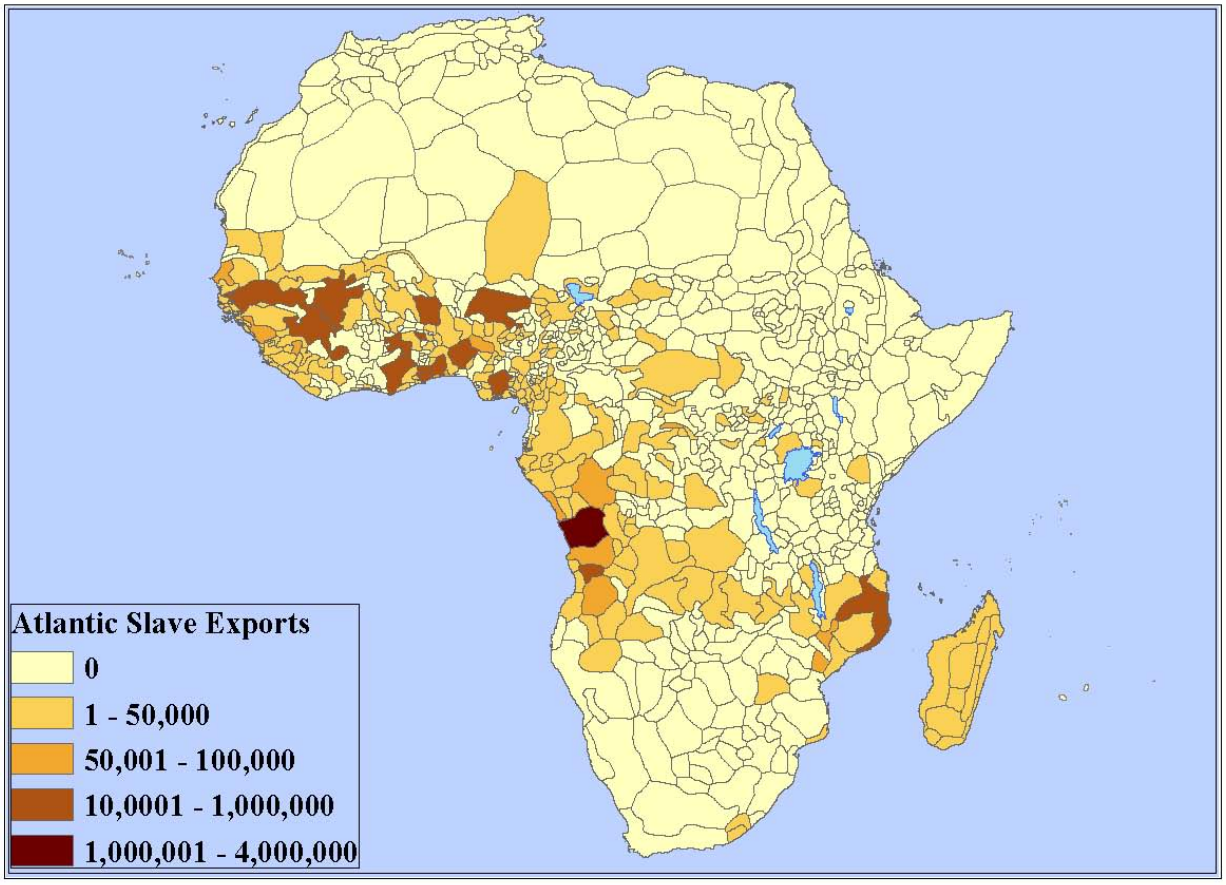
Table 1: Summary Statistics

	Mean	Standard Dev.	N
Wives	1.2465	0.5623	51197
$\ln(1+\frac{\text{trans-Atlantic slave trade}}{\text{land area}})$	0.7622	1.1437	50778
$\ln(1+\frac{\text{Indian Ocean slave trade}}{\text{land area}})$	0.0224	0.1184	50778
Owns a TV	0.2117	0.4656	50522
Owns a Car	0.0558	0.3344	49940
Muslim	0.3215	0.4671	51197
Christian	0.3335	0.4715	51197
Age	38.647	10.840	51197
Urban	0.3192	0.4662	51197
Primary Education	0.3216	0.4671	51196
Secondary Education	0.2349	0.4239	51196
Tertiary Education or Higher	0.0586	0.2349	51196

Source: Demographic and Health Surveys (2011) and Nunn and Wantchekon (2010)

[2]The *Abouré* fall under the *Assini* in Murdock (1959)'s classification.

Figure 4: Ethnicity-Level Slave Exports during Trans-Atlantic Slave Trade



Source: Nunn and Wantchekon (2010)

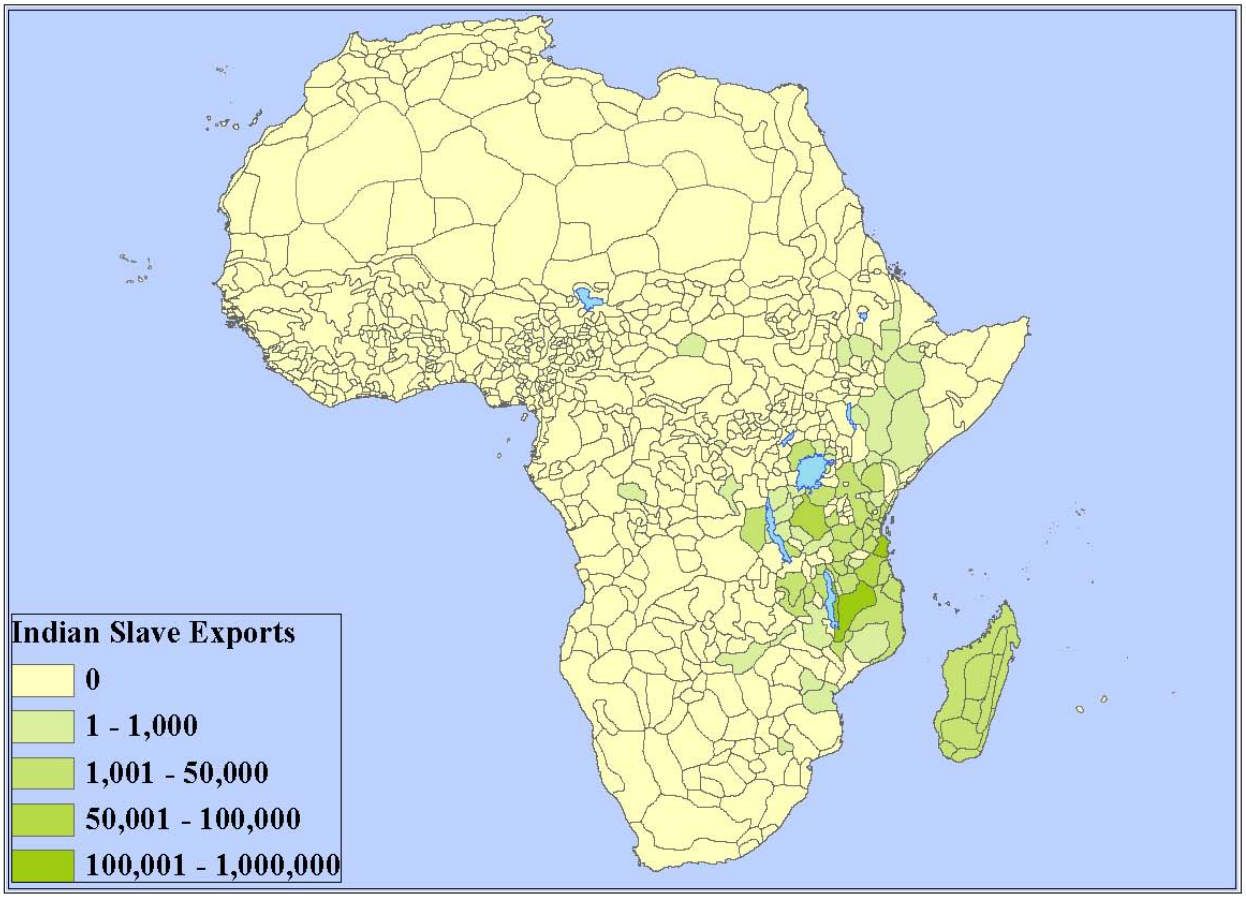
3.1 Slave Export Data

The ethnicity-level data on slave exports is from Nunn and Wantchekon (2010).[3] Out of the four slave trades, Nunn and Wantchekon (2010) compiles only the ethnicity-level slave exports data for the trans-Atlantic and Indian Ocean slave trades due to data limitations. The slave exports data cover four time periods (1400-1599, the 1600's, 1700's, and 1800's) for 841 ethnic groups. As Nunn (2008) shows, the impact of the slave trades as a whole is driven almost solely by the trans-Atlantic trade; omitting the Red Sea and trans-Saharan slave trades will likely not change the results.

Figures 4 and 5 are extracted from Nunn and Wantchekon (2010). The figures map the historic boundaries of ethnic groups according to Murdock (1959). Figure 4 shows the trans-

[3]The data can be obtained at `http://www.economics.harvard.edu/faculty/nunn/data_nunn`.

Figure 5: Ethnicity-Level Slave Exports during Indian Ocean Slave Trade



Source: Nunn and Wantchekon (2010)

Atlantic slave trade, which exported disproportionately more males, affected much of the African continent, but the Western Coast was the most affected region since it is closest to the New World. Figure 5 shows the Indian Ocean slave trade, which exported disproportionately more females, was confined primarily to the Eastern Coast.

3.2 Polygyny Data

We obtain our ethnicity-level polygyny data from the male Demographic and Health Surveys conducted by the Measure DHS Project.[4] Since 1984, Measure DHS Project has conducted more than 260 demographic and health surveys in over 90 developing countries. We restrict

[4]Dorjahn (1954) reports aggregate ethnicity-level data on polygyny for a limited number of years in the first half of the twentieth century. However, the data in Dorjahn (1954) is not comprehensive enough for use in our analysis.

Table 2: Distribution of the Number of Married Men's Wives in Various African Countries

Country	Mean	Standard Dev.	Max	% of Polygyny	N
Benin	1.4000	0.7349	8	29.679	5327
Burkina Faso	1.4265	0.7421	9	31.449	3981
Cameroon	1.1944	0.5179	6	15.218	1991
Central African Republic	1.1486	0.4254	3	12.145	774
Chad	1.2222	0.4535	3	20.635	189
Congo	1.0819	0.2962	3	7.573	647
Democratic Republic of Congo	1.1143	0.3228	2	11.429	35
Ethiopia	1.0755	0.3354	7	6.131	2251
Gabon	1.1426	0.4245	6	12.747	659
Ghana	1.1924	0.4722	5	16.367	3566
Guinea	1.4244	0.6454	5	35.037	1918
Kenya	1.1095	0.4216	15	9.206	4812
Malawi	1.1111	0.3519	6	10.101	3277
Mali	1.3730	0.6154	5	31.469	1287
Mozambique	1.1923	0.4268	3	17.949	156
Namibia	1.0758	0.3070	4	6.587	501
Niger	1.3025	0.5623	4	25.717	2512
Nigeria	1.2308	0.5093	5	19.706	5303
Rwanda	1.1290	0.5054	10	10.696	589
Senegal	1.4444	0.7166	5	33.359	3843
Sierra Leone	1.2040	0.4869	5	17.016	1716
Togo	1.3600	0.6122	4	29.793	1111
Uganda	1.1818	0.442	4	16.151	1034
Zambia	1.0760	0.2976	5	6.824	3722

Source: Demographic and Health Surveys (2011)

our data to 24 African countries from 45 surveys conducted between 1990 and 2009 that have polygyny and ethnicity information. In the male surveys, respondents were asked to provide information on the number of wives they currently have (our measure of polygyny), ethnicity, and demographics, including age, education level, residence location, etc. We also use household-level surveys from DHS to extract household-level variables of interest not included in the male surveys, such as whether the household has a television or car.

The respondents were asked their ethnicity in the surveys. We rename their ethnicity based on Murdock (1959)'s classification.[5] We also drop observations whose ethnicities are: (i) listed as "other"; (ii) listed as a country, instead of an ethnic group; (iii) not indigenous African ethnicities; or (iv) are indigenous but could not be mapped cleanly into Murdock (1959)'s classification. After mapping respondents into Murdock (1959)'s classification, 51,197 respondents

[5]We used the Joshua Project located online at `http://www.joshuaproject.net` to help classify some of the DHS ethnicities according to Murdock (1959).

with at least one wife remain in our sample.[6] These respondents represent 173 ethnic groups.

Table 2 shows the distribution of the number of wives a man with at least one wife has by country. This table establishes the stylized facts regarding polygyny being more prevalent on the Western Coast where most of the trans-Atlantic slave trade occurred. The average number of wives of a man with at least one wife in western African countries like Guinea, Togo, and Benin is 1.4244, 1.3600, and 1.4000, respectively, while that in eastern African countries like Ethiopia, Kenya, and Malawi is 1.0755, 1.1095, and 1.1111, respectively. The percentage of men in polygynous marriages in Guinea, Togo, and Benin is 35.037, 29.793, and 29.679, whereas in Ethiopia, Kenya, and Malawi the percentage is 6.131, 9.206, and 10.101.

4 Empirical Model and Results

4.1 OLS Estimates

In this section, we estimate the relationship between the number of slaves taken from a respondent's ethnic group during the trans-Atlantic slave trade and the respondent's number of wives. The baseline estimating equation is:

$$\text{wives}_{i,e,c} = \alpha_c + \beta \text{slave exports}_e + \mathbf{X}_i'\mathbf{\Psi} + \mathbf{X}_c'\mathbf{\Theta} + \epsilon_{i,e,c} \tag{1}$$

where i indexes respondents, e ethnic groups, and c countries. The variable $\text{wives}_{i,e,c}$ denotes the number of wives for respondent i. The country fixed effects, α_c, should capture country-specific factors that affect polygyny, such as the imposition and enforcement of monogamy laws and income inequality. The number of slaves taken from ethnic group e during the trans-Atlantic slave trade is measured by the variable slave exports_e.

As Nunn and Wantchekon (2010) notes, it would be ideal to use a measure of slave exports normalized by the pre-slave trade population of each ethnic group. These data do not exist, however. In this paper, we follow Nunn and Wantchekon (2010) by using the natural log of one plus slave exports normalized by land area as our measure of slave exports.

[6] Among those respondents without a wife, 50 percent are 20 years of age or younger, and nearly 90 percent are 30 years of age or younger.

We include a set of respondent-level controls by the vector $\mathbf{X}_i'$. These include the respondent's age, age squared, two religion dummies (Muslim and Christian), a dummy variable for living in an urban location, three education dummies (primary, secondary, and tertiary or higher), and two wealth proxy dummies (television and car). We also include a country-level control by the vector $\mathbf{X}_c'$, which includes the region dummies (Western, Eastern, or Southern Africa).

Table 3: OLS Estimates of the Impacts of Slave Trade on Polygyny[a]

	(1)	(2)	(3)
Trans-Atlantic Slave Trade	0.042**	0.035***	0.005
	(0.017)	(0.012)	(0.007)
Owns a TV		0.011	0.014
		(0.009)	(0.009)
Owns a Car		0.028**	0.029***
		(0.011)	(0.011)
Muslim		0.049***	0.068***
		(0.018)	(0.017)
Christian		-0.096***	-0.039***
		(0.015)	(0.010)
Age		0.008	0.010**
		(0.005)	(0.005)
Age^2		0.00006	0.00004
		(0.00005)	(0.00005)
Urban		-0.074***	-0.084***
		(0.013)	(0.014)
Primary Education		-0.091***	-0.067***
		(0.019)	(0.016)
Secondary Education		-0.125***	-0.091***
		(0.021)	(0.016)
Tertiary Education or Higher		-0.195***	-0.158***
		(0.028)	(0.023)
Southern Africa			0.045***
			(0.005)
Western Africa			0.203***
			(0.025)
Eastern Africa			-0.097***
			(0.027)
Country Fixed Effect	No	No	Yes
Constant	1.216	0.934***	0.820***
	(0.028)	(0.097)	(0.096)
N	50,778	48,888	48,888
$\bar{R}^2$	0.0072	0.1172	0.1315

[a] Standard errors, reported in brackets, are adjusted for clustering within ethnic groups. ***, **, and * indicate significance at the 1%, 5% and 10% levels.

Table 3 reports the estimates of the OLS regression. The first column reports the results of the OLS regressing the number of wives of a respondent on the slave trade variable. The second

column includes respondent controls. The third column includes both the respondent controls and country controls.[7] All coefficients have the expected sign.

As Becker (1974) shows, polygyny is more common among wealthier men. It is then not surprising to see that a respondent who comes from a wealthier family, as measured by either owning a TV or a car, is more likely to have more wives.

Religion also plays an important role in polygyny. It is a tradition in Islam to allow men to have up to four wives, conditional on the approval of the senior wives. Our results also suggest Muslims tend to have more wives than people of other religion like Christians.

Older people tend to have more wives. In some ethnic groups, like the *Bété* described by Clignet (1970), men recruit wives through levirate, or the custom by which the wives of a deceased person are transmitted to his heir.[8] And, older people are more likely to be heirs than their younger counterparts.

Men living in urban locations or having received more education tend to have fewer wives. This might be because the wives these men select tend to also be from urban areas or be educated. These women might tend to be more independent and less tolerant of polygyny.

Slave exports during the trans-Atlantic slave trade are also positively correlated with the level of polygyny. The positive coefficient estimates in columns 1 and 2 of Table 3 are statistically significant. After including both region dummies and country fixed effects in column 3, however, the coefficient estimate on the trans-Atlantic slave trade variable is no longer statistically significant. The estimate remains meaningful in an economic sense. In order to see this, first note that the standard deviation of the slave trade variable is about 1.14. Thus, one standard deviation increase in the slave trade variable is almost one tenth of the effect of being a Muslim.

We also run separate regressions with an additional variable, the Indian Ocean slave trade. The estimate on the Indian Ocean slave trade is positive and with about the same magnitude compared to that of the trans-Atlantic slave trade but is statistically insignificant. The result neither verifies nor refutes the qualitative and quantitative evidence on the impact the slave trades had on marriage arrangements on the Eastern Coast, as reported in Section 2. The

[7]We also obtain OLS estimates excluding the region dummies but including the country fixed effects. The results are not substantially different, and we choose not to report them due to space considerations.

[8]The *Bété* fall under the *Bete* in Murdock (1959)'s classification.

estimates of the rest of the coefficients are essentially the same.

Table 4: IV Estimates of the Impacts of Slave Trade on Polygyny[a]

	(1)	(2)	(3)
Trans-Atlantic Slave Trade	0.226***	0.092***	0.043*
	(0.067)	(0.027)	(0.026)
Owns a TV		-0.004	0.010
		(0.014)	(0.010)
Owns a Car		0.025**	0.028**
		(0.012)	(0.011)
Muslim		0.077***	0.083***
		(0.024)	(0.024)
Christian		-0.069***	-0.041***
		(0.016)	(0.012)
Age		0.007	0.009**
		(0.005)	(0.005)
Age^2		0.00007	0.00004
		(0.00005)	(0.00005)
Urban		-0.077***	-0.084***
		(0.014)	(0.014)
Primary Education		-0.087***	-0.074***
		(0.021)	(0.016)
Secondary Education		-0.124***	-0.100***
		(0.023)	(0.016)
Tertiary Education or Higher		-0.194***	-0.165***
		(0.026)	(0.023)
Southern Africa			-0.053*
			(0.031)
Western Africa			0.053
			(0.075)
Eastern Africa			0.060
			(0.037)
Country Fixed Effect	No	No	Yes
Constant	1.076***	0.899***	0.873***
	(0.018)	(0.101)	(0.101)
N	50,778	48,888	48,888

[a] Standard errors, reported in brackets, are adjusted for clustering within ethnic groups. ***, **, and * indicate significance at the 1%, 5% and 10% levels.

4.2 IV Estimates

In the previous section, we demonstrate there is a positive correlation between trans-Atlantic slave exports and the level of polygyny. One might argue, however, that there are omitted variables biasing the estimates. The omitted variables can bias the estimates both up and down. On the one hand, there might be substantial income inequality within ethnic groups in the pre-slave trade period which led to a high level of polygyny, and many of the lower-class

males who were single might be bought up as slaves to be exported to the New World. If men in these ethnic groups continue to marry multiple wives, this could generate a positive relationship between the slave trade and the level of polygyny and bias the estimates upward. On the other hand, certain ethnic groups might have a strong cultural preference for monogyny and be less capable of defending themselves against slave raids. This might be due to the higher cost married males face when joining a militia or other armed group. Since monogynous ethnic groups have fewer unmarried males, members of these ethnic groups would be more vulnerable to capture during slave raids and, thus, be more likely to be exported as slaves. If the strong cultural preference for monogyny continues to persist after the slave trades, this channel could bias the estimates downward. If monogynous ethnic groups tend to be from more developed and densely populated societies pre-slave trades, then this channel would be consistent with the historical evidence provided in Nunn (2008).

In this section, we use the instrumental variable approach to show the correlations are causal. In this approach, we need to find an instrument that is correlated with slave exports but is uncorrelated with any characteristics of the ethnic group that affect the level of polygyny. For the trans-Atlantic slave trade, we use the instrument in Nunn (2008). The instrument measures the sailing distance between the point on the African coast closest to the centroid of the country in which the respondent currently resides and the closest major destination market of the trans-Atlantic slave trade. The destination markets include Virginia, USA; Havana, Cuba; Haiti; Kingston, Jamaica; Dominica; Martinique; Guyana; Salvador, Brazil; and Rio de Janeiro, Brazil.[9] The instrument captures the exposure of an ethnic group to the trans-Atlantic slave trade and, thus, is correlated with our slave exports variable. Also, as Nunn (2008) argues, there is no historical evidence showing the location of the slave supply influenced the location of slave demand. In particular, it was because of the closer distance to the plantation in the West Indies that slaves were taken from Western Africa. And, so, our instrument should be valid.

Table 4 reports our IV estimates.[10] Trans-Atlantic slave exports still have a positive and significant impact on the level of polygyny. In fact, the magnitude of the estimates are ten

[9]We cannot use the corresponding instrument for the Indian Ocean slave trade because of collinearity problems. Thus, we do not include the Indian Ocean slave trade in our IV regression.

[10]Again, we obtain IV estimates excluding the region dummies but including the country fixed effects. The results are not substantially different, and we choose not to report them due to space considerations.

times higher than that of the OLS estimates, which is likely due to measurement error biasing the OLS estimates downward. Or, it could be possible the monogyny channel biasing the OLS estimates downward dominates the polygyny channel biasing the OLS estimates upward. A 1.5 times increase in the standard deviation of the slave trade coefficient has roughly the same impact of being a Muslim on the number of wives an African man would have. Most of the other coefficients have similar estimates when compared to the OLS.

5 Additional Cross-Country Evidence

In this section, we perform an additional test of our idea by evaluating country-level data for evidence of the link between the slave trades and polygyny. This allows us to use all of the country-level slave trade data from Nunn (2008), which includes data for all four African slave trades (trans-Atlantic, Indian Ocean, Red Sea, and trans-Saharan). Like the Indian Ocean slave trade, the Red Sea and trans-Saharan slave trades exported a far smaller percentage of males than the trans-Atlantic trade. The polygyny data described in Section 3.2 represents 24 African countries. In order to examine the largest number of countries possible, we use the country-level data on polygyny reported in Tertilt (2005).[11] Tertilt (2005) reports both the percentage of men in polygynous marriages and the percentage of women in polygynous marriages by country. Using the percentage of men, we are able to match 30 countries with the slave trades data, while using the percentage of women allows us to match 37 countries. We perform our analysis with both measures of polygyny.

5.1 Cross-Country OLS Estimates

We estimate the relationship between the number of slaves exported from a country and the country's polygyny rate. The estimating equation is:

$$\text{polygyny}_c = \beta_0 + \beta_1 \text{trans-Atlantic exports}_c + \beta_2 \text{Other slave exports}_c + \mathbf{X}_c'\mathbf{\Theta} + \epsilon_c \qquad (2)$$

[11] The data resides at `http://www.stanford.edu/~tertilt`.

where c indexes countries. The variable polygyny$_c$ denotes one of the two measures of polygyny for country c, either the percentage of men or the percentage of women in polygynous marriages. The number of slaves exported from country c during the trans-Atlantic slave trade is measured by the variable trans-Atlantic exports$_c$. The variable Other slave exports$_c$ measures the number of slaves exported from country c during the Indian Ocean, Red Sea, and trans-Saharan slave trades combined. Again, we normalize the slave exports by land area, as in Section 4. The vector $\mathbf{X}_c'$ includes a set of country-level controls. These country controls include the percentage of people practicing Islam; a dummy variable for whether the country's laws have French origin; dummy variables indicating the colonizer prior to the country's independence; variables capturing the country's natural resource endowments of gold, oil, and diamonds; and variables measuring the country's real GDP per capita and level of inequality.

Table 5: OLS Estimates on the Relationship Between Slave Exports and Polygyny at Country-Level[a]

	(1)	(2)	(3)	(4)	(5)	(6)
Trans-Atlantic Slave Trade	1.898***	2.115***	2.174***	1.721***	1.811***	1.473***
	(0.316)	(0.383)	(0.414)	(0.378)	(0.431)	(0.519)
Other Slave Trade	0.247	0.135	-0.092	-0.134	-0.298	-0.900*
	(0.338)	(0.391)	(0.460)	(0.350)	(0.387)	(0.445)
% of Islam		0.049	0.086		0.077	0.083
		(0.057)	(0.066)		(0.064)	(0.063)
French Legal Origin		4.354	9.501		-4.299	-7.964
		(9.880)	(11.405)		(10.435)	(12.948)
Ln(gold prod/pop)			0.450			0.180
			(0.401)			(0.410)
Ln(oil prod/pop)			1.319			1.135
			(0.840)			(0.772)
Ln(diamond prod/pop)			-2.575*			-1.601
			(1.244)			(1.193)
Gini			0.629			-0.037
			(0.420)			(0.333)
Ln(Real GDP per capita)			-7.202			-12.103**
			(5.358)			(4.510)
Colonizer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.192	-6.971	-6.416	3.018	2.527	108.410**
	(8.928)	(13.874)	(51.875)	(11.259)	(11.405)	(47.207)
N	30	30	27	37	37	36
$\bar{R}^2$	0.64	0.62	0.66	0.48	0.47	0.53

[a] The dependent variable for (1)-(3) is the percentage of men in polygynous marriages, and the dependent variable for (4)-(6) is the percentage of women in polygynous marriages. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at the 1%, 5% and 10% levels.

Table 5 reports the estimates of the OLS regression for both measures of polygyny. Columns 1-3 correspond to the OLS regression when the dependent variable is the percentage of men in polygynous marriages, and columns 4-6 similarly correspond to the percentage of women. Columns 1 and 4 report the results regressing the percentage of men and women in polygynous marriages on the trans-Atlantic and other slave trades variables, including colonizer fixed effects. Columns 2 and 5 include the country-level controls capturing Islam and legal origin. Columns 3 and 6 include the country-level controls capturing natural resource endowments, real GDP per capita, and inequality.[12]

The relationship between the trans-Atlantic slave trades and polygyny is significant and positive and remains so across all specifications. The other slave trades, however, show no consistent relationship with polygyny across specifications and are not significant except in one case, column 6. Column 6 also shows real GDP per capita is negatively correlated with polygyny and is significant. These OLS results corroborate the previous qualitative and quantitative findings in Sections 2 and 4.

5.2 Cross-Country IV Estimates

We use the instrumental variable approach to show the OLS correlations are causal. In addition to the instrument used in Section 4.2, we use three instruments for the other slave trades, all of which are taken from Nunn (2008). The first measures the sailing distance between the point on the African coast closest to the centroid of the country and the closest major destination markets of the Indian Ocean slave trade, Mauritius and Muscat, Oman. The second measures the overland distance from the centroid of the country to the closest port of export for the trans-Saharan slave trade. These ports include Algiers, Tunis, Tripoli, Benghazi, and Cairo. The third measures the overland distance from the centroid of the country to the closest port of export for the Red Sea slave trade. These ports include Massawa, Suakin, and Djibouti.

Table 6 reports our IV estimates. Again, the trans-Atlantic slave trade has a positive and significant effect on polygyny across all specifications. The effect of the other slave trades remains

[12]We also obtain OLS estimates including region dummies and geographic controls, such as the distance from the equator and a measure of humidity. The results are not substantially different. We choose not to report them due to space considerations.

Table 6: IV Estimates on the Relationship Between Slave Exports and Polygyny at Country-Level[a]

	(1)	(2)	(3)	(4)	(5)	(6)
Trans-Atlantic Slave Trade	1.786***	1.856***	2.038***	2.373***	2.289**	1.456**
	(0.359)	(0.428)	(0.338)	(0.802)	(0.926)	(0.604)
Other Slave Trade	0.896	0.910	-0.092	1.940*	1.893*	-0.389
	(1.063)	(0.723)	(0.422)	(1.087)	(1.027)	(0.604)
% of Islam		-0.017	0.081*		-0.035	0.065
		(0.066)	(0.049)		(0.097)	(0.053)
French Legal Origin		7.534	8.914		-2.564	-8.488
		(9.823)	(8.157)		(14.893)	(11.732)
Ln(gold prod/pop)			0.436			0.129
			(0.285)			(0.326)
Ln(oil prod/pop)			1.338**			1.130*
			(0.589)			(0.676)
Ln(diamond prod/pop)			-2.516***			-1.143
			(0.884)			(1.027)
Gini			0.646**			0.026
			(0.295)			(0.298)
Ln(Real GDP per capita)			-7.640*			-10.346**
			(3.975)			(4.380)
Colonizer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.339	-10.365	1.688	-0.534	-0.076	98.591
	(12.015)	(14.002)	(30.210)	(15.536)	(15.433)	(53.788)
N	30	30	27	37	37	36

[a] The dependent variable for (1)-(3) is the percentage of men in polygynous marriages, and the dependent variable for (4)-(6) is the percentage of women in polygynous marriages. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at the 1%, 5% and 10% levels.

inconsistent across specifications. Real GDP per capita is negatively correlated with polygyny and is significant. Column 3 shows the coefficient on inequality is positive and significant for the case when the dependent variable is the percentage of men in polygynous marriages. The result for inequality is consistent with previous literature in economics on the determinants of polygyny, such as Becker (1974) and Grossbard (1978). The slave trade results are consistent with the other findings in the paper.

6 Conclusion

The slave trades touched the lives of many Africans over the course of hundreds of years. It is unsurprising the impact of the slave trades can still be felt today. This paper shows those ethnic groups most severely affected by the trans-Atlantic slave trades tend to have more polygynous

marriages today. Conclusively showing the effect of the Indian Ocean slave trades on marriage arrangements requires further research. Since previous literature establishes a link between polygyny and economic development, our paper suggests a channel through which the trans-Atlantic slave trades have had a long-term effect on current economic outcomes in Africa. Future research should focus on the polygyny channel to further understand the legacy of the trans-Atlantic slave trades. For example, polygyny has been shown to correspond with higher gender inequality. In so far as polygyny drives the outcomes of other commonly measured development indicators, this suggests our paper might have far reaching implications for understanding the origins of the outcomes.

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