

ON THE ROAD TO HEAVEN: SELF-SELECTION, RELIGION, AND SOCIOECONOMIC STATUS*

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Abstract

Inter-religion socioeconomic differences are often attributed to a causal impact of religion. Instead, I trace the phenomenon in Egypt to selection-on-socioeconomic-status during Egypt's conversion from Coptic Christianity to Islam since the Arab Conquest in 641. Self-selection was driven by a regressive poll tax removed upon conversion to Islam that was imposed in 641-1856. Using novel primary data sources, I document that (a) long-term trends of poll tax and conversions are consistent with the selection hypothesis and (b) districts with a higher tax in 641-1100 had relatively fewer, but differentially better-off, Copts in 1848-1868. I specify persistence mechanisms of tax effects.

Keywords: discriminatory taxation; intergenerational persistence; conversion; self-selection; endogenous group formation

JEL Classification: N35; O15

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1. Introduction

Scribes in the Levant and Egypt are Christians.

Al-Muqaddasi (1877, p. 183), Muslim historian and geographer, tenth century

Inter-religion differences in socioeconomic status (henceforth, SES) have been an intriguing topic in social sciences since at least Max Weber's (1930 [1905]) seminal work on Protestantism. Explanations of the phenomenon abound. Weber traced the Protestant-Catholic SES gap to a causal impact of religion that operates through a Protestant work ethic, and, extending his thesis to Asia, he argued that Asiatic religions were less conducive to capitalism. The recent economics of religion literature, while acknowledging the endogeneity of religion, attempts to disentangle its causal impact on SES in cross-country studies (Barro and McCleary, 2003; Guiso, Sapienza, and Zingales, 2006), or in single-country/religion studies that emphasize the impact of religion on human capital (Botticini and Eckstein, 2005; Boorooah and Iyer, 2005; Becker and Woessmann, 2009; Chaudhary and Rubin, 2011).

This paper proposes a different answer. Drawing on the inter-religion SES differences in Egypt, one of the largest countries in the Middle East, I argue that self-selection-on-SES during the historical process of formation of religious groups is the likely cause of the observed differentials. Newly digitized data from Egypt's population censuses of 1848 and 1868 reveal that among adult active men 33 percent of Copts (Egyptian Christians) and only 14 percent of Muslims worked in white-collar jobs.¹ This phenomenon is striking if we take into account that Egypt was almost entirely Coptic Christian before the Arab Conquest in 639-641 and hence Egyptian "Copts" and (the vast majority of) "Muslims" are descendants of Egypt's pre-641 population who either chose to remain Coptic or to convert to Islam. Bearing this fact in mind, I argue that Copts' conversion to Islam since 641 was characterized by selection-on-SES because of the Islamic tax system. Arabs imposed

¹ I focus on the Coptic-Muslim SES gap because Copts constituted 94 percent of non-Muslims in 1848-1868. Other non-Muslims were non-Coptic Christians (5 percent) and Jews (1 percent). For this reason, I use the terms "Copts" and "non-Muslims" interchangeably throughout the paper.

a poll tax (*jizya*) on every adult free Coptic male upon the Conquest in 641; a tax that remained until 1856. As a *regressive* tax removed upon conversion to Islam, I hypothesize that the poll tax led to the conversion of poorer Copts to Islam and to the shrinkage of Copts into a better-off minority.

The evidence on the hypothesis draws on novel primary data sources including papyri poll tax registers and receipts in 641-1100, data on religion and occupations in papyri documents in 641-969, data on Christian churches and monasteries in 1200 and 1500 from medieval sources, and, most importantly, individual-level population census samples from 1848 and 1868 that I digitized from the original manuscripts at the Egyptian Archives. Those censuses are among the earliest pre-Colonial individual-level population censuses from any non-Western country.

The first suggestive evidence is based on documenting the national-level long-term trends of the poll tax and of the two outcomes of interest, Copts' population share and the Coptic-Muslim SES gap. Three key findings emerge. (1) The poll tax rate among middle- and low-income Copts was highest in 661-969 before it declined in 969-1517; it was negligible though among high-income Copts in 661-1517. (2) Copts shrank from almost 100 percent of Egypt's population in 641 to 42 percent in 680, 16 percent in 1200, and 7 percent in 1848-1868. (3) The Coptic-Muslim SES gap emerged in 641-969, where Copts were over-represented among white-collar workers (specifically, mid-low bureaucrats) and artisans, and the gap persisted in 1848-1868.

Those findings, I argue, are consistent with the selection hypothesis. Whereas the high tax rate in 661-969 caused a rapid decline in Copts' population share and the emergence of a positive Coptic-Muslim SES gap since farmers and unskilled Copts were more likely to convert, conversions subsided after 969 as the tax rate decreased.

Because the poll tax assessment and collection were decentralized, the second piece of evidence is based on exploiting the sub-national variation in the poll tax in 641-1100, the period where most conversions took place. A simple static framework predicts that, *ceteris paribus*, districts with a higher poll tax would have relatively

fewer, yet *differentially* better-off, Copts (latter result depends on income distribution; it holds, for example, under Pareto). The ideal experiment to test this prediction would be to randomly assign the tax in 641 across districts that were otherwise identical before 641 and to compare converts' population share and the Coptic-Muslim SES gap across districts after 641. Unfortunately, this is impossible because (a) the tax was not random and (b) the earliest sub-national data source on religion and SES (occupations) is the 1848-1868 population census samples.

Hence, my empirical strategy compares religious affiliation and occupational outcomes among a sample of Egyptian free local adult active men of a rural origin in 1848-1868. The main regressor is poll tax in district of origin in 641-1100, which I measure by two variables: (1) indicator denoting if average nominal annual poll tax payment in 641-1100 was "high," which I computed from papyri poll tax registers and receipts, and (2) since tax registers and receipts survived for only 4 *kuras* (Egypt's administrative units in 641-1036), which map into 11 (out of 76) rural districts in 1848-1868, I alternatively use an indicator for Arab settlement in 700-969 (observed for all 76 districts) as a proxy for the tax. This is based on historical evidence of stricter tax enforcement in districts where Arabs settled and replaced indigenous Coptic local elites who were in charge of tax assessment and collection, compared to districts where Coptic rural elites remained intact.

The findings lend support to the selection hypothesis. I find that districts with a higher tax in 641-1100, or where Arabs settled in 700-969, had relatively fewer, yet *differentially* better-off, Copts in 1848-1868. Findings are robust to controlling for geographic fixed effects and for (proxies of) a number of pre-641 characteristics of districts, including income, psychological attachment to Coptic Christianity, generosity of the Coptic transfer system, power of Coptic local elites, and resistance to Arabs. Since all districts were 100 percent Copt before 641, and assuming away cross-district movement in 641-1868, the findings suggest that districts with a higher

poll tax witnessed relatively more conversions and thus a more extensive selection-on-SES effect that resulted in a larger Coptic-Muslim SES gap.

I conducted a number of robustness checks. The findings are robust to alternative measures of the poll tax (I also discuss alternative interpretations of the Arab settlement variable). They are robust to using distance to Arish, the first town on Egypt's North Eastern borders to be captured by Arabs in 639, as an instrumental variable for the poll tax (and Arab settlement). As to the concern about poll-tax-induced cross-district movement in 641-1868, (a) I document a negative impact of the poll tax on the share of villages in district with at least one Coptic church or monastery in 1200 and 1500 as a proxy of medieval Copts' population share in district and (b) I provide historical evidence on state restrictions on spatial mobility across villages in 641-1868.

A fundamental limitation of the empirical evidence is that there are more than twelve centuries between observing the poll tax and the outcomes. In the absence of sub-national information on religion and SES before 1848, it is difficult to rule out this criticism empirically. Furthermore, the long-term persistence of outcomes poses certain theoretical dilemmas. Why did not Copts disappear or, conversely, why did not converts switch back to Coptic Christianity? Why did the Coptic-Muslim SES gap persist although Becker and Tomes (1979)'s model would predict convergence even at very high intergenerational persistence of SES? I suggest two complementary persistence mechanisms using theory and historical evidence. First, there were likely new conversions among Copts in *every* period because the poll tax persisted from 641 until 1856. As Islamic laws (e.g. death penalty of apostates) made conversion an "absorbing state," I argue that with a continuous process of conversions, or *endogenous* group formation, the Coptic-Muslim SES gap may *increase* over time if the *poorest* Copts convert in every period although Copts would vanish quite rapidly. This result is contrary to the convergence story that treats groups as exogenous. Second, historical evidence indicates that each religious group imposed barriers to entry in

order to preserve its over-representation in certain skilled jobs after initial conversion took place. These “group effects” slowed down the decline in Copts’ population share and suppressed any trends in the SES gap. Those mechanisms fit historical facts better than alternative explanations such as the hypotheses that Copts benefited from European influence after 1800, that Coptic Christianity was more conducive to Capitalism and/or to investment in human capital, or that Muslim rulers favored recruiting Copts, who lacked a local support base, in the bureaucracy.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 documents the long-term trends. Section 4 describes the empirical evidence. Section 5 discusses mechanisms of persistence. Section 6 concludes.

2. Related Literature

The paper contributes to several lines of literature. First, it contributes to economics of religion. There are three distinguishing features of the paper. (1) It explains correlation between religion and SES by self-selection of converts. This idea was endorsed by Weber (1996 [1958], p. 6), where he noted that conversions to Christianity and Islam in India came from lower Hindu castes. (2) Unlike the selection mechanism in Botticini and Eckstein (2005) whereby Rabbinic Jews with lower taste for education converted out of Judaism because of its emphasis on literacy, selection of converts is caused in the Coptic-Muslim case by an economic incentive, exemption from taxation, and not by a religious incentive, or the requirement to read the scripts. (3) To the best of my knowledge, the paper provides, despite its data limitations, the first empirical evidence on selection of converts.

Second, the paper contributes to the empirical literature on institutions (Engerman and Sokoloff, 2000; Acemoglu, Johnson, and Robinson, 2001; Nunn, 2008; Dell, 2010), and particularly, institutions transplanted through conquests (Acemoglu et al., 2011). I document that Islamic taxation that was exported to Egypt after a critical juncture, the Arab Conquest, shaped religious adherence and inter-group SES inequalities that persisted for over twelve centuries.

Third, the paper contributes to the intergenerational mobility literature (Becker and Tomes, 1979; Borjas, 1992), where I argue that continuous endogenous group formation may increase inter-group SES gap over time. Persistence of the Coptic-Muslim SES gap is consistent with the literature on intergenerational persistence of SES across multiple generations (Long and Ferrie, 2013; Clark and Cummins, 2015).

Fourth, the paper contributes to the economic history of the Middle East; specifically, the economic advantage of non-Muslim minorities. The paper is in line with Courbage and Fargues (1997, pp. 22-3) who suggested that the poll tax caused the phenomenon. I discuss Issawi's (1981) and Kuran's (2004) theories in section 5.

Finally, the paper contributes to Egyptian history. Documenting the trend of Copts' population share using new data contributes to the debate on timing of Islamization. Also, arguing that poll tax caused *selected* conversions links two literatures: (a) effect of poll tax on *systematic* conversions [Wellhausen (1927 [1902]), but debated by Dennett (1950) and El-Leithy (2005)] and (b) the advantage of Copts in bureaucracy (Tagher, 1998 [1951]). I do *not* argue though that the poll tax was the sole cause of conversions. What I *do* claim is that conversions were characterized by selection-on-SES and that the tax is the likely cause of the Coptic-Muslim SES gap.

3. Documenting the National-Level Long-Term Trends

3.1. Egypt's Taxation in 641-1856

3.1.1 Coptic-Muslim Difference in Net Taxes

Arabs captured Egypt from the Byzantine Empire in 639-641. On the eve of the Conquest, Coptic Christians constituted the vast majority of Egypt's population, whereas non-Coptic Christians and Jews were two small minorities. The conquering Arabs introduced to Egypt a tax system that provided incentives to convert to Islam. Table (I) summarizes taxes and benefits in 641-1856. Every free adult Coptic male had to pay a poll tax (*jizya*), an annual per head tax paid in coins, and Coptic landholders paid an additional annual land tax (*kharaj*) assessed on area and yield of

landholdings and paid in both coins and crops.² Copts also paid other miscellaneous taxes, and Coptic churches and monasteries imposed taxes on rich Copts and gave transfers to the poor. By contrast, Muslims were *not* subject to the poll tax and, until around 750, did not pay the miscellaneous taxes. Muslim landholders also paid a reduced land tax (tithe, *ushur*). However, the decline in tax revenues, presumably due to conversions, led to the imposition of *kharaj* and miscellaneous taxes on Muslims since 750. Also, Muslims faced two other taxes, the alms tax (*zakat, sadaqa*), a transfer from rich to poor Muslims, and military conscription in 641-833 and 1822-1856.³

I make two approximations in order to compute the Coptic-Muslim difference in net taxes: (a) Muslim and Coptic transfers were equally generous, which is plausible but cannot be verified historically because I do not observe intra-group transfers, and (b) conscription was compensated for by state pensions (*rizq, 'ata*) or war booties in 641-833 and by wages in 1822-1856, which is historically documented. It follows that converts enjoyed in 641-750 more tax cuts than in 750-1856, although those cuts were often violated in practice during that period (see section A1.5 in the online appendix for details). Since 750 though, the Coptic-Muslim net tax difference became composed solely of the poll tax until its abolition in 1856.

3.1.2. Long-Term Trend of the Poll Tax

Panel (A) of Figure (I) depicts the long-term trend of the de jure nominal annual poll tax among low-, middle-, and high-income brackets. The figure indicates that the nominal poll tax remained almost constant until around 1700. Panel (B) translates the nominal tax into real values in 701-1500 (due to price data limitation) showing that the *real tax decreased* among all income-brackets. Perhaps a better measure of the tax burden is the poll tax *rate* (tax divided by wage), which is plotted in Panel (C). The figure indicates that the poll tax in 661-969 was 8-10 percent of annual wage among low- and middle-income brackets, presumably a significant financial burden,

² The Quran (9:29) orders Muslims explicitly to impose the poll tax on Christians and Jews.

³ Conscription was abolished in 833-1822 with the shift to slave armies (Blaydes and Chaney, 2013).

but it declined to 6 percent in 969-1250 and 1.4 percent in 1250-1517. The tax was negligible though among the high-income bracket.

But did the *actual* tax coincide with the de jure values? (1) Papyri poll tax registers and receipts in 641-1100 show that the actual tax varied much more than the de jure amounts. However, the average tax in the papyri is 1.5 dinar (N = 552; SD = 3.7), which is close to the average de jure tax in 701-1100 if most Copts belonged to the low-income bracket. (2) The de jure amounts in 1101-1500 are from officials' handbooks, which are, according to Goitein (1963, p. 286), "basically correct."

3.1.3. *Was the Poll Tax Regressive?*

Figure (II) shows that the poll tax rate was *decreasing* in wages in all three periods indicating that the three-bracket variation in the tax did *not* offset wage variation. But was the *actual* tax regressive? A few poll tax registers in 703-733 contain information on both poll tax and total land tax. Since *total* land tax is assessed on total area and yield of landholdings, I use it as a proxy of wealth of landholding farmers. I thus regress poll tax rate (poll tax divided by total land tax) on total land tax. Results in Table (II) indicate that the poll tax rate is decreasing in total land tax; poorer landholders, who paid lower total land tax, faced, on average, higher poll tax rate.

3.2. Copts' Population Share in 641-1868

There are no statistics on Egypt's religious composition before 1848. Yet, using data on churches and monasteries in 1200 and 1500 that I constructed from medieval sources, I estimated non-Muslims' population share by the share of villages that had at least one Christian church or monastery [Figure (III)]. I find that the share was 16 percent in 1200 and decreased to 3 percent in 1500. My estimates are consistent with those of Courbage and Fargues (1997, pp. 27-28), who estimated that non-Muslims shrank to 42 percent in 680, 23 percent in 813, and 8 percent in 1897. Altogether, it appears that non-Muslims shrank into a minority by 680 or, at the latest, by 1200 (see section A1.4 in the online appendix for details on the dataset on churches and monasteries and its contribution to the historical literature).

Four demographic processes may account for the decline in Copts' population share in 641-1868 (Fargues, 2001): (1) population replacement via Muslims' in-migration or Copts' out-migration, (2) Muslims' higher birth and/or lower death rates, (3) intermarriage between Coptic females and Muslim males (opposite scenario is prohibited), which results, by Islamic law, in Muslim children, and (4) conversion of Copts to Islam either voluntarily or by coercion. Historical evidence suggests that Islamization was driven by conversions (mostly, voluntary) and that the poll tax triggered conversions in 641-800. Below, I argue why this is so.

First, Arab in-migration, the largest *Muslim* in-migration, was small compared to Copts' population. On the Eve of the Arab Conquest, Egypt's population (2.7 millions) was three times that of the Arab peninsula (1 million) and Russell (1966) estimates Arab immigrants in 650 by 100,000. Arab immigration subsided after 969 as Arabs lost their elite position with the shift to slave armies. At the same time, there was no significant Coptic out-migration from Egypt, because of Copts' unique doctrine that differed from both Catholics and Greek Orthodox. Second, as the 1848-1868 censuses predate the demographic transition, they provide a glimpse of the demographics of medieval Egypt. The samples suggest that: (a) within male household heads, Copts had, on average, *more* children than Muslims (1.48 versus 1.35)⁴ and (b) Muslims had lower mortality at younger ages (10-29 or 10-39), but higher mortality at older ages (30-79 or 40-79).⁵ Third, cross-marriages were extremely rare. Mikhail (2004, pp. 63-65) notes that cross-marriage contracts in 641-969 are "notoriously few." The 1848-1868 samples record only two cross-marriages.

This leaves Copts' conversion as the main cause behind Islamization. Conversion was observable by the state; a convert had to endorse Islam in front of authorities, and, in 641-833, had to become a client of an Arab patron and enlist in the army. Most conversions were by choice, except for two persecution episodes in 847-861

⁴ Difference between Copts and Muslims is statistically significant (p-value = 0.003).

⁵ Details are in section A1.2 in online appendix. Mortality differences may stem from age heaping and age exaggeration. Since both are negatively correlated with SES they are less prevalent among Copts.

and in 996-1021, and the largest persecution wave was in 1250-1517 *after* non-Muslims shrank into a minority. Historical evidence also indicates that the poll tax triggered waves of conversions. The Coptic chronicler, John of Nikiu (1916, p. 201), described the consequences of increasing the poll tax in 642-644, “... *And now many of the Egyptians who had been false Christians denied the holy orthodox faith and lifegiving baptism, and embraced the religion of the Moslem.*” Other poll-tax-induced conversions in 701-750 are mentioned by the Coptic chronicler, Sawirus Ibn-Al-Muqaffa’ (1910).

3.3. Coptic-Muslim SES Gap in 641-1868

Documenting the trend of the Coptic-Muslim SES gap is more challenging because it requires observing religion and SES simultaneously. For this purpose, I collected individual-level data on occupations and religion (inferred from names as converts adopted an Arabic name) (N = 402) from all Arabic papyri documents in 641-969 in the Arabic Papyrology Database (henceforth, APD). I describe the data and their representativeness in section A1.3 in the appendix but I note here that 72 percent of the sample is from administrative lists and receipts, where, arguably, each individual has an equal chance of appearance. I compare the APD sample to the 1848-1868 census samples [see section 4.2 and section A1.1 in the online appendix].

In order to measure SES, I constructed three dummy variables as measures of white-collar jobs: (1) White-Collar1 denotes if an individual is professional, high-level bureaucrat, or mid-low bureaucrat; those are literate white-collar jobs that are non-political and non-religious. (2) White-Collar2 denotes if White-Collar1= 1 or if an individual belongs to judiciary, military/police, or clergy and rural elites; those additional occupations are literate white-collar occupations that are political or religious, and (3) White-Collar3 denotes if White-Collar2= 1 or if an individual is a merchant; a white-collar job that is not necessarily literate. I also created indicators for three other occupational outcomes: artisans, farmers, and unskilled (non-farmer) workers. By construction, the population shares of White-Collar3, artisans, farmers, and unskilled workers sum up to one, exhausting the full occupational distribution.

The findings are in Table (III). Copts (56 percent of the APD sample) are over-represented among white-collar workers in 641-969, which is *entirely* attributable to their over-representation in mid-low bureaucracy (scribes, land tax collectors, accountants). In fact, Muslims are slightly over-represented among the judiciary, military/police, and merchants, but the differences are not statistically significant and the population share of these jobs among Muslims is too small to offset Copts' over-representation in mid-low bureaucracy. The advantage of Copts is not limited to white-collar jobs, however, as they are over-represented among artisans (weavers, carpenters, tailors) (p-value = 0.13) and are under-represented among farmers. The results in 1848-1868 are strikingly similar. Copts are more likely to be white-collar workers (as mid-low bureaucrats) and artisans and are less likely to be farmers or unskilled workers. And even though Muslims are over-represented among professionals, high-level bureaucracy, judiciary, military/police, clergy, and rural elites, the population share of these jobs is still too small.

Comparing estimates in 641-969 and 1848-1868 indicates that the Coptic-Muslim differences persisted with respect to most outcomes, although the gaps with respect to mid-low bureaucracy, artisanal jobs, and unskilled jobs increased significantly.

A few notes on the findings are in order. (1) High-level bureaucracy, judiciary, military/police, and Muslim clergy were restricted to Muslims by Islamic law because of their political and/or religious nature. Nevertheless, Egyptian Muslims (converts) were under-represented in those jobs vis-à-vis non-Egyptian Muslim elites (Arabs, and later, Turks) for political reasons.⁶ (2) Although the evidence relies on occupations, Ashtor (1969) suggests that bureaucrats were better paid than artisans and unskilled workers, which indicates that occupational differences reflected an income difference. (3) The observed Coptic-Muslim occupational differences and their long-term persistence are documented in history (see section A1.3.3 for details).

⁶ Egyptian Muslims entered the military/police as soldiers, and possibly officers, in 641-833, and they later gained access to the judiciary and clergy (but less to high-level bureaucracy). Yet, they were excluded from the military from 833 until the reintroduction of military conscription in 1822.

3.4. Interpretation of the Long-Term Trends

The key findings in the long-term trends are as follows. (1) The poll tax rate among low- and middle-income brackets was highest in 661-969 before declining in 969-1517; it was negligible though among the high-income bracket throughout the whole period. (2) Copts shrank from (almost) 100 percent of the population in 641 to 42 percent in 680, 16 percent in 1200, and 7 percent in 1848-1868. (3) Copts were better off than Muslims in 641-969 and the gap persisted in 1848-1868.

Overall, the trends lend support to the selection hypothesis. The high poll tax rate in 641-969 caused a rapid decline in Copts' population share and the emergence of the Coptic-Muslim SES gap as farmers and unskilled Copts were more likely to convert, leaving behind a Coptic minority that was over-represented in artisanal and white-collar jobs. The tax decline after 969 caused conversions to subside. What I still have to explain is why Copts' population share and the Coptic-Muslim SES gap both persisted between 969 and 1868. I come back to this point in section 5.

4. Empirical Evidence from the 1848-1868 Census Samples

4.1. Conceptual Framework

I use a simple static framework to guide the empirical analysis. Each Copt is endowed with income $y \sim f(y)$ and religiosity $r \sim g(r)$ where $y > 0$ and $r > 0$. For the purpose of the model, I assume that income and religiosity are independent but I am agnostic about their relationship in the empirics. I think of y as SES that has multiple dimensions in addition to income such as education, occupation, and wealth, and of r as the non-pecuniary cost of conversion which includes psychological attachment to Coptic Christianity and the potentially bad treatment of converts (as outcasts by Copts or as subordinates by Arabs). Population size is of measure one: $\int f(y)dy = \int g(r)dr = 1$. Copts pay a lump-sum poll tax τ that is removed upon conversion. More broadly, I think of τ as the Coptic-Muslim net tax difference. A Copt chooses consumption (c) and religious affiliation ($\kappa = 1$ if remains Coptic Christian and $\kappa = 0$ if converts to Islam) in order to maximize:

$$(1) U = u(c) - (1 - \kappa)r$$

$$\text{Subject to: } (2) c \leq y - \tau\kappa$$

where $u'(\cdot) > 0$ and $u''(\cdot) < 0$. A Copt converts to Islam if:

$$(3) u(y) - u(y - \tau) \geq r$$

Hence, holding religiosity constant, poorer Copts are more likely to convert, and, similarly, holding income constant, less religious Copts are more likely to convert. I examine the effects of changing the poll tax on converts' population share and on the difference in average income between those who remain Copts and converts (Muslims), which captures the selection-on-income effect of the poll tax. The following propositions hold (proofs are in section A3 in the online Appendix).

Proposition 1: *Holding religiosity constant, Copts' population share is decreasing in the poll tax.*

Proposition 2: *Holding religiosity constant, the average (before-tax) income of those who remain Copts, $E(y|y > y^*)$, and of those who convert to Islam, $E(y|y \leq y^*)$, are increasing in the poll tax. Thus, the Coptic-Muslim difference in average income could be either increasing or decreasing in the poll tax depending on the income distribution.*

Proposition 3 (Jewitt, 2004): *Holding religiosity constant, the Coptic-Muslim difference in average income is increasing in the poll tax if $f(y)$ is everywhere decreasing.*

Figure (IV) illustrates the intuition behind these results. Let $y^*(\tau; r)$ denote the threshold level of income at which a Copt is indifferent about conversion to Islam at a given level of religiosity. The concavity of u implies that y^* moves rightwards in response to an increase in τ , reducing Copts' population share (Proposition 1). As y^* increases, the remaining Copts are richer on average as they lost their poorest members who were just above y^* . A less intuitive result is that the same effect holds for converts (Muslims) who are richer on average because they gained new converts who are richer than any previous convert. Hence, the average income for Copts and converts both increase and the Coptic-Muslim income gap may go up or down depending on income distribution (Proposition 2). For example, it increases if distribution is Pareto, which is commonly used in the literature (Proposition 3).

Two remarks are in order. (1) I do not endogenize the poll tax as this goes beyond the scope of the paper (see conclusion), but I allow for endogeneity in the empirics. (2) I assume that the tax is a lump-sum tax, which implies a greater incentive to convert among poor Copts. This is a simplification because there were other policies that triggered conversions among rich Copts. For example, rich Copts were probably willing to convert in order to access political and religious white-collar jobs that were restricted to Muslims. I argue though that the model captures the empirical facts because (a) political and religious jobs were less accessible to converts and (b) the population share of those jobs was relatively small [Table (III)].

4.2. Data and Empirical Strategy

To test the conceptual framework, I exploit the sub-national variation in the poll tax in 641-1100, the period where most conversions took place. I observe the two outcomes, religious affiliation and occupational outcomes, in the 1848 and 1868 population censuses, the earliest sub-national data on religion and occupations.⁷ I digitized two nationally-representative samples in 1848 and 1868 and two over-samples of non-Muslims in Cairo in both years. I pooled the samples and restricted the analysis to Egyptian local free Coptic and Muslim active men of rural origin who are at least 15 years of age and with non-missing age, religion, occupation, and district of origin. These restrictions aim at (a) limiting analysis to likely descendants of the pre-641 population and (b) mitigating the concern about cross-district mobility of an individual's ancestors in 641-1868 by excluding those whose family origin is in Egypt's largest cities (see section A1 in the online appendix for details).

The empirical strategy is based on regressing religious affiliation and occupational outcomes of the 1848-1868 sample on (a measure of) poll tax in district of origin in 641-1100. Specifically, I estimate the following OLS regressions:

$$(4) \text{copt}_{ij} = \beta_k + \beta_{11}\tau_j + X_j'\beta_{12} + \varepsilon_{1ij}$$

$$(5) y_{ij}^o = \beta_j^o + \beta_{21}^o \text{copt}_i + \beta_{22}^o (\text{copt}_i \cdot \tau_j) + (\text{copt}_i \cdot X_j')\beta_{23}^o + \varepsilon_{2ij}^o; o = 1, \dots, 12$$

⁷ The sub-national (district) location of 65 percent of the APD sample (see section 3.3) is unknown.

where *copt* is equal to one if individual *i* with district of origin *j* is Coptic Christian and y^o is equal to one if individual has occupation *o*. I estimate equation (5) for twelve occupational outcomes separately: (1) the three white-collar indicators, (2) indicator variables for six sub-outcomes that form the white-collar indicators, and (3) indicator variables for artisan, farmer, and unskilled outcomes. β_k and β_j^o are full sets of province and district of origin fixed effects respectively (11 provinces, 76 districts), τ_j is poll tax in district in 641-1100, and X_j is a vector of pre-641 district-level controls (I describe poll tax measures and controls in the next sub-sections). I expect that: (1) $\beta_{11} < 0$; districts with higher tax in 641-1100 would have relatively fewer Copts in 1848-1868. As all districts were 100 percent Copts before 641, Copts' population share in district in 1848-1868 is equal to one minus population share of converts, assuming that there was no cross-district movement or different birth and death rates that varied by both district and religion in 641-1868. (2) $\beta_{21}^o > 0$ for white-collar and artisanal indicators and $\beta_{21}^o < 0$ for farmer and unskilled indicators; Copts are better off than Muslims in low-tax districts because the positive selection of Copts holds in *every* district. (3) Under certain income distributions (e.g. Pareto), I expect that $\beta_{22}^o > 0$ for white-collar and artisanal indicators and $\beta_{22}^o < 0$ for farmer and unskilled indicators; Copts in high-tax districts are, because of more extensive selection-on-SES, *differentially* more likely to be white-collar workers and artisans and *differentially* less likely to be farmers and unskilled than in low-tax districts.

4.3. Measuring Cross-District Variation in Poll Tax in 641-1100

The empirical strategy relies on observing cross-district variation in the poll tax in 641-1100, a challenging task given the remoteness of the time period. For this purpose, I collected all available individual-level data on annual nominal poll tax payments from the surviving papyri poll tax registers and receipts in 641-1100 with location information (N = 408). Unfortunately though, papyri poll tax documents survived in only four *kurus* (Egypt's administrative units in 641-1036), all located in the Nile Valley. Panel (A) of Table (IV) shows the summary statistics of poll tax

payments in each *kurra*. The average tax is lower in *Qahqawa* than in the three other *kurras* by 25 percent, which is due to the higher share of Copts who paid *no* tax in that *kurra*, indicating that there were cross-*kurra* differences in poll tax enforcement. I mapped the 4 *kurras* into 11 districts in 1848-1868 and created my first measure of the poll tax: an indicator variable denoting if average poll tax was “high” in district in 641-1100 (> 1.3 dinars, the cross-district average).

But why was there cross-*kurra* variation in poll tax enforcement? I conjecture that that was because of cross-*kurra* variation in Arab settlement that changed the composition of local elites who were in charge of assessment and collection of poll and land taxes.⁸ In *kurras* where Arab tribes settled permanently by purchasing land in 700-969, they replaced the indigenous Coptic elites as large landholders and village- and *kurra*-headmen (Sijpesteijn, 2009). In those *kurras*, I argue, Arabs were stricter in enforcing poll tax on Copts. By contrast, in *kurras* where Arabs did not settle, Coptic elites remained in power and were presumably more lenient in taxation with their fellow Copts. That was manifested in their higher tolerance for (a) Copts paying zero or reduced poll tax, (b) piling-up of tax arrears, and (c) fugitives who fled their villages to avoid taxation [those phenomena, but not their cross-*kurra* variation, are documented in history (Morimoto, 1981)]. The impact of Arab settlement on tax enforcement is supported by historical evidence. Panel (B) of Table (IV) indicates that the poll tax is positively correlated with Arab settlement in 700-969. This

⁸ In 641-720, Arabs kept the decentralized Byzantine tax system intact, whereby village headmen (supervised by *pagarchs* or headmen of *kurras*) assessed individual poll and land taxes, which were then aggregated to estimate the village’s tribute. Starting from 720, rulers attempted to tighten their control over taxation via appointing Arabs as headmen of districts (Morimoto, 1981, pp. 66-91; 175-81). This process coincided with Arabs’ settlement in rural Egypt starting from 700. However, in response to tax revolts that were ignited by strict tax enforcement, the state resorted to the decentralized tax contracting (later, tax farming) system in the ninth century (Sijpesteijn, 2009), which remained in effect until 1813 (Cuno, 1992, pp. 17-32). Under that system, the state contracted out through auctions tax collection of each district to individuals (Morimoto, 1981, pp. 231-3). In 1171-1813, tax farming took the form of feudalism, whereby high-ranked military officers were granted large landholdings and control over taxation of districts. However, throughout the whole period in 641-1813, local elites remained influential in tax assessment and collection whether they did so directly in 641-720 or in cooperation with tax collectors (appointed by the state in 720-900 or by tax contractors/farmers in 900-1856) (Ismail, 1998, pp. 164-7; Mahmoud, 2009, pp. 147-81).

justifies my second measure of the tax that is observed for all districts, an indicator denoting if at least one Arab tribe settled permanently in the district in 700-969.

Figure (V) maps the key variables in the analysis. First, within the 11 districts on which I have poll tax information, the tax is higher in the north. Second, Arabs settled in all regions, but less so in the Nile Valley.⁹ Third, Copts were a minority in all districts in 1848-1868, but were relatively more concentrated in the Nile Valley. Finally, Copts are better off than Muslims in 41 out of the 49 districts in which there are any Copts, but the gap is bigger in districts with relatively fewer Copts.¹⁰

4.4. Controlling for Pre-641 Cross-District Differences

Cross-district differences in the poll tax could be driven by a host of pre-641 cross-district differences and their omission would bias the OLS estimates. First, *ceteris paribus*, I expect Arabs to enforce higher tax (or settle) in richer districts. I thus control for pre-641 average income in district by the natural logarithm of urban population in the Greek cities (*metropolis*) and the capital of each *nome* (Roman Egypt's administrative units) in Roman Egypt (circa 300), which I then mapped into districts in 1848-1868. Urbanization is commonly used in the economic history literature as a measure of economic development.

Second, I predict that Arabs would enforce higher tax (or settle) in more religious districts since Copts in those districts could afford higher tax without converting to Islam. I thus control for pre-641 religiosity or psychological attachment to Coptic Christianity by an indicator denoting if district is believed, according to pre-641 local Coptic traditions, to have been visited by the Holy Family during its legendary flight to Egypt.¹¹ The path, officially endorsed by the Coptic Church today, is based on a

⁹ The Nile Delta is the northern triangle on the map. The Nile Valley extends from the south of the Nile Delta to Egypt's southern border with Sudan.

¹⁰ The negative correlation between Copts' population share and the Coptic-Muslim SES gap, which follows from propositions 1-3, is confirmed in the regression: $y_{ij}^o = \beta_j^o + \beta_{41}^o \text{copt}_{ij} + \beta_{42}^o (\text{copt}_i \times \text{coptpopshare}_j) + \varepsilon_{4ij}^o$; $o = 1, \dots, 12$ [see Table (A.10) in the online appendix].

¹¹ The path may also reflect cross-district variation in income, because it included sites that became pilgrimage destinations at some point and a potential source of income for Copts in district.

book that is (thought to be) written around 400. As the date of the book is not certain though, this variable must be interpreted with caution.

Third, I control for the generosity of the Coptic transfer system in district. As a proxy for this variable, I use the share of villages in district with at least one Coptic monastery in 1200, since monasteries were the main charity institutions before 641.¹² The number of monasteries in 1200 should not differ too much from before 641 because: (a) monasteries were more likely than churches to survive because of their larger size and wealth, and (b) building new monasteries was prohibited under Islam.

Fourth, I control for the power of pre-641 local Coptic elites in district, which may have reduced Arabs' ability to enforce a higher tax (or to settle). As a proxy for this variable, I use an indicator denoting if the district had an *autopract* agricultural estate in 600. The *autopract* status was a privilege granted to large landholders that allowed them to (a) pay taxes directly to Egypt's capital rather than to district authorities and (b) collect taxes from taxpayers in their constituencies.

Finally, I control for resistance to Arabs in district, which may have also reduced tax enforcement and Arab settlement. As a proxy for *military* resistance, I constructed a dummy variable denoting if there was a Byzantine garrison in district in 600; those garrisons fought against the Arab army in 639-641. And as a proxy for *popular* resistance, I examined Copts' tax revolts in 726-768 (this variable is at the region level and is not included in regressions). Table (A.9) in the online appendix shows that 4 out of 5 revolts were in the Delta, indicating that revolts were negligible in the Valley. Since districts on which I have poll tax information are all in the Valley, it seems unlikely that poll tax variation is driven by differences in popular resistance.

Table (V) shows the descriptive statistics for all variables in the analysis [occupational outcomes are in Table (III)]. Muslims are more likely to come from districts with higher poll tax in 641-1100 or where Arabs settled in 700-969. Those

¹² Coptic monasteries leased out their land to farmers and provided loans and grants to poor Copts to help them pay poll and land taxes. Copts often took refuge in monasteries (pretending to be monks) to avoid paying the poll tax as monks were often exempted from taxation (Morimoto, 1981, p. 118).

districts had slightly bigger urban population in 300, were slightly more likely to lie on the Holy Family legendary path, had slightly lower share of villages with a Coptic monastery in 1200, and were more likely to have a Byzantine military garrison in 600, but did not differ in the incidence of having an *autopract* estate in 600.

4.5. Findings

Table (VI) shows the results on religious affiliation [equation (4)]. Using the poll tax indicator, I find that individuals who come from districts with a higher tax in 641-1100 are less likely to be Coptic in 1848-1868 by about 16 percentage points; a large magnitude given that the cross-district average Copts' population share is 6 percent. The effect remains negative and statistically significant if I include pre-641 controls and province fixed effects in columns (2)-(10). Using the full sample with the Arab settlement indicator generates qualitatively similar results (smaller in magnitude). Individuals from districts where Arabs settled in 700-969 (hence, faced a higher tax) are less likely to be Copts in 1848-1868 by 6-9 percentage points, and the effect is robust to including pre-641 controls and province fixed effects.¹³

Results on occupational outcomes [equation (5)] are in Table (VII). Using the poll tax variable in Panel (A), I document that Copts in high-tax districts are *differentially* more likely to be professionals and bureaucrats (White-Collar1=1) than their co-religionists in low-tax districts. Basically, the Coptic-Muslim gap with respect to White-Collar1 is positive in low-tax districts, but is larger in high-tax districts by 85 percent. The effect stems from Copts' *higher* over-representation among mid-low bureaucrats in high-tax districts, but the effect holds if I use wider definitions of white-collar workers in White-Collar2 and White-Collar3. The results on artisan, farmer, and unskilled indicators all have the expected signs but are statistically insignificant. Panel (B) controls for interactions of pre-641 controls with the Coptic Christian indicator. Although the coefficients are imprecisely estimated, the

¹³ I am not able to include both the poll tax and Arab settlement indicator variables in the same regression because they are identical in the 11 districts for which I observe the poll tax.

interaction terms in the regressions of white-collar and artisanal indicators remain positive and statistically significant.

Results in Panel (C) which uses the Arab settlement indicator are similar but of greater magnitude. Among individuals from districts where Arabs did *not* settle in 700-969 (low-tax districts), Copts are more likely than Muslims to be professionals and bureaucrats by 10 percentage points, but the Coptic-Muslim difference in Arab-settlement districts is greater by an additional 15 percentage points. I obtain similar results if I use White-Collar2 or White-Collar3. The findings with respect to artisanal, farmer, and unskilled indicators are mostly of the expected signs, but the interaction terms are not significant. Including interactions of all controls with the Coptic indicator in Panel (D) restricts sample to individuals from 35 districts (all in the Valley) where I have information on *autopract* estates. This reduces the magnitude of the interaction term for white-collar indicators although they remain positive.

Overall, results suggest that Copts from districts with a higher tax in 641-1100, or where Arabs settled in 700-969, are relatively fewer, but differentially better off. They are *more* over-represented among white-collar workers (mid-low bureaucrats). There is also indicative evidence that they are differentially more likely to be artisans and less likely to be farmers (the latter results are not always statistically significant).

4.6. Robustness Checks

There are at least three concerns about OLS estimates. First, there may be measurement error in the poll tax. Second, OLS estimates may be biased because of *unobserved* district-level variables. Third, there was likely cross-district poll-tax-induced movement of individuals in 641-1868. I discuss these issues below.

4.6.1. Measurement Error in the Poll Tax

I run a number of robustness checks to address measurement error in observing the poll tax in papyri poll tax registers and receipts in 641-1100 [Tables (A.2) and (A.3) in the online appendix]. (1) Instead of using the “average” tax, I re-estimated the regressions using an indicator denoting if *median* poll tax was “high.” (2) I

dropped two *kurus* where sample size in the papyri is less than ten. (3) Instead of using an indicator variable, I used the actual average and median poll taxes (in dinars). (3) I clustered standard errors at the *kura* level [downside is that there are only 4 *kurus* (clusters)]. (4) I dropped the *kura* of *Qabqawa* (where papyri come from an earlier date) where I used the median poll tax indicator. (5) I argue that controlling for urbanization in 300 and for geographic fixed effects mitigates the concern that I only observe the *nominal* tax and not the real tax or the tax *rate*.

As a proxy, the Arab settlement indicator admits of alternative interpretations, but a valid interpretation must predict that Copts in Arab-settlement districts are relatively fewer *and* differentially better off. This seems unlikely. (1) Settlement captures a *mechanical* negative effect on Copts' population share, because Arabs were Muslims. This effect is negligible though because settlement was small (section 3.2.2) and it does not explain why Copts of those districts are *differentially* better off. (2) Arabs may have forced *poorer* Copts to convert in districts they settled in. Coerced conversions were rare though in 700-969. (3) Arabs may have promised *poorer* Copts with non-pecuniary benefits of conversion (e.g. salvation). However, settlement is positively correlated with the Holy Family path indicator, suggesting that Arabs settled in *more* religious districts. (4) As Arab settlers replaced Coptic elites, it would mechanically reduce Copts' average SES. But this would predict differentially *worse-off* Copts in settlement districts. (5) Settlement may reflect district's income only, as Arabs chose richer districts. But there is no reason in this case to observe correlation between settlement and Copts' population share (or the SES gap).

4.6.2. Instrumental Variable (IV) Strategy

I employ an alternative strategy to address the potential endogeneity of the poll tax that stems from omitted *unobserved* characteristics of districts. Basically, as an IV for the poll tax (and Arab settlement) in equation (4), I use district's distance to Arish, a small town close to Egypt's North Eastern borders that was the first to be

captured by Arabs in 639 because of its proximity to the Arab peninsula. Also, I use “Copt * Distance to Arish” as an IV for the interaction term in equation (5).

Is distance to Arish a *relevant* and *exogenous* IV? First, Table (A.4) in the online appendix suggests that the poll tax was higher and Arabs were more likely to settle in districts closer to Arish (that were conquered first). Second, distance to Arish arguably satisfies the exclusion restriction, because Arish was a small town and so proximity to it was likely uncorrelated with other variables. Table (A.4) indicates that pre-641 urbanization, religiosity, power of Coptic elites, and Byzantine military resistance are all uncorrelated with distance to Arish. The only exception is that the share of villages in district with a Coptic monastery in 1200 is positively correlated.

The IV estimation results on religious affiliation are shown in Table (A.5). First-stage regressions indicate that the poll tax was lower, and Arab tribes were less likely to settle, in districts further away from Arish. Weak-IV Tests indicate that distance to Arish is a strong IV (except in column 6, where I use a smaller sample for which I observe *autopract* estates). Second-stage estimates of the effects of the poll tax (Arab settlement) on the Coptic indicator are negative, statistically significant, and larger in absolute value than the OLS estimates, except in column (6).

The results on occupational outcomes are in Table (A.6). The first-stage regression in Panel (A), which uses the poll tax variable, shows that “Copt * Distance to Arish” is a strong IV. Second-stage regression indicates that Copts in high-tax districts are differentially more likely to be white-collar workers and artisans and differentially less likely to be farmers than those in low-tax districts. Panel (B), which uses Arab settlement, produces stronger results than OLS.

4.6.3. Poll-Tax-Induced Movement across Districts in 641-1868

Another source of endogeneity is the possibility of cross-district movement in 641-1868 (via migration or inter-religious differential birth and death rates) that was induced by differences in poll tax. There are two counter-arguments here. First, using the share of villages in district with at least one Coptic church or monastery in 1200

and 1500 as a proxy of Copts' population share in district in equation (4), yields qualitatively similar results to Table (VII) [see Table (A.7)]. This indicates that the impact of the tax on Copts' population share held in 1200 and 1500. Second, the state controlled mobility in rural Egypt in 641-1868 as assignment of land, tax on land, military conscription, and corvée in public works were all based on village of residence. Morimoto (1981, pp. 113-24) describes the problem of fugitives in 641-969, who fled their villages to avoid taxation, and the state's measures to identify and send fugitives back to their villages. This problem persisted in 1517-1868 according to Mahmoud (2009, pp. 159-60) and Cuno (1992, pp. 121-4). In the nineteenth century, the state required travel permits in order to control movement.

5. Explaining the Persistence of the Poll Tax Effects

5.1. Mechanisms of Persistence

A fundamental limitation of the empirical strategy is that there is more than a millennium that elapsed between observing the poll tax and observing the outcomes. Drawing on both theory and historical evidence, I suggest two complementary mechanisms of persistence of the poll tax effects. The first mechanism is based on two historical facts: (1) the poll tax was *not* a one-time policy introduced in 641, but was rather a long-standing institution that persisted from 641 to 1856, and (2) three Islamic laws made conversion to Islam an “absorbing state:” (a) death penalty of apostates, (b) the offspring of a Muslim father is automatically Muslim, and (c) Muslim females may only marry Muslim males. Adding to these two facts the (plausible) assumption that in every period some Copts may experience downward mobility (e.g. due to a negative income shock), I predict that Copts' population share would decrease to zero over time, because in every period some poor Copts may convert to Islam (the fall in the tax rate in 969-1517 could partially explain the slowdown in conversions after 969). More important though, once we allow for a *continuous* process of *endogenous group formation* via Copts' conversions to Islam in 641-1856, there is no reason to expect that the Coptic-Muslim SES gap would disappear.

In fact, the gap may even *increase* as the *poorest* Copts convert in every period, leaving behind a continuously shrinking Coptic minority that is growing richer over time.

The second mechanism of persistence is that there were religious group effects on occupational outcomes, because each group imposed barriers to entry into skilled occupations in which they were over-represented after initial conversions took place. Conceptually, adding a group effect is similar to Borjas' (1992) concept of "ethnic capital," in which child's human capital depends on both parental human capital and the average human capital of the group. But unlike Borjas' model that treated inter-group human capital differences as exogenous, the Coptic-Muslim SES gap was *endogenously* formed via conversions to Islam among Copts in every period. Because the group effect partially offsets the poll tax incentive to convert, it slows down the decline in Copts' population share, hence protecting Copts from "extinction." It also slows down any upward or downward trends in the Coptic-Muslim SES gap making it more likely for the gap to persist over time.

There are two pieces of evidence on the existence of religious group effects. First, the guild system restricted access to apprenticeship that was required in most artisanal and white-collar occupations (Raymond, 1973, pp. 544-51). Copts restricted access to guilds of carpenters, jewelers, and tailors, as well as to mid-low bureaucracy. In the words of Lord Cromer, the British consul of Egypt in 1883-1908, the Coptic accounting system was "*archaic*" and "*incomprehensible to anyone but themselves*" (Tagher, 1998 [1951], p. 213). This was not a nineteenth-century phenomenon, because in 969-1171, "*the persistence of Coptic administrative personnel [was because] the agrarian administration was very complex and not easily mastered. In it the Copts played an important role at the local level as well as at the central offices in the capital... The administrative knowledge was passed on by the officials in their families when fathers employed their sons, thus maintaining the hold of the family over posts,*" (Samir, 1996, p. 190).¹⁴ In addition, Coptic schools that,

¹⁴ (3) It may appear surprising that Copts preserved their advantage and succeeded in hiding their wealth from Muslim rulers who often taxed wealth opportunistically. The reason is that Copts' economic advantage did not stem from wealth but from wages.

unlike Muslim schools, taught arithmetic and geometry in order to train Coptic children for jobs in mid-low bureaucracy were not open to Muslim students, because schools were religiously segregated (Heyworth-Dunne, 1938, pp. 2-7, 84-92).

Second, I used the 1848-1868 samples to estimate the impact of religious affiliation on son's occupational outcome, controlling for father's occupation. One caveat is that I only observe son's and father's occupations if sons resided with their fathers. Specifically, I estimate the following OLS regressions:

$$(7) y_{ih}^o = \beta_3^o + \beta_{31}^o \text{fatherocc}_{ih} + \beta_{32}^o \text{occsharegroup}_{ih} + \varepsilon_{3ih}^o; o = 1, \dots, 12$$

where y_{ih}^o denotes if son i in household h has occupation o ; fatherocc denotes if father has same occupation as son; occsharegroup is sample share of occupation o in religious group (in father's generation). The results are shown in Table (A.8) in the online appendix. (1) Intergenerational correlations of occupational outcomes (β_{31}^o) are positive for white-collar, artisan, farmer, and unskilled indicators. (2) Group effects (β_{32}^o) are positive and large for white-collar, artisan, and farmer occupations, but are not statistically significant for unskilled occupations (where imposing barriers to entry is presumably difficult due to the low skill level of the job).

A final remark on the group effect is important here. One may interpret the group effect, and, in particular, teaching secular subjects in Coptic schools, as evidence on Copts' higher taste for education that induced Copts with lower taste to convert out of Coptic Christianity. I argue that this interpretation, which is inspired by Botticini and Eckstein (2005), is not consistent with historical evidence because (a) there is no literacy requirement under Coptic Christianity (illiteracy among adult male Copts was 34 percent in 1986) and (b) Coptic schools were purely religious before 641 (Nasim, 1991) and, in fact, the earliest evidence on teaching secular subjects comes from 1693, long after Copts shrank into a minority.¹⁵ Hence, I

¹⁵ Earliest account on Coptic schools is by Sadlier (1693): "... the children were taught religion, good manners, to read and write Arabic *and Coptic*... and were taught geometry and arithmetic because *these two sciences are very useful and necessary on account of the overflowing of the Nile, whereby the limits are lost; so that it*

interpret Copts' higher investment in secular education in 1693-1868 as an example of barriers to entry into skilled occupations; specifically, a mechanism to preserve Copts' advantage in mid-low bureaucracy in which they were over-represented, but it did not itself serve as a *selection* mechanism. Moreover, this mechanism does not account by itself for Copts' persistent over-representation in artisanal jobs which is perhaps explained by other occupational barriers to entry (apprenticeship).

5.2. Alternative Explanations

I argue that alternative explanations of the Coptic-Muslim SES gap are not consistent with historical evidence. Weber explained Protestants' economic advantage by their work ethic. Yet, both Coptic and Egyptian Muslim cultures were mystical, and, moreover, Copts' advantage stemmed from bureaucracy and *not* from commerce, indicating that Coptic Christianity was not more conducive to Capitalism than Islam.¹⁶ Using a different rationale, Kuznets (1960) explained Jews' advantage by minorities' attempt to preserve their identity via specializing in occupations in which they built a tradition. But this does not explain why Copts, who were initially the majority, became a minority. Jews' economic advantage is also explained by banning Jews from certain occupations such as farming. Yet, Copts were not banned from farming (one third of adult active male Copts in 1848-1868 were farmers). If anything, Copts were banned from political and religious white-collar occupations, which may have mitigated the gap. Within the Middle East, Issawi (1981) and Kuran (2004) argued that the privilege of non-Muslim minorities emerged in the nineteenth century because Europeans favored non-Muslims, or because non-Muslims adopted European legal structures. However, this theory does not explain why the Coptic-Muslim SES gap emerged in 641-969, long before the rise of Europe. Moreover, Copts' privilege did *not* originate from commerce where European influence was

becomes necessary for them to measure out their land, and by the benefit of the first of these sciences they compute the yearly increase," Heyworth-Dunne (1938, p. 85).

¹⁶ Copts and Egyptian Muslims (traditionally, Sufis) shared beliefs in saints, martyrs, miracles, and apparitions that often attributed materialistic success to metaphysical factors rather than to hard work.

important but from bureaucracy and artisanship, where Europeans had less of an influence. For those reasons, Issawi's and Kuran's theories do not seem applicable to Copts, although they may explain the privilege of other Middle Eastern non-Muslim minorities who excelled in commerce. Finally, one may argue that rulers favored Copts in bureaucracy for political reasons (because as a minority, Copts lacked a support base) and not because of selection-on-SES of converts. This theory is not complete though because it does not explain (a) why Copts are over-represented in *artisanal* jobs, (b) why Copts shrank into a minority, and, (c) why Copts are over-represented in mid-low bureaucracy in the APD sample in 641-969 although they are in the majority (56 percent).¹⁷ Hence, I argue that the persistence of Copts in bureaucracy was not only for political reasons, but also because (a) the population share of skilled converts was relatively small, and (b) human capital was occupation-specific (e.g. a literate convert could not work as a scribe without apprenticeship).

6. Conclusion

Drawing on several new data sources, I traced the origins of the superior SES of the Coptic Christian minority in Egypt to the Islamic tax system that was imposed upon the Arab Conquest of the then-Coptic Christian Egypt in 639-641. Specifically, I hypothesized that the poll tax, a regressive tax removed upon conversion to Islam, led to the shrinkage of Copts into a better-off minority. I first drew suggestive evidence on the hypothesis from the long-term trends of the poll tax, Copts' population share, and the Coptic-Muslim SES gap. Then, using the 1848-1868 population censuses, I documented that districts with a higher tax in 641-1100 had fewer, but differentially better-off, Copts in 1848-1868. Finally, I argued that the persistence of the tax effects is explained by continuous Copts' conversions, as the tax persisted until 1856 and by group effects in access to skilled jobs.

The findings raise intriguing questions that open up two future areas of research. First, and foremost, there is the issue of the determinants of Islamic taxation. Why

¹⁷ This is because most papyri come from the Nile Valley where there were relatively more Copts.

did Arabs choose a “soft” policy, taxation, to win converts? Why did they choose a regressive tax that triggered the masses, but not the elites, to convert? In doing so, why did they risk creating hostile elites? Why did not they raise the poll tax over time in order to induce the remaining Copts to convert as they were shrinking into an increasingly richer minority? Theory and historical evidence offer some clues to these questions. (1) Taxation was preferable to coerced conversions, because it created a large (potential) support base without running into the risk of rebellions. Indeed, it appears that Romans followed a similar policy of taxation and “citizenship.” (2) Arabs wanted, besides winning converts, a stable stream of poll tax revenues, and imposing a regressive tax was an efficient way to achieve the two objectives. (3) Islamic law actually ensured that the political elite was Muslim (not necessarily, Egyptian), while leaving the politically-powerless mid-low bureaucracy in Copts’ hands. (4) Poll tax revenues became negligible as Copts shrank into a minority, and given the cost of tax collection, rulers shifted their efforts in 750 from the poll tax to the land tax (*kharaj*), which became a universal tax on both Copts and Muslims. And, even on pure theoretical grounds, it may not be optimal to increase the poll tax over time because the elasticity of demand for Coptic Christianity is in fact unchanged in the case of *positive* selection of Copts (Tirole, forthcoming).¹⁸

The second area of research is the external validity of the poll tax hypothesis to other parts of the Middle East (and beyond). At this stage, we know very little about the formation processes of non-Muslim minorities in the region so I could only speculate on the answer. (1) Selection-on-SES of converts (not necessarily caused by taxation) is perhaps generalizable to other contexts. (2) There were cross-country differences in Arab settlement during the post-Conquest period due to differences in land confiscation policies. (3) Copts restricted entry to bureaucracy partially because of Egypt’s complex agricultural system, but group effects were perhaps less

¹⁸ I examine endogenous taxation in work-in-progress (with Jean Tirole) where the fact that rulers put a *negative* weight on Coptic taxpayers’ welfare, as their goal was to induce Copts to convert, leads to (a) the poll tax remains constant over time and (b) all conversions take place in the first period.

important in other countries. (4) Egypt's non-Coptic Christians and Jews, who excelled in commerce, may be more comparable than Copts to other non-Muslims in the region. Fortunately, there are unexplored data sources that could be used to extend this research including, papyri documents (98 percent of which are unpublished), sixteenth-century Ottoman tax registers, and Ottoman population censuses. These sources may reshape our understanding, not only of non-Muslim minorities, but also of the history of the region more generally.

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TABLE I
Coptic-Muslim Differences in Net Taxes in 641-1856

Tax/Benefit	Copts	Converts (Muslims)	Coptic-Muslim Difference in Net Taxes	
			641-750	750-1856
1. Poll tax	Yes	No	Yes	Yes
2. Land tax (<i>kharaj</i>)	Yes	No in 641-750 [reduced tax (<i>ushur</i>)]; Yes since 750	Yes [= <i>kharaj</i> - <i>ushur</i>]	No
3. Miscellaneous taxes	Yes	No in 641-750; Yes since 750	Yes	No
4. Intra-group transfers	Yes	Yes	No (?)	No (?)
5. Military conscription	No	Yes [compensated by state pensions (<i>ata</i>) in 641-833 and by wages in 1822-1856]; No in 833-1822	No (?)	No (?)

Sources: See section A1.5 in the online appendix. Miscellaneous taxes varied over time. In 641-661, they provided funds for the “entertainment” of Muslims (military expenses and lodging for officials) and village overhead expenses. In 661-750, they supplied maintenance for the governor and officials and funds for public projects. In 750-1171, they expanded to include pasture tax, weir tax, and taxes on various crops and products. In 1171-1856, they included taxes on pasturage, industry, mines, fisheries, trade and transactions, property, maintenance of public services, war taxes, and taxes on vice. See discussion in section A1.5 (pp. 52-53) on how the actual tax system, especially in 641-750, may have deviated from that described in the table.

TABLE II
Landholding Farmers’ Poll Tax Rate and Total Land Tax in 700

Dependent Variable: Poll Tax Rate = Annual Poll Tax (Dinars)/Annual Total Land Tax (Dinars)

	(1)	(2)
Annual total land tax (dinars)	-0.041*** (0.015)	-0.036*** (0.013)
Sub-district FE?	No	Yes
Observations	230	230
Adjusted R ²	0.014	0.112

Source: Greek papyri poll and land tax registers of three sub-districts in the *kura* of *Qabqawa* (pre-641, *Aphrodito*) in 703-733 (Morimoto 1981, pp. 67-79, 85-87). Sample is restricted to landholding farmers, i.e. individuals who paid a positive land tax. See section A1.7 in the online appendix for more details. Robust standard errors are in parentheses. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01. A constant term is included in the first regression.

TABLE III
Coptic-Muslim Occupational Differences in 641-1868

	641-969			1848-1868			Change between 641-969 and 1848-1868		
	(1) Copts	(2) Muslims	(3) Diff	(4) Copts	(5) Muslims	(6) Diff	(7) = (4) - (1) Copts	(8) = (5) - (2) Muslims	(9) = (6) - (3) Diff
White-Collar1	0.18	0.09	0.09***	0.18	0.02	0.16***	0.00	-0.07***	0.07**
= 1 if:	(0.39)	(0.28)	[0.03]	(0.39)	(0.13)	[0.01]	[0.03]	[0.02]	[0.04]
<i>= 1 if Professional</i>	0.03	0.01	0.02	0.00	0.00	-0.00***	-0.03**	-0.01	-0.02
	(0.16)	(0.11)	[0.01]	(0.03)	(0.06)	[0.00]	[0.01]	[0.01]	[0.01]
<i>= 1 if High</i>	0.02	0.01	0.02	0.00	0.00	-0.00***	-0.02**	-0.00	-0.02*
<i>Bureaucracy</i>	(0.15)	(0.08)	[0.01]	(0.00)	(0.06)	[0.00]	[0.01]	[0.01]	[0.01]
<i>= 1 if Mid-Low</i>	0.13	0.07	0.06**	0.18	0.01	0.17***	0.05*	-0.06***	0.11***
<i>Bureaucracy</i>	(0.34)	(0.25)	[0.03]	(0.38)	(0.10)	[0.01]	[0.03]	[0.02]	[0.03]
White-Collar2	0.22	0.13	0.09**	0.20	0.07	0.13***	-0.01	-0.05**	0.04
= 1 if White-Collar1 = 1 or:	(0.41)	(0.33)	[0.04]	(0.40)	(0.26)	[0.01]	[0.03]	[0.03]	[0.04]
<i>= 1 if Judiciary,</i>	0.01	0.02	-0.01	0.01	0.03	-0.02***	-0.00	0.01	-0.01
<i>Military, Police</i>	(0.09)	(0.15)	[0.01]	(0.08)	(0.17)	[0.00]	[0.01]	[0.01]	[0.01]
<i>= 1 if Clergy,</i>	0.03	0.02	0.01	0.02	0.03	-0.01***	-0.01	0.01	-0.02
<i>Rural Elite</i>	(0.16)	(0.13)	[0.01]	(0.12)	(0.16)	[0.00]	[0.01]	[0.01]	[0.01]
White-Collar3	0.22	0.15	0.07*	0.22	0.10	0.13***	0.00	-0.06**	0.06
= 1 if White-Collar2 = 1 or:	(0.42)	(0.36)	[0.04]	(0.42)	(0.30)	[0.01]	[0.03]	[0.03]	[0.04]
<i>= 1 if Merchant</i>	0.01	0.03	-0.02	0.02	0.02	-0.00	0.01*	-0.00	0.02
	(0.09)	(0.17)	[0.01]	(0.14)	(0.15)	[0.00]	[0.01]	[0.01]	[0.01]
= 1 if Artisan	0.19	0.14	0.06	0.27	0.11	0.16***	0.08***	-0.03	0.11***
	(0.40)	(0.34)	[0.04]	(0.44)	(0.31)	[0.01]	[0.03]	[0.03]	[0.04]
= 1 if Farmer	0.34	0.44	-0.10**	0.34	0.50	-0.15***	0.00	0.06	-0.05
	(0.47)	(0.50)	[0.05]	(0.47)	(0.50)	[0.01]	[0.03]	[0.04]	[0.05]
= 1 if Unskilled	0.24	0.27	-0.03	0.16	0.30	-0.14***	-0.08***	0.03	-0.11**
	(0.43)	(0.44)	[0.04]	(0.37)	(0.46)	[0.01]	[0.03]	[0.03]	[0.05]
% Copts		56.47%			6.7%				
Observations	227	175		1121	15520				

Source: APD and the 1848-1868 census samples (see the text and sections A1.1 and A1.3 in the online appendix for details). Standard deviations are in parentheses. Robust standard errors are in brackets. * P-value < 0.10, ** P-value < 0.05, and *** P-value < 0.01. Differences in columns (3), (6), (7), (8), and (9) are estimated from the regressions: $y_{it} = \sum_{l=1}^2 \beta_{1l} d_l + \sum_{l=1}^2 \beta_{2l} (copt_{it} \times d_l) + \varepsilon_{it}$, where y_{it} is a dummy variable indicating the occupational outcome of individual i in period t (= 641-969 or 1848-1868); d_l are period fixed effects; $copt$ is an indicator for being Coptic Christian; ε_{it} is an error term.

TABLE IV
Individual-Level Annual Poll Tax Payments (Dinars) in 641-1100

Panel (A): Descriptive Statistics by <i>Kura</i>								
Name	Period	N	% No Tax	Median	Mean	Std. Dev.	Min	Max
<i>Ihnas</i>	701-900	10	0	1.38	1.35	0.50	0.88	2.25
<i>Ashmunayn</i>	731-1100	77	0	0.96	1.36	1.18	0.17	6.71
<i>Fayum</i>	641-1005	7	0	0.99	1.34	0.81	0.25	2.67
<i>Qabqawa</i>	703-733	314	46.5	1	1.07	1.27	0.00	5.00

Panel (B): Determinants of Individual-Level Poll Tax Payments in 641-1100					
<i>Dependent Variable: Individual-Level Annual Poll Tax Payment in Dinars</i>					
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in <i>kura</i> in 700-969	0.290** (0.133)			0.203 (0.985)	0.214 (0.960)
Log (urban population) in 600		0.131** (0.062)		0.040 (0.468)	0.032 (0.515)
=1 if <i>kura</i> on Holy Family route in 400			0.285** (0.139)		0.007 (0.346)
Observations	408	408	408	408	408
Adjusted R ²	0.007	0.005	0.007	0.007	0.002

Source: Papyri poll tax documents combined with multiple data sources. See sections A1.7, A1.8, and A1.9 in the online appendix for details. Robust standard errors are in parentheses. A constant term is included in every regression.

TABLE V
Summary Statistics - The 1848-1868 Population Census Samples

	Individual-Level			District-Level
	Copts	Muslims	Total	Total
District's Share of Copts in 1848-1868	0.17 (0.10)	0.06 (0.08)	0.07 (0.08)	0.06 (0.08)
=1 if average poll tax high in district in 641-1100 (11 districts; 2682 individuals)	0.42 (0.49)	0.71 (0.45)	0.67 (0.47)	0.73 (0.47)
=1 if Arab settlement in district in 700-969	0.46 (0.50)	0.71 (0.46)	0.69 (0.46)	0.64 (0.48)
Log (urban population) in 300	9.87 (0.92)	9.92 (0.68)	9.91 (0.70)	9.96 (0.71)
=1 if district on Holy Family route in 400	0.29 (0.45)	0.32 (0.47)	0.32 (0.46)	0.28 (0.45)
Percentage of Villages with at least one Coptic monastery in 1200	0.06 (0.10)	0.04 (0.08)	0.04 (0.08)	0.04 (0.08)
=1 if an <i>Autopract</i> estate in district in 600 (35 districts; 6792 individuals)	0.68 (0.47)	0.67 (0.47)	0.67 (0.47)	0.66 (0.48)
=1 if Byzantine garrison in district in 600	0.24 (0.43)	0.30 (0.46)	0.29 (0.45)	0.30 (0.46)
Observations	1121	15520	16641	76

Source: The 1848-1868 census samples combined with other data sources. See sections A1.1, A1.4, A1.7, A1.8, A1.9, and A1.10 in the online appendix for details. Standard deviations are in parentheses.

TABLE VI
Poll Tax, Arab Settlement, and Copts' Population Share in 1848-1868 - OLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Dependent Variable = 1 if Coptic Christian</i>										
=1 if average poll tax high in district in 641-1100	-0.163*** (0.043)	-0.281** (0.099)	-0.551* (0.275)	-0.176*** (0.030)	-0.617* (0.320)					
=1 if Arab settlement in district in 700-969						-0.071** (0.029)	-0.074*** (0.028)	-0.079** (0.036)	-0.057*** (0.020)	-0.091*** (0.026)
Controls for urbanization and religiosity?	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes
Other controls?	No	No	Yes	No	Yes	No	No	Yes	No	Yes
Province of origin FE?	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Number of districts	11	11	11	11	11	76	76	35	76	35
Observations	2682	2682	2682	2682	2682	16641	16641	6792	16641	6792
Adjusted R ²	0.047	0.058	0.060	0.057	0.075	0.017	0.017	0.020	0.078	0.053

Source: The 1848-1868 population census samples combined with multiple data sources. See sections A1.1, A1.3, A1.7, A1.8, A1.9, and A1.10 in the online appendix for details. Standard errors clustered at district level are in parentheses. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01. Constant is included in all regressions.

TABLE VII
Poll Tax, Arab Settlement, and Coptic-Muslim Occupational Differences in 1848-1868 - OLS Estimates

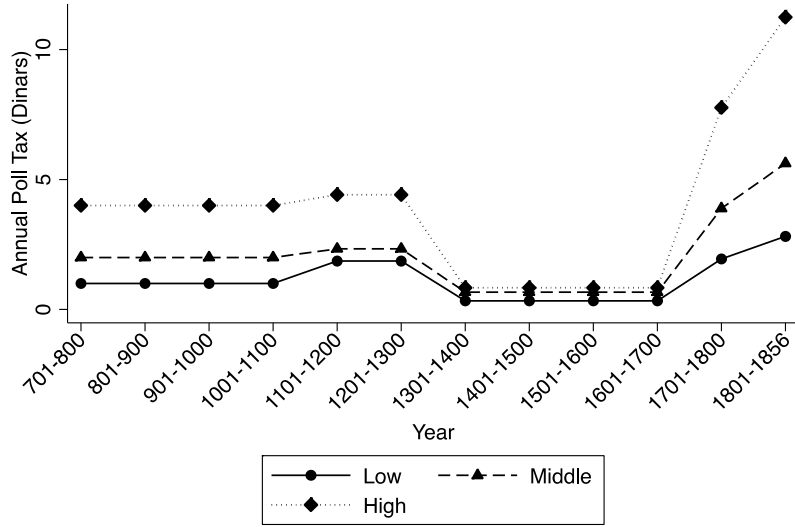
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	=1 if White-Collar1	=1 if White-Collar2	=1 if White-Collar3	=1 if Professional	=1 if High Bureaucracy	=1 if Mid Bureaucracy	=1 if Judiciary, Military	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Panel (A): Average Poll Tax High in District in 641-1100 - No Controls												
=1 if Copt	0.087*** (0.014)	0.003 (0.015)	0.010 (0.024)	-0.005** (0.002)	0.000 (0.000)	0.092*** (0.015)	-0.029*** (0.001)	-0.055*** (0.014)	0.007 (0.010)	0.151** (0.049)	-0.061 (0.039)	-0.100* (0.048)
Copt * Poll tax	0.074* (0.039)	0.129*** (0.034)	0.097* (0.044)	0.003 (0.002)	-0.003* (0.002)	0.074* (0.040)	-0.018*** (0.004)	0.073** (0.024)	-0.032* (0.015)	0.110 (0.137)	-0.143 (0.166)	-0.063 (0.057)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.072	0.026	0.016	-0.002	0.001	0.097	0.036	0.018	0.009	0.065	0.056	0.035

Panel (B): Average Poll Tax High in District in 641-1100 - With Controls												
=1 if Copt	0.875 (0.606)	-1.278 (0.973)	0.928 (1.019)	0.052 (0.044)	-0.007 (0.029)	0.830 (0.564)	-0.294* (0.153)	-1.859*** (0.351)	2.206*** (0.055)	6.541** (2.723)	-7.618*** (0.272)	0.150 (1.882)
Copt * Poll tax	0.349** (0.155)	0.032 (0.221)	0.439* (0.233)	0.011 (0.009)	-0.001 (0.006)	0.339** (0.148)	-0.050 (0.033)	-0.267*** (0.070)	0.406*** (0.015)	1.701*** (0.533)	-2.268*** (0.155)	0.129 (0.391)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.081	0.026	0.018	-0.003	-0.001	0.111	0.034	0.019	0.011	0.089	0.077	0.037
Panel (C): Arab Settlement in District in 700-969 - No Controls												
=1 if Copt	0.104*** (0.021)	0.038 (0.023)	0.056* (0.032)	-0.001 (0.002)	-0.002* (0.001)	0.107*** (0.022)	-0.022*** (0.005)	-0.045** (0.008)	0.018 (0.012)	0.212*** (0.033)	-0.158*** (0.049)	-0.110*** (0.040)
Copt * Arab settlement	0.153*** (0.055)	0.183*** (0.064)	0.151** (0.070)	-0.002 (0.002)	-0.002 (0.002)	0.157*** (0.055)	-0.004 (0.008)	0.035** (0.016)	-0.032** (0.015)	-0.059 (0.058)	-0.037 (0.093)	-0.055 (0.046)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Districts	76	76	76	76	76	76	76	76	76	76	76	76
Observations	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641
Adjusted R ²	0.087	0.035	0.028	0.002	0.004	0.116	0.035	0.011	0.017	0.039	0.105	0.060
Panel (D): Arab Settlement in District in 700-969 - With Controls												
=1 if Copt	0.051 (0.213)	-0.166 (0.280)	-0.060 (0.297)	-0.006 (0.016)	0.026 (0.019)	0.031 (0.218)	-0.092*** (0.026)	-0.125 (0.087)	0.106* (0.058)	-0.438* (0.239)	0.157 (0.423)	0.342* (0.173)
Copt * Arab settlement	0.098 (0.069)	0.082 (0.087)	0.080 (0.089)	-0.001 (0.002)	-0.003 (0.002)	0.101 (0.071)	-0.018*** (0.006)	0.002 (0.022)	-0.002 (0.011)	-0.122* (0.061)	0.102 (0.124)	-0.060 (0.045)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Districts	35	35	35	35	35	35	35	35	35	35	35	35
Observations	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792
Adjusted R ²	0.062	0.024	0.024	0.001	0.006	0.083	0.047	0.015	0.015	0.063	0.109	0.068

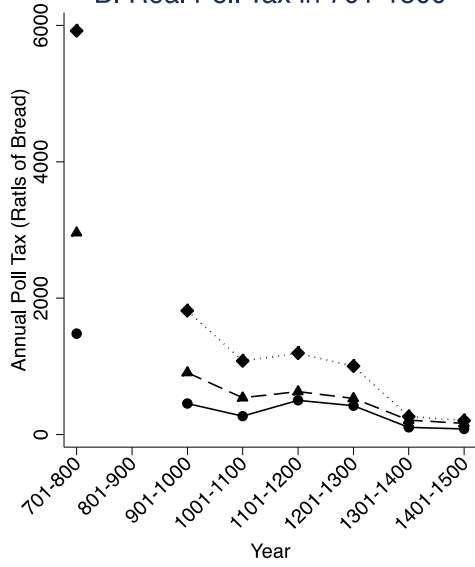
Source: The 1848-1868 population census samples combined with multiple data sources. See sections A1.1, A1.3, A1.7, A1.8, A1.9, and A1.10 in the online appendix for details. Standard errors clustered at the district of origin level are in parentheses. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

FIGURE I
De Jure Poll Tax in 701-1856

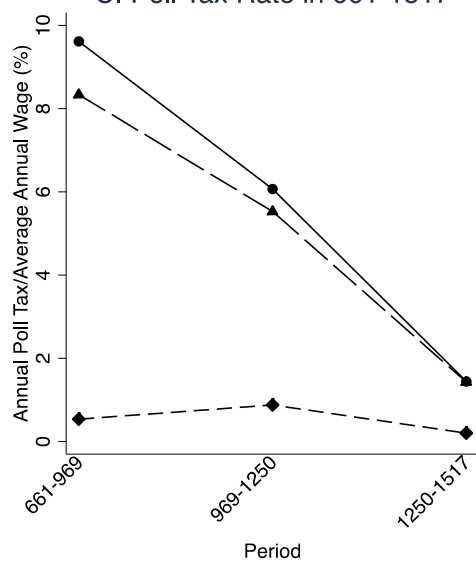
A. Nominal Poll Tax in 701-1856



B. Real Poll Tax in 701-1500

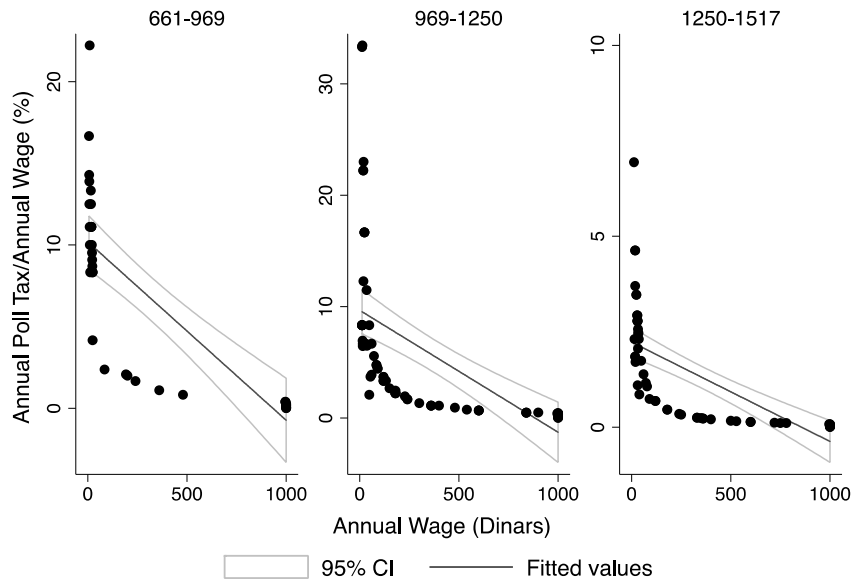


C. Poll Tax Rate in 661-1517



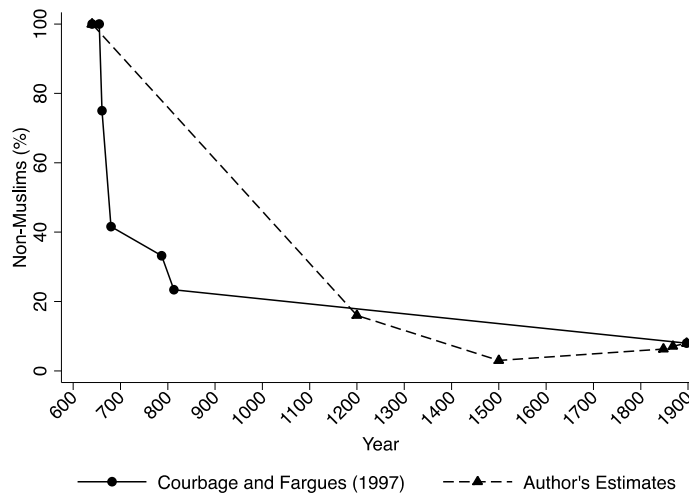
Source: See section A1.6 in the online appendix.

FIGURE II
De Jure Poll Tax Rate and Wages in 661-1517



Source: See section A1.6 in the online appendix. Fitted regression lines are (robust standard errors are in parentheses): (1) 661-969: $y = -0.011 (0.001) + 10.187 (0.911) x$ [$N = 35$; $R^2 = 0.59$]; (2) 969-1250: $y = -0.011 (0.002) + 9.666 (1.310) x$ [$N = 77$; $R^2 = 0.32$]; (3) 1250-1517: $y = -0.003 (0.000) + 2.228 (0.235) x$ [$N = 60$; $R^2 = 0.47$].

FIGURE III
Islamization of Egypt in 641-1868



Source: See text and section A1.4 in the online appendix.

FIGURE IV
Effects of Poll Tax in a Static Environment

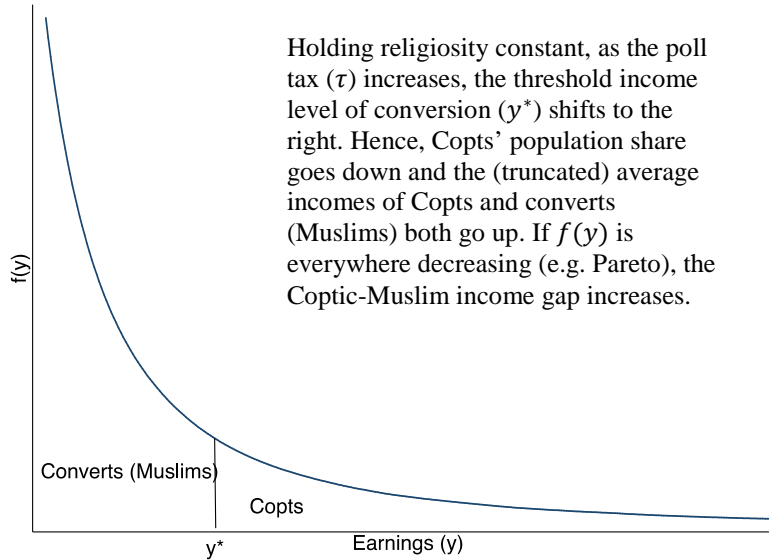
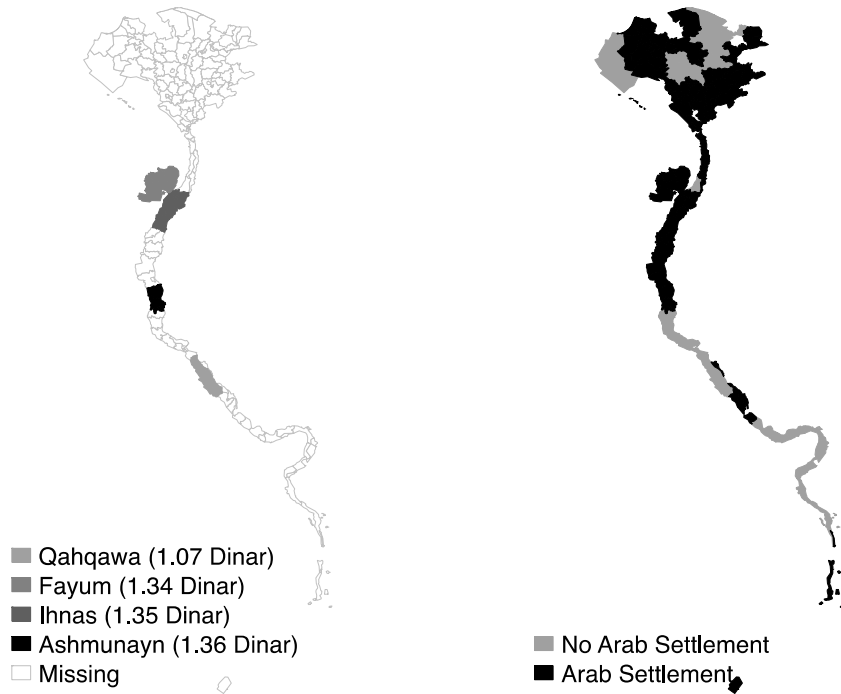


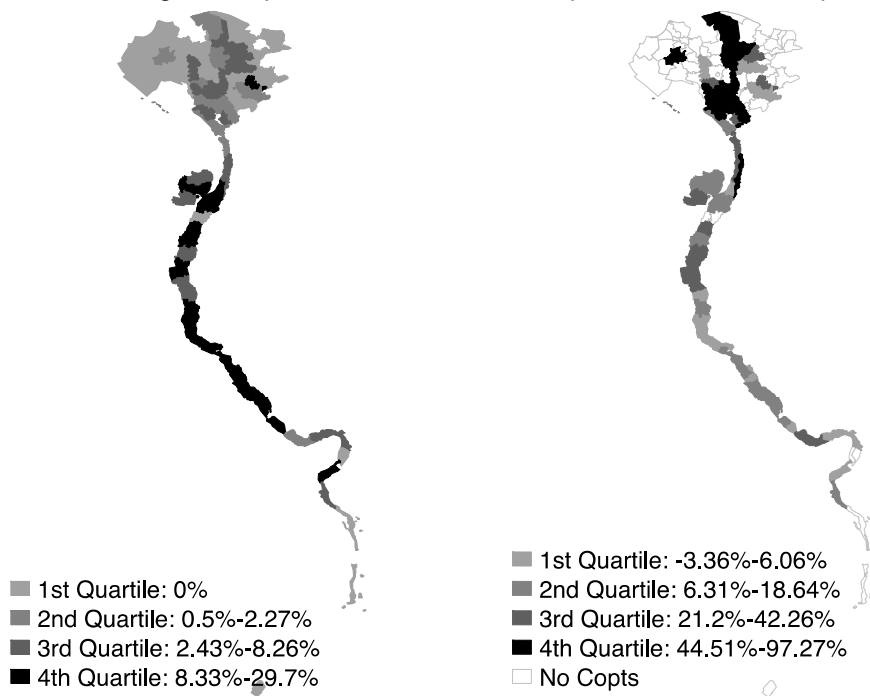
FIGURE V
Spatial Distribution of Key Variables

A. Average Poll Tax in 641-1100

B. Arab Settlement in 700-969



C. Percentage of Copts in 1848-1868 D. Coptic-Muslim SES Gap in 1848-1868



Source: Panel (A) is from papyri poll tax registers and receipts, Panel (B) is from Arab settlement data, and Panels (C) and (D) are from the 1848-1868 population census samples. The Coptic-Muslim SES gap is the difference between Copts and Muslims in the population share of professionals and bureaucrats (white-collar1 = 1). See sections A1.1, A1.7, A1.8, and A1.10 in the online appendix for details.

APPENDIX FOR ONLINE PUBLICATION

**ON THE ROAD TO HEAVEN: SELF-SELECTION,
RELIGION, AND SOCIOECONOMIC STATUS**

Mohamed Saleh

December 2, 2015

Abstract

The appendix is divided into three parts. First, I describe the data sources that are employed throughout the paper. Second, I present the results of the robustness checks section in addition to other results that I omitted from the paper due to space limitations. Third, I present the proofs of the conceptual framework.

A1. Data Sources

A1.1. Egypt's 1848 and 1868 Population Census Samples

The 1848 and 1868 population censuses are the earliest comprehensive individual-level data source on religious affiliation and occupational attainment in Egypt and among the earliest individual-level population censuses from any non-Western country. They contain information on a wide range of variables including religious affiliation, occupation, nationality, ethnicity, gender, age, household relationships, and dwelling characteristics. I digitized nationally representative samples of the two censuses (around 80,000 individuals in each sample) from the original Arabic manuscripts at the National Archives of Egypt. The sampling rate is 8-10 percent in Egypt's two major cities, Cairo and Alexandria, and 1 percent in other provinces. Sampling strategy is described in Saleh (2013).

I pooled the samples from both years and restricted the analysis to Egyptian local free Coptic and Muslim active men of a rural origin who are at least 15 years of age with non-missing age, religion, occupation, and district of origin. The sample restrictions aim at limiting the sample to the likely descendants of Egypt's pre-641 population who either converted to Islam or remained Coptic Christian. First, I restrict the sample to "Egyptians," or individuals who are listed in the census manuscripts as *dakbil al-bukuma* (under the control of the Egyptian government); this excludes foreigners such as Turks, Levantines, Armenians, Ottoman Greeks, North Africans, Asians, Americans, and Europeans. Second, I restricted the sample further to "locals," which excludes certain groups of "Egyptians" who are not originally from the Nile Delta and Valley (North of Nubia), namely, Arab Bedouins, Nubians, Sudanese, and Abyssinians.¹ Third, I included only individuals of a rural origin. The place of origin in the census manuscripts refers to the place of family's origin (i.e. it is not necessarily the place of birth). This excludes individuals whose families are from large cities and deserts. This aims at mitigating the potential cross-district movement of an individual's ancestors in 641-1868 under the presumption that most migration was directed to large cities.²

In order to measure socioeconomic status, I first manually translated and coded all occupational titles in the census manuscripts using the Historical International Standard Classification of Occupations (HISCO). I then classified the occupational codes into the twelve occupational categories for which I created indicator variables in the empirical analysis.

¹ Arab Bedouins (*urban*) in the 1848-1868 census samples are likely (descendants of) Arab tribes that immigrated to Egypt during the eighteenth century. That was the second large wave of Arab settlement in Egypt after the one in 700-969 that I exploit in the paper.

² Specifically, I excluded individuals whose family origin is from urban provinces (Cairo, Alexandria, Rosetta, and Damietta) or border provinces (Al-Arish, Al-Qusayr, and Western Desert Oases). District of origin is the district that an individual's *family* comes from. Children in the 1848 census, but not in the 1868 census, inherited their father's district of origin (Saleh, 2013).

A1.2. Estimating Coptic-Muslim Difference in Adult Mortality (Life Expectancy) from the 1848-1868 Population Census Samples

The handbook of the UN Population Division (2002, pp. 5-20) outlines a method for estimating adult mortality from any two consecutive censuses, with an interval of x years, where x is a multiple of 5. The method uses the relative sizes of age cohorts (defined in groups of 5-year intervals) in the two censuses in order to estimate the probability of survival to an age $y + x$, conditional on being of age y in the first census. A slightly different method, the synthetic survival ratio, calculates the growth rate of each age cohort in order to make the method applicable to any census interval, i.e. not necessarily multiple of 5. I applied the two methods to the census samples of 1848 and 1868 (excluding the oversamples of non-Muslims in Cairo) in order to estimate adult mortality by religious group. A few caveats arise though: (a) the time interval separating the two Egyptian censuses (20 years) is too long to apply these estimation methods; ideally, the interval should be around 5 or 10 years, (b) I do not have 100-percent samples of the two censuses, and hence, there is sampling error in estimating the size of age cohorts, and (c) there is a problem of age misreporting; in particular, age heaping and age exaggeration, which is typical in historical censuses (and even in contemporary censuses from developing countries). Age misreporting is likely correlated with SES and thus may differ in a non-random way by religious group (Muslims are more likely to misreport their true age). In order to mitigate age misreporting, I defined age groups in intervals of 10 years instead of 5 years. The estimation results are shown in Table (A.1).

TABLE A.1
Estimating Adult Mortality from the 1848-1868 Census Samples

	Age Group	Estimated Size in 1848	Estimated Size in 1868	Estimated Life Expectancy (Method 1)	Estimated Life Expectancy (Method 2)
Copts	0-9	90,740	117,801	NA	NA
	10-19	32,981	51,600	41.45	42.90
	20-29	33,290	52,466	44.59	44.59
	30-39	40,100	36,657	30.44	32.20
	40-49	27,031	26,187	25.46	24.72
	50-59	15,325	25,345	22.61	21.02
	60-69	11,406	12,595	17.67	16.10
	70-79	7,849	10,899	11.52	9.03
	80+	7,094	5,107	NA	NA
Muslims	0-9	1,148,827	1,458,614	NA	NA
	10-19	377,685	603,264	43.44	44.82
	20-29	406,293	622,071	49.08	48.73
	30-39	457,208	481,535	32.97	32.65
	40-49	348,101	360,926	25.90	23.79
	50-59	243,063	288,588	21.83	19.98
	60-69	171,180	195,387	16.88	13.53
	70-79	99,442	111,561	12.26	8.68
	80+	125,336	78,559	NA	NA

Source: The 1848-1868 population census samples. See sections 3.2 in the main text and sections A1.1 and A1.2 in the online appendix for details.

A1.3. Data on Religion and Occupations in 641-969 from the Arabic Papyrology Database (APD)

A1.3.1. Data Construction

Arabic papyri documents, most of which were discovered in the dry-climate Egypt's Nile Valley since the late nineteenth century, remain a mostly unpublished source of information on the micro-level characteristics of Egypt's population in the medieval period, especially in early Islamic Egypt in 641-969 (Umayyad and Abbasid period). An ongoing research project entitled the Arabic Papyrology Database (henceforth, APD) attempts at the digitization of all Arabic papyri that were ever

published.³ There are various types of documents in the APD, namely, (1) protocols, (2) legal texts (e.g. marriage contracts, sale contracts), (3) administrative texts (e.g. official letters, lists, and accounts), (4) private texts (e.g. private letters, business letters), and (5) literary texts.⁴

I used all documents in the APD in order to construct an individual-level dataset on occupational titles and religious affiliation, where I inferred religion from worker's name because converts adopted an Arabic name upon conversion.⁵ I included in my sample *every* male with a non-missing name and occupational title who is mentioned in *any* APD document. This resulted in a final sample of 402 males with religious affiliation and occupational title in 641-969. This is the APD sample that I used in constructing Table (III).

A few notes on the APD sample construction are in order:

(1) As the occupational title of "landholding farmer" is almost never mentioned in the papyri [landless farmers (*agiri*) are explicitly mentioned though], I inferred if a male with a non-missing name is a landholding farmer if he is recorded as paying a positive land tax in papyri land tax registers and receipts. Notice that the vast majority of farmers in Egypt were assigned land plots on which they held usufruct rights and paid a positive land tax.

(2) Because my goal is to compare Copts to Egyptian Muslims (converts), I ideally want to exclude non-Egyptian Muslims (mainly, Arabs and Turks) from my sample. For this purpose, I excluded individuals in top government posts, namely, Caliphs, viceroys, and top government administrators, who were certainly Arab settlers in

³Out of more than 150,000 Arabic papyri that were ever *discovered*, there are only 2,500 documents (less than 2 percent) that were published since 1900. The APD, which was launched in 2004, has, as of April 2015, digitized 2,068 documents or about 83 percent of published papyri.

⁴ Papyrus is a material of writing that was most prevalent in Egypt until 969. The APD documents are written on various writing materials besides papyrus including paper, ostrakon, woodtable, waxtable, stone, parchment, leather, bone, and textile. All those documents are included in the data collection.

⁵ A papyri list of converts from 700-900 (Morimoto 1981, p. 131) indicates that a convert had to adopt an Arabic name and become a client of an Arab patron (tribe).

641-969. I am unable though to identify all Arab settlers because converts adopted Arabic names upon conversion.

(3) Although there are APD documents from 969-1517, I restricted the sample to 641-969 because (a) there are fewer papyri after 969 (the Fatimid Conquest of Egypt) as paper increasingly replaced papyrus as the writing material and (b) most Copts' conversions to Islam took place in 641-813 (or in 641-1200), and thus the early Islamic period is arguably the most important to examine.

(4) I inferred religious affiliation from names *only*. In particular, I chose to *not* use any other contextual information (such as occupation) in the inference of religion in order to mitigate *non-random* measurement error. Moreover, I limited the sample to names that are *certainly* Muslim or Christian based on list of names in the 1848-1868 census samples and on papyrologists' interpretations of the text.

A1.3.2. Addressing Concerns about the APD Sample

There are at least three concerns about the APD sample that I must address. First, there is a concern about the national representativeness of the sample, because (a) it may be non-random on location; 65 percent of the sample is from unknown locations inside Egypt, 34 percent from the Nile Valley, and only less than one percent comes from the (more humid) Nile Delta and (b) it may be non-random on SES, because it likely over-represents males of high SES who had a higher chance of appearance in the documents. Second, I may misidentify Copts and converts because I cannot tell if a Muslim name is (a descendant of) a convert or an Arab settler and, similarly, I cannot tell if a Christian name is Coptic or non-Coptic. Third, there is measurement error in occupational outcomes because I inferred if an individual is a landholding farmer from the incidence of payment of a positive land tax.

While I cannot rule out these concerns, there are arguments that mitigate each of them. On the first concern, even if the APD sample is mostly from the Nile Valley (which is not necessary because location is missing in 65 percent of the cases), the population census samples in 1848-1868 reveal that the Nile Valley had higher

Copts' population share and smaller, yet positive and statistically significant, Coptic-Muslim SES difference than the Delta. Hence, the APD sample in the Nile Valley would, if anything, *underestimate* the true Coptic-Muslim SES difference. More important, 72 percent of the sample is from *administrative* documents, namely, lists (54 percent) and receipts of payment (18 percent). Those are arguably *neutral* documents in which every individual had an equal chance of appearance. And while the remaining 28 percent of the sample are from contracts (sale, lease, marriage, divorce, and written obligation contracts) and private and business letters, where selection-on-SES is more likely, the results do not change if I limit the sample to administrative lists and receipts. Finally, even if the APD sample is not representative of the *level* of the population share of each occupational outcome within each religious group, it may be still representative of the Coptic-Muslim *difference* in the population share of each outcome under the assumption that non-random selection is the same within each group.

On the second concern, non-Muslims in the APD sample are almost certainly Copts because those were the vast majority of non-Muslims (about 96 percent of Christians in 1200, based on the dataset on Christian churches and monasteries that I describe in section A1.4) and because non-Coptic Christians and Jews rarely settled in the Nile Valley where 34 percent of the APD sample is from.⁶ Moreover, even if I misidentify Arab settlers as Egyptian converts, this would *overestimate* the share of high-SES workers among converts since Arab settlers in 641-969 were more likely to work in high-SES occupations as they were the political elite. This would in turn underestimate the true Coptic-Muslim SES difference; i.e. it operates against finding a positive Coptic-Muslim SES difference.

⁶ Jews were mostly urban and Mikhail (2004, p. 134) states that there is no literary or documentary evidence on *Melkites*' (non-Coptic Christians) presence in the Nile Valley in the post-Conquest period. There were only 7 *Melkite* churches in all Egypt in 600 (Mikhail 2004, p. 48) and in 1200, 91 percent of non-Coptic (*Melkite* and Armenian) Christian churches and monasteries were in the Nile Delta and major cities (Cairo, Alexandria, and Damietta).

Finally, on the third concern, the share of males who are assigned as landholding farmers in the APD sample is similar to the share of farmers within each religious group in the 1848-1868 population census samples, which lends support to the procedure of inferring the “landholding farmer” job from paying a positive land tax.

A1.3.3. Historical Evidence on the Findings in Table (III)

The occupational differences that I documented in Table (III) are supported by historical evidence. Copts’ over-representation in mid-low bureaucracy from 641 to, at least, 1900 is well documented in history (Tagher, 1998 [1951]; Sheikho, 1987; Samir, 1996; Amer, 2000). According to Tagher (1998 [1951], p. 142), “*the condition of the Copt did not change during the six centuries preceding (the nineteenth century)... His work, tax collecting, was the basis of his existence and his only hope to accumulate wealth.*” Circa 1000, Al-Muqaddasi (1877, p. 183) noted that, “*scribes in the Levant and Egypt are Christians.*” A millennium later, Lord Cromer, the British Consul of Egypt (1883-1908), observed, “*When the English took Egyptian affairs in hand, the accountants in the employment of the Egyptian government were almost exclusively Copts,*” (Tagher, 1998 [1951], p. 213). Historical evidence also indicates that Copts’ advantage over Muslims was *not* limited to mid-low bureaucracy. Raymond (1973, pp. 456-59) lists artisanal occupations where Copts were over-represented in eighteenth-century Cairo (carpenters, tailors, weavers) and the list is essentially the same as the set of occupations that I observe in 641-969 and in 1848-1868. As for Muslims, political and religious white-collar jobs were restricted to them by Islamic law, although those were not necessarily accessible to Egyptian converts. There is also historical evidence that Muslims were over-represented in commerce; under the *Mamluks* in 1250-1517, for example, all merchants of spices were Muslims (Tsugitaka, 2006).

A1.4. Data on Churches and Monasteries in 1200 and 1500

A1.4.1. Data Construction

I constructed a village-level dataset on the number of Christian (both Coptic and non-Coptic) churches and monasteries in 1200 and 1500 from two independent

medieval sources, (1) Abul-Makarim's (1984 [1200]) *History of Churches and Monasteries*, which provides a comprehensive list of Christian churches and monasteries in Egypt at the end of the twelfth century, and (2) Al-Maqrizi's (2002 [1500]) *Sermons and Considerations in Examining Plans and Monuments*, which listed Christian churches and monasteries in Egypt in the fifteenth century. There are two versions of Abul-Makarim's book. The first is *The Churches and Monasteries of Egypt and Some Neighboring Countries* that was edited by Evetts and was first published in an English translation from the original Arabic manuscript in 1895 where it was wrongly attributed to "Abu-Saleh, the Armenian." That version listed Christian churches and monasteries in the Nile Valley only. The second version, which I used in the paper, is by Anba-Samuel, who edited a two-volume version of the book in 1984; the first volume included the missing part of the book about the Nile Delta, whereas the second volume was a re-publication of Evetts' version on the Nile Valley. The book is now believed to belong to the twelfth-century Coptic chronicler, Abul-Makarim.

Both sources listed Christian churches and monasteries at the village level, which is smaller than districts in 1848-1868. I thus matched villages in both sources to villages in 1848-1868 according to the administrative division of the 1897 census, where I either manually searched for villages in the 1897 census or referred to Ramzi (1994 [1954]). I was therefore able to calculate the number of Coptic and non-Coptic Christian churches and monasteries in each village in 1200 and 1500.

I used this dataset in order to construct three variables. (1) The share of villages in all Egypt with at least one Christian church or monastery in 1200 and 1500 (both Coptic and non-Coptic), which I used as estimates of non-Muslims' population share in 1200 and 1500 in Figure (III), under the presumption that a village with at least one church/monastery is 100 percent non-Muslim and that a village without any church or monastery is 100 percent Muslim. I supplemented these estimates by the 1848-1868 census samples where non-Muslims were around 7 percent of the population. (2) The share of villages in each district with at least one Coptic church

or monastery in 1200 and 1500, which I used as estimates of Copts' population share in district in the robustness checks in section 4.6.3 [Table (A.7)]. (3) The share of villages in each district with at least one Coptic monastery in 1200, which I used as a control variable (as a proxy for the generosity of the Coptic transfer system) in the empirical analysis [Tables (VI) and (VII)]. The denominator in all three measures, the total number of villages (either in all Egypt or in each district), was computed as of 1477 in order to mitigate the concern about the emergence of new villages between 1200 (or 1500) and 1848-1868. This was based on Ramzi's (1994 [1954]) list of "old" (i.e. pre-1477) and "new" (i.e. post-1477) villages, which is in turn based on a cadastral survey published in Ibn Al-Jay'an's (1477) *al-tuhfa al-saniya bi asmaa' al-bilad al-misriya* (List of Names of Egyptian Localities).

A1.4.2. Data's Contribution to Historical Literature

The dataset on Christian churches and monasteries in 1200 and 1500 makes two contributions to the historical literature. First, it contributes to the historical debate on the timing of Egypt's Islamization. Second, it allows me to trace the evolution in 1200-1868 of the religious composition of Egypt's Christian population between Copts and non-Coptic Christians. Below, I discuss each of these contributions.

A1.4.2.1. Historical Debate on Egypt's Islamization

There are no statistics on Egypt's religious composition before 1897, the year of the first *published* population census with information on religious affiliation (this is apart from the 1848 and 1868 *unpublished* population census manuscripts from which I digitized nationally representative samples). However, the historical facts are as follows. Christianity reached Egypt in the first century and the Church of Alexandria was a major theological center since the second century (Bowman, 1989, pp. 191-202). The last pocket of paganism in Egypt was Christianized in the mid-sixth century (Bowman, 1989, p. 192). The Coptic Christian Church of Alexandria, followed by the Egyptian masses, separated from the Byzantine church because of a theological debate in 451 (Tagher, 1998 [1951], pp. 1-7; Atiya, 2005, pp. 71-76). But

Greeks and Hellenized Egyptians remained loyal to the Byzantine church forming a parallel church, the *Melkite* Church of Alexandria. Condemned as heretics by the Byzantines, Copts suffered from persecution until the Arab Conquest in 639-641 (Bowman, 1989, p. 198; Atiya, 2005, pp. 87-99). Hence, on the eve of the Conquest, Coptic Christians constituted the vast majority of Egypt's population, whereas non-Coptic Christians (mostly, *Melkites*) and Jews were two small minorities (Lane-Poole, 1969, p. 2; Tagher, 1998 [1951], p. 4; Wilfong, 1998, p. 175).⁷ During the twelve and a half centuries that followed the Arab Conquest, Non-Muslims shrank from 100 percent of the population in 641 to 7 percent in 1897.

Determining the date at which non-Muslims shrank into a minority is a very old debate in Egyptian history since at least the work of the renowned fifteenth-century Egyptian historian, Al-Maqrizi. There are two viewpoints on this debate. One tradition (Al-Maqrizi, 2002 [1500]; Dennett, 1950; Lane-Poole, 1969; Mikhail, 2004) argued that Egypt was Islamized by the ninth century because of the suppression of the Coptic tax revolts that erupted between 726 and 866. This view seems to be supported by a quantitative study by Bulliet (1979), who used family lineages of a sample of prominent individuals in medieval narratives to identify the date at which an individual's ancestors converted to Islam and adopted an Arabic name, finding that conversions peaked in the ninth century. Another tradition (Wiet, 1927; Little, 1976; El-Leithy, 2005; Werthmuller, 2010) argued, to the contrary, that Copts remained in the majority until the fourteenth century, where an unprecedented wave of state persecution triggered mass conversions to Islam among Copts. The only other quantitative study (besides Bulliet's study) is that of Courbage and Fargues (1997, pp. 27-28). The authors used information on total poll and land tax revenues in order to estimate the share of the non-Muslim population. These are the estimates to which I compare my own estimates in Figure (III).

⁷ Non-Coptic Christians were mostly *Melkites*. There were also other minor non-Coptic and non-*Melkite* Christian factions before 641 that were later assimilated into either the Coptic or *Melkite* Churches (Mikhail, 2004, pp. 46, 48).

A1.4.2.2. Documenting the Religious Composition of Egypt's Non-Muslim Population in 1200-1868

Data on Christian churches and monasteries indicate that only 4 percent of those institutions were non-Coptic, mostly, *Melkite* and Armenian, in 1200 and in 1500. This is equal to the percentage of non-Coptic Christians out of all Christians (Coptic and non-Coptic) in the 1848-1868 census samples, indicating that their population share persisted between 1200 and 1868. Their ethnic composition expanded in 1848-1868 though beyond *Melkites* (Oriental Greek Orthodox) and Armenians to include Greeks, Levantines, and Europeans. I do not have estimates of Jews' population share before 1848-1868, where they constituted 2 percent of the non-Muslim population, but it seems plausible that their population share persisted as well.

To sum up, it appears that Copts constitutes the vast majority of non-Muslims in 1848-1868 as in 641, 1200, and 1500, with non-Coptic Christians and Jews forming two small minorities. That indicates that all three groups experienced equal rates of decline in their relative shares out of the *total* population since the Arab Conquest. However, because there were major in- and out-migration waves of non-Coptic Christians and Jews in 1200-1868, it is impossible at this stage to determine the exact causes of the decline in the population shares of the latter groups.

A1.5. Taxes and Benefits in 641-1856 [Table (I)]

The composition of taxes and benefits in Table (I) is based on Morimoto (1981, pp. 51, 140, 257-263), Rabie (1972, pp. 73-132), Ismail (1998, pp. 153-208), and Mahmoud (2009). The actual tax system in 641-750 may have deviated though from that depicted in Table (I), before jurists established the *canonical* form of Islamic taxation around 750. There are three manifestations of this deviation:

(1) Although converts in 641-750 were in principle exempted from the poll tax and were subject to a reduced land tax (tithe, *ushur*) that was less than half of the *kbharaj* tax on Coptic landholders (Frantz-Murphy 1999, p. 238), Muslim rulers, confronted by sharp declines in tax revenues due to widespread conversions, often

did not exempt converts from poll or *kharaj* land taxes during that period, with the reduced *ushur* land tax being likely limited to Arabs (Morimoto, 1981, pp. 66-91).

(2) It is not certain if poll and *kharaj* land taxes in 641-750 were the *same* tax or *different* taxes. The reason is that there is confusion in medieval narratives and papyri tax registers and receipts in 641-750 over the usage of the two Arabic terms for poll and land taxes, *jizya* and *kharaj*. Faced by this confusion, earlier historians such as J. Wellhausen, Carl H. Becker, A. Grohmann, and H. I. Bell argued that the two taxes were synonyms where they simply meant a *tribute* collected from the village as a whole, rather than distinct individual taxes, and that the distinction occurred only later on with the fiscal reform of 720 under the Umayyad Caliph, Umar II. Daniel C. Dennett (1950, pp. 62-103) argued, to the contrary, that the distinction between the two taxes existed from 641 and that both taxes were individual taxes. Kosei Morimoto attempted to reconcile the two viewpoints by arguing that the individual-level assessment of poll and land taxes, which is manifested in papyri tax records, was the basis for estimating each community's tribute. In my view, the papyri tax records provide decisive evidence that both taxes were collected individually. For more information, see the discussion in Morimoto (1981, pp. 51-57).

(3) It is not certain that the *zakat* tax on rich Muslims was actually enforced in 641-750. Sijpesteijn (2013, pp. 181-99) argues that the institutionalization of *zakat* as a tax paid to the state rather than an informal transfer paid directly by rich Muslims to poor Muslims might have only occurred around 750. Another viewpoint argues that the *zakat* was first institutionalized under Saladin in 1174-1193.

A1.6. Data on De Jure Poll Tax and Wages in 641-1517

The de jure annual nominal poll tax amounts in Panel (A) of Figure (I) are based on (1) Muslim jurists' handbooks in 701-1100 [Abu-Youssef (1979, pp. 122-4) for the Umayyad and Abbasid periods in 701-900 and Al-Qadi Al-Nu'man (1963, pp. 379-381) for the Fatimid period in 900-1100] (2) governmental officials' handbooks of administration in 1101-1700 [Ibn-Mamati (1991, p. 318) for the Ayyubid period in

1101-1300 and Al-Qalqashandi (1914, p. 462) for the Mamluk and early Ottoman periods in 1301-1700], and (3) Ottoman Egypt's tax tabulations in 1701-1856 [Mahmoud (2009a, pp. 112, 136)]. Two viewpoints prevailed among jurists on the tax amount. Both the *Hanafi* Sunni School (official under the Abbasids in 750-969 and the Ottomans in 1517-1856) and the *Ismaili* Shiite School (official under the Fatimids in 969-1171) imposed the tax according to three income-brackets: one dinar on manual or low-income workers, two dinars on the middle-income, and four dinars on the rich (*Hanafi*: Abu-Youssef, 1979, pp. 122-4; *Ismaili*: Al-Qadi Al-Nu'man, 1963, pp. 379-381), whereas the *Shafi'i* Sunni School dictated that the tax was fixed at one dinar per person (Al-Shafi'i, 2001, pp. 423-30). Although the Ayyubids (1171-1250) and the Mamluks (1250-1517) officially endorsed the *Shafi'i* School, they often adhered to the three-bracket formula (Mahmoud, 2009a; pp. 32-37).

Relatedly, Muslim jurists disagreed as to the exemption of the poor from the poll tax. While the *Hanafi* Sunni School dictated that the poor were exempted from the tax, both the *Ismaili* Shiite and the *Shafi'i* Sunni schools did not grant such exemption. Using evidence from the Cairo Geniza on destitute Jews who paid the poll tax, Goitein (1963) and Alshech (2003) argued that the Ayyubids applied the *Shafi'i* view. Importantly, under both viewpoints any *working* adult male is considered non-poor and is thus *not* exempted from the poll tax.

Nominal poll tax amounts are in Islamic dinars weighing 4.25 grams of gold. Those dinars remained in circulation until they were replaced in 1425 with *Asbrafi* dinars that weighed 3.45 grams. Since the nominal poll tax is recorded in each source in a different currency, I transformed the amounts into Islamic dinars in Panel (A) of Figure (I) as follows:

1. In 701-1100, I used the exchange rate of 12 Dirhams: 1 Dinar under the Umayyads and Abbasids (661-969) from Ashtor (1969, p. 77).
2. In 1101-1300, I used the following exchange rates:
 - a) 9 Dirhams: 1 Dinar under Saladin (1171-1193) in Ashtor (1969, p. 122).

b) 24 Kirats: 1 Dinar from Zambaur (2013).

c) 72 Habbas: 1 Dinar from Goitein (1967, p. 371).

3. In 1301-1700, I used the exchange rate of 30 Dirhams: 1 Dinar under Barquq (1382-99) from Ashtor (1969, p. 277).

4. In 1701-1800, I used the exchange rate of 45 Nisfs: 1 Sharifi Dinar in 1608 from Mahmoud (2008, p. 112). The Sharifi Dinar weighed 3.45 grams of gold and is thus equivalent to 0.81 Islamic Dinars.

5. In 1801-1856, I used the exchange rate of 6 Piasters: 1 Mahbub Dinar in 1807 from Mahmoud (2009, p. 123). The Mahbub Dinar weighed 3.45 grams of gold and is thus equivalent to 0.81 Islamic Dinars.

In order to translate the nominal annual poll tax amounts into real values in Panel (B), I adjusted the nominal amounts by the purchasing power of the dinar in *ratls* of bread as recorded in Ashtor (1969, p. 465). The *ratl* in Cairo weighed 450 grams.

Panel (C) of Figure (I) plots the poll tax *rate* in 661-1517. I used Ashtor (1969, pp. 90-4, 223-9, 372-81) in order to collect individual-level data on occupational titles and wages in each of the main periods in medieval Egypt's history, where I classified each occupation into one of the three income-brackets according to the criteria in Abu-Youssef (1979, p. 122-4) and assigned to each occupational title the *de jure* poll tax amount that was in effect in each historical period, where the *de jure* nominal annual poll tax amounts are taken from Abu-Youssef (1979, pp. 122-4) for the Umayyad and Abbasid period (661-969), Al-Qadi Al-Nu'man (1963, pp. 379-381) for the Fatimid period (969-1171), Ibn-Mamati (1991, p. 318) for the Ayyubid period (1171-1250), and Al-Qalqashandi (1914, p. 462) for the Mamluk period (1250-1517). I then computed within each income bracket and period the average *de jure* annual poll tax *rate* defined as the average *de jure* nominal annual poll tax divided by the average nominal annual wage. Those averages are plotted in Panel (C).

Figure (II) plots the full scatterplot of the *de jure* poll tax rate (= *de jure* poll tax divided by wage) and wages in each historical period using the same dataset as above.

A1.7. Data on Poll Tax in 641-1100

I collected all available information in Greek and Arabic papyri sources on individual-level annual nominal poll tax payments (in Islamic dinars) in 641-1100 (N = 552). I know the location (*kura*) of the papyri document in a smaller sample (N = 408) in four *kuras* in the Nile Valley. The data come from two sources: (1) Fragments of Greek papyri poll tax registers of the *kura* of *Qabqawa* (pre-641, *Aphrodito*) in 703-733 in Morimoto (1981, pp. 67-79) and (2) Fragments of Arabic papyri poll tax registers and receipts in the APD for the three *kuras* of *Fayum* (pre-641, *Arsinoe*) in 641-1005, *Ibnas* (pre-641, *Herakleopolis*) in 701-900, and *Al-Asbmunayn* (pre-641, *Hermopolis*) in 731-1100, besides unknown locations. I depict the full distribution of poll tax payments by *kura* in Figure (A.1).

I used this dataset for three purposes. (1) I computed the average poll tax payment in *kura* in 641-1100, which I mapped into 11 districts in 1848-1868, and I used an indicator variable indicating if average poll tax was “high” (> 1.3 dinars, the cross-district average) in district as the first measure of the poll tax in the empirical analysis. (2) A few poll tax registers from three sub-districts in the *kura* of *Qabqawa* contain information on both poll and total land taxes, which is the restricted sample (N = 230) that I used in Table (II). (3) I computed the national-level average poll tax payment using the full sample (N = 552) which I used in section 3.1.2.

A1.8. Data on Arab Settlement in 700-969

Data on Arab settlement are from Al-Barri (1992) who compiled information from Arabic medieval sources (most important source is Al-Maqrizi’s book on Egypt’s Arab tribes) in order to trace the destinations of Arab tribes that settled permanently in Egypt between 700 and 969. Destination is recorded at the *kura* level (although in a few cases, I am able to determine the district). I focus on permanent Arab settlers and so I excluded seasonal migration waves (*irtiba*) in 641-700.⁸

⁸ *Irtiba*’ is from *rabi*’, the Arabic word for “spring,” and refers to Arabs’ policy in 641-700 whereby Arab tribes were encouraged to settle temporarily during the spring season in any Egyptian village of

A1.9. Data on Pre-641 Control Variables

1. Log (urban population) in Roman Egypt (in 300) is from Wilson's (2011, pp. 185-187). These are estimates of the population size of Egypt's Greek cities (*metropolis*) and of capitals of *nomes* (Egypt's administrative units in the Roman period) around 300. Wilson assigned fixed population size for all other capital *nomes* that are not mentioned in his estimates. I used these estimates at the *nome* level and mapped them to districts in 1848-1868 using the routine that I outline in section A1.10.

2. Legendary Route of the Holy Family: as a proxy for pre-641 average religiosity, I use a dummy variable that denotes if a district is believed, according to local Coptic traditions, to have been visited by the Holy Family during its legendary flight to Egypt after Jesus' birth. Copts' local beliefs that a certain district was on the legendary route of the Holy Family may reflect, I argue, higher religiosity or psychological attachment to Coptic Christianity of its population. I constructed this variable from the Holy Family path as described in Anba-Bishoy (1999) and Gabra (2001). The places that were visited by the Holy Family (according to the legend) are recorded at the village level and hence I was able to match those villages to districts in 1848-1868 using Ramzi (1994 [1954]) and manual search for villages in the 1897 census. The path of the flight of the Holy Family in Egypt, officially endorsed by the Coptic Christian Church, is in turn based on a book attributed to Theophilus, the Patriarch of Alexandria in 385-412, and so it should reflect in principle pre-641 local Coptic beliefs. The date of the book is debated though as scholars believe that it was written in the fifteenth century, and thus it reflects post-641 Coptic beliefs that were likely affected by the conversion process. There are two points that mitigate this concern though: (a) there is evidence that local beliefs about the journey of the Holy Family, although not the specific path itself, emerged in as early as the Roman

their choice for grazing their animals. Egyptians (Copts) were required to provide them with food and shelter (Al-Barri, 1992, pp. 56-60) as part of the "miscellaneous taxes" in Table (I).

period, and (b) I use the Holy Family legendary route indicator as a control variable only and I show the results both with and without it.⁹

3. Share of villages in district with at least one Coptic monastery in 1200: I use this variable as a proxy for the generosity of the Coptic transfer system (I described its construction in section A1.4). Coptic monasteries leased out their landholdings to farmers (Richter, 2009) and provided loans and grants to poor Copts to help pay poll and land taxes (Markiewicz, 2009).

4. Large *autopract* estates in 600: I constructed this variable based on Hardy (1931), who traced large agricultural estates in late Byzantine Egypt that were mentioned in papyri or secondary sources. I restricted the sample to *nomes* in the Nile Valley, as papyri documents from the Delta were less likely to survive. I then created an indicator variable at the *nome* level denoting if *nome* had at least one large agricultural estate, which I then matched to districts in 1848-1868 (section A1.10).

5. Byzantine military garrisons in 600: I constructed an indicator variable if district had at least one Byzantine military garrison in 600 based on Maspero (1912). The author compiled information on the location of Byzantine military garrisons from primary sources. Locations are mentioned at a fine geographic level that allowed me to identify the district in 1848-1868 in which each garrison was located.

A1.10. Mapping *Nomes* and *Kuras* into Districts

Nomes were Egypt's administrative units since ancient times until 641, whereby Egypt was divided into about 40 *nomes* (20 in the Nile Valley and 20 in the Nile Delta). After the Arab Conquest of Egypt in 639-641, Egypt was re-divided into a

⁹ The legendary flight of the Holy Family to Egypt is based on Matthew 13: "*When they had gone, an angel of the Lord appeared to Joseph in a dream. "Get up," he said, "take the child and his mother and escape to Egypt. Stay there until I tell you, for Herod is going to search for the child to kill him."*" The book which describes the path of the Holy Family journey in Egypt is entitled *Vision of Theophilus*. However, Mingana (1931, pp. 3-4) argues that the book was written by Cyriacus, a Coptic bishop in the fifteenth century. Yet, there is evidence on the existence of local Coptic beliefs surrounding the journey of the Holy Family although not the specific path itself. The earliest post-biblical record of the flight of the Holy Family dates back to the third century and the event was recorded by historians and theologians in both the Roman and Byzantine periods. Whether the specific route was totally invented before Islam or was rather altered throughout the centuries is impossible to tell though.

larger number of *keuras* (about 50). Nineteenth-century rural Egypt, on the other hand, was divided into provinces, where each province was divided into districts, and districts divided into villages. *Nomes* and *keuras* were smaller in surface area than nineteenth-century provinces but larger than districts (76 districts; excluding Egypt's largest cities and deserts).

I mapped *Nomes* and *keuras* into rural districts in the 1848-1868 census samples using the 1897 census administrative division of districts (i.e. the list of villages under each district). The reason is that the 1848 and 1868 population censuses were never published and hence there is no official list indicating the villages under each district in these censuses. Therefore, I matched each village in the 1848-1868 census samples to its equivalent village in 1897 and assigned each village to a district in 1897. This is the administrative division of the 1848-1868 census samples that I used.

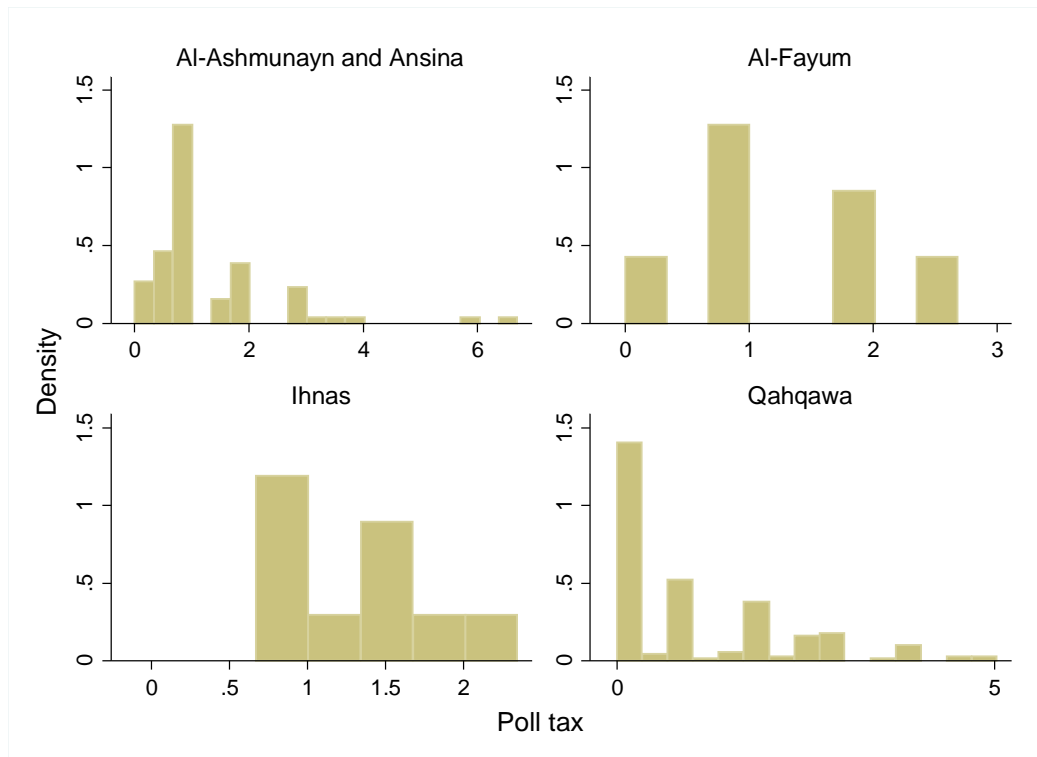
In the absence of information on the boundaries of *nomes*, mapping of pre-641 *nomes* into rural districts in 1897 was based on the mapping of the capital of each rural district in 1897 to the *nome* with the closest major town. In order to this matching, I first compiled the full list of *nomes* from http://www.trismegistos.org/geo/about_egyptiannomes.php; a specialized portal in papyri documents from Egypt in 800 BC - 800 CE. Second, I determined the current location of the major town of each *nome* using the mapping of *nomes* on Google Maps in <http://www.trismegistos.org/>.¹⁰ Finally, I assigned each rural district in 1897 to the nearest *nome* based on the proximity of the capital of each district to the *nome*'s major town according to Google maps.

Similarly, in the absence of information on boundaries of *keuras*, mapping of *keuras* into rural districts in 1897 was conducted using exactly the same routine. I first compiled the full list of *keuras* from Tousson (1926). Second, I determined the current location of the major town of each *keura* using Ramzi (1994 [1954]), which I complemented by information in Tousson (1926). Finally, I assigned each rural

¹⁰https://www.google.com/maps/d/viewer?hl=en&t=h&msa=0&ie=UTF8&om=1&mid=zX_awZMfxZcs.kyy5P2mblFhs

district in 1897 to the nearest *kura* based on the proximity of the capital of each district to the *kura*'s major town according to Google maps.

FIGURE A.1
Distribution of Poll Tax Payments (Dinar) by *Kura*



Source: Greek and Arabic papyri poll tax registers and receipts in 641-1100. See section A1.7 for details.

A2. Robustness Checks and Other Results

TABLE A.2
Measurement Error in Poll Tax in 641-1100

Panel (A): Poll Tax in 641-1100 and Copts' Population Share in 1848-1868										
Dependent variable = 1 if Coptic Christian										
	Full Sample		Excluding <i>Kuras</i> of <i>Ihnas</i> and <i>Fayum</i>		Excluding <i>Kura</i> of <i>Qahqawa</i>		Full Sample		Full Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
=1 if median poll tax high in district in 641-1100	-0.128** (0.051)	-0.096* (0.045)			-0.069 (0.046)	-0.057 (0.033)				
=1 if average poll tax high in district in 641-1100			-0.070 (0.058)	-0.128 (0.127)						
District's median poll tax in 641-1100 (dinars)									-0.315** (0.127)	-0.239* (0.110)
District's average poll tax in 641-1100 (dinars)							-0.573*** (0.168)	-2.723** (1.131)		
Control for urbanization?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Other controls?	No	Yes	No	No	No	No	No	Yes	No	Yes
Number of districts	11	11	5	5	8	8	11	11	11	11
Observations	2682	2682	1300	1300	1790	1790	2682	2682	2682	2682
Adjusted R ²	0.021	0.062	0.005	0.005	0.011	0.032	0.045	0.061	0.019	0.062

Panel (B): Poll Tax in 641-1100 and Coptic-Muslim Occupational Differences in 1848-1868 - OLS Estimates												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	=1 if White- Collar1	=1 if White- Collar2	=1 if White- Collar3	=1 if Professi- onal	=1 if High Bureau- cracy	=1 if Mid Bureau- cracy	=1 if Judiciary, Military	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
1. Median Poll Tax High in District in 641-1100 Indicator - No Controls												
=1 if Copt	0.112*** (0.018)	0.050 (0.030)	0.040 (0.025)	-0.004** (0.002)	-0.002 (0.001)	0.118*** (0.018)	-0.037*** (0.005)	-0.025 (0.026)	-0.010 (0.012)	0.207** (0.067)	-0.110 (0.079)	-0.137*** (0.033)
Copt * Median poll tax high	0.124 (0.086)	0.167 (0.122)	0.200* (0.106)	0.004** (0.002)	0.002 (0.001)	0.118 (0.086)	-0.001 (0.013)	0.044 (0.034)	0.033 (0.019)	-0.074 (0.093)	-0.237 (0.131)	0.111 (0.074)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.070	0.023	0.017	-0.002	0.001	0.095	0.035	0.013	0.008	0.062	0.055	0.035
2. Median Poll Tax High in District in 641-1100 Indicator - With Controls												
Copt	-0.682* (0.365)	-1.257** (0.534)	-0.961* (0.467)	0.006 (0.011)	0.003 (0.014)	-0.692* (0.357)	-0.041 (0.057)	-0.534** (0.234)	0.296** (0.128)	-2.013 (1.590)	3.098*** (0.936)	-0.123 (0.682)
Copt * Median Poll Tax High	0.091*** (0.023)	0.100* (0.053)	0.153*** (0.037)	0.005*** (0.002)	0.003 (0.002)	0.084*** (0.022)	0.004 (0.009)	0.005 (0.033)	0.052** (0.019)	-0.088 (0.233)	-0.265* (0.119)	0.200** (0.088)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.083	0.027	0.019	-0.003	-0.001	0.112	0.034	0.018	0.011	0.085	0.075	0.039
3. Average Poll Tax High in District in 641-1100 Indicator - Excluding <i>Kuras of Ihnas</i> and <i>Fayum</i> - No Controls												
=1 if Copt	0.087*** (0.014)	0.003 (0.016)	0.010 (0.026)	-0.005* (0.002)	0.000 (.)	0.092*** (0.016)	-0.029*** (0.001)	-0.055** (0.015)	0.007 (0.010)	0.151** (0.052)	-0.061 (0.042)	-0.100 (0.051)
Copt * Average poll tax high	0.004 (0.019)	0.094** (0.026)	0.042 (0.030)	0.001 (0.002)	-0.001 (0.001)	0.004 (0.020)	-0.016* (0.006)	0.106*** (0.021)	-0.052** (0.012)	-0.109 (0.052)	0.177** (0.055)	-0.110 (0.054)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	5	5	5	5	5	5	5	5	5	5	5	5
Observations	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
Adjusted R ²	0.050	0.016	0.009	-0.001	0.006	0.064	0.007	0.017	0.016	0.033	0.058	0.039

4. Median Poll Tax High in District in 641-1100 Indicator - Excluding <i>Kura of Qahqawa</i> - No Controls												
=1 if Copt	0.147***	0.116***	0.082**	-0.003***	-0.004	0.154***	-0.049***	0.017	-0.033***	0.284	-0.178	-0.189***
	(0.037)	(0.025)	(0.030)	(0.001)	(0.002)	(0.038)	(0.003)	(0.023)	(0.009)	(0.158)	(0.189)	(0.027)
Copt * Median poll tax high	0.089	0.102	0.158	0.003***	0.004	0.082	0.011	0.002	0.056**	-0.151	-0.169	0.163*
	(0.093)	(0.123)	(0.109)	(0.001)	(0.002)	(0.093)	(0.013)	(0.033)	(0.018)	(0.171)	(0.217)	(0.072)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	8	8	8	8	8	8	8	8	8	8	8	8
Observations	1790	1790	1790	1790	1790	1790	1790	1790	1790	1790	1790	1790
Adjusted R ²	0.085	0.031	0.022	-0.003	-0.001	0.121	0.039	0.004	0.010	0.077	0.056	0.042
5. Average Poll Tax (Dinars) in District in 641-1100 - No Controls												
=1 if Copt	-0.177	-0.479***	-0.349*	-0.015	0.011	-0.174	0.038**	-0.340***	0.130*	-0.201	-0.177	-0.479***
	(0.156)	(0.135)	(0.183)	(0.011)	(0.007)	(0.160)	(0.014)	(0.099)	(0.065)	(0.536)	(0.156)	(0.135)
Copt * Average poll tax (dinars)	0.249	0.452***	0.337*	0.009	-0.011	0.250	-0.063***	0.266***	-0.115*	0.335	0.249	0.452***
	(0.141)	(0.119)	(0.157)	(0.008)	(0.006)	(0.144)	(0.012)	(0.083)	(0.055)	(0.485)	(0.141)	(0.119)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.071	0.026	0.016	-0.002	0.001	0.097	0.036	0.018	0.009	0.064	0.071	0.026
6. Average Poll Tax (Dinars) in District in 641-1100 - With Controls												
=1 if Copt	-0.274	-1.249**	-0.461	0.018	0.001	-0.294	-0.105*	-0.870***	0.789***	0.151	0.338	-0.027
	(0.372)	(0.544)	(0.560)	(0.016)	(0.015)	(0.353)	(0.053)	(0.185)	(0.030)	(1.325)	(0.525)	(0.839)
Copt * Average poll tax (dinars)	1.856**	0.612	2.515**	0.070**	0.007	1.779**	-0.184	-1.059***	1.903***	6.495***	-10.494***	1.485
	(0.599)	(0.801)	(0.815)	(0.029)	(0.025)	(0.580)	(0.129)	(0.262)	(0.035)	(1.740)	(0.586)	(1.216)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.082	0.026	0.018	-0.003	-0.001	0.111	0.034	0.018	0.011	0.088	0.077	0.037

7. Median Poll Tax (Dinars) in District in 641-1100 - No Controls												
=1 if Copt	-0.189	-0.307	-0.430	-0.014***	-0.006	-0.168	-0.046	-0.072	-0.123*	0.345	0.565	-0.479**
	(0.216)	(0.316)	(0.270)	(0.004)	(0.004)	(0.217)	(0.037)	(0.134)	(0.064)	(0.332)	(0.429)	(0.201)
Copt * Median poll tax (dinars)	0.305	0.363	0.477	0.010***	0.005	0.290	0.009	0.050	0.114*	-0.141	-0.681	0.345
	(0.215)	(0.310)	(0.266)	(0.003)	(0.003)	(0.215)	(0.036)	(0.115)	(0.057)	(0.280)	(0.377)	(0.191)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.070	0.022	0.016	-0.002	0.001	0.095	0.035	0.013	0.008	0.062	0.056	0.035
8. Median Poll Tax (Dinars) in District in 641-1100 - With Controls												
=1 if Copt	-0.937**	-1.535**	-1.386**	-0.008	-0.004	-0.925**	-0.051	-0.547**	0.149	-1.779	3.844***	-0.679
	(0.358)	(0.528)	(0.461)	(0.011)	(0.014)	(0.350)	(0.057)	(0.240)	(0.130)	(1.644)	(0.978)	(0.698)
Copt * Median poll tax (dinars)	0.224***	0.242*	0.373***	0.013***	0.006	0.206***	0.009	0.009	0.131**	-0.189	-0.669**	0.485*
	(0.056)	(0.132)	(0.093)	(0.004)	(0.004)	(0.054)	(0.021)	(0.081)	(0.044)	(0.567)	(0.282)	(0.219)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of districts	11	11	11	11	11	11	11	11	11	11	11	11
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.083	0.027	0.019	-0.003	-0.001	0.112	0.034	0.018	0.011	0.085	0.076	0.038

Source: The 1848-1868 population census samples combined with multiple data sources. See section 4.6.1 in the main text and sections A1.1, A1.4, A1.7, A1.8, A1.9, A1.10 in the online appendix for details. Standard errors clustered at the district of origin level are in parentheses. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

TABLE A.3
OLS Estimates - Standard Errors Clustered at the *Kura* Level

Panel (A): Dependent Variable =1 if Coptic Christian										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
=1 if average poll tax high in district in 641-1100	-0.163** (0.031)	-0.281** (0.066)	-0.551 (0.249)	-0.176** (0.035)	-0.617 (0.448)					
=1 if Arab settlement in district in 700-969						-0.071* (0.040)	-0.074* (0.039)	-0.079** (0.034)	-0.057*** (0.020)	-0.091*** (0.026)
Controls for urbanization and religiosity?	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes
Other controls?	No	No	Yes	No	Yes	No	No	Yes	No	Yes
Province of origin FE?	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Number of districts	11	11	11	11	11	76	76	35	76	35
Observations	2682	2682	2682	2682	2682	16641	16641	6792	16641	6792
Adjusted R ²	0.047	0.058	0.060	0.057	0.075	0.017	0.017	0.020	0.078	0.053

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	=1 if White-Collar1	=1 if White-Collar2	=1 if White-Collar3	=1 if Professional	=1 if High Bureaucracy	=1 if Mid Bureaucracy	=1 if Judiciary, Military	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Panel (B): Average Poll Tax High in District in 641-1100												
=1 if Copt	0.087*** (0.000)	0.003*** (0.000)	0.010*** (0.000)	-0.005*** (0.000)	0.000 (0.000)	0.092*** (0.000)	-0.029*** (0.000)	-0.055*** (0.000)	0.007 (.)	0.151*** (0.000)	-0.061*** (0.000)	-0.100*** (0.000)
Copt * Poll tax	0.074 (0.041)	0.129** (0.023)	0.097* (0.036)	0.003** (0.001)	-0.003 (0.002)	0.074 (0.042)	-0.018** (0.003)	0.073** (0.023)	-0.032* (0.013)	0.110 (0.168)	-0.143 (0.203)	-0.063 (0.034)
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of <i>kuras</i>	4	4	4	4	4	4	4	4	4	4	4	4
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.072	0.026	0.016	-0.002	0.001	0.097	0.036	0.018	0.009	0.065	0.056	0.035

	=1 if White- Collar1	=1 if White- Collar2	=1 if White- Collar3	=1 if Professi- onal	=1 if High Bureau- cracy	=1 if Mid Bureau- cracy	=1 if Judiciary, Military	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Panel (C): Average Poll Tax High in District in 641-1100 - With Controls												
Copt	0.875** (0.238)	-1.278** (0.385)	0.928 (0.407)	0.052 (0.030)	-0.007 (0.012)	0.830** (0.229)	-0.294* (0.115)	-1.859*** (0.145)	2.206*** (0.031)	6.541** (1.501)	-7.618*** (0.063)	0.150 (1.162)
Copt * Poll tax	0.349* (0.116)	0.032 (0.201)	0.439 (0.211)	0.011 (0.009)	-0.001 (0.006)	0.339** (0.105)	-0.050 (0.030)	-0.267** (0.075)	0.406*** (0.011)	1.701* (0.599)	-2.268*** (0.017)	0.129 (0.410)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of <i>kuras</i>	4	4	4	4	4	4	4	4	4	4	4	4
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Adjusted R ²	0.081	0.026	0.018	-0.003	-0.001	0.111	0.034	0.019	0.011	0.089	0.077	0.037
Panel (D): Arab Settlement in District in 700-969												
=1 if Copt	0.104*** (0.017)	0.038** (0.018)	0.056*** (0.019)	-0.001 (0.002)	-0.002** (0.001)	0.107*** (0.017)	-0.022*** (0.005)	-0.045*** (0.004)	0.018** (0.008)	0.212*** (0.037)	-0.158*** (0.041)	-0.110*** (0.013)
Copt * Arab settlement	0.153** (0.073)	0.183** (0.085)	0.151* (0.086)	-0.002 (0.002)	-0.002 (0.002)	0.157** (0.073)	-0.004 (0.010)	0.035** (0.014)	-0.032*** (0.010)	-0.059 (0.072)	-0.037 (0.102)	-0.055** (0.025)
Copt * Controls?	No	No	No	No	No	No	No	No	No	No	No	No
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of <i>kuras</i>	42	42	42	42	42	42	42	42	42	42	42	42
Observations	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641
Adjusted R ²	0.087	0.035	0.028	0.002	0.004	0.116	0.035	0.011	0.017	0.039	0.105	0.060
Panel (E): Arab Settlement in District in 700-969 - With Controls II												
Copt	0.051 (0.195)	-0.166 (0.261)	-0.060 (0.280)	-0.006 (0.010)	0.026 (0.021)	0.031 (0.200)	-0.092*** (0.029)	-0.125 (0.091)	0.106 (0.077)	-0.438* (0.236)	0.157 (0.412)	0.342*** (0.113)
Copt * Arab settlement	0.098 (0.070)	0.082 (0.088)	0.080 (0.089)	-0.001 (0.002)	-0.003 (0.002)	0.101 (0.071)	-0.018*** (0.006)	0.002 (0.022)	-0.002 (0.009)	-0.122* (0.069)	0.102 (0.132)	-0.060* (0.033)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of <i>kuras</i>	17	17	17	17	17	17	17	17	17	17	17	17
Observations	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792
Adjusted R ²	0.062	0.024	0.024	0.001	0.006	0.083	0.047	0.015	0.015	0.063	0.109	0.068

Source: The 1848-1868 population census samples combined with multiple data sources. See section 4.6.1 in the main text and sections A1.1, A1.4, A1.7, A1.8, A1.9, A1.10 in the online appendix for details. Standard errors clustered at the *kura* of origin level are in parentheses. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

TABLE A.4
Relevance and Exogeneity of Distance to Arish

	(1) =1 if poll tax high in district in 641-1100	(2) =1 if Arab settlement in district in 700-969	(3) Log (urban population) in 300	(4) =1 if district on Holy Family route in 400	(5) % Villages with Coptic monasteries in 1200	(6) =1 if <i>Autopract</i> estates in district in 600	(7) =1 if Byzantine garrison in district in 600
District's distance to Arish (km)	-0.0049*** (0.0011)	-0.0006* (0.0003)	0.0003 (0.0005)	-0.0005 (0.0003)	0.0002*** (0.0001)	-0.0006 (0.0005)	-0.0001 (0.0003)
Districts	11	76	76	76	76	35	76
Adjusted R ²	0.656	0.032	-0.009	0.015	0.147	0.003	-0.012

Source: Multiple data sources. See section 4.6.2 in the main text and sections A1.4, A1.7, A1.8, A1.9, A1.10 for details. Standard errors are in parentheses. A constant term is included in all regressions.

TABLE A.5
Poll Tax, Settlement, and Copts' Population Share in 1848-1868 - IV Estimates

I. Second Stage Regressions - Dependent Variable =1 if Coptic Christian						
	(1)	(2)	(3)	(4)	(5)	(6)
=1 if average poll tax high in district in 641-1100	-0.215*** (0.043)	-0.374** (0.147)	-0.592** (0.251)			
=1 if Arab settlement in district in 700-969				-0.234*** (0.071)	-0.243*** (0.075)	-0.013 (0.117)
Controls for urbanization and religiosity?	No	Yes	Yes	No	Yes	Yes
Other controls?	No	No	Yes	No	No	Yes
II. First Stage Regressions						
	Dependent Variable in (1) - (3) =1 if average poll tax high in district in			Dependent Variable in (4) - (6) =1 if Arab settlement in district		
	(1)	(2)	(3)	(4)	(5)	(6)
District's distance to Arish (km)	-0.005*** (0.001)	-0.002*** (0.001)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001 (0.001)
Controls for urbanization and religiosity?	No	Yes	Yes	No	Yes	Yes
Other controls?	No	No	Yes	No	No	Yes
Observations	2682	2682	2682	16641	16641	6792
Number of districts	11	11	11	76	76	35
Kleibergen-Paap LM (P-value)	0.036	0.075	0.162	0.003	0.003	0.096
Kleibergen-Paap Wald F statistic	30.408	10.230	1264.182	9.972	10.072	1.703
Anderson-Rubin Wald (P-value)	0.000	0.004	0.047	0.001	0.001	0.921

Source: The 1848-1868 census samples combined with multiple data sources. See section 4.6.2 in the main text and sections A1.1, A1.4, A1.7, A1.8, A1.9, A1.10 for details. Standard errors clustered at the district of origin level are in parentheses. A constant term is included in the estimation and is partialled out in both stages.

TABLE A.6
Poll Tax, Arab Settlement, and Coptic-Muslim Occupational Differences in 1848-1868 - IV Estimates

Panel (A): Average Poll Tax High in District in 641-1100 - No Controls												
I. Second Stage Regressions - Dependent Variable Indicated on Top of Each Column												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	=1 if White- Collar1	=1 if White- Collar2	=1 if White- Collar3	=1 if Professi- onal	=1 if High Bureau- cracy	=1 if Mid- Low Bureau- cracy	=1 if Judiciary, Military	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
=1 if Copt	0.067** (0.029)	-0.001 (0.018)	-0.001 (0.030)	-0.005** (0.002)	0.001 (0.001)	0.071** (0.031)	-0.028*** (0.002)	-0.040* (0.024)	0.001 (0.013)	0.057 (0.120)	0.058 (0.135)	-0.114** (0.048)
Copt * Poll tax	0.118*** (0.045)	0.138*** (0.045)	0.121** (0.055)	0.003 (0.002)	-0.005*** (0.002)	0.120** (0.046)	-0.020*** (0.004)	0.040* (0.022)	-0.017 (0.017)	0.312* (0.162)	-0.401** (0.174)	-0.032 (0.063)
II. First Stage Regressions - Dependent Variable is Copt * Poll Tax												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
=1 if Copt	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)	3.088*** (0.335)
Copt * Dist. to Arish	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)
Observations	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
Districts	11	11	11	11	11	11	11	11	11	11	11	11
Kleibergen- Paap LM test (P-value)	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Kleibergen- Paap Wald F statistic	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740
Anderson- Rubin Wald test (P-value)	0.033	0.034	0.085	0.274	0.005	0.031	0.001	0.183	0.358	0.047	0.024	0.645

Panel (B): Arab Settlement in District in 700-969 - No Controls												
I. Second Stage Regressions - Dependent Variable Indicated on Top of Each Column												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	=1 if White-Collar1	=1 if White-Collar2	=1 if White-Collar3	=1 if Professional	=1 if High Bureaucracy	=1 if Mid-Low Bureaucracy	=1 if Judiciary, Military	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
=1 if Copt	-0.044 (0.082)	-0.134 (0.095)	-0.104 (0.093)	-0.001 (0.003)	-0.003 (0.002)	-0.039 (0.082)	-0.032*** (0.008)	-0.058*** (0.016)	0.030* (0.018)	0.137** (0.061)	0.036 (0.119)	-0.070 (0.051)
Copt * Arab settlement	0.452*** (0.117)	0.529*** (0.135)	0.473*** (0.134)	-0.001 (0.003)	0.001 (0.003)	0.453*** (0.117)	0.015 (0.012)	0.061*** (0.021)	-0.056** (0.025)	0.091 (0.132)	-0.429*** (0.160)	-0.135 (0.087)
II. First Stage Regressions - Dependent Variable is Copt * Arab settlement												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
=1 if Copt	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)	1.554*** (0.207)
Copt * Dist. to Arish	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)
Observations	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641
Districts	76	76	76	76	76	76	76	76	76	76	76	76
Kleibergen-Paap LM test (P-value)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Kleibergen-Paap Wald F statistic	19.707	19.707	19.707	19.707	19.707	19.707	19.707	19.707	19.707	19.707	19.707	19.707
Anderson-Rubin Wald test (P-value)	0.000	0.000	0.000	0.628	0.782	0.000	0.193	0.003	0.014	0.465	0.000	0.090

Source: The 1848-1868 census samples combined with multiple data sources. See section 4.6.2 in the main text and sections A1.1, A1.4, A1.7, A1.8, A1.9, A1.10 for details. Standard errors clustered at the district of origin level are in parentheses. District of origin fixed effects are included in the estimation and are partialled out in both stages. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

TABLE A.7
Poll Tax, Arab Settlement, and Copts' Population Share in 1200 and 1500

Dependent Variable is Share of Villages in District with at Least One Coptic Church or Monastery

	1200: Columns (1) - (4)				1500: Columns (5) - (8)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
=1 if average poll tax high in district in 641-1100	-0.011 (0.056)	-0.049 (0.159)			-0.164** (0.058)	0.060 (0.182)		
=1 if Arab settlement in district in 700-969			-0.047 (0.045)	-0.043 (0.051)			-0.077*** (0.027)	-0.072*** (0.024)
Controls for urbanization and religiosity?	No	Yes	No	Yes	No	Yes	No	Yes
Observations (Districts)	11	11	76	76	11	11	76	76
Adjusted R ²	-0.105	-0.410	0.001	-0.025	0.584	0.600	0.147	0.146

Source: Data on medieval churches and monasteries combined with other data sources. See section 4.6.3 in the main text and sections A1.4, A1.7, A1.8, A1.9, and A1.10 in the online appendix for details. Robust standard errors are in parentheses. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01. Constant is included in all regressions.

TABLE A.8
Intergenerational Occupational Mobility and Religious Group Effects in 1848-1868

Dependent variable is son's occupational outcome

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	=1 if White-Collar1	=1 if White-Collar2	=1 if White-Collar3	=1 if Professional	=1 if High Bureaucracy	=1 if Mid-Low Bureaucracy	=1 if Judiciary, Military	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
=1 if father of same occupation	0.340*** (0.101)	0.265*** (0.056)	0.321*** (0.049)	0.333 (0.315)	0.199 (0.175)	0.477*** (0.120)	0.136** (0.069)	0.380*** (0.137)	0.444*** (0.103)	0.577*** (0.040)	0.602*** (0.022)	0.626*** (0.027)
Share of occupation in religious group	1.461*** (0.417)	1.647** (0.690)	1.563** (0.685)	0.000 (0.000)	0.134 (0.095)	1.120*** (0.350)	1.362*** (0.195)	2.109 (2.981)	0.398 (6.364)	0.653*** (0.178)	1.011*** (0.242)	0.195 (0.304)
N	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168

Source: The 1848-1868 census samples. Sample is restricted to Egyptian free local Coptic and Muslim adult sons for whom I observe father's occupation, with non-missing religion, age, nationality, ethnicity, occupation, and district of origin. See section 5.1 in the main text and section A1.1 in the online appendix for details. Constant is included in all regressions. Standard errors clustered at the household level are in parentheses.

TABLE A.9
Copts' Tax Revolts in 726-768

Year	Region	Reasons Cited	Parties Revolting
726	Nile Delta	Tightening state control over the tax system	Copts
740	Nile Valley	Higher tax enforcement, collecting poll tax from fugitives, higher tax rate, uniform tax regardless of income	Copts
750	Nile Delta	Heavy taxation and general suffering	Copts; Arabs also revolted to overthrow the Umayyads
753	Nile Delta	Reorganizing the tax system under the Abbasids and heavy taxation	Copts
768	Nile Delta	Abbasids' fiscal reforms	Copts

Sources: Morimoto (1981, pp. 145-72) and Mikhail (2004, pp. 195-211). See section 4.4 in the main text. I excluded ten tax revolts that erupted in 783-866 (nine of them were in the Nile Delta) because both Arabs and Copts participated in them and, thus, they may have been motivated by other reasons.

TABLE A.10
Copts' Population Share and Coptic-Muslim Occupational Differences in 1848-1868

	Dependent Variable Indicated on Top of Each Column											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	=1 if	=1 if	=1 if	=1 if	=1 if	=1 if	=1 if	=1 if	=1 if	=1 if	=1 if	=1 if
	White- Collar1	White- Collar2	White- Collar3	Professi- onal	High Bureau- cracy	Mid- Low Bureau- cracy	Judiciary, Military	Clergy, Rural Elite	Merchant	Artisan	Farmer	Unskilled
Copt	0.367*** (0.053)	0.346*** (0.060)	0.337*** (0.062)	-0.004** (0.002)	-0.004*** (0.001)	0.375*** (0.053)	-0.020*** (0.007)	-0.001 (0.009)	-0.008 (0.011)	0.261*** (0.069)	-0.401*** (0.063)	-0.198*** (0.039)
Copt * Percent Copts in district	-1.199*** (0.256)	-1.391*** (0.279)	-1.326*** (0.291)	0.009 (0.017)	0.009 (0.006)	-1.216*** (0.260)	-0.024 (0.037)	-0.168** (0.079)	0.065 (0.057)	-0.506 (0.327)	1.440*** (0.467)	0.393 (0.258)
District of origin FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641
Adjusted R ²	0.102	0.042	0.034	0.002	0.004	0.136	0.035	0.011	0.017	0.040	0.109	0.061

Source: The 1848-1868 census samples. See footnote 10 in the main text and section A1.1 in the online appendix for details. Standard errors clustered at the district of origin level are in parentheses. * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

A3. Proofs of the Conceptual Framework

PROOF OF PROPOSITION (1): Let y^* denote the threshold level of income at which a Copt is indifferent about conversion to Islam. Copts' population share is given by $M_c = \int_{y^*}^{\infty} f(y)dy = 1 - F(y^*)$. It directly follows that:

$$\frac{\partial M_c}{\partial \tau} = -f(y^*) \times \frac{\partial y^*}{\partial \tau} = -f(y^*) \times \frac{-u'(y^* - \tau)}{u'(y^*) - u'(y^* - \tau)} < 0$$

Because $u'(\cdot) > 0$ and $u''(\cdot) < 0$ ■

PROOF OF PROPOSITION (2):

$$\begin{aligned} \frac{\partial}{\partial \tau} E(y|Copt) &= \frac{\partial}{\partial \tau} E(y|y > y^*) = \frac{\partial}{\partial \tau} \left[\frac{\int_{y^*}^{\infty} yf(y)dy}{1 - F(y^*)} \right] \\ &= \frac{1}{(1 - F(y^*))^2} \left[-y^* f(y^*) \frac{\partial y^*}{\partial \tau} (1 - F(y^*)) \right. \\ &\quad \left. + f(y^*) \frac{\partial y^*}{\partial \tau} \int_{y^*}^{\infty} yf(y)dy \right] = \frac{f(y^*) \frac{\partial y^*}{\partial \tau}}{1 - F(y^*)} \left[-w^* + \frac{\int_{y^*}^{\infty} yf(y)dy}{1 - F(y^*)} \right] \\ &= \frac{f(y^*) \frac{\partial y^*}{\partial \tau}}{1 - F(y^*)} [E(y|y > y^*) - y^*] > 0 \end{aligned}$$

$$\begin{aligned} \frac{\partial}{\partial \tau} E(y|Muslim) &= \frac{\partial}{\partial \tau} E(y|y \leq y^*) = \frac{\partial}{\partial \tau} \left[\frac{\int_0^{y^*} yf(y)dy}{F(y^*)} \right] \\ &= \frac{1}{(F(y^*))^2} \left[y^* f(y^*) \frac{\partial y^*}{\partial \tau} (F(y^*)) - f(y^*) \frac{\partial y^*}{\partial \tau} \int_0^{y^*} yf(y)dy \right] \\ &= \frac{f(y^*) \frac{\partial y^*}{\partial \tau}}{F(y^*)} \left[y^* - \frac{\int_0^{y^*} yf(y)dy}{F(y^*)} \right] = \frac{f(y^*) \frac{\partial y^*}{\partial \tau}}{F(y^*)} [y^* - E(y|y \leq y^*)] \\ &> 0 \end{aligned}$$

Define the Coptic-Muslim income gap as $\Delta \equiv E(y|Copt) - E(y|Muslim) = E(y|y > y^*) - E(y|y \leq y^*)$. It follows that the derivative of Δ with respect to the poll tax is:

$$\frac{\partial \Delta}{\partial \tau} = f(y^*) \frac{\partial y^*}{\partial \tau} \left[\frac{1}{1 - F(y^*)} (E(y|y > y^*) - y^*) - \frac{1}{F(y^*)} (y^* - E(y|y \leq y^*)) \right]$$

This could be either positive or negative depending on the income distribution ■

PROOF OF PROPOSITION (3): It follows from Jewitt (2004) and $\frac{\partial y^*}{\partial \tau} > 0$.

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