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JEL Classification: J13, N35

Keywords: Malthusian model, Polygamy, Middle East, Fertility, Marriage

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September 10, 2021

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Malthus predicted that fertility rises with income and that people regulate fertility via regulating marriage. However, evidence on the Malthusian equilibrium has been mostly confined to Europe and East Asia. We employ Egypt's population censuses in 1848 and 1868 to provide the first evidence on the pre-industrial Malthusian dynamics in the Middle East and North Africa. At the aggregate level, we document rural Egyptian women having a high fertility rate that is close to the Western European level, combined with low age at marriage and low celibacy rate, that are closer to the East Asian levels. This resulted in a uniquely high fertility regime that contributed to the region's lower wages. Next, we provide individual-level evidence on the positive correlation between fertility and income (occupation). We find that the higher fertility of rural Egyptian white-collar men is attributed to the extensive margin of fertility, and not to marital fertility differentials. Specifically, white-collar men's higher polygyny rate explains 70% of their fertility advantage, whereas their higher marriage rate and lower wife's age at marriage explain 30%, suggesting that polygyny led to a steeper income-fertility curve than in Western Europe, by enabling the Egyptian rural bourgeoisie to out-breed the poor.

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Introduction

The Malthusian model implies that fertility rises with income, and that people regulate fertility at the extensive margin via regulating marriage (Malthus, 1826; Guinnane, 2011).[1] Most famously, Hajnal (1965) documented a (Western) European Marriage Pattern (EMP) of late marriage and high celibacy that restricted fertility at the extensive margin. The reduction of fertility, and therefore population pressure, via the EMP has been used to explain the rise of Western Europe during the early modern period (Greif, 2006; Greif and Tabellini, 2010; De Moor and Van Zanden, 2010; Foreman-Peck, 2011; Voigtländer and Voth, 2013), generating much debate (Guinnane, 2011; Dennison and Ogilvie, 2014). By contrast, scholars have also documented an East Asian pattern of low marital fertility (via longer breastfeeding and infanticide), early marriage, and low celibacy, suggesting fertility regulation within marriage, although its effect on living standards remain contested (Tomobe, 1991; Lee and Feng, 1999; Kurosu et al., 1999).

In comparison, while societies in the Middle East and North Africa (MENA) had stagnant incomes (Özmucur and Pamuk, 2002; Pamuk and Shatzmiller, 2014), we know little about the existence (or lack thereof) of Malthusian demographic patterns prior to MENA's demographic transition during the second half of the 20th century.[2] It is important to study the Malthusian dynamics in MENA, though, because of their implications for the region's lower and stagnant incomes, and because of MENA's peculiar demographic institutions, among which are polygyny and slavery.[3] While under monogamy, male fertility is concave in income due to the biological limit to childbearing, polygyny and female slave ownership enable richer men to significantly out-breed the poor, leading to a steeper income-fertility relationship.

This paper introduces the first evidence from the MENA region on the existence of Malthusian dynamics prior to the demographic transition. We draw on a unique and novel data source: two cross-sectional individual-level samples of Egypt's popu-

[1]Consequently, the Malthusian model implies that any rise in income due to technological progress is offset by higher fertility and population growth, which keeps income per capita stable over the long run. This contrasts with the modern fertility regime, brought about via the demographic transition, with negative (or zero) income elasticity of fertility, and marital fertility control.

[2]Data from the United Nations reveal that the birth rate declined in most MENA countries from 40–50 per 1,000 in 1950–55 to 20–25 per 1,000 in 2005–10. Data on the total fertility rate (TFR) show a similar decline.

[3]Polygyny is the marriage of one man to multiple wives.

lation censuses in 1848 and 1868 that were digitized by Saleh (2013) from the original Arabic manuscripts at the National Archives of Egypt. These are among the earliest precolonial individual-level population censuses from any non-Western country (and the earliest in MENA), to include demographic information on every household member, including females, children, and slaves. Although the censuses do not record the marital status or the number of children ever born, a common limitation of historical censuses, they do record the relationship to the household head that we use to infer both marriage and fertility. Furthermore, they record the age of women in rural provinces (90% of the population), to which we restrict our analysis. Due to the absence of vital records before 1902, these censuses are a unique micro-data source for examining Egypt's pre-industrial demographic patterns. We address two questions. First, at the aggregate level, what were the nuptiality and fertility patterns in rural Egypt? Did they (not) resemble that in Western Europe or East Asia? Second, at the individual level, was there a Malthusian relationship of higher fertility among those in higher income occupations and if so, what was generating this positive relationship? Was it higher marriage probability and lower age at marriage, as predicted by Malthus, and what role did polygyny and female slavery play? Did Muslims and Coptic Christians have different fertility and marriage patterns?

At the aggregate level, we find that 19th-century rural Egypt combined the early and near universal marriage of East Asia with the high marital fertility of Western Europe. The female total marital fertility rate (TFMR) at age 21-45 was 7.2 in Egypt, which is comparable to the 7-9 found in Western Europe, and much higher than the TFMR of 5.7 in Japan, 1665-1871, and 3.8-4.76 in northeast China, 1789-1907 (Tomobe, 1991; Lee and Campbell, 1997; Chen et al., 2010). However, Egypt was comparable to East Asia in marriage patterns, with all but 6% of women marrying at the mean age of 18. This resulted in a uniquely high fertility regime which was partially driven by Egypt's high mortality rates at age 0-15.

At the individual level, we find that rural white-collar men–mainly village headmen who were medium landholders and not the urban upper class–had significantly higher fertility than men in other occupations, as has been found for other populations (Clark and Hamilton, 2006; Boberg-Fazlic et al., 2011; Dribe and Scalone, 2014; Clark and Cummins, 2015; Lee and Park, 2019; Hu, 2020).[4] Furthermore,

[4]Egypt's upper class, the Ottoman-Egyptian aristocracy, lived in cities and were the largest (absentee) landholders in rural Egypt. Village headmen instead constituted an agrarian bourgeoisie.

white-collar workers' higher fertility was not driven by their higher marital fertility. Instead, we show that they had higher marriage rate, lower wife's age at marriage, higher polygyny rate, and higher probability of owning female slaves. These findings are consistent with the findings from pre-industrial Western societies showing the lack of targeting in marital fertility (Clark et al., 2020), and the use of the timing of marriage to regulate fertility (De La Croix et al., 2019; Cummins, 2020).

However, unlike Western societies, we find that polygyny–but not ownership of female slaves who rarely had children–functioned as a powerful mechanism generating the occupational differentials in Egyptian fertility. First, 12% of white-collar men were polygynous, as opposed to 5% in the whole male population; this difference remains statistically significant even after controlling for age (among other controls). Second, while polygynous men had significantly more children than monogamous men, polygynous couples had slightly fewer children per wife than monogamous couples, which was potentially due to the less fertility of the first wife, as has been argued for China (Feng et al., 2001). Third, we evaluate the relative contributions of polygyny versus the age-specific marriage rates in driving the occupational differences in male fertility. We find that over 70% of the fertility differences across occupations is due to polygyny.

Finally, we test whether Muslims and Coptic Christians had different fertility and marriage patterns, conditional on occupation (among other controls). Rural Egypt provides a rare context in which we are able to compare people of different religions living within the same environment. Importantly, we find no statistically significant difference in fertility or marriage among the two religious groups. The only exception was in polygyny, which was practiced by Muslims but not among Coptic Christians, as the Coptic Church prohibited the practice.

The main contribution of this paper is to show whether and how the Malthusian mechanism functioned in a MENA population before the demographic transition. The literature on this region had mainly focused on wages (Özmucur and Pamuk, 2002; Pamuk and Shatzmiller, 2014) as a measure of Malthusian stagnation. This literature found that Egypt, and the Ottoman Empire in general, had lower wages than Western Europe. Further, the wage trends suggest a region in stagnation, as would be predicted by the Malthusian model.

This paper also shows, both theoretically and empirically, how polygyny and female slavery may alter the Malthusian equilibrium. Polygyny was the most common marriage system in pre-industrial times. The ethnographic atlas shows 84% of societies allowed some form of polygyny (Gray, 1998) which is in line with other studies (Burton et al., 1996). Therefore, monogamy in marriage was the peculiar institution (Henrich et al., 2012) that had become common in early modern Europe and may have originated in Ancient Greece/Rome (Scheidel, 2009).[5] We show that polygyny and female slave ownership were (unsurprisingly) positively correlated with income. This is consistent with empirical findings from China, 1400-1900 (Hu, 2020), although polygyny was less prevalent in China (<2%) than in Egypt (≈5%), and hence its demographic impact was smaller. We further show polygyny had two consequences. First, it could have led to modestly higher population pressure if marriage was partially a result of women choosing husbands in order to maximize reproductive success, as hypothesized by Becker (1974). Second and more importantly, polygyny was the major channel by which the Egyptian rural bourgeoisie could out-breed the poor to a far greater extent than the monogamous rich in the West, resulting in a steeper fertility-income curve in Egypt.

This paper primarily speaks to the micro-level literature that examines the marriage and fertility behavior of households. The first group of these studies examines the heterogeneity in (net) fertility by income level (e.g. wealth, occupational status), possibly over time (Clark and Hamilton, 2006; Boberg-Fazlic et al., 2011; Clark and Cummins, 2015; Lee and Park, 2019; Hu, 2020), finding that higher income is associated with greater fertility as theorized by Malthus. The primary mechanism is through the extensive margin of fertility via an earlier age of marriage (Cummins, 2020), and not via marital fertility control (Clark et al., 2020). It was only in later stages of development that fertility and income lost their correlation (Hacker, 2003; Ruggles, 2016; Ager et al., 2020; Chatterjee and Vogl, 2018).

The second group of these micro-level studies investigates the impact of shocks to income on fertility (Weir, 1984; Galloway, 1988; Guinnane and Ogilvie, 2008; Lagerlöf, 2015), finding a negative effect of food price shocks on fertility, that operates via marriage. Relatedly, Chaney and Hornbeck (2016) used a population shock in Valencia whereby Moriscos were expelled in 1609, triggering an increase in the incomes of those who remained. They found convergence in output per capita, a proxy for income,

[5]This is not to suggest that polygyny in mating did not occur in Europe, as illegitimate children existed, although their social status became diminished in later periods (De La Croix and Mariani, 2015).

and population.

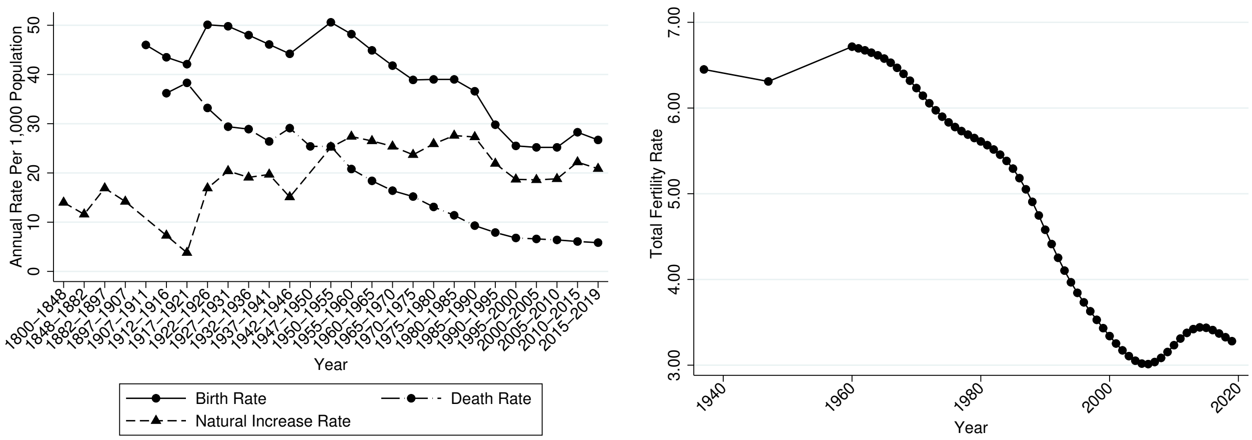
The paper is also related to the macroeconomic literature on the demographic transition that enabled technological growth to increase income per capita. The "unified growth model" argues that this transition was motivated by the quality-quantity trade-off (Galor and Weil, 2000; Galor, 2005a,b). A number of empirical papers have attempted to test the macro-level prediction of the transition from a Malthusian regime to modern growth (Clark, 2008; Ashraf and Galor, 2011). Although an initial finding was little or no Malthusian effect by the 18th century (Nicolini, 2007; Kelly and Gráda, 2012; Fochesato, 2018), a recent paper by Madsen et al. (2019) showed this was likely due to omitted variable bias and strong Malthusian forces were in fact active. It was only in the 19th century that societies emerged from this trap.

Egypt's Demographic Institutions

Egypt was an autonomous Ottoman vassal state during the 19th century, ruled by the Ottoman viceroy Muhammad Ali Pasha (1805–1848) and his descendants. Following the British occupation in 1882, Egypt remained under the nominal Ottoman sovereignty, represented by Ali's dynasty, although it was de facto ruled by Britain. After the Ottoman Empire joined the Central Powers in 1914, Britain declared Egypt a British protectorate independent of the Ottoman Empire, under the nominal rule of Ali's dynasty. From 1922 to 1952, Egypt became nominally independent from Britain, as a constitutional monarchy ruled by Ali's dynasty, yet de facto ruled by Britain.

Figure 1a shows Egypt's birth, death, and natural increase (=birth−death) rates per 1,000 population from 1800 to 2019. Prior to the establishment of the universal vital registration system in Egypt in 1902, we plot the intercensal growth rates based on the population censuses of 1800 (total estimate by the French occupation), 1848 (total estimate by Fargues (1986)), 1882, 1897, and 1907. The figure shows that Egypt witnessed its demographic transition after World War II, with the secular decline in both birth and death rates. Figure 1b plots the total fertility rate from 1937 to 2019. We do not have estimates of the TFR prior to 1937, because the 1937 census is the first published census report to tabulate the number of births by mother's age. The figure shows that the TFR started to decline after 1960.

Egypt, and the Ottoman Empire at large, had two distinct demographic insti-



(a) Birth and Death Rates, 1800-2019

(b) Total Fertility Rate, 1937-2019

Figure 1: Egypt's Demographics, 1800–2019

Notes: The natural increase rate in 1800–1907 is the intercensal growth rate (per 1,000 population) per year, based on the population censuses of 1800 (total estimate by the French occupation), 1848, 1882, 1897, and 1907. For the subsequent period 1907–2010, the natural increase rate is the difference between the birth and death rates.
Sources: Panel (a): 1800–1950: Fargues (1986, p. 210); 1950–2019: World Development Indicators. Panel (b): 1937, 1947: Fargues (1986, p. 223). 1960-2019: World Development Indicators.

tutions: polygyny and slavery. Polygyny was allowed for Muslim males by Islamic jurisprudence; a Muslim male may marry up to four wives simultaneously. Polygyny was not unique to this region as it was a common institution in the non-Western world. The best studied case from pre-industrial times are East Asian societies which allowed for polygyny via concubines. However, polygyny rates in early modern China were low and could not have exceeded 1-2% (Feng et al., 2001).[6] However, levels of polygyny were generally higher than 4% in this region with some variation. In the case of Egypt, 5% of rural adult men were polygynous in the 1848 and 1868 censuses. About 6% among all Egyptian men were polygynous according to the 1907 census (Fargues, 2001). Elsewhere, the percentage of men married polygynously was 15% in Algeria in 1886 (Fargues, 2001), 6.6% in Morroco in 1951, 4.5% in Tunisia in 1946, 4.3% in Syria in 1960, and 3.2% in Libya in 1954 (Chamie, 1986).

Slavery was also a long-standing institution until Egypt's abolition of slavery in 1877, as enslavement of foreign non-Muslims via "holy" raids (*ghazwas*) was permitted

[6]Accurate statistics do not exist for early modern East Asia. However, polygyny among peasants would have been extremely rare in both Japan and China at this time.

by Islamic law. Slavery was self-perpetuating by law; a slave's conversion to Islam did not result in emancipation, and the offspring of a male slave were automatically slaves. Slaves constituted 1.2% of Egypt's population in 1848, and rose to 3% in 1868 following the cotton boom in 1861–1865. Around 94% of slaves were blacks (*aswad*, *sudani*) from the Nilotic Sudan. The remaining 6% were either Abyssinians (*habashi*) from Ethiopia, or whites (*abyad*) from Circassia and Georgia.

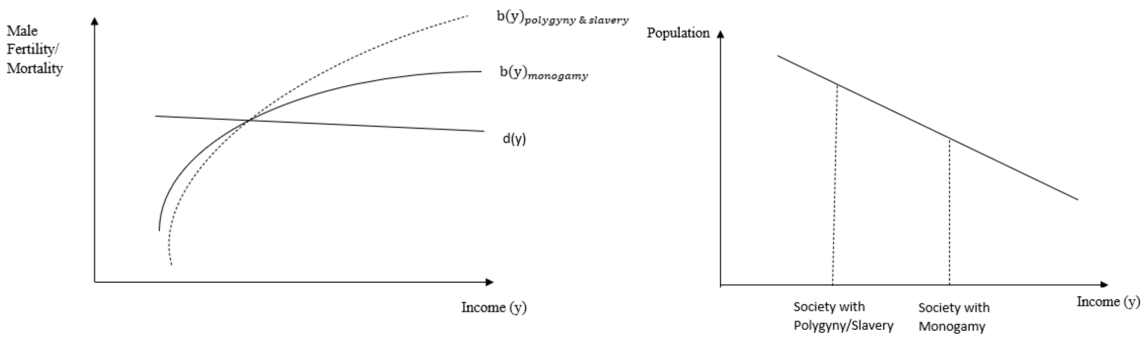
Most slaves were traditionally employed as domestic servants. Female domestic servants were legally coerced to provide sexual services to their male masters (without marriage), and their offspring born to their male masters were free. The two other sectors of slave employment were agriculture and the military: Employing slaves in agriculture increased after the cotton boom in 1861–1865, whereas employing slaves in the military declined during the 19th century.

The Malthusian Model with Polygyny and Slavery

The simple Malthusian model (Malthus, 1826) is based on three assumptions as shown in Figure 2. First, birth rates are increasing in income (A1). Second, death rates are decreasing in income (A2). Third, decreasing returns to labor due to limited land results in decreasing average income per person as population increases (A3). If we define the income where birth rate equals death rate as the subsistence income, any income above this will result in population growth. As population increases over the long run, the income per capita decreases due to A3 until it reaches equilibrium at the subsistence level.

The equilibrium income can be shifted upwards in this model, if there is either lower birth rate or higher death rate conditional on income. In either case, the mechanism works through the equilibrium population level. However, any technological growth has no effect on equilibrium income because any short-term gains are eventually eaten away by population growth.

Polygyny and female slavery may both affect the Malthusian equilibrium. Under monogamy and no slavery, there is steep decline in the birth rate function as income increases, due to biological limits in childbearing under monogamy, as shown in Figure 2a. The institutions of polygyny and female slavery can partially loosen this constraint by allowing richer men to significantly out breed the poor by having multiple wives, or owning female slaves. This may be accompanied by a decrease in fertility among



(a) Fertility/Mortality and Income (b) Income and Population

Figure 2: A Malthusian Model with Polygyny and Female Slavery

the poor who have to compete for wives with the rich. Therefore, these institutions could affect the curvature of the fertility. It could also increase fertility for society as a whole if women married to the rich, or female slaves, have more children. This could result in higher population and lower average income per person in equilibrium (Figure 2b).

Furthermore, because polygyny was practiced by Muslims only, and not by non-Muslim minorities, it can alter the inter-religious differences in fertility (if any) in favor of Muslims. This may partially offset the fertility advantage of non-Muslims, who were traditionally better off than the Muslim majority (Appendix Figure A2).

Data

Egypt's 1848 and 1868 population census samples are two nationally representative cross-sectional samples of $\approx$ 80,000 individuals in each year.[7] Each sample is selected via a random draw of pages within the census registers of each province, where all households on a selected page are included in the sample.[8] Because we do not observe women's age in urban Egypt, we restrict the analysis to free Muslim and Coptic men

[7]The sampling rate is 8–10% in Cairo and Alexandria, and 1% in the rural provinces.

[8]Within the census registers of each province, one page is selected every x number of pages until the end of the province's census registers. The range (x) is decided based on (1) the average number of individuals in a page in the province's census registers and (2) the target sample size in each province. If a household begins on a selected page, it is included in its entirety, regardless of the page in which the household ends. For more detail, see Saleh (2013).

and women in rural Egypt who are 15 to 64 years of age.[9] In the analysis of fertility, we restrict the sample of women further to those in the reproductive age who are 15 to 54 years old. Throughout the analysis, we weight the observations by the inverse of the sampling probability, in order to account for inter-province differences in the sampling rate. While the 1848 census enumerated all 14 rural provinces, only 6 rural provinces have extant census registers in 1868. This can be due to either the non-survival of the 1868 census registers of these provinces and/or their non-enumeration. The personal weights in 1868 account for this issue by assigning higher personal weights to the individuals in the neighboring provinces.[10]

The Egyptian censuses record neither the marital status nor the number of children ever born. However, the censuses record for each individual their relationship to the household (HH) head. We thus follow the historical demography literature that employs the relationship to the HH head to infer marriage and fertility (Hacker, 2003; Ruggles, 2016). The availability of the relationship to the HH head in the Egyptian censuses is actually remarkable from an international perspective. For example, the U.S. censuses did not record this information before 1880, and so U.S. historical demographers relied instead on the age and sex structure of the HH members. The Egyptian censuses have the further advantage of recording other demographic and socioeconomic characteristics that are typically not available in vital records, and that we use to explain the variation in fertility and marriage.

Below we briefly explain how we measure fertility and marriage. We relegate the detailed technical description of these variables to Appendix A.

The first outcome variable is fertility, which we measure at the individual level by the number of surviving children aged between 0 and 1.5 year old who co-resided with their parent(s) at the time of the census. We use the 1.5 age threshold due to age heaping around ages 1 and 2. In the case of multiple potential fathers or mothers, we assign the child to the parent with the smallest parent-child age difference. When we measure fertility at the aggregate level, we correct for unobserved children due to

[9]This means excluding urban provinces: Cairo, Alexandria, Rosetta, *Qusayr*, *'Arish*, and Damietta. Urban women's age is recorded merely as adult or juvenile.

[10]Specifically, individuals in the two Lower Egypt provinces that we observe in 1868, al-Sharqiya and al-Daqahliya, are assigned higher personal weights to account for the population of the other four missing provinces of Lower Egypt (al-Buhayra, al-Menoufiya, al-Gharbiya, al-Qalyubiya). Similarly, the four observed Upper Egypt provinces, Giza, Fayyum, Beni Soueif, and Asyut, are assigned higher weights to account for the population of the other four missing provinces of Upper Egypt (Minya, Girga, Qena, Aswan).

both child death and unmatched children who did not co-reside with their parent(s).

The second outcome variable is marriage. We measure the marital status at the individual level (never married, in a monogamous marriage, in a polygamous marriage, separated) by the number of surviving marital partners who co-resided with the individual at the time of the census. In the case of multiple potential partners (e.g., multiple brothers of HH head and multiple wives of brothers of HH head), we assign to the individual the partner with the smallest couple age differential.

An important variable in the fertility and marriage analysis is age. We use the 10-year age bin, because of the age heaping around ages ending in 0's (Appendix Figure A1).

Egypt's Demographics in International Perspective

One way of studying the Malthusian dynamics is to think of the society as a whole in equilibrium. In this case, the population is mostly stable, due to birth control (the preventative check) or high mortality (the positive check). Most studies have found little evidence for a positive check (Clark, 2008), while there is substantial evidence for a preventative check. We therefore focus on the preventative check, for which our data is best suited (censuses enumerate the survivors). In this section, we construct Egypt-level measures of fertility, mean age at marriage, and the celibacy rate, using the censuses of 1848 and 1868, and we compare them to the demographics of other regions. These aggregate statistics demonstrate how pre-industrial societies prevented over-population. The literature has shown that Western Europe achieved this objective via late marriage and high celibacy rate despite high marital fertility (Hajnal, 1965; Clark, 2008), whereas East Asia had low fertility within marriage despite early and universal marriage (Lee and Feng, 1999; Feng et al., 2001).

We follow Hajnal (1965)'s method to estimate the singulate mean age at marriage using our marital status variable. To measure fertility, we use the number of surviving children aged 0-1.5 to estimate the age-specific number of births, where we correct for unobserved and unmatched children as documented in Appendix A.3. We present the results for marriage and fertility by age and census year in Table 1.

We find that the marriage rate generally increases up to age 44 for both sexes. The share separated increases thereafter, which is due to both the death of spouses and divorce. While the share never married increases after age 44, this is likely due to

Table 1: Marriage and Fertility by Sex, Age, and Census Year

Panel A: Marriage by Age

	15-24	25-34	35-44	45-54	55-64
Women 1848					
Monogamous	0.47	0.62	0.61	0.51	0.33
Polygamous	0.11	0.17	0.18	0.15	0.12
Separated	0.11	0.12	0.14	0.25	0.41
Never Married	0.30	0.09	0.07	0.10	0.14
Women 1868					
Monogamous	0.52	0.67	0.66	0.54	0.37
Polygamous	0.08	0.16	0.16	0.11	0.09
Separated	0.07	0.10	0.14	0.30	0.44
Never Married	0.33	0.07	0.04	0.05	0.10
Men 1848					
Monogamous	0.16	0.52	0.67	0.73	0.73
Polygamous	0.01	0.06	0.08	0.10	0.13
Separated	0.01	0.02	0.03	0.04	0.04
Never Married	0.82	0.41	0.22	0.13	0.10
Men 1868					
Monogamous	0.23	0.60	0.77	0.80	0.78
Polygamous	0.01	0.03	0.07	0.11	0.12
Separated	0.00	0.02	0.02	0.03	0.04
Never Married	0.75	0.35	0.15	0.06	0.06

Panel B: Age at Marriage

	Women		Men	
	1848	1868	1848	1868
Mean	17.6	18.3	27.6	26.4
Median	18.3	18.6	29.0	27.1

Table 1 Continued

Panel C: Female Fertility by Age					
	15-24	25-34	35-44	45-54	Total 21-45
Total Marital Fertility Rate					
1848	249	328	241	129	6.8
1868	295	356	265	141	7.5
Total Fertility Rate					
1848	184	293	206	95	5.8
1868	201	321	228	93	6.4
General Fertility Rate					
1848	181	261	156	64	5.0
1868	197	286	173	63	5.4

Panel D: Male Fertility by Age						
	15-24	25-34	35-44	45-54	55-64	Total 21-64
Total Marital Fertility Rate						
1848	117	288	331	304	237	12.1
1868	266	339	339	322	241	13.5
Total Fertility Rate						
1848	22	168	255	256	208	9.0
1868	66	214	286	295	218	10.4
General Fertility Rate						
1848	21	146	184	141	81	5.6
1868	65	186	206	162	85	6.7

the miss-assignment of widows and divorcees as never married due to our matching procedure. We therefore assume that the share never married is non-increasing over age when estimating the singulate mean age at marriage.[11] We find the mean age at marriage was 18 for women and 27 for men resulting in a large age gap among couples. Reassuringly, the median age at marriage (not shown) is very similar.

To estimate fertility, we construct three measures. The total marital fertility rate (TMFR) is the number of children among married couples aged 21-45 assuming that they survive for the entire age bracket.[12] The total fertility rate (TFR) is the number of children among all women aged 21-45, assuming they survive for the entire age bracket. Both the TMFR and TFR do not account for female mortality. Our third measure, the general fertility rate (GFR), adjusts the TFR by accounting for female mortality at each age bracket using Egypt's first life table that was constructed by El-Shanawany (1936) based on the 1917 and 1927 censuses. Notice that while the TMFR measures the intensive margin of fertility within marriage, the TFR and GFR account for the extensive margin of fertility.

We find that male and female fertility both increased slightly between 1848 and 1868. Across the three measures, the female TMFR is 7.2 on average across 1848 and 1868, and is 20% higher than the average TFR of 6.1. This difference is due to the existence of unmarried women who drive down the TFR. However, the effect of unmarried women is relatively small due to the high marriage rate among women who are in fertility age. The average female GFR of 5.2 is 17% lower than the average female TFR due to the effect of female mortality. Male fertility rates differ from females in having a fertility peak at age 35-44 due to men's later age at marriage. The male TMFR and TFR both appear high but once we account for mortality, the GFR is much lower at an average of 6.1. The GFR remains higher for men than women, due to the skewed adult sex ratio as there are 10% more men than women. Despite the assumptions that are required for our calculations, it is reassuring that the estimated female TFR in both 1848 and 1868 are actually very close to the first available TFR estimate for Egypt from the 1937 census (see Figure 1b) which preceded the Egyptian demographic transition.

Next, we compare our findings to other pre-industrial populations in Table 2.

[11]Specifically, as the share never married increases after age 35-44, we assign the celibacy rate at age 35-44 to the higher age bracket 45-54. However, using the celibacy rate at age 45-54 only increases the estimated celibacy rate to 7%.

[12]We use the age bracket 21-45 because it is comparable to the international literature.

Table 2: International Comparisons of Pre-industrial Fertility & Marriage

Country	Period	Female Total Marital Fertility Rate (21-45)	Female Mean Age at Marriage	Female Celibacy (%)	Total Mortality Rate 0-1	Total Mortality Rate 0-15
Western Europe						
England	1740-1790	7.7	25.3	11.3	16.8	30.4
France	1740-1790	9.0	26.0	12.0	28.1	52.5
Scandinavia	1740-1790	7.1	25.5	14.1	20.8	39.8
Middle East						
Egypt	1848, 1868	7.2	18.0	6.0	19.3	41.3
East Asia						
China (Liaoning)	1774-1840	3.8	18.3	1.0		
Japan	1665-1871	5.7	21.5	1.0	17.7	35.6

Notes: Due to different measures in the literature, the proportion of women who never married is measured at age 30 for China, age 45-49 for Japan, lifetime celibacy for Western European countries, and age 35-44 for Egypt. We use the figures for lifetime celibacy from Dennison and Ogilvie (2014) for Western Europe. In the case of Japan, we use the average mean age at marriage and the share of women never married measured in various regions.
For mortality rate, we use averages from the period 1750-1799 for England, 1740-1789 for France, the 1751-1790 mortality rates for Sweden in the case of Scandinavia, the 1877 statistical yearbook for Egypt, and estimates from Mino region in Japan. Sources: Ministère de l'Intérieur (1877), Blayo (1975), Flinn (1985), Tomobe (1991), Saito (1992), Lee and Campbell (1997), Wrigley et al. (1997), rapporter (1999), Kurosu et al. (1999), Feng et al. (2001), Ochiai (2004), and Dennison and Ogilvie (2014).

We find that rural Egypt was a high fertility society, with almost universal marriage among women, low female age at marriage, and high marital fertility. Egypt's TMFR of 7.2 was comparable to the 7-9 that we observe in Western Europe. However, it is much higher than the East Asian levels of fertility which generally ranged from 4 to 6.[13] Importantly, this is not due to unobserved births in the censuses, due to infant mortality before the census enumeration, as we account for this in our measure using the infant mortality rate in the Egyptian 1877 statistical yearbook (Ministère de l'Intérieur, 1877) (see Appendix A.3). It is not due either to our use of 10 year age brackets, as we obtain very similar results if we employ instead the 5 year age brackets (see Appendix Figure A3). Further, the shape of the fertility-age curve is

[13]Although not included in the table, Shuangcheng, 1866-1907, in China also had a total marital fertility rate of 4.76 (Chen et al., 2010). It is not included in the table because we lack most other statistics from this region.

similar to that we observe in other societies.

These results suggest that birth spacing amounted to slightly below three years in Egypt. This could be possibly due to a relatively short breastfeeding period which may have contributed to Egypt's high marital fertility. Recent archaeological evidence from skeletal remains have shown the breastfeeding period was a key factor in determining fertility in other pre-industrial societies. For example, the literature has found declining periods of breastfeeding in England over two millenia (Haydock et al., 2013), from 4 years in Roman Britain to less than 2 years by the 19th century. In contrast, similar studies from Eastern Europe and East Asia suggest longer breastfeeding periods. They find 3.1 years in 17th century Japan (Tsutaya et al., 2014), 3-4 years in 4th-7th century Korea (Choy et al., 2010), 4 years in 11th-18th century rural Romania (Voas et al., 2021), 3-4 years in 6th-15th century Greek byzantine population (Bourbou et al., 2013). Although there are no archaeological studies for Egypt or the Middle East during this period, the Islamic law recommended a two years period of breastfeeding (Giladi, 1998). This would be similar to Western European standards and may have resulted in the similarly high marital fertility rates.

Marital fertility rates only matter insofar as women are married. Regarding the extensive margin, we find that the female mean age at marriage and the female celibacy rate were both low in rural Egypt, which probably contributed to increasing fertility. Rural Egyptian women typically married at the mean age of 18 (or median age of 18.4). Assuming that women can typically have children between ages 15 and 45, Egyptian women would only avoid 10% of their childbearing years. Moreover, Egyptian women also had a low celibacy rate as almost all women married by age 45. In comparison, Western European women typically married at the age of 25-26 meaning that they avoided 33% of their childbearing years, many of which were their most fertile years. In addition, 11-14% of Western European women never married. Hence, Egypt is more similar to East Asian societies with respect to the extensive margin with fertility being close to natural fertility levels. One small difference was in the celibacy rate, which was almost zero in East Asia but 6% in Egypt. However, infanticide and the skewed sex ratio in China implied there were fewer women relative to men, which in itself lowered potential fertility (Feng et al., 2001).

To conclude, Egypt had a marriage and fertility pattern that differed from both East Asian and Western European societies. It was a very high fertility regime unlike other societies that limited fertility by some means. However, this can be partially explained by two factors. First, very high child mortality rates in Egypt may have necessitated the high birth rates. As shown in the mortality rate for age 0-15, Egypt had lower probability of child survival to adulthood than Western Europe with the exception of France whose mortality rates may be vastly over-estimated.[14] Second, we are only looking at rural fertility. Due to the urban graveyard effect, rural areas would have higher fertility in order to compensate for the population decrease in urban areas. One interesting implication of these aggregate findings is that fertility was high despite Egypt having low wages (Özmucur and Pamuk, 2002; Pamuk and Shatzmiller, 2014). This implies the low wages can be partially explained by the demographic pressure generated by Egypt's high fertility regime.

Individual-Level Analysis of Income and Fertility

We next examine the individual-level Malthusian prediction for the positive correlation between income and fertility, and whether individuals regulated fertility via marriage. To this end, we pool the 1848 and 1868 census samples. As we lack income data, a common shortcoming of historical censuses, we use occupation as a proxy for income as has become the norm in the economic history literature. We examine both the extensive margin of fertility via marriage patterns, and the intensive margin of fertility via births within marriage, by estimating the following regression:

$$Y_{i,q,t} = \alpha_q + \theta_t + \sum_o \beta_{1,o} occupation_o + \gamma X + \epsilon_i \quad (1)$$

where $Y_{i,q,r}$ is the outcome of individual i residing in village q in census year $t \in \{1848, 1868\}$. We examine the following dependent variables: (1) the number of surviving children aged 0-1.5, (2) a dummy variable (defined for the whole sample) that takes the value 1 if the person is currently married and equals 0 if never married or separated, (3) age at marriage (defined for married individuals with at least one child $\leq$ 7 years) which we estimate by the difference in years between the parent's age and the age of the oldest observed child, minus one, assuming that the oldest child was born one year after marriage,[15] (4) a dummy variable that takes the value

[14] French infant mortality rates in the early 19th century are about 20% which are much lower (Mesle and Vallin, 1991).

[15] This estimate is subject to certain shortcomings, as we discuss in Appendix A. These concerns are mitigated in equation 1, though, because we are interested in the occupational *differences* in,

1 if polygynous (defined for married men) and equals 0 if monogamous, (5) a dummy variable that takes the value 1 if the HH head owns at least one female slave (defined for male HH heads).

Our main explanatory variable is the occupation status, where we classify the occupational titles into four categories: (1) white-collar workers: they include professionals (e.g., physicians, engineers, teachers), bureaucrats, military, police, judiciary, clergy, rural elites (e.g., village headmen), and merchants, (2) artisans (e.g., weavers, carpenters), (3) farmers: they include small landholders (peasantry), sharecroppers, and agricultural laborers, (4) unskilled non-farmer workers (e.g., porters). We observe the occupational title for men, but not for women (except those working in low-status occupations such as servants and slaves). We thus impute the occupational title for married women by assigning to them the husband's occupation. We do not impute the occupational status for non-married women.

We control for a full set of village fixed effects (α_q)[16] to account for the spatial differences in marriage and fertility as shown in Appendix Figure A5, and a dummy variable for the 1868 census (β_t) to account for the aggregate changes in marriage and fertility between 1848 and 1868. The control vector X includes: =1 if Coptic Christian,[17] age measured by a full set of 10-year age bin indicators, spouse's age (for married individuals) measured by a full set of 10-year age bin indicators,[18] =1 if migrant (born outside village of residence), and =1 if foreigner (e.g., Turkish). The standard errors are White-Huber heteroskedasticity robust.

Findings: Intensive versus Extensive Margins of Fertility

Table 3 shows our findings for fertility. Column (1) reports the fertility differences across occupations when we use the sample of all men, both married and unmarried. Consistent with the Malthusian prediction on the positive correlation between income and fertility, we find that white-collar men, presumably the richest on average, had higher fertility than men in any other occupation: They have 0.07 more children aged 0–1.5 years than unskilled men, amounting to 32% of the sample average. We

rather than the *levels* of, age at marriage. For robustness, we also created alternative measures of age at marriage and we present the results in Appendix D.

[16]This is Egypt's third administrative level in rural provinces, below the province and the district.

[17]Non-Coptic Christians and Jews, are almost entirely urban, and are thus excluded from our analysis.

[18]We do not measure spouse's age for polygynous men, because they have more than one wife.

Table 3: Occupational Differences in Fertility

	(1) All Men	(2) Monogamous Women	(3) Polygamous Men	(4) Polygamous Women
=1 if Farmer	-0.015	-0.006	0.253	0.066
	(0.018)	(0.026)	(0.319)	(0.099)
=1 if Artisan	0.011	-0.017	0.270	-0.013
	(0.026)	(0.035)	(0.384)	(0.182)
=1 if White Collar	0.069***	-0.002	0.209	0.057
	(0.025)	(0.035)	(0.344)	(0.219)
=1 if Coptic Christian	0.006	0.032	-0.409	-0.277
	(0.026)	(0.037)	(0.473)	(0.353)
Age FE	Yes	Yes	Yes	Yes
Spouse Age FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes
Obs	11392	6928	531	1210
Adj-R^2	0.080	0.058	0.112	0.062
Av. dep. var.	0.218	0.321	0.567	0.280
p-val Artisan-Farmer	0.266	0.733	0.961	0.638
p-val W. Col.-Farmer	0.000	0.890	0.832	0.964
p-val W. Col.-Artisan	0.042	0.699	0.855	0.755

Notes: The dependent variable is the number of surviving children aged 0-1.5 who co-resided with their parent(s) at the time of the census. White-Huber robust standard errors are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$. The sample is restricted to free Muslim and Coptic men (resp. women) aged 15-64 (resp. 15-54) years who resided in rural Egypt. The omitted category for occupation is unskilled non-farmer workers. The omitted category for religion is Muslim. Other controls are =1 if migrant and =1 if foreigner. In column (1), the sample includes all men, whether married or not. In column (2), the sample is restricted to women in monogamous marriages. In column (3), the sample is restricted to men in polygynous marriages. In column (4), the sample is restricted to women in polygynous marriages. All regressions are weighted by the inverse probability of sampling.
Source: The 1848 and 1868 population census samples.

also find that artisans, farmers, and unskilled workers exhibited similar fertility rates. While this null finding is not surprising for unskilled workers and farmers, who likely had similar income levels, the fact that artisans did not have a higher fertility rate is surprising.

The positive correlation between income and fertility incorporates the effects from both the intensive margin, via marital fertility, and the extensive margin, via regulating marriage. To investigate the relative contribution of the intensive margin, we study in columns (2)–(4) marital fertility among married individuals. Again, consistent with the Malthusian prediction, we find no statistically significant difference in marital fertility across occupations. This suggests that the higher fertility of white-collar men in column (1) is *not* driven by the intensive margin. This is also consistent with the finding that European couples were not aiming for certain family sizes, which suggests the lack of control over fertility once people married (Clark et al., 2020).

Finally, we fail to detect differences across Muslims and Coptic Christians with respect to men's overall fertility, or marital fertility. This suggests that religious affiliation, as a system of beliefs, played little role in driving fertility decisions.

If marital fertility played less of a role in driving the higher fertility of white-collar men, can we explain the latter by differences in marriage patterns across occupations? We present the results for marriage outcomes, the extensive margin of fertility, in Table 4. Column (1) shows that white-collar men had the highest probability of being married, followed by artisans, farmers, and unskilled non-farmer workers. In terms of magnitude, the proportion married among white-collar men is 5.6 percentage points higher than among unskilled workers, which amounts to 9% of the proportion married in the population.

Column (3) demonstrates that white-collar couples had the lowest female age at marriage: Women married to white-collar workers 1.3 year younger than women married to unskilled non-farmer men. The coefficient for white-collar men in column (2) is also negative in sign but statistically insignificant. Appendix Table A3 shows that the results for both sexes are robust to changes in the way we define the age at marriage. Furthermore, when we compute in Appendix Table A4 the singulate age at marriage by occupation using the methodology by (Hajnal, 1965), we find that women married to white-collar men have the lowest age at marriage in both 1848 and 1868, in comparison to women married to artisans, farmers, and unskilled workers.

These results suggest that the higher fertility of white-collar men relative to other occupations is partially attributable to their higher probability of marriage, and to the lower age at marriage of their wives. By contrast, both farmers and artisans did not have significantly different fertility from unskilled workers, probably because their marriage patterns did not significantly differ from the latter.

Next, we investigate whether polygyny and female slave ownership were more widespread among white-collar men. Column (4) reveals that among married men,

Table 4: Occupational Differences in Marriage

	=1 if Currently Married	Age at Marriage		= 1 if Polygamous	=1 if Owns Female Slave
	(1)	(2)	(3)	(4)	(5)
	All Men	Married Men	Married Women	Married Men	Male HH Head
=1 if Farmer	-0.022	-0.779	-0.489	-0.004	0.000
	(0.013)	(0.873)	(0.535)	(0.011)	(0.003)
=1 if Artisan	0.032	1.787	0.333	0.014	0.003
	(0.022)	(1.560)	(0.870)	(0.016)	(0.005)
=1 if White Collar	0.056***	-0.616	-1.373**	0.103***	0.033***
	(0.017)	(1.114)	(0.661)	(0.018)	(0.008)
=1 if Coptic Christian	0.034	-0.657	-0.739	-0.055***	0.011
	(0.026)	(1.431)	(0.827)	(0.012)	(0.010)
Age FE	Yes	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes	Yes
Obs	11392	2900	2915	7233	6271
Adj-R^2	0.317	0.118	0.145	0.069	0.232
Av. dep. var.	0.625	34.926	24.945	0.074	0.010
p-val Artisan-Farmer	0.007	0.089	0.325	0.249	0.532
p-val W. Col.-Farmer	0.000	0.869	0.126	0.000	0.000
p-val W. Col.-Artisan	0.296	0.135	0.055	0.000	0.002

Notes: White-Huber robust standard errors are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$. The sample is restricted to free Muslim and Coptic women and men aged 15-64 who resided in rural Egypt. The omitted category for occupation is unskilled non-farmer workers. The omitted category for religion is Muslim. Other controls are =1 if migrant and =1 if foreigner. In column (1), the sample includes all men. In columns (2)–(3), the sample is restricted to men and women in monogamous marriages with at least one child $\leq$ 7 years, respectively. In column (4), the sample is restricted to married men. In column (5), the sample is restricted to male HH heads. All regressions are weighted by the inverse probability of sampling.
Source: The 1848 and 1868 population census samples.

white-collar men were (unsurprisingly) far more likely to be polygynous than unskilled non-farmer workers by 10 percentage points (the sample average polygyny rate is 7%). Examining the occuaptional titles of polygynous white-collar men reveals that they were mostly village headmen. However, we fail to detect differences in the polygyny rate across artisans, farmers, and unskilled workers, which suggests that only white-collar men could afford to have multiple wives. However, we issue a cautionary note in interpreting the polygyny results, because we only observe polygyny if the polygynous wives are co-residing within the same HH of their husband. This can either over-estimate or under-estimate the differences in the polygyny rate across occupations, depending on the inter-occupation differences in the residence norm of the second (and subsequent) wife.[19]

We find similar results for the ownership of female slaves in column (5): White-collar male HH heads were far more likely to own female slaves than male HH heads in other occupations. These female slaves were mostly domestic servants, and by Islamic law were obliged to provide sexual services to their masters. Similar to our finding on the polygyny rate, we detect no difference in female slave ownership across the other occupations, suggesting that female slave ownership was mostly confined to white-collar workers.

Similar to our null finding on religious affiliation and fertility in Table 3, we fail to find statistically significant differences across Muslims and Copts with respect to the probability of marriage, the age at marriage, and female slave ownership. However, Coptic Christians had a lower polygyny rate, which is not surprising given that, like the Catholic Church, the Coptic Church prohibited polygyny. Overall, these null results suggest that religious affiliation did not affect the individual decision making of fertility and marriage conditional on the available demographic institutions. However, religious affiliation did affect the available demographic institutions themselves; in Egypt's case the institution of polygyny.

Findings: Female Slave Ownership, Polygyny, and Fertility

Having shown that white-collar men were more likely to be polygynous and to purchase female slaves, we turn to investigate whether polygyny and female slave ownership contributed to the higher fertility of white-collar men. Conceptually, both institutions could differentially increase the fertility of rich men, unlike in Western Europe where the rich had no access to such institutions. Furthermore, polygyny may reduce the marriage rate among poorer men who may not be able to marry due to the lower supply of women. While female slaves were imported from the Nilotic Sudan, meaning that slavery did not mechanically alter the supply of Egyptian women, female slave ownership could increase the marriage rate among poorer men, if it acted as a substitute for marriage among the rich.

[19] For example, white-collar men may afford to have big enough houses that can accommodate all their wives. But they can also afford to have a separate house for each wife.

We first show female slave ownership did not increase the fertility of white-collar men, and hence it did not act as a (perfect) substitute for marriage. Female slaves had an extremely low probability of having children. Among female slaves aged 15-54, the probability of having a child aged 0-1.5 was only 8% of that among free women. This suggests that, contrary to marital relationships, female slave owners controlled their fertility within the master-slave sexual relationship. While this may speak to the low rates of illegitimate children seen in Western Europe, at roughly 2-4% of all live births before 1800 (Flinn, 1985), we emphasize that the master-slave sexual relationship in Egypt was considered legitimate from the Islamic law viewpoint, and the resulting offspring were free. Hence, unlike Western Europe, the fertility control within the master-slave relationship in Egypt may have been driven by racism–the social stigmatization of the offspring of (black) female slaves–rather than illegitimacy concerns. This probably triggered female slave owners to prefer to have (male) heirs from their free wives rather than their female slaves.[20]

Next, we examine whether polygyny contributed to the higher fertility of white-collar men. We plot the average male fertility by age bracket for monogamous and polygynous men in Figure 3. Polygynous men consistently had more children than monogamous men at all age brackets. Because white-collar men were over-represented among polygynous men, this figure suggests that polygyny contributed to the higher fertility of white-collar men.

Figure 3 also reveals that the fertility of polygynous men was slightly less than double that of monogamous men, although it is much higher than what has been documented for China. This implies that the average fertility per woman in polygynous marriages was less than in monogamous marriages. There are two potential reasons for this finding. First, the oldest wife may have been less fertile, and polygyny was thus (at least partially) motivated by the husband's attempt to secure an heir by marrying a second wife. This explanation has been hypothesized in the cases of Istanbul and Albania in the 19th and 20th centuries (Behar, 1991; Nicholson, 2006). The second explanation is that polygynous men did not simultaneously engage in sexual relationships with all of their wives, leading to lower fertility per woman. This explanation has been hypothesized in the case of China, where polygynous men out-

[20]We note here that the Ottoman-Egyptian aristocracy (including Khedives) often had children born to white female slaves, suggesting that the stigmatization of the practice was directed toward black female slaves in particular, rather than female slaves in general.

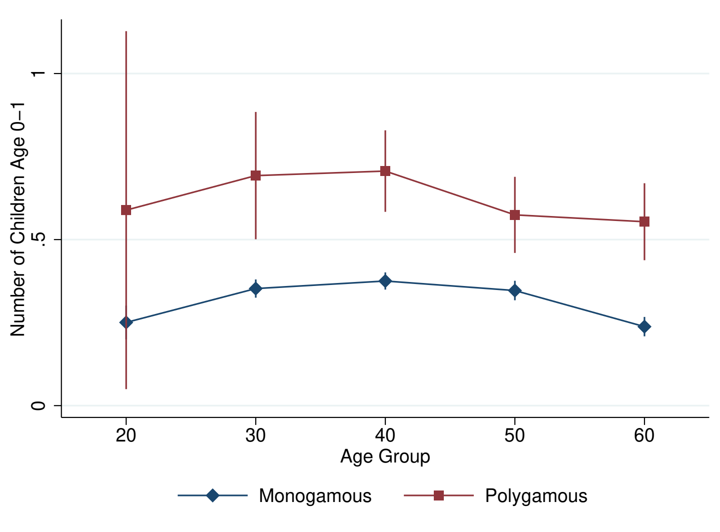


Figure 3: Male Marital Fertility by Marriage Type

Notes: The plotted numbers are based on the regression of the number of children aged 0-1.5 on a full set of interactions of the 10-year age bracket fixed effects with a dummy variable that takes the value 1 for polygynous men, and 0 for monogamous men. We control for the 1868 census year fixed effect, village fixed effects, a dummy variable for being Coptic Christian, a dummy variable for being immigrant, and a dummy variable for being foreigner. The 95% confidence intervals are based on White-Huber heteroskedasticity robust standard errors. The sample is restricted to married free rural Coptic and Muslim men aged 15-64 years. All regressions are weighted by the inverse probability of sampling.
Source: The 1848 and 1868 population census samples.

bred monogamous men by only 20-30% even when they had two fertile wives (Feng et al., 2001). Unfortunately, the data do not enable us to distinguish between these two mechanisms, because we observe neither the timing of marriage nor the existence of sexual relationships between married couples.[21]

[21] Appendix Table A1 shows the results of estimating equation (1) for female fertility, when controlling for a dummy variable that takes the value 1 if the woman is the oldest wife in a polygynous marriage (as a proxy for the first wife), and a dummy variable that takes the value 1 if she is the second oldest (or younger) wife; the omitted group consists of monogamous women. We find that the oldest wife in polygynous marriages had 0.15 fewer births than monogamous wives, whereas the subsequent wives had 0.27 more births, which is consistent with both mechanisms. However, these results can be mechanically driven by our procedure of assigning children of polygamous marriages to the mother with the smallest mother-child age difference.

Decomposing the Effects of Polygyny and Marriage

We then estimate the relative contributions of polygyny, versus the age-specific marriage rates, in driving the higher fertility of white-collar men. Our approach is to compare the male general fertility rate (GFR) by occupation for all men, married men (monogamous and polygynous), and monogamous men. Then, we can attribute the difference in GFR between monogamous men and all married men to the effect of polygyny. The difference between married men and all men can be attributed to the age-specific marriage rates.

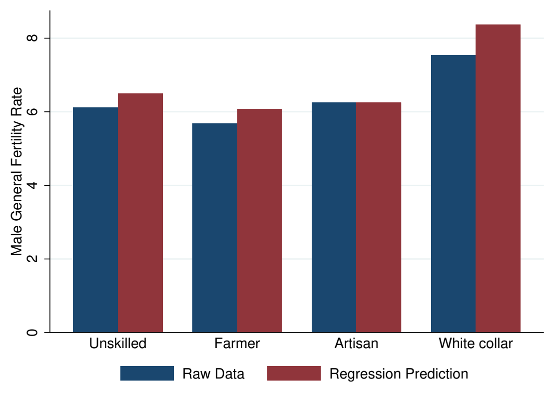
To estimate the male GFR by occupation, we use the predicted male fertility rate using an individual-level regression, where we allow the coefficient of each occupational indicator in equation (1) to vary by age:

$$Y_{i,q,t} = \alpha_q + \theta_t + \sum_{o,a} \beta_{1,o,a} occupation_o \times agegroup_a + \gamma Z + \epsilon_i \tag{2}$$

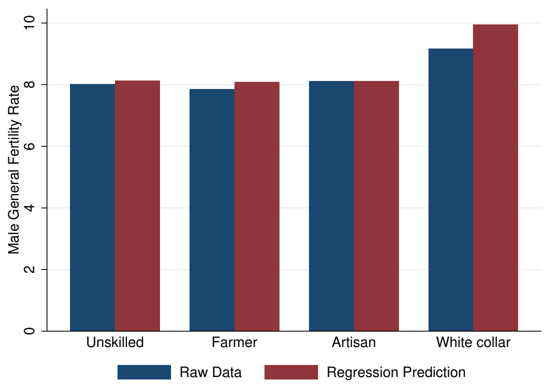
where $Y_{i,q,t}$ is the number of children aged 0-1.5, and $agegroup_a$ is a full set of 10-year age brackets fixed effects. The control vector Z includes =1 if Coptic Christian, =1 if migrant, and =1 if foreigner. The other variables are defined as in equation (1).

We first estimate equation (2) for all men. We then use the regression estimates to predict the male fertility by occupation and age group, holding the other controls at the average value. Similar to the aggregate-level GFR estimation, we adjust the predicted age-specific fertility by accounting for male mortality using El-Shanawany (1936)'s life table, the unobserved births, and the unmatched children. We compare the regression based male GFR to the male GFR that is based on the observed sample mean fertility by occupation and age group.

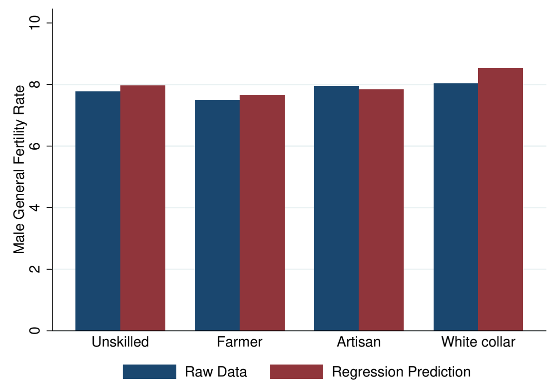
Figure 4a, which replicates the results in column (1) in Table 3, shows that white-collar men significantly out-bred poorer men in all the other occupations; they had approximately 2.1 more children (or 33% higher fertility), on average, than men in the other occupations. Next, we measure the relative contributions of the age-specific marriage rates, versus the age-specific polygyny rates, in driving the higher fertility of white-collar men. To this end, we re-estimate equation (2) for the sample of monogamous men, as well as for the sample of married men, whether polygynous or monogamous. Two remarks are in order. First, we are not able to estimate equation (2) for polygynous men separately, due to the small number of observations in each



(a) All Men



(b) Married Men 27-64



(c) Monogamous Men 27-64

Figure 4: Male General Fertility Rate by Occupation

The sample is restricted to free Muslim and Coptic men aged 15-64 years who resided in rural Egypt. The regression predictions are based on equation (2). The numbers underlying this figure are shown in Appendix Table A2.

occupation and age cell. Second, we limit the sample to men aged 27 to 64, because the male singulate mean age at marriage in 1848 and 1868 is about 27 years.

Figure 4c shows that the male GFR is 8 children among monogamous men, and that it is largely similar across occupations. This confirms our findings in Table 3 that marital fertility within monogamous marriages is not driving the higher fertility of white-collar men. However, when we limit our sample to all married men in Figure 4b, we find that the male GFR of white-collar men is 10 children, whereas men in all the other occupations remain at close to 8 children. This implies that white-collar workers had 23% higher fertility than men in the other social classes. These findings are in line with the finding that 16% of married white-collar men were polygynous, compared to only 7% among married men in other occupations. Since the difference in overall fertility between white-collar workers and other occupations in Figure 4a was 33%, this suggests that 70% of the overall difference can be explained by polygyny, whereas the remaining 30% can be explained by age-specific marriage rates.

Finally, could polygyny have increased the population in the Egyptian rural society as a whole leading to lower average income? If so, the effect would be through the marriage rate of polygynous women and the degree to which they had outside options to marry (Becker, 1974). If we assume women would not have married, an upper bound case, given that 8% of married women were second (or subsequent) wives, the overall effect of polygyny would be to increase population by up to 8%. Thus, given a more realistic case, it is unlikely that polygyny increased the population pressure to a great degree. Hence, the main factor that was increasing the population pressure was the aggregate pattern of high marital fertility, low female age at marriage, and the high marriage rate among women. Instead, the main effect of polygyny was in making the Malthusian fertility-income curve steeper via richer men significantly out-breeding the poor.

Conclusion

This paper had two objectives. First, we introduced novel aggregate-level estimates of marriage and fertility for rural Egypt based on the individual-level population census samples of Egypt in 1848 and 1868 that were digitized by Saleh (2013). Our estimates precede the demographic estimates for Egypt that are available in the literature by almost a century, and are the first for any pre-industrial population in the MENA region. We documented that rural Egypt women had a high total marital fertility rate that was similar to pre-industrial Western Europe (Hajnal, 1965), combined with a low age at marriage and almost universal marriage (whereby all but 6% of women married by age 45) that was similar to pre-industrial East Asia (Lee and Campbell, 1997; Kurosu et al., 1999; Feng et al., 2001; Ochiai, 2004). Combining these characteristics, Egypt had a unique marriage pattern yielding the highest fertility among societies studied in the literature.

Second, we used the individual-level census data to test two implications of the Malthusian model: the positive elasticity of fertility with respect to income, and the hypothesis that people regulated their fertility via regulating marriage, rather than controlling births within marriage. Egypt, and MENA at large, had two distinct demographic institutions that differed from Western Europe: polygyny and female slave ownership. These institutions can alter the Malthusian equilibrium by enabling richer men to increase their fertility by having multiple wives or by owning female slaves. Consistent with the Malthusian predictions, we found that white-collar men had higher fertility than artisans, farmers, and unskilled workers, and that marital fertility did not differ across occupations. Instead, the higher fertility of white-collar men emerged from their higher age-specific marriage rate and the lower age at marriage of their wives. Furthermore, we found that polygyny allowed males to almost double their fertility, and that the substantial advantage in fertility given by polygyny explains more than 70% of the fertility differentials between white-collar men and other social classes. This is surprising because fertility differentials by income in Western Europe were mostly generated by differences in age at marriage and in the marriage rate. Instead, we find the positive gradient in the Egyptian fertility-income curve was mostly generated by polygyny. However, we also found that female slavery did not play an important role in the Malthusian equilibrium, as female slaves, who provided sexual services to their male masters, rarely had children. Therefore, this institution was not functioning as a substitute to marriage. We also found that religion did not affect fertility or marriage choices. The one exception was that Coptic Christians did not enter into polygynous marriages because polygyny was prohibited by the Coptic Church.

We believe that the findings in this paper may have important implications for the region as a whole. At the aggregate level, the region may have had a similarly high fertility pattern. The high fertility regime itself may have therefore played an important role in explaining the region's relatively low wages (Özmucur and Pamuk, 2002; Pamuk and Shatzmiller, 2014). At the individual level, polygyny was practiced widely in this region ranging from 4 to 15% among married man (Chamie, 1986; Fargues, 2001). As polygyny was also generally practiced by the rich in these regions, it may have similarly played an important role in driving the fertility differentials between the rich and the poor.

The paper opens two areas of future research. First, the differing demographic institutions between the MENA region, Western Europe, and East Asia, goes beyond what has been explored in this paper. One unexplored institution that may have affected fertility is divorce. Although we do not directly observe divorce in the census data, it was extremely common in the 1930s when up to one third of marriages ended in divorce (Fargues, 1997). Divorce could have had two effects. First, it could reduce female fertility due to the early stopping of fertility. Second, if divorce was partially motivated by infertility, much like in Japan (Fuess, 2004), divorce could affect the gradient of the fertility-income curve: Richer men with infertile wives may have divorced and remarried to have children, whereas poorer men would find it harder to divorce and find a new marriage partner. This could have been a further channel leading to the rich out-breeding the poor. Whether divorce led to a further difference in the Malthusian equilibrium remains a question for future study.

Second, we regard this paper as the first step in a research agenda aiming at documenting the historical demographic facts about the pre-industrial MENA region. For example, it is possible to construct a life table for Egypt using the two censuses of 1848 and 1868. It is also possible to document inter-racial differences in fertility, age at marriage, and mortality. We leave these exciting areas to future research.

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Appendices

A Measuring Marriage and Fertility

A.1 Marriage

We first construct a family tree of the universe of HH relationships that we observe in the two census samples. In this regard, we note that the Egyptian censuses distinguish between maternal and paternal relatives, and specify the relationship to the HH head in detail (e.g., daughter of sister of wife of HH head, son of maternal aunt of HH head). We then employ the constructed family tree to infer for each individual their marital status and the number of their surviving children aged between 0 and 1 who co-reside with their parent(s) at the time of the census.

We infer for each individual their marital partner(s) based on the relationship to the HH head, provided that (1) partners must co-reside in the same HH at the time of the census, and (2) because Islamic law allows for polygyny, and not polyandry, a female can have at most one male partner, whereas a male may have up to four female partners. Partner assignment is straightforward when we identify exactly one partner, or when there are multiple females matched to exactly one male partner. When there are "multiple matches," i.e. more than one male partner matched to one or more female partners (e.g., HH containing two brothers of the HH head and one or more females each recorded as the wife of brother of HH head"), we apply the following rule: (1) if the number of females is less than or equal to the number of males, we assigned to each female the male partner with the smallest age difference to the female, so that each female is matched to a monogamous male partner, and (2) if the number of females is greater than the number of males, we first assigned to each female the closest-in-age male partner, so that each male is matched to a monogamous partner, before applying the same age rule to assign a male partner to the excess number of females within polygynous marriages.

Using partner assignment and child assignment (see below), we create a marital status variable, where we distinguish between the following categories: (1) Never married: These are individuals for whom we cannot identify any partner or child in the household, and their relationship to the household head does not imply by itself any (past) marital or parental status.[22] (2) Currently in a monogamous marriage: These are individuals for whom we identify exactly one partner in the household. (3) Currently in a polygynous marriage: These are individuals where we identify multiple female partners matched with one male partner. (4) Currently separated: These are individuals for whom we cannot identify any partner in the household, but whose relationship to the HH head implies a past marital or parental relationship, or for whom we assign a child in the household. (5) Missing or erroneous HH relationship: These are individuals whose relationship to the HH head is missing or recorded with error (either in the census return itself or in the data entry phase).[23]

We create four individual-level marriage outcomes for men and women aged 15–64 years. First, we define a dummy variable that takes the value 1 if the person is currently married (i.e. in monogamous or polygynous marriage) and =0 if never married or currently separated. Second, we estimate age at marriage (which we do not observe) by the difference in years between the parent's age and the age of the oldest observed child. We further subtract one, assuming that the oldest child was born one year after marriage. This variable is subject to a number of shortcomings: (i) We only estimate age at marriage for currently married couples who have at least one child. (ii) The couple may not necessarily have a child one year after marriage. (iii) The oldest observed child may not necessarily be the oldest existing child because a child has either died or left the HH. To mitigate the third concern, we only construct this variable for couples whose oldest child is less than 7 years old, as this should decrease cases where an older child has left the household.[24] The average of our individual-level measure of age at marriage among females (males) is 7 (8) years higher than our Egypt-level SMAM estimate. However, for the present purpose of measuring differences in age at marriage across occupations, this is only problematic if the bias is differential across occupations, which is possible but seems less likely. For robustness, we also created alternative measures of age at marriage and we present the results in Appendix D. Third, we measure polygyny among currently married men by a dummy variable that is equal to 1 if in a polygynous marriage and equal

[22]Examples of household relationships that imply marital or parental status are grandfather and brother in law.

[23]Examples of errors in HH relationships are having more than one person in the HH recorded as the father of HH head.

[24]We chose the age of 7 because most children 7 or younger were likely age-heaped into the age of 5.

to 0 if in a monogamous marriage. Fourth, we measure female slavery among male HH heads by a dummy variable that is equal to 1 if the HH head owns at least one female slave who co-resides with her master. This measure is defined among (male) HH heads only, because female slaves in the HH belong to the head.

A.2 Fertility

We infer the father and mother of each individual based on the relationship to the HH head, provided that (1) a parent must co-reside with their child in the same HH, and (2) each individual can be matched to at most one father and one mother in the HH. Parent assignment is straightforward when we identify exactly one father or one mother (e.g., HH contains one "sister" and one "daughter of sister"). When there are "multiple matches," i.e. more than one potential father or mother matched to the child (e.g., HH contains two "sisters" and two "daughters of sister"), we assign to the child the parent with the smallest parent-child age difference, conditional on having a minimum parent-child age difference of 16 years. This method of parent assignment to children is known in the historical demography literature as the Own Children Method (OCM), where children are linked to their parent(s) in a cross-sectional individual-level dataset (typically, a population census) based on HH relationships.

Using parent assignment, we measure the fertility for each man and woman (15–64 years) by the number of their surviving children who are aged between 0 and 1 year old. Due to heaping around 1 year of age, we include in our measure all children up to the age of 1 year and 6 months (the censuses recorded some children's ages in days or months) and we assume that this is a good approximation of all children within this age bracket. We verify the accuracy of this assumption by examining the number of children aged 1.5-2.5, relative to the number of children aged 0-1.5, and comparing this share to what we would expect according to the Egyptian mortality statistics. We expected to observe 63% of children below age 2.5 to be of age 0-1.5 and our observation was 61%, suggesting that our assumption is reasonable. We then divide our the total number of children aged 0-1 by 1.5 in order to obtain the true number of children aged 0-1. We also additionally account for the unobserved children dying between age 1 and 1.5.

The number of children aged 0 to 1.5 captures *net* fertility, i.e. the difference between the number of children of age 0 to 1 who are ever born (which we do not observe) and infant mortality between 0 and 1 year, under the assumption that every infant co-resides with their mother or father. This assumption may be violated due to (1) parental death, (2) the child's movement out of their HH of birth, and (3) mismatching of children with parents due to our matching procedure. Concern (1) does not affect the individual-level measure of fertility, which measures the fertility of the surviving parents. Nor does it affect the Egypt-level total fertility rate estimate, which does not take into account maternal mortality. However, we correct for maternal mortality when we estimate the Egypt-level general fertility rate. Concern (2) is likely negligible because we focus on infants aged 0-1 years who are less likely to have left their HH of birth. Concern (3) can arise in complex HHs that have multiple co-residing families. We correct for the share of unmatched children when estimating the Egypt-level fertility estimates (see below).

A.3 Aggregate-Level Fertility

We estimate the aggregate-level fertility by taking the individual-level age-specific number of children aged 0-1.5 and adjusting for unobserved births and unmatched children. The main concerns are (1) child's death after birth and before the census, and (2) mismatching of children with their parents due to our parental assignment procedure.[25] While these issues arise in both the individual-level and aggregate-level measures of fertility, our correction factor (see below) does not vary by individual, and hence is only applied when estimating the fertility rate at the aggregate level.

The first issue, the case of a child who was born and then died before the census enumeration, had a high likelihood. Egypt's first age-specific mortality statistics (available up to age 20) in the 1877 statistical yearbook (Ministère de l'Intérieur, 1877) show that 19.3% of children died before reaching age 1 (also known as the infant mortality rate). This is similar to the figure of 22% in Egypt's first life table to estimate mortality rates below age 10, that was constructed by Kiser (1944) based on the 1927 and 1937 censuses. Many of these deceased infants would not be observed in the censuses. A further complication is that these deaths did not occur linearly over age. A large share occurred in the first month after birth (a neonatal death), with a significant share occurring within the first day of birth. Almost all births where

[25] While parental death (orphans) leads to observing children who are not matched to a parent, it does not bias the fertility estimate, because the latter measures fertility among the surviving adult population.

the infant died within the first day of birth would not be observed in the census. Unfortunately, detailed post-birth mortality statistics, that estimate mortality at each age in days or months, are extremely rare and not systematically known for pre-industrial countries.

However, statistics from the World Bank for Egypt in 1960 suggests an infant mortality rate of 21.18%, while the neonatal mortality rate was 6.54%. This suggests that 31% of infant deaths occurred within the first month. This is not far from findings for "low income" countries in 1990, where the equivalent figure was 44%. It is lower than the findings by Wrigley (1966) from 2 areas in pre-industrial England, 1538-1649, where the comparable figure was 52%. However, the Egyptian figure from 1960 are more consistent with the 37% of infant mortality cases occurring within the first 3 months of births, according to the 1877 Egyptian mortality statistics (Ministère de l'Intérieur, 1877). Therefore, we favor using the figure from Egypt in 1960 and assume that 31% of all infant mortality cases were neonatal. While we do not know how these deaths were distributed over the days after birth in Egypt, a study from Rural Bangladesh in 2003-2004 shows that 37% of deaths occurred within 24 hours, 76% within 36 hours, and 84% within the first week (Chowdhury et al., 2010). We utilize these figures from rural Bangladesh.[26] They suggest 11.5% of infant mortality in Egypt occurred within 24 hours. We assume that these deaths were never registered in the censuses. For the remaining deaths, we also use the figures above to distribute infant deaths linearly for days 1-3, days 4-7, and day 7-30. Beyond the neonatal mortality, we also distribute the remaining deaths by using the Egyptian 1877 mortality statistics (Ministère de l'Intérieur, 1877). Altogether, this suggests that 13% of births would not be observed in the census among children between age 0-1.5.

The second issue is that some children were unmatched to their parent(s) due to our algorithm, resulting in a downward bias of the fertility measure. To account for this mismatching error, we calculated the share of children aged 0-1.5 who had a female aged 16-54 within the HH (thus who could have potentially been the mother) but were not assigned a mother in our matching algorithm. We then adjusted our estimates upwards to adjust for the bias due to unmatched children. We found that

[26] These figures are also not too far from the study on pre-industrial England where 52% of neonatal deaths occurred in the first day and 69% within the first week (Wrigley, 1966). We do not use these numbers as they are a limited and small sample from two areas in England.

8.5% of children were unmatched, leading us to adjust our estimates upwards by 9.4%. While there is a possibility that we overly adjust, due to the existence of orphans who lived in HHs with an adult female, our main results remain mostly unchanged without this adjustment.

The total adjustment factor that accounts for both issues (1) and (2) requires us to multiply the number of children age 0-1.5 by 0.854 in order to estimate the total births per year (or the total number of children aged 0-1 inclusive of those who died).

B Additional Summary Statistics

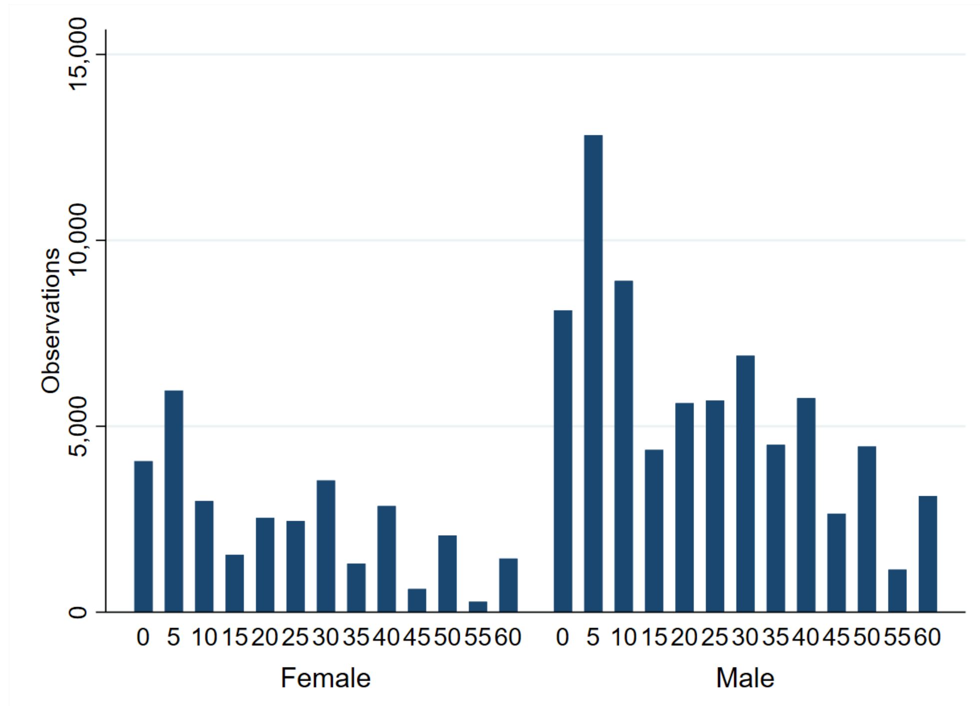


Figure A1: The Age Distribution by Sex

Most of the ages in our sample are heaped, with the exception of children in the first few years of birth. Among women aged 0-64, 62% of the sample has an age that is a multiple of 5, and 40% are a multiple of 10. Among men aged 0-64, 57% of the sample has an age that is a multiple of 5, and 33% are a multiple of 10. Both women and men are more likely to be heaped to an age that is a multiple of 10. This can be seen in Appendix Figure A1, which shows the age distribution of men and women in

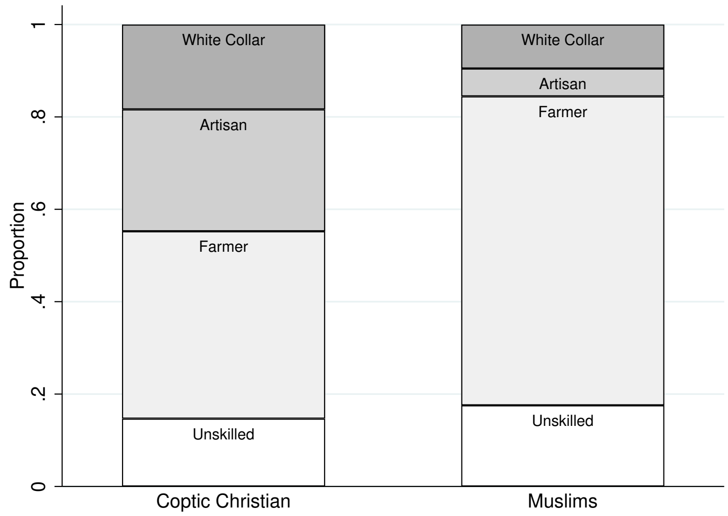


Figure A2: Male Occupation by Religion

the sample by 5 year age groups. The age group is defined by rounding the age to the nearest number that is a multiple of 5. It is evident that age heaping to a number that is a multiple of 10 becomes more likely as age rises, which may be due to older people losing track of their true ages.

Appendix Figure A2 shows the occupational distribution by religious group. It demonstrates that Coptic Christians were more likely to be artisans and white-collar workers than Muslims.

Our Egypt-level demographic statistics remain unchanged whether we use our preferred 10 year age group or the 5 year age group. The results for the 10 year and 5 year age groups, respectively, are 7.2 and 7.2 for the female total marital fertility rate, 6.1 and 6.3 for the female total fertility rate, and 5.2 and 5.4 for the female general fertility rate. One advantage of the 5 year age group is that it is the same level of measurement as the findings in the literature. Appendix Figure A3 graphically shows the marital fertility, when we alternatively use the estimate based on the 5 year age groups. This shows Egypt is very similar in marital fertility to Western European countries. The curvature of marital fertility is also similar, suggesting that our estimates are accurate.

Finally, we show some of the tabulated statistics in Table 1 as graphs in Appendix Figure A4. This is purely for presentation purposes and the potentially easier interpretation.

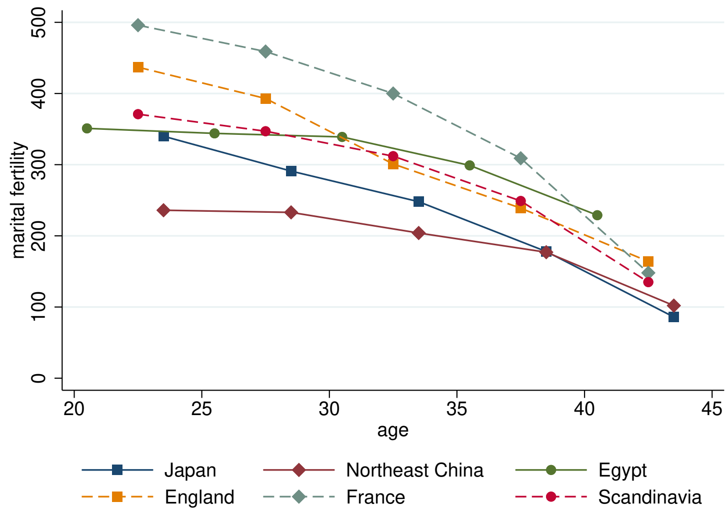


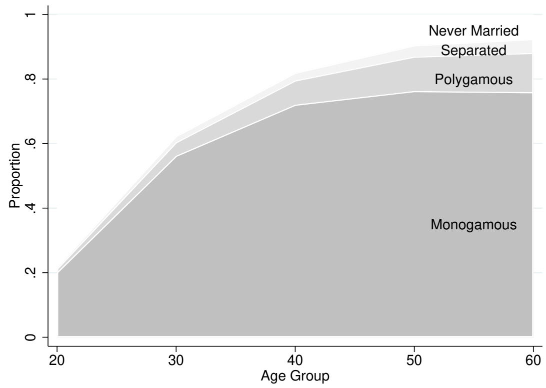
Figure A3: International Comparisons of Marital Fertility

C Fertility and Polygyny

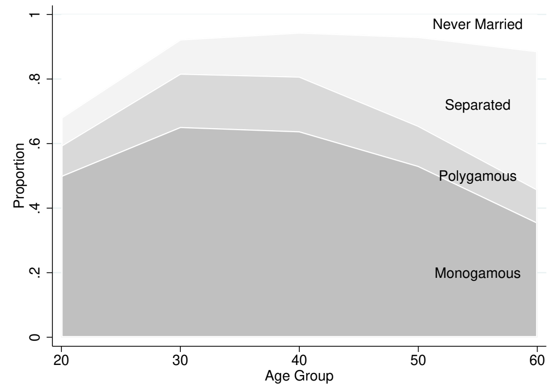
We test for whether polygnous women had lower fertility by controlling for the wife's age rank, as a proxy for the wife's order in polygynous marriages, in equation (1) of women's marital fertility. Specifically, we control for a dummy variable that takes the value 1 if the woman is the oldest wife in a polygynous marriage (who is presumably the oldest wife), and a dummy variable that takes the value 1 if she is the second oldest (or younger) wife; the omitted group consists of monogamous women.

Consistent with the hypothesis, we find that relative to monogamous wives, the oldest wife in a polygynous marriage had, on average, 0.27 fewer children aged 0-1 year, which amounts to 87% of the sample average. In contrast, younger polygynous wives had 0.15 more children than monogamous wives. This suggests that the oldest wives in a polygynous marriage were less fertile than the younger wives. This result is partially mechanical, though, because of the potential miss-assignment of children to the correct wife due to our parent assignment procedure.[27] More importantly, we find that the sum of the fertility of the oldest wife and a subsequent wife is less than double the fertility of the monogamous wife and the difference is statistically different from zero.

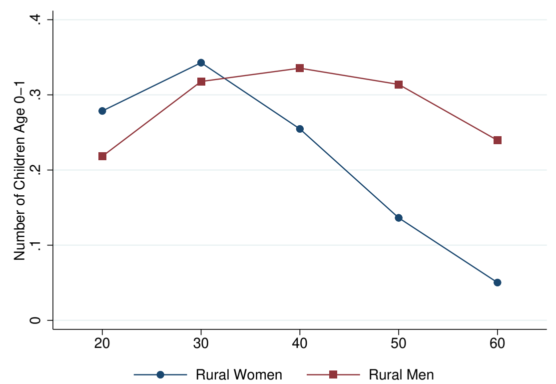
[27]Recall that in the case of finding multiple potential mothers of the child, which is the case of polygynous HHs, we assigned to the child the mother with the smallest age difference.



(a) Marriage: Rural Men



(b) Marriage: Rural Women



(c) Fertility

Figure A4: Marriage and Fertility by Age

D Additional Robustness Tests

We constructed alternative measures of the age at marriage in Appendix Table A3. First, we included all married people with children and calculated the age of the parent minus the age of the oldest child. Second, we only use cases where the oldest child is younger than or equal to 7 years, but we also heap the age of the parent. This is to prevent differential age heaping by occupation from affecting our estimates.

Appendix Table A3 shows that our findings are mostly robust despite changes in the specification. The coefficients for white-collar workers are always negative although not always statistically significant. We can further test for robustness by calculating the singulate mean age at marriage by occupation in Appendix Table A4. However, we note that we are no longer controlling for location, migrant, and

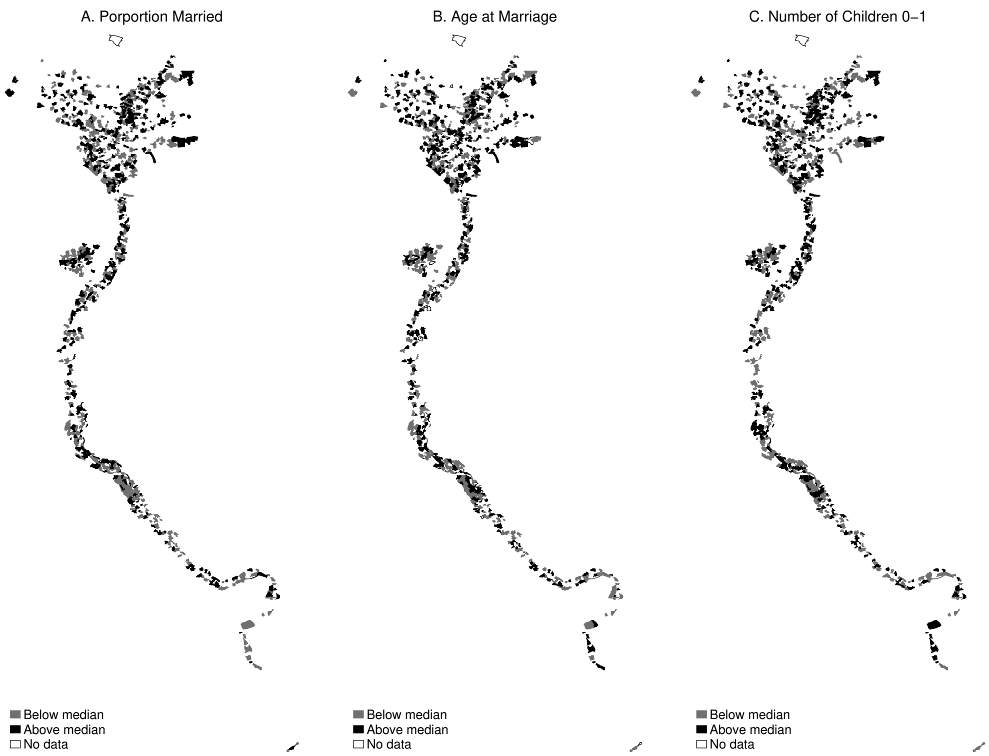


Figure A5: Mapping Rural Women's Marriage and Fertility, 1848 and 1868

Notes: The maps show the spatial distribution at the village level (504 villages).
Sources: The 1848 and 1868 census samples.

Table A1: Female Marital Fertility and Age at Marriage by Woman's Marriage Type

	Number of Children Age 0-1 (1) Women
Oldest Wife in Polygamous	-0.273***
	(0.022)
Younger Wives in Polygamous	0.148***
	(0.035)
Age FE	Yes
Spouse Age FE	Yes
Occupation Status	Yes
Religion	Yes
Other Controls	Yes
Year FE	Yes
Quarter FE?	Yes
Obs	8138
Adj-R^2	0.075
Av. dep. var.	0.315
p-val Polygamous Wives = 2 × Monogamous Wives	0.005
p-val Oldest Wife = Younger Wives	0.000

Notes: White-Huber robust standard errors are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$. The sample is restricted to married free Muslim and Coptic women who resided in rural Egypt. The list of regressors is identical to that in Table 3, with the additional controls for the wife's age rank. In column (1), the sample is restricted to women aged 15-54 years. In columns (2)–(3), the sample is restricted to women aged 15-64 years with at least one child $\leq$ 7 years. All regressions are weighted by the inverse probability of sampling.
Source: The 1848 and 1868 population census samples.

foreigner status. We find that women married to white-collar workers married at 16 relative to 18 for other occupations. Therefore, our age at marriage findings are not driven by how we define it.

Appendix Table A5 shows the occupational differences in fertility when the dependent variable is the number of children who are 0-5 years of age. The results are identical to Table 3. White-collar men have higher fertility when we consider all men, inclusive of unmarried men. This is likely driven by marriage and polygyny. When we consider marital fertility, there is no difference by occupation.

Appendix Table A2 shows the tabulated version of the male general fertility rate by occupation that underlies Figure 4. This is tabulated for purposes of replication.

Table A2: Male General Fertility Rate by Occupation

	Unskilled	Farmer	Artisan	White Collar
All Men				
Data Avg.	6.3	5.7	6.1	7.5
Predicted	6.3	6.1	6.5	8.4
Married Men 27-64				
Data Avg.	8.1	7.9	8.0	9.2
Predicted	8.1	8.1	8.1	10.0
Monogamous Men 27-64				
Data Avg.	8.0	7.5	7.8	8.0
Predicted	7.8	7.7	8.0	8.5

Table A3: Occupational Differences in Age at Marriage: Robustness Checks

	Women			Men		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Recent	Recent + Heaped	All	Recent	Recent + Heaped
=1 if Farmer	0.411	-0.489	-0.329	0.551	-0.779	-0.644
	(0.343)	(0.535)	(0.562)	(0.593)	(0.873)	(0.895)
=1 if Artisan	-0.021	0.333	0.611	-0.636	1.787	1.804
	(0.542)	(0.870)	(0.860)	(0.914)	(1.560)	(1.557)
=1 if White Collar	-0.786*	-1.373**	-1.123	-2.036***	-0.616	-0.733
	(0.441)	(0.661)	(0.706)	(0.759)	(1.114)	(1.170)
=1 if Coptic Christian	0.166	-0.739	-0.729	0.319	-0.657	-0.484
	(0.510)	(0.827)	(0.818)	(0.860)	(1.431)	(1.497)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs	5582	2915	2915	5557	2900	2900
Adj-R^2	0.127	0.145	0.137	0.092	0.118	0.115
Av. dep. var.	24.895	24.945	26.538	36.039	34.926	36.409
p-val Artisan-Farmer	0.390	0.325	0.250	0.164	0.089	0.102
p-val W. Col.-Farmer	0.001	0.126	0.199	0.000	0.869	0.119
p-val W. Col.-Artisan	0.176	0.055	0.050	0.146	0.135	0.531

Table A4: Singulate Mean Age at Marriage by Occupation and Year

	Unskilled	Farmer	Artisan	White Collar	Overall
Women					
1848	17.5	17.2	17.4	17.0	17.6
1868	18.5	18.4	18.2	14.9	18.3
Men					
1848	25.2	27.7	28.0	26.2	27.6
1868	23.4	25.7	26.4	24.3	26.4

Table A5: Occupational Differences in Fertility: Children Aged 0-5

	(1) All Men	(2) Monogamous Women	(3) Polygamous Men	(4) Polygamous Women
=1 if Farmer	-0.018	0.021	-0.287	-0.249
	(0.037)	(0.052)	(0.709)	(0.305)
=1 if Artisan	0.059	0.018	-0.046	-0.182
	(0.055)	(0.077)	(0.764)	(0.404)
=1 if White Collar	0.240***	0.098	-0.378	-0.594
	(0.053)	(0.074)	(0.782)	(0.487)
=1 if Coptic Christian	-0.008	0.032	-1.152	-0.181
	(0.060)	(0.081)	(0.859)	(0.951)
Age FE	Yes	Yes	Yes	Yes
Spouse Age FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes
Obs	11808	6928	531	1210
Adj-R^2	0.198	0.103	0.092	0.050
Av. dep. var.	0.753	1.150	2.117	1.056
p-val Artisan-Farmer	0.126	0.962	0.680	0.830
p-val W. Col.-Farmer	0.000	0.253	0.880	0.379
p-val W. Col.-Artisan	0.004	0.351	0.635	0.368