On the Road to Heaven:
Taxation, Conversions, and the Coptic-Muslim
Socioeconomic Gap in Medieval Egypt[*]

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Abstract

Self-selection of converts is an under-studied explanation of inter-religion socioeconomic status (SES) differences. Inspired by this conjecture, I trace the Coptic-Muslim SES gap in Egypt to self-selection-on-SES during Egypt's conversion from Coptic Christianity to Islam. Selection was driven by a poll tax on Copts, imposed from 641 until 1856. I hypothesize that taxation caused Copts to shrink into a better-off minority and induced non-converts to invest more in human capital leading the initial selection to perpetuate. Using novel data, I document that high-tax districts in 641-1100 had in 1848-1868 relatively fewer Copts but greater SES and human-capital investment differentials.

Keywords: conversion; self-selection; discriminatory taxation; inter-group inequality in human capital
JEL Classification: N35; O15
Word count: 13,668

> "At the order of the most glorious [governor] it has been determined that the poll tax will be levied .. and I am worried that this will scare them."
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> Athanasios, (Coptic) head of Hermopolis district in Upper Egypt, in a letter to his subordinate Shenoute, March 3, 644 CE (cited in Sijpesteijn (2013, p. 73)).

Differences in socioeconomic status (henceforth, SES) between religious groups have been an intriguing topic in social sciences since at least Weber (1905)'s seminal work on Protestantism. Explanations of the phenomenon abound. Weber traced the Protestant-Catholic SES gap to a causal impact of religious beliefs that operates through a Protestant work ethic, and, extending his thesis to Asia, he argued that Asiatic religions were less conducive to Capitalism. Relatedly, the recent economics of religion literature, while acknowledging the endogeneity of religion, attempted to disentangle its impact on SES in cross-country studies (Barro and McCleary, 2003), or in single-country studies that emphasized the human capital channel (Borooah and Iyer, 2005; Becker and Woessmann, 2009; Chaudhary and Rubin, 2011). A different explanation that remains far less studied is that of self-selection of converts on SES. An early example of this hypothesis is to be found in Weber (1958, p. 6), who noted that conversions to Christianity and Islam in India came from the lower Hindu castes. Recently, Botticini and Eckstein (2005) hypothesized that Rabbinic Jews with a lower taste for education converted out of Judaism because of its emphasis on literacy, with the remaining Jews forming a better-off minority.

Inspired by the selection conjecture, this article hypothesizes that self-selected conversions were an important cause of the inter-religious SES gap in Egypt, one of the largest Middle Eastern countries. Newly digitized data from Egypt's population censuses of 1848 and 1868 reveal that, among adult employed men, 33 percent of Copts (Egyptian Christians; 7 percent of Egypt's population) worked in white-collar jobs, compared to 14 percent among Muslims.[1] This phenomenon is striking if we take into account that Egypt was Coptic Christian before the Arab Conquest in 641, and, since in- and out-migration were limited, Egypt's "Copts" and "Muslims" are mostly descendants of the pre-641 population who either chose to remain Coptic or to convert to Islam (converts could not switch back to Christianity due to the death penalty of apostates in Islam). Bearing this fact in mind, I argue that Copts' conversion between 641 and 1868 was characterized by selection-on-SES due to the tax system. Upon the Conquest, Arabs

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[1]I focus on the Coptic-Muslim SES gap because Copts constituted 94 percent of Egypt's non-Muslims in 1848-1868, whereas non-Coptic Christians and Jews comprised 4 percent and 2 percent respectively. I use the terms "Copts" and "non-Muslims" interchangeably thereafter.

imposed an annual poll tax on every adult free Coptic male; a tax that was enforced until 1856. As conversion to Islam freed Copts from the poll tax liability, and since the conversion incentive was decreasing in income owing to the (quasi) lump-sum feature of the tax, I hypothesize that the tax led to the conversion of poorer Copts, leading Copts to shrink into a better-off minority. It also induced Copts to invest more in human capital than converts, causing the initial selection to perpetuate thereafter. There are three distinguishing features of this hypothesis: (1) Unlike Weber (1958) who did not specify a selection mechanism of converts, selection is caused here by an economic incentive, the tax exemption. (2) The tax exemption incentive is distinct from the religious incentive to read the Bible in Botticini and Eckstein (2005). (3) Human capital investment operates as a persistence and not a selection mechanism, unlike in Botticini and Eckstein (2005).

The article contributes to a century-long debate on the Middle East. It has been long documented, albeit qualitatively, that native non-Muslim minorities of Egypt, Iraq, Jordan, Lebanon, Palestine/Israel, and Syria have, on average, higher SES than the Muslim majority (Tagher, 1951; Issawi, 1981; Courbage and Fargues, 1997). Inspired by major papyri discoveries from early Islamic Egypt, pioneering early-twentieth-century scholars such as Wellhausen (1902), Becker (1902), Bell (1910), and Grohmann (1932), emphasized the tax incentive of conversion to Islam under the early Arab Caliphate. Two Coptic chronicles dating from the seventh and ninth centuries (and uncovered around 1900) lent support to their theory as they included narratives of tax-induced conversion waves, which were not mentioned by the Arabic sources.[2] The hypothesis of tax-induced conversions triggered fierce debates among historians. Scholars such as Dennett (1950), Morimoto (1981), and Sijpesteijn (2013) took a cautious stance towards the hypothesis in light of the growing papyri discoveries that suggested that conversions in Egypt may not have started until the mid-eighth century. Others argued that conversions occurred even later for other causes including the suppression of Coptic tax revolts in the ninth century (Al-Maqrizi, 1500; Mikhail, 2004) and state persecution in 1250-1517 (El-Leithy, 2005). A third group contended that it was Islam's appeal that attracted converts (El-Shayyal, 1966). Despite this large body of scholarship, and partially due to data limitations, the "conversion" literature did not address the SES advantage of the surviving non-Muslim

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[2]The Coptic chronicler, John of Nikiu (1916, p. 201), described the consequences of increasing the 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.*" Two other tax-induced conversion waves in the eighth century are documented by Ibn-Al-Muqaffa' (1910, pp. 116-117, 189).

minorities; a task that was left to a separate body of (qualitative) literature, and so the impact of taxation on the inter-religious SES differences has remained a black box. As a result of this omission, neither the regressivity of the poll tax nor the possibility of selection-on-SES of converts, a logical consequence of tax regressivity, was examined by this literature, with the exception of a conjecture in Courbage and Fargues (1997, pp. 22-23). The novelty of this article is thus threefold: (a) to hypothesize that taxation led to *self-selected* conversions (and not simply, conversions); this distinguishes taxation from the other causes of conversion that did not necessarily trigger self-selection of converts, (b) to draw on economic theory, empirics, and novel data in order to rigorously test this hypothesis, and (c) to provide the first quantitative evidence on Copts' population share and the Coptic-Muslim SES differential in Egypt in both the medieval period and the nineteenth century. This is, to the best of my knowledge, the first empirical test of self-selected conversions not only in the Middle East but more generally.

To guide the empirical analysis, section 2 sets up a conceptual framework, in which a Copt's decision of whether to convert rationally hinges on both his income and his religiosity, both of which vary in the population. The model predicts that an increase in the poll tax (unsurprisingly) leads to more conversions, and that the Coptic-Muslim SES differential increases with the poll tax if the density of the income distribution is decreasing. It also obtains a sufficient condition for the poll tax to be regressive even when income is observed by tax collectors. Finally, it is shown that non-convert Copts invest more in human capital than converts (Muslims), and that if Copts were sufficiently religious in the initial period, the investment incentive of non-converts would be increasing in the poll tax. The intuition is that human capital investment reduces the probability that the children will be "forced" to convert by economic misery. This result sheds light as to why the Coptic population did not vanish, and hence, why the initial positive selection of Copts (or the initial Coptic-Muslim SES gap) persisted.

The country-level long-term trends of the poll tax, Copts' population share, and the Coptic-Muslim SES gap, that are documented in section 3, provide a first (suggestive) evidence on the selection hypothesis. They draw on novel data including papyri documents form early Islamic Egypt and two samples of Egypt's population censuses of 1848 and 1868 that I digitized at the National Archives of Egypt and that are among the earliest pre-Colonial censuses from any non-Western country. Three key findings emerge: (1) The

poll tax rate among middle- and low-income Copts was, on average, 6-10 percent of the annual wage in 661-1250 but became negligible in 1250-1517; it was negligible though for high-income Copts in 661-1517. (2) Copts shrank from almost 100 percent of the population in 641 to 16 percent in 1200 and 7 percent in 1848-1868. (3) The Coptic-Muslim SES gap emerged by 969, where Copts were over-represented among white-collar workers (mid-low bureaucrats) and artisans, and the gap persisted through 1868. These findings, I argue, are consistent with the selection conjecture. Whereas the higher tax rate among poorer Copts in 661-1250 is correlated with a decline in Copts' population share and the emergence of a positive Coptic-Muslim SES gap as farmers and unskilled Copts were more likely to convert, conversions subsided after 1200 as the tax rate declined.

Being at the country level though, the long-term trends do not allow a rigorous test of the conceptual framework. Since taxes were administered at the district level, my second evidence that I describe in section 4 is based on exploiting the cross-district variation in the poll tax in 641-1100, the period where most conversions took place. The ideal experiment to test the conceptual framework is to randomly assign the tax across districts that were otherwise identical before 641 and to compare Copts' population share and the Coptic-Muslim SES gap after the imposition of the tax. Unfortunately, this is impossible because (a) the tax was not random and (b) the earliest district-level data on religion and SES (occupations) are the 1848-1868 censuses. Hence, my empirical strategy compares Copts' population share and the Coptic-Muslim occupational differences across districts using a sample of Egyptian free local adult employed men in 1848-1868. The main regressor is the poll tax in 641-1100 in an individual's district of origin, which I measure by a dummy variable that takes the value of one if the average poll tax in a district is above the cross-district average. This is computed from papyri poll tax registers and receipts that survived for 4 *kuras* (Egypt's administrative units in 641-1036), and that map into 11 out of 76 districts in 1848-1868, all located in the Nile Valley.

The findings lend support to the selection hypothesis. I document that compared to Copts in "low-tax" districts, Copts whose origin is in a "high-tax" district are relatively fewer but *differentially* more likely to be white-collar workers in 1848-1868. The results hold controlling for geographic fixed effects and a host of pre-641 district-level characteristics. Since all districts were (almost) 100 percent Copt in 641, the findings suggest that high-tax districts witnessed relatively more conversions and a more extensive selection-

on-SES that resulted in a greater Coptic-Muslim SES gap. I conduct several robustness checks. The findings are robust to an alternative measure of the poll tax that is observed for all 76 districts; a dummy variable that takes the value of one if Arabs settled in a district between 700 and 969, which is based on evidence on the stricter tax enforcement in districts where Arabs settled and replaced the Coptic local elites compared with districts where Coptic elites remained intact. The findings are also robust to using the distance to *Arish*, the first town to be captured by Arabs in 639, as an instrumental variable for the poll tax. Finally, to address the potential tax-induced cross-district movement, I document that the poll tax had a negative impact on Copts' population share as early as 1200 and 1500, where I proxy for Copts' presence in a district by the share of villages with at least one Coptic church or monastery. Historians document that the state imposed restrictions on mobility since 641; these restrictions were only lifted in 1857.

The cross-district evidence indicates that the initial selection of Copts persisted at the district level for over twelve centuries. The conceptual framework suggests that the poll tax induced non-convert Copts to invest more in human capital than converts, which could explain why the initial selection persisted through 1868. Using the 1848-1868 census samples, I document in section 5 that, controlling for the occupation of the household head, Coptic households invested more than Muslims in the human capital of their children and the Coptic-Muslim differential investment in human capital was greater in high-tax districts. I also provide historical evidence that Copts' human capital investment advantage precedes the nineteenth century, and that their SES advantage declined in the late twentieth century with the expansion of modern education among the Muslim masses in 1951-1953 (Saleh, 2016). Nonetheless, in the absence of sub-country data on human capital investment (by religion) before 1848, the evidence on the human capital mechanism essentially rests on theory, history, and the 1848-1868 censuses.

There are other theories that may explain the decline in Copts' population share and the Coptic-Muslim SES gap. I examine some of these theories in section 6, where I argue that they are either complementary to the selection hypothesis or inconsistent with the available evidence. Importantly, I do *not* claim that taxation was the *sole* cause of conversions, but that, compared to the other causes, taxation offers a consistent answer to *both* conversions and the Coptic-Muslim SES gap. Furthermore, the selection hypothesis complements Kuran (2004a)'s thesis that non-Muslims' SES dominance in the Middle

East emerged due to their adoption of European legal structures. While Kuran's thesis is less applicable to Copts, it is relevant for other minorities.

Besides the social science literature on religion and SES and the historical literature on conversions in the Middle East, the article contributes to the literature on institutions and cultural beliefs, both in general (North, 1990; Greif, 1994; Sokoloff and Engerman, 2000; Acemoglu et al., 2001, 2011; Nunn, 2008; Dell, 2010; Tabellini, 2010) and in the Muslim World (Kuran, 2004b; Blaydes and Chaney, 2013; Carvalho, 2013; Jha, 2013; Meyersson, 2014; Artunç, 2015). I document that Egypt's taxation shaped religious adherence and inter-group SES inequalities that persisted for over twelve centuries. The persistence of the Coptic-Muslim SES gap is consistent with the literature on SES persistence across multiple generations (Long and Ferrie, 2013; Clark and Cummins, 2015).

The article does *not* claim that Copts were a political elite minority. In fact, half of Copts in 1848-1868 were farmers or unskilled workers, and Muslims (often non-Egyptians) monopolized top political elite positions in the high-level bureaucracy, the military, the judiciary, the police, and the Muslim clergy. Furthermore, the highest white-collar positions that Copts reached were limited to the mid-low bureaucracy such as scribes, accountants, and land tax collectors. However, the article seeks to understand why Copts were richer, *on average*, than Muslims by 969 and why this gap persisted through 1868. Neither does the article claim to generalize its hypothesis beyond Egypt as we know little about the formation processes of other non-Muslim minorities in the Middle East. However, understanding the origins of Copts' privilege over Muslims is valuable because (a) Copts were the *largest* non-Muslim minority (in absolute number) in the region, (b) unlike other non-Muslims who were mostly urban and traders, Copts' spatial and occupational distributions exhibited greater cross-district variation that allows testing the selection hypothesis, and (c) using the medieval Greek, Coptic, and Arabic papyri advances our knowledge of this phenomenon instead of relying on often subjective narratives.

The rest of the article is organized as follows. Section 1 provides a historical background. I describe the conceptual framework in section 2. Section 3 introduces the country-level long-term trends evidence on the selection hypothesis, while section 4 describes the cross-district evidence. Evidence on Copts' higher human capital investment (as a persistence mechanism) is in section 5. I examine other theories of the decline in Copts' population share and the Coptic-Muslim SES gap in section 6. Section 7 concludes.

1 Historical Background

1.1 Egypt's Conversion to Islam in 641-1897

Christianity reached Egypt in the first century and the last pocket of paganism was Christianized by the sixth century. The Coptic Christian church, followed by the Egyptian masses, split from the Byzantine church in 451. Yet, Greeks and Hellenized Egyptians stayed loyal to the Byzantine church forming a parallel church, the *Melkite* church. Condemned as heretics, Copts were persecuted by the Byzantines until the Arab Conquest.

On the eve of the Conquest in 641, Copts constituted the vast majority of Egyptians, with non-Coptic Christians and Jews being two small elite minorities. Following the Conquest, Egypt was ruled by the Rashidun Caliphate in Medina in 641-661, the Umayyads in Damascus in 661-750, the Abbasids in Baghdad in 750-969, the Fatimids in Cairo in 969-1171, the Ayyubids in Cairo in 1171-1250, the Mamluks in Cairo in 1250-1517, and the Ottomans in Istanbul in 1517-1914. During these thirteen centuries, Copts shrank from (almost) 100 percent of Egypt's population in 641 to 7 percent in 1897. Historical evidence suggests that Egypt's Islamization was primarily driven by voluntary conversions among Copts to Islam (see section 6.1). Conversion was observed by the state; a papyri list of converts in 700-900 reveals that converts had to endorse Islam in front of the authorities, adopt an Arabic name, become a client of an Arab patron, and enlist in the army (in order to receive a stipend). More importantly, Conversion was an "absorbing state" due to three Islamic laws: (a) the death penalty of apostates, (b) the offspring of a Muslim male is Muslim, and (c) Muslim females may only marry Muslim males.

Since there are no published statistics on Egypt's religious composition before the 1897 population census, determining the date at which Copts shrank into a minority remains to be a matter of strong debate. Scholars such as Al-Maqrizi (1500) and Mikhail (2004) set the date between 641 and 969, while others pushed it forward to the fourteenth century (El-Leithy, 2005). Two studies attempted to address the question quantitatively. Bulliet (1979) used lineages of prominent individuals in medieval narratives to identify the date at which an individual's ancestors converted to Islam and adopted an Arabic name. He found that conversions peaked in the ninth century. Courbage and Fargues (1997, pp. 27-28) used total poll and land tax revenues to estimate non-Muslims' population share between 641 and 813, finding that non-Muslims shrank into a minority by 680.

1.2 Egypt's Tax System in 641-1856

1.2.1 The Coptic-Muslim Difference in Net Taxes

To provide an incentive to Egyptians to convert to Islam, Arabs introduced in 641 a tax system that tied tax liability to the taxpayer's religion. After a formation period between 641 and 750, Arab taxation evolved into its canonical form around 750 and remained unchanged in essence until 1856. Table 1 summarizes the taxes and benefits that were imposed on each of Muslims and Copts in 641-1856. Every free adult Coptic male had to pay a poll tax (*jizya*), an annual per head tax paid in cash, and Coptic landholders paid an additional land tax (*kharaj*) that was assessed on both the acreage and yield of their landholdings and paid in both cash and crops.[3] By contrast, Muslims were not subject to the poll tax and, until around 750, Muslim landholders paid a reduced land tax (tithe, *ushur*, *zakat*, *sadaqa*) that was assessed on the yield (and not the acreage) of their landholdings.[4] However, the rapid decline in tax revenues, perhaps due to widespread conversions, led around 750 to the imposition of the higher *kharaj* tax on Muslims. In addition, Muslims were subject to military conscription in return for a cash stipend (*'ata'*) and an in-kind stipend (*rizq*); an obligation that was abolished in 833 with the shift to recruiting slave soldiers and was only resumed a millennium later in 1822.

Table 1 suggests that converts enjoyed in 641-750 more tax exemptions than afterwards, but these exemptions were often violated in practice. Since 750, however, the Coptic-Muslim net tax differential was equal to the poll tax.

1.2.2 The *Regressivity* of the Poll Tax Schedule

The *de jure* poll tax was imposed in three lump-sum amounts of 1, 2, and 4 dinars on the poor, middle, and rich respectively.[5] However, papyri poll tax registers and receipts in 641-1100 indicate that the *de facto* poll tax varied much more than the *de jure* amounts. Despite the poll tax variation, the poll tax rate, both *de jure* and *de facto*, was higher for

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[3]The Quran (9:29) ordered Muslims (circa 622) to impose the *jizya* on Christians and Jews. Nonetheless, historians have long debated whether Egypt's *jizya* between 641 and 750 was an individual tax or a tribute on each village, and whether the poll and land taxes during that period were distinct taxes or a single tax. There is a consensus, however, that starting from 750 (at the latest), the poll and land taxes were two distinct individual taxes.

[4]Sijpesteijn (2013, pp. 181-99) argues that Muslims did not pay the *ushur* before 750.

[5]Muslim jurists disagreed as to the exemption of the poor from the poll tax, although they agreed that every employed adult male was considered non-poor. For example, evidence from the Cairo Geniza reveals that poor Jews in Egypt were obliged to pay the poll tax (Alshech, 2003).

Table 1: **The Coptic-Muslim Difference in Net Taxes in 641-1856**

Tax/Benefit	Copts	Converts (Muslims)		Coptic-Muslim Δ in Net Taxes	
		641-750	750-1856	641-750	750-1856
1. Poll tax (*jizya*)?	Yes	No	No	*jizya*	*jizya*
2. Land tax (*kharaj*)?	Yes	*ushur*	Yes	*kharaj - ushur*	0
3. Miscellaneous taxes?	Yes	No	Yes	Misc. taxes	0
4. Military conscription?	No	Yes	Mostly No	(-) Conscription	0
5. Stipend (*'ata' + rizq*)?	No	Yes	Mostly No	*'ata' + rizq*	0

Notes: Between 641 and 750, the term *jizya* meant "taxes in cash" that included both the poll tax and the cash land tax. The term *kharaj* was first used to describe the land tax in 776. Miscellaneous taxes changed over time. In 641-857, they provided funds for military expenses, lodging for officials, governor's expenses, the village overhead expenses, and public projects. In 857-1171, 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.
Sources: Morimoto (1981, pp. 51, 140, 257-263) and other historical sources.

low-income Copts. First, Figure 1 reveals that the *de jure* poll tax rate was decreasing in wages. Second, A few papyri tax registers in 703-733 contain information on both the poll tax and the total cash land tax payment at the individual level. Since the total cash land tax was a fixed amount (1 dinar) per acre of landholdings, I use it as a measure of wealth (landholdings) for landholding farmers. I thus regress the poll tax rate (poll tax divided by total cash land tax) on the total cash land tax. The results in Table 2 show that the *de facto* poll tax rate was decreasing in the total land tax (hence, in the area of landholdings); smaller landholders faced, on average, a higher poll tax rate.

Table 2: **Landholders' Poll Tax Rate in 703-733**
Dependent Variable: Poll Tax Rate = Annual Poll Tax/Annual Total Land Tax

	(1)	(2)
Land tax	-0.041***	-0.036***
	(0.015)	(0.013)
Sub-district FE?	No	Yes
Observations	230	230
Adjusted R^2	0.014	0.112

Notes: Robust standard errors are in parentheses. $*p < 0.1, **p < 0.05, ***p < 0.01$. A constant term is included in the first regression.
Source: Greek papyri tax registers of three sub-districts in the *kura* of *Qahqawa* (pre-641, *Aphrodito*) in 703-733 (Morimoto, 1981, pp. 67-79, 85-87). The sample is restricted to landholders.
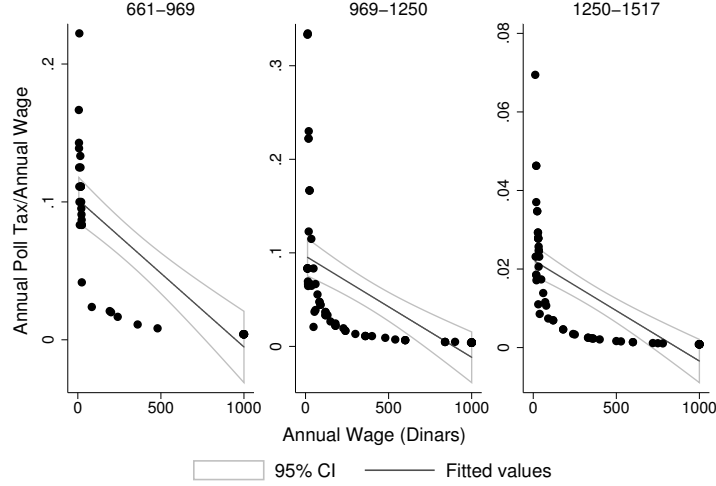
Figure 1: **The *De Jure* Poll Tax Rate and Wages in 661-1517**

Notes: The fitted lines estimate the following OLS regression in each period: $t_i = \alpha + \beta y_i + \eta_i$ where t_i is the poll tax rate for individual i and y_i is the annual wage of individual i. The estimates are as follows (robust standard errors are in parentheses): (1) In 661-969: $t = 0.10175$ (0.00913) - 0.00011 (0.00001) y [$N = 35$; $R^2 = 0.58$]; (2) In 969-1250: $t = 0.09650$ (0.01311) - 0.00011 (0.00001) y [$N = 77$; $R^2 = 0.32$]; (3) In 1250-1517: $t = 0.02225$ (0.00235) - 0.00003 (0.00000) y [$N = 60$; $R^2 = 0.46$]. Source: I draw on Ashtor (1969, pp. 90-4, 223-9, 372-81) to construct a dataset on occupations and wages. I assigned to each occupation the *de jure* poll tax amount according to jurists' criteria.

2 Conceptual Framework

2.1 Modeling Selection

I employ a simple framework to guide the empirical analysis. Each Copt is endowed with income y distributed with density $f(.)$ and distribution $F(.)$, and religiosity r distributed with density $g(.)$ and distribution $G(.)$, 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 besides income such as education, occupation, and wealth, and of r as the non-pecuniary cost of conversion that includes the 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. While the *de jure* poll tax was imposed in three amounts on the poor, middle, and rich, it resembled a lump-sum tax to the extent that the poll tax rate, both *de jure* and *de facto*, was decreasing in income (Figure 1 and Table 2).

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A Copt chooses consumption (c) and religious affiliation ($\kappa = 1$ if he remains Coptic Christian and $\kappa = 0$ if he converts to Islam) in order to maximize:

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

$$\text{s.t.} \qquad c \leq y - \tau\kappa$$

where $u'(.)>0$ and $u''(.)<0$. It follows that a Copt converts if and only if:

$$u(y) - u(y - \tau) \geq r \tag{2}$$

Hence, because of both the lump-sum feature of the poll tax and the concavity of the utility function, the model predicts that, holding religiosity constant, poorer Copts are more likely to convert, and, similarly, holding income constant, less religious Copts are more likely to convert. It is important to note that the screening mechanism predicts that the poorest Copt is at least as rich as the richest convert, *at a given level of religiosity*. This may *not* hold though if religiosity differs among Copts. Specifically, the model allows for the possibility of poor Copts choosing to stay Coptic because they are highly religious and of rich Copts choosing to convert because they are not attached to Coptic Christianity. The model, however, generates the major empirical fact that this article seeks to understand, namely, that Copts are richer, *on average*, than Muslims.

Holding the income distribution constant, I examine at a given level of religiosity the partial effects of changing the tax on converts' population share and on the difference in the average (before-tax) income between those who remain Copts and converts (Muslims), which captures the selection-on-income effect of the poll tax. The following propositions hold (I relegate all proofs to section A of the online Appendix):[6]

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

Proposition 2 *Holding religiosity constant:*

1. *The average (before-tax) income of those who remain Copts, $E(y \mid y>y^*)$, and of those who convert to Islam, $E(y \mid y \leq y^*)$, are both increasing in the poll tax. Thus, the Coptic-Muslim difference in average income could be increasing or decreasing in the poll tax depending on the income distribution.*

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[6]Proposition 2 is an adaptation to my environment of results obtained in other contexts, such as the provision of pro-social behavior (Bénabou and Tirole, 2006) and coarse grading (Harbaugh and Rasmusen, 2016). By contrast, Propositions 3 and 4 in the next two sub-sections are new.
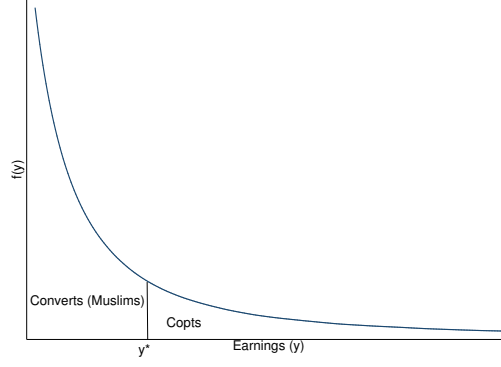
Figure 2: **The Marginal Effects of the Poll Tax in a Static Environment**

Source: See text.

2. *The Coptic-Muslim difference in average income is increasing in the poll tax if f(y)*
   is everywhere decreasing.

Figure 2 illustrates the intuition behind these results. Let $y^*(\tau; r)$ be the income at which a Copt is indifferent about conversion at a given level of religiosity. The concavity of u implies that y^* moves rightwards in response to an increase in τ, which decreases Copts' population share (Proposition 1). As y^* increases, the remaining Copts are richer on average as they lose their poorest members. The same holds for converts who are richer on average as they gain new converts who are richer than any previous convert. Hence, the average income of each of Copts and converts increases and the Coptic-Muslim income gap may go up or down depending on the income distribution. For example, it increases if the density of the income distribution is everywhere decreasing (Proposition 2). This condition is satisfied by the occupational distribution in 1848-1868 that is tabulated in Table 3.[7]

2.2 Why Was the Poll Tax Regressive?

The framework above treats the poll tax as exogenous. In reality however, the *de jure* poll tax was determined by Egypt's rulers while its actual enforcement was delegated to the local authorities in each district. The political economy of the poll tax raises an intriguing question: Why did rulers choose a regressive poll tax that triggered the masses,

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[7]I classified occupations into three categories: The highest rank includes white-collar workers, the middle rank includes artisans, and the lowest rank includes farmers and unskilled workers. I find that the population share of each occupational category is decreasing in its rank.

and not the elites, to convert? There are two possible answers. The first possibility is that actual incomes be imperfectly observable despite the delegation of the tax collection to the local authorities. The poll tax is then by necessity regressive as it cannot be finely tailored to individual incomes. This subsection envisions the other polar case and the possibility that rulers do not want to (as opposed to "cannot") impose a progressive poll tax. To this purpose, it assumes that an individual's income is perfectly verifiable and it unveils a sufficient condition for the optimal poll tax schedule to be regressive. The reality was between the two polar cases. The *de jure* three-bracket poll tax required observing occupations, whereas the *de facto* tax varied with landholdings.

Sijpesteijn (2013, p. 189) documents that rulers wanted, besides winning converts, a stable stream of tax revenues. Suppose that rulers could observe Copts' incomes y and hence maximize for all y:

$$V = R(r^*) - b(1 - G(r^*)) \tag{3}$$

where r^* is the threshold level of Copts' religiosity, at a given level of income, below which Copts convert and is defined by: $u(y) - u(y - \tau) = r^*$, $R(r^*) = \tau(1 - G(r^*))$ is the total poll tax revenue, and b is the (psychological) cost incurred by the ruler due to the non-conversion of the remaining Copts. Let $t = \tau/y$ be the poll tax rate. Hence, the rulers' objective function can be rewritten as:

$$V(y, t) = y(t - (b/y))(1 - G(u(y) - u((1 - t)y))) \tag{4}$$

Assume a constant relative risk aversion (CRRA) utility function with an RRA coefficient $\theta > 0$:

$$u(c) = \begin{cases} \frac{c^{1-\theta}}{1-\theta}, & \text{if } \theta \neq 1; \\ ln(c), & \text{if } \theta = 1. \end{cases} \tag{5}$$

Proposition 3 *Assuming that rulers observe Copts' incomes, a sufficient condition for the optimal poll tax rate to be decreasing in income is $\theta \leq 1$.*

Hence, the optimal tax is regressive if taxpayers are not *too* risk averse. Recent studies estimate the RRA coefficient to be around one (Chetty, 2006). The intuition is that a regressive tax would allow rulers to attract poorer Copts to convert (the "cheap converts") without causing a large loss in tax revenues that could arise from the conversion of richer (or more religious) Copts. That could also explain why rulers preferred a soft policy, such as taxation, to coercive conversions that use the threat of death since the latter policy deprives the state from tax revenues.

2.3 Persistence: Adding Investment in Human Capital

The poll tax was imposed from 641 to 1856 and so it likely caused new conversions over time. How long it takes for Copts to disappear when apostasy is punishable by death is ultimately an empirical question. To take an extreme case on the theoretical side, the framework above, extended to a dynamic context, predicts that in the absence of shocks to income and religiosity, and if the poll tax is constant over time, all conversions should occur at the initial stage and both the Coptic population and the Coptic-Muslim SES gap thereafter remain constant.[8] While it may not be optimal from the rulers' perspective to increase the poll tax over time as the elasticity of demand for Coptic Christianity is unchanged because of the "positive selection" of Copts (Tirole, 2016), income and religiosity definitely vary within a dynasty and so new conversions are expected even in the absence of tax rises. New conversions would cause Copts to disappear at a speed that depends on the magnitudes of income and religiosity shocks. However, even in the presence of new conversions, there is no reason to expect that the Coptic-Muslim SES gap must vanish over time, in contrast with Becker and Tomes (1979). In fact, the gap may well increase as poorer Copts convert in every generation, leaving behind a shrinking Coptic minority that is growing increasingly richer (relatively to Muslims) over time.

I now introduce a two-period model to prove a result that does not speak directly to Copts' eventual disappearance, but sheds light on its speed and furthermore generates a testable implication: non-converts invest more in human capital than converts.[9] I then derive (under a certain assumption) a sufficient condition for the investment incentive of non-converts to be increasing in the poll tax. This result suggests a mechanism as to why Copts may not necessarily vanish, and why the Coptic-Muslim SES gap (or the initial positive selection of non-convert Copts) may persist.

Suppose that there two periods, $t = 1, 2$ (the discount factor is denoted by δ) and a continuum of levels of religiosity. Let $G(r_2 \mid r_1)$ denote the conditional distribution of date-2 religiosity given date-1 religiosity, with $g(r_2 \mid r_1)$ being the corresponding density function. This conditional distribution satisfies first-order stochastic dominance (G is decreasing in r_1). There are two levels of possible incomes at date 2, y_H and $y_L < y_H$. The

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[8]The result also holds if the tax is declining over time since conversion is an absorbing state. A tax rise, on the other hand, triggers new conversions and widens the SES gap (if the density of income is everywhere decreasing).

[9]The two-period model captures the essence of a multiple-period Overlapping Generations Model (OLG) with one parent and one child in each period and where each generation lives for two periods.

poll tax is τ_1 at date 1 and τ_2 at date 2. The probability of a high income is $\rho < 1$ in the absence of investment and 1 if an investment costing i is sunk at date 1. The payoff of converts is hence given by:

$$U = u(y_1) + \delta \max\{u(y_H) - i/\delta; \rho u(y_H) + (1-\rho)u(y_L)\} \tag{6}$$

while a non-convert has payoff:

$$V^+ \equiv u(y_1 - \tau_1) + r_1 - i + \delta \left[\int \max\{u(y_H); u(y_H - \tau_2) + r_2\} dG(r_2 \mid r_1) \right] \tag{7}$$

if he invests in human capital, and

$$\begin{aligned} V^- \equiv \ & u(y_1 - \tau_1) + r_1 + \delta[\rho \int \max\{u(y_H); u(y_H - \tau_2) + r_2\} dG(r_2 \mid r_1) \\ & + (1-\rho) \int \max\{u(y_L); u(y_L - \tau_2) + r_2\} dG(r_2 \mid r_1)] \end{aligned} \tag{8}$$

if he does not.

Proposition 4 *In the framework augmented by investment in human capital:*

1. *Copts with religiosity r_1 below some cutoff convert and others do not.*

2. *Investment incentives increase with religiosity r_1. In particular, non-converts are more likely to invest in human capital than converts.*

3. *Suppose that $g(r_2 \mid r_1)$ is decreasing in r_1 for any $r_2 \in [0, u(y_L)]$. Then, the impact of τ_2 on non-converts' incentive to invest in human capital is increasing in r_1. In particular, there exists a unique cutoff $\tilde{r}_1$ such that non-converts' incentive to invest in human capital is increasing in τ_2 if and only if $r_1 > \tilde{r}_1$.*

Intuitively, non-converts have an option value of remaining Copt at date 2 that converts do not have. This option is more valuable, the higher the income, since remaining Copt entails sacrifice τ_2, which is less costly in terms of utility if the non-convert (or his descendant) is rich. And it is more valuable overall for more religious individuals as they are also more likely to be religious later on. Finally, suppose that having higher values of date-1 religiosity reduces the probability of having lower values of date-2 religiosity over a certain interval. Then if a non-convert Copt were *sufficiently* religious in the initial period, his incentive to invest in human capital would be increasing in the date-2 poll tax. The condition on religiosity likely holds because Copts resisted the conversion from the Coptic Church to the *Melkite* Church between 451 and 641 despite widespread persecution by the Byzantines. Since the investment incentive of converts is not affected by the date-2 poll tax, this result implies that the *difference* in the human capital investment incentive between non-converts and converts is increasing in the date-2 poll tax.

3 Evidence on Selection (I): Country-Level Evidence

Propositions 1 and 2, extended to a dynamic context, predict that in the absence of shocks to income and religiosity, an increase in the poll tax causes a decline in Copts' population share. It also causes the Coptic-Muslim SES gap to increase if the density of the income distribution is everywhere decreasing. By contrast, a tax decrease should leave both outcomes unchanged due to the fact that conversion to Islam is irreversible. In this section, I introduce my first (suggestive) evidence on propositions 1 and 2 that is based on the country-level long-term trends of the poll tax, Copts' population share, and the Coptic-Muslim SES gap. These trends, I argue, are consistent with both propositions.

3.1 The Poll Tax Rate in 641-1856

Panel (A) of Figure 3 depicts the long-term trend of the *de jure* nominal annual poll tax for low-, middle-, and high-income brackets. The figure shows that the nominal tax remained mostly stable until 1856. However, panel (B) that translates the nominal tax into real values in 701-1500 (data on the price level stop in 1500) shows that the real tax decreased for all income brackets during that period. Finally, panel (C) plots the *de jure* poll tax rate (tax divided by wage) between 661 and 1517. It indicates that the poll tax rate in 661-969 was, on average, 8-10 percent of the annual wage for low- and middle-income brackets, likely a significant financial burden, and that the tax declined to 6 percent in 969-1250 and 1.4 percent in 1250-1517. The tax was negligible though for the high-income bracket throughout the whole period.

Even though Figure 3 plots the *de jure* poll tax, the *de facto* tax likely coincided with the *de jure* values. First, the average poll tax payment in the papyri poll tax registers and receipts in 641-1100 is 1.5 dinar ($N = 552$; $SD = 3.7$), which is close to the average *de jure* poll tax (1-2 dinars) since most taxpayers belonged to the low and middle brackets. Second, the *de jure* amounts in 1101-1856 in Figure 3 are from officials' handbooks, which are roughly equal to the actual poll tax amounts (paid by Jews) that are observed in the Cairo Geniza (Goitein, 1963, p. 286).
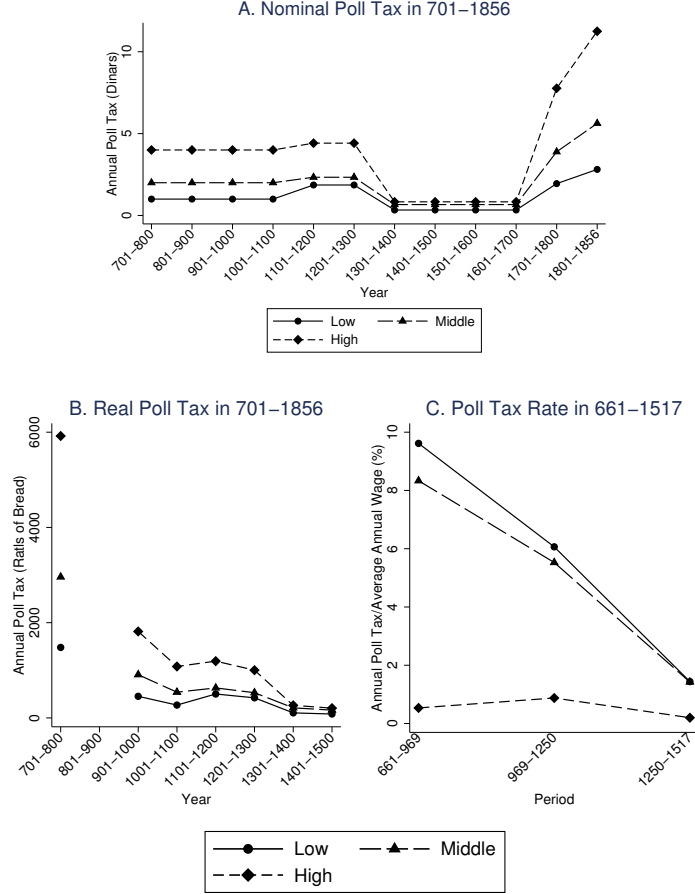
Figure 3: **The *De Jure* Poll Tax in 701-1856**

Notes: A *ratl* weighed 450 grams. Tax is in dinars weighing 4.25 grams of gold.
Sources: Panel (A): Jurists' handbooks in 701-1100, officials' handbooks in 1101-1700, and Ottoman official tax tabulations in 1701-1856. Panel (B): Ashtor (1969, p. 465). Panel (C): The same dataset as in Figure 1.

3.2   Copts' Population Share in 641-1897

Two novel data sources allow me to estimate non-Muslims' population share between 641 and 1897 (see online appendix B). The first is a dataset on Christian churches and monasteries (both Coptic and non-Coptic) in 1200 and 1500 that I constructed from medieval lists. Using this dataset, I estimate non-Muslims' population share in those years by the share of villages in all Egypt that had at least one Christian church or monastery. The second is the 1848 and 1868 population census samples that record the religious affiliation of each individual. My estimates, plotted in Figure 4, suggest that non-Muslims' population share decreased from 100 percent in 641 to 16 percent in 1200, 3 percent in 1500, and 7 percent in 1848-1868. This time path, which is consistent with

Courbage and Fargues (1997)'s estimates, indicates that non-Muslims fell into a minority by 1200, before declining slowly through 1897. It is also likely that the composition of Egypt's non-Muslims, with a Coptic majority and two small (urban) non-Coptic Christian and Jewish minorities, persisted through 1868.[10]
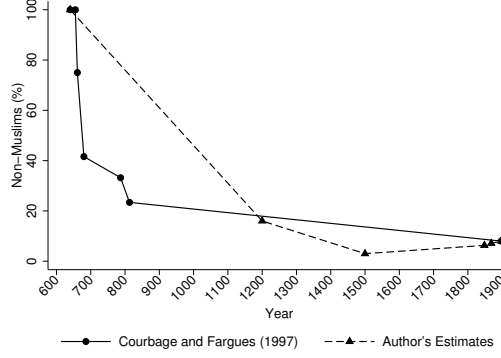
Figure 4: **Copts' Population Share in 641-1897**

Source: See text and sections B.1 and B.2 in the online appendix.

3.3 The Coptic-Muslim SES Gap in 641-1868

Documenting the trend of the Coptic-Muslim SES gap between 641 and 1868 is a more challenging task because it requires observing religion and occupational outcomes simultaneously. For this purpose, I collected all the available individual-level information on occupations and religion in 641-969 ($N = 402$) from the papyri documents in the Arabic Papyrology Database (henceforth, APD), where I inferred a worker's religion from his name (converts adopted an Arabic name). Importantly, 72 percent of the sample is from administrative lists and receipts, where, arguably, each individual has an equal chance of appearance. I compare Copts' and Muslims' occupational distributions estimated from the APD sample in 641-969 to those estimated from the 1848-1868 census samples.

To measure SES in both the APD sample and the 1848-1868 samples, I constructed three dummy variables that measure the incidence of working in a white-collar job (see section B.1 in the online appendix for details): (1) White-collar1 =1 if an individual

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[10]Four pieces of evidence support this claim. (1) In 600, most non-Coptic Christians were *Melkites* but there were only 7 *Melkite* churches in Egypt (Mikhail, 2004, p. 48). (2) In 1200 and 1500, only 4 percent of Christian churches and monasteries were non-Coptic (*Melkite* and Armenian), mostly in urban Egypt. (3) In 1848-1868, non-Coptic Christians, who were still urban, comprised 4 percent of non-Muslims, even though their ethnic composition expanded to include Greeks, Levantines, and Europeans. (4) Jews were a "small" urban minority in 641 and constituted 2 percent of non-Muslims in 1848-1868.

is a professional, a high-level bureaucrat, or a mid-low bureaucrat; these are literate white-collar jobs that are non-political and non-religious (perhaps except, high-level bureaucrats). (2) White-collar2 =1 if white-collar1 =1 or if an individual belongs to the judiciary, the military, the police, the clergy, or the rural elites; these are literate political or religious white-collar jobs, and (3) White-collar3 =1 if white-collar2 =1 or if an individual is a merchant; a white-collar job that is not necessarily literate. I also created dummy variables for three other occupational outcomes: artisans, farmers, and unskilled workers. By construction, the population shares of white-collar3, artisans, farmers, and unskilled workers sum up to one, thus exhausting the occupational distribution.

The findings are in Table 3. 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 the mid-low bureaucracy (scribes, land tax collectors, accountants). In fact, Copts are seldom observed among the judiciary, the military, the 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 the 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) ($p = 0.13$) and 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) or artisans and are less likely to be farmers or unskilled workers. Even though Muslims are over-represented among professionals, high-level bureaucrats, the judiciary, the military, the police, the clergy, and the rural elites, the combined population share of these jobs is too small to offset Copts' advantage. Comparing the figures in 641-969 and 1848-1868 indicates that the Coptic-Muslim gaps persisted with respect to most outcomes, although the gaps with respect to mid-low bureaucrats, artisans, and unskilled workers increased significantly.

A few notes on the findings are in order. (1) Because of their political and/or religious nature, the judiciary, the military, the police, the (Muslim) clergy, and the high-level bureaucracy were (mostly) restricted to Muslims by law.[11] But since Egyptian Muslims (converts) were under-represented in these jobs vis-à-vis non-Egyptian Muslim elites (Arabs, and later on, Turks), the findings likely *underestimate* the true Coptic-Muslim SES gap. (2) Ashtor (1969) documents that bureaucrats were better paid than artisans

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[11]This legal restriction does not apply to every occupation under these categories. For example, I observe Copts working as "legal delegates" in the judiciary, and as "shipbuilder soldiers" in the military.

Table 3: **The Coptic-Muslim Occupational Differences in 641-969 and 1848-1868**

	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 = 1 if:	0.18	0.09	0.09***	0.18	0.02	0.16***	0.00	-0.07***	0.07**
	(0.39)	(0.28)	[0.03]	(0.39)	(0.13)	[0.01]	[0.03]	[0.02]	[0.04]
= 1 if professional	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]
= 1 if high bureaucrat	0.02	0.01	0.02	0.00	0.00	-0.00***	-0.02**	0.00	-0.02*
	(0.15)	(0.08)	[0.01]	(0.00)	(0.06)	[0.00]	[0.01]	[0.01]	[0.01]
= 1 if mid-low bureaucrat	0.13	0.07	0.06**	0.18	0.01	0.17***	0.05*	-0.06***	0.11***
	(0.34)	(0.25)	[0.03]	(0.38)	(0.10)	[0.01]	[0.03]	[0.02]	[0.03]
White-collar2 = 1 if	0.22	0.13	0.09**	0.20	0.07	0.13***	-0.01	-0.05**	0.04
White-collar1 = 1 or:	(0.41)	(0.33)	[0.04]	(0.40)	(0.26)	[0.01]	[0.03]	[0.03]	[0.04]
=1 if judiciary, military, police	0.01	0.02	-0.01	0.01	0.03	-0.02***	0.00	0.01	-0.01
	(0.09)	(0.15)	[0.01]	(0.08)	(0.17)	[0.00]	[0.01]	[0.01]	[0.01]
= 1 if clergy, rural elite	0.03	0.02	0.01	0.02	0.03	-0.01***	-0.01	0.01	-0.02
	(0.16)	(0.13)	[0.01]	(0.12)	(0.16)	[0.00]	[0.01]	[0.01]	[0.01]
White-collar3 = 1 if	0.22	0.15	0.07*	0.22	0.10	0.13***	0.00	-0.06**	0.06
White-collar2 = 1 or:	(0.42)	(0.36)	[0.04]	(0.42)	(0.30)	[0.01]	[0.03]	[0.03]	[0.04]
= 1 if merchant	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***
	(0.4)	(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)	(0.5)	[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%				6.70%				
Observations	227	175		1121	15520				

Notes:

1. Standard deviations are in parentheses. Robust standard errors are in brackets. $*p < 0.10, **p < 0.05, ***p < 0.01$.

2. Differences in columns (3), (6), (7), (8), and (9) are estimated from the regression: $y_{it} = \sum_{l=1}^{2} \beta_{1l} d_l + \sum_{l=1}^{2} \beta_{2l}(copt_{it} \times d_l) + \epsilon_{it}$, 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; $copt_{it}$ is an indicator variable for being Coptic Christian; ϵ_{it} is an error term.

Sources: The APD sample in 641-969 and the 1848-1868 census samples (see the text and sections B.1 and B.3 in the online appendix for details).

and unskilled workers, and hence the occupational gap likely reflected an income gap. (3) The persistence of the Coptic-Muslim SES gap raises a question: how did Copts succeed in hiding their wealth from Muslim rulers who often taxed wealth opportunistically despite the fact that Copts were not (normally) able to form *waqfs* (pious endowments) that allowed rich Muslims to protect their wealth from arbitrary taxation? There are two possible answers. First, unlike elite Muslims, rich Copts were mostly mid-low bureaucrats who rarely possessed the wealth that would attract the attention of tax collectors. Second, Copts donated to Coptic churches and monasteries that were taxed less: Most Coptic *waqfs* in 1848-1868 were dedicated to the Coptic church. (4) Copts' persistent over-representation in the mid-low bureaucracy and skilled artisanal jobs, and Muslims' over-representation in trade, are both well documented in history. According to Tagher (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 noted that, "*scribes in the Levant and Egypt are Christians.*" A millennium later, Lord Cromer, the British Consul of Egypt (1883-1908), observed that, "*when the English took Egyptian affairs in hand, the accountants in the employment of the Egyptian government were almost exclusively Copts,*" (Tagher, 1951, p. 213). Raymond (1973, pp. 456-59) documents that Copts in eighteenth-century Cairo were over-represented among jewelers, carpenters, tailors, and weavers, which are almost the same set of occupations in which I observe Coptic artisans in both 641-969 and 1848-1868. Muslims, on their part, were over-represented in trade. Under the Mamluks, for example, all merchants of spices were Muslims.

3.4   Can the Poll Tax Explain the Long-Term Trends?

The key findings of the country-level long-term trends could be summarized as follows. (1) The poll tax rate for low- and middle-income Copts was high in 661-1250 but became negligible in 1250-1517; it was negligible though for high-income Copts throughout the whole period. (2) Copts shrank from (almost) 100 percent of the population in 641 to 16 percent in 1200 and 7 percent in 1848-1868. (3) Copts were richer than Muslims by 969 and the gap persisted through 1868.

I argue that these findings are consistent with the conceptual framework. The high tax rate in 641-1250 triggered a decline in Copts' population share between 641 and 1200

and the emergence of a Coptic-Muslim SES gap by 969 as farmers and unskilled Copts were more likely to convert. Conversions then subsided after 1200 with the decline in the tax rate. Being at the country level though, the long-term trends do not allow me to rigorously test the tax-induced selection hypothesis. Therefore, I now turn to my second empirical evidence that is based on exploiting the cross-district variation in the poll tax in 641-1100, the period where most conversions took place.

4   Evidence on Selection (II): Cross-District Evidence

In this section, I exploit the cross-district variation in the poll tax between 641 and 1100 in order to explain the cross-district variation in Copts' population share and the Coptic-Muslim SES gap in 1848-1868. I first introduce the data and the empirical strategy. Second, I describe the findings. Finally, I discuss the robustness checks.

4.1   Data and Empirical Strategy

Tax assessment and collection were delegated to the local authorities of each district, which led the poll tax to vary across districts.[12] The model predicts that, holding the distributions of income and religiosity constant across districts, a district with a higher tax would have a smaller Copts' population share (proposition 1) but a greater Coptic-Muslim SES gap if the density of the SES distribution is decreasing (proposition 2).

To measure the cross-district variation in the poll tax, I collected data from the extant papyri poll tax registers and receipts on individual annual nominal poll tax payments in 641-1100, the period where most conversions took place ($N = 408$). Using this dataset, I created my measure of the poll tax, a dummy variable that takes the value of one if the average poll tax in a district in 641-1100 was "high," defined as being above the cross-district average. The main caveat here is that papyri tax documents survived for only 4 *kuras* (Egypt's administrative units in 641-1036), all located in the Nile Valley, that map into 11 districts in 1848-1868 (I address this issue in section 4.3.1). Table 4 shows the

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[12]In 641-720, Arabs left taxation in the hands of the Coptic rural elites. But starting from 720, they attempted to centralize taxation via appointing Arabs as headmen of districts (Morimoto, 1981, pp. 66-91; 175-81). In response to a series of tax revolts between 726 and 866, they resorted around 900 to tax farming (Sijpesteijn, 2009) that remained in effect until 1813. Under that system, the state contracted out the tax collection of each district to individuals (Morimoto, 1981, pp. 231-3), who, in 1171-1813, were often high-ranked military officers.

Table 4: **Individual-Level Annual Poll Tax Payments (Dinars) in 641-1100: Summary Statistics by _Kura_**

Name	Period	N	% No Tax	Median	Mean	Std. Dev.	Min	Max
Ihnas	701-900	10	0	1.38	1.35	0.5	0.88	2.25
Ashmunayn	731-1100	77	0	0.96	1.36	1.18	0.17	6.71
Fayum	641-1005	7	0	0.99	1.34	0.81	0.25	2.67
Qahqawa	703-733	314	46.5	1	1.07	1.27	0	5

Source: Papyri poll tax registers and receipts in 641-1100. See section B in the online appendix.

summary statistics of the poll tax by _kura_. The average tax is lower in _Qahqawa_ than in other _kuras_ by 25 percent due to the higher share of Copts who paid no tax in that _kura_, which suggests that there were cross-_kura_ differences in tax enforcement.

While I am able to observe the district-level poll tax in 641-1100, the earliest district-level data on religious affiliation and occupational outcomes come from the 1848 and 1868 population census samples. For the purpose of this article, I pooled the two samples and restricted the analysis to Egyptian local free Coptic and Muslim employed men of a rural district of origin who are at least 15 years of age and with non-missing information on age, religion, occupation, and district of origin. These sample restrictions aim at (a) limiting the analysis to the likely descendants of the pre-641 population (via excluding foreigners, blacks, and Bedouins), and (b) mitigating the possibility of cross-district movement of an individual's ancestors in 641-1868 by excluding those whose district of origin is in urban Egypt and were thus more likely to have moved there from another district.

To test propositions 1 and 2, I estimate two individual-level regressions that capture the impact of a district' poll tax in 641-1100 on its population share of Copts and its Coptic-Muslim SES differential, both observed in 1848-1868:

$$copt_{ij} = \beta_k + \beta_{11}\tau_j + X_j\beta_{12} + \epsilon_{1ij} \tag{9}$$

$$y_{ij}^o = \beta_j + \beta_{21}^o copt_i + \beta_{22}^o(copt_i \times \tau_j) + (copt_i \times X_j)\beta_{23}^o + \epsilon_{2ij}^o; o = 1, ..., 12 \tag{10}$$

where $copt$ =1 if individual i of district of origin j is Coptic Christian and y_{ij}^o =1 if individual i of district j works in occupation o. I estimate equation (10) for twelve occupational outcomes separately (the same categories as in Table 3): (1) the three white-collar indicators, (2) indicators for the six sub-outcomes that comprise the white-collar indicators, and (3) indicators for artisanal, farmer, and unskilled jobs. β_k and β_j are full sets of province and district of origin fixed effects respectively, τ_j is the measure of

the poll tax in 641-1100 in an individual's district of origin. Standard errors are clustered at the district of origin level.[13]

I include in X_j a set of pre-641 district-level controls, most importantly proxies for income and religiosity (since propositions 1 and 2 hold the distribution of each constant): (1) the natural logarithm of the urban population in a district circa 300, as a proxy for income (or economic development), (2) a dummy variable that takes the value of one if a district is believed (according to a Coptic book written around 400) to have been visited by the Holy Family during its legendary flight to Egypt; I use this variable as a proxy for pre-641 religiosity or attachment to Coptic Christianity, but since the book's date is not certain it must be interpreted with caution,[14] (3) a district's share of villages with at least one Coptic monastery in 1200, as a proxy for the generosity of the intra-Coptic transfer system since monasteries were the main Coptic charity institutions,[15] [16] (4) a dummy variable that takes the value of one if a district had at least one *autopract* estate in 600, as a proxy for the power of the Coptic elites since the *autopragia* was a privilege granted to large landholders in late Byzantine Egypt allowing them to pay taxes directly to the capital and to collect taxes in their constituencies, (5) a dummy variable that takes the value of one if there was at least one Byzantine garrison in a district in 600, as a proxy for Byzantines' resistance to Arabs (Copts did not hold arms during the Conquest).

Equations (9) and (10) are direct tests of propositions 1 and 2. Basically, they are identical to district-level regressions (weighted by a district's population) with Copts' population share being the dependent variable (in the case of equation (9)), and the Coptic-Muslim difference in the population share of each occupational outcome being the dependent variable (in the case of equation (10)). The thought experiment here is to vary the tax across districts and observe the two outcomes, while holding the initial distributions of income and religiosity (and other confounding factors) constant across districts via the set of control variables in X_j and the province (or district) fixed effects.

Propositions 1 and 2 make the following predictions with respect to the signs of

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[13]I also clustered standard errors at the *kura* level (results are available upon request).

[14]The path may also reflect income, because it included sites that later became pilgrimage destinations and a potential source of income for local Copts.

[15]Coptic monasteries leased out their landholdings to farmers and provided loans and grants to poor Copts to help pay the poll and land taxes. Copts often took refuge in monasteries to escape paying the poll tax since monks were exempted from the latter tax (Morimoto, 1981, p. 118).

[16]The number of Coptic monasteries in a district in 1200 should not differ too much from their number before 641 because (a) monasteries were unlikely to be demolished owing to their large size and wealth, and (b) the construction of new monasteries was in principle prohibited under Islam.

the coefficients of interest. (1) β_{11} captures the poll tax effect on Copts' population share. Proposition 1 predicts that $\beta_{11}<0$; districts with a higher poll tax would have relatively fewer Copts in 1848-1868. As all districts were almost 100 percent Copt in 641, and assuming away cross-district migration, Copts' population share in 1848-1868 is approximately equal to one minus the share of converts between 641 and 1868. (2) β_{21}^o captures the Coptic-Muslim SES gap in low-tax districts. The model predicts that $\beta_{21}^o>0$ for the white-collar and artisanal outcomes and <0 for the farmer and unskilled outcomes. Due to the initial positive selection of non-convert Copts in every district, and assuming that the initial selection perpetuated through 1868, Copts in low-tax districts are expected to be over-represented among white-collar workers and artisans and under-represented among farmers and unskilled workers. (3) β_{22}^o, the coefficient on the interaction term ($copt_i \times \tau_j$), captures the impact of the tax on the Coptic-Muslim SES *differential*. Proposition 2 predicts that $\beta_{22}^o>0$ for the white-collar and artisanal outcomes and <0 for the farmer and unskilled outcomes. Assuming that the initial selection persisted through 1868, one expects that, compared to Copts in low-tax districts, Copts in high-tax districts are *differentially* more likely than Muslims to be white-collar workers or artisans and *differentially* less likely to be farmers or unskilled workers.

Figure 5 maps the poll tax in 641-1100 and Copts' population share and the Coptic-Muslim SES gap, both observed in 1848-1868. First, within the 11 districts for which I observe the poll tax, the tax is higher in the north. Second, Copts are a minority in all districts in 1848-1868, but are relatively more concentrated in the Nile Valley. Finally, Copts are more likely than Muslims to be white-collar workers in 41 out of the 49 districts in which there are any Copts, but the gap is larger in districts with a relatively smaller Coptic minority.[17]

Table 5 shows the summary statistics of the 1848-1868 sample for which I observe the poll tax (statistics on occupational outcomes in the 1848-1868 full sample are in Table 3). Muslims are more likely than Copts to be of a district of origin that faced a higher-than-average poll tax in 641-1100. These districts had a larger urban population in 300, were less likely to lie on the Holy Family legendary path, and were more likely to have an *autopract* estate and a Byzantine garrison in 600. They did not differ though in the

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[17]The negative correlation between Copts' population share and the Coptic-Muslim SES gap, that follows from Propositions 1 and 2, is confirmed by the regression: $y_{ij}^o = \beta_j + \beta_{41}^o copt_i + \beta_{42}^o(copt_i \times coptpopshare_j) + \epsilon_{4ij}^o; o = 1, \ldots, 12$, where *coptpopshare* is Copts' population share in a district in 1848-1868. The results are available upon request.

share of villages that had at least one Coptic monastery in 1200.

Table 5: **The 1848-1868 Census Samples: Summary Statistics**

	Individual-Level			District-Level
	Copts	Muslims	Total	Total
District's Copts' population share in 1848-1868	0.22	0.14	0.15	0.13
	(0.08)	(0.10)	(0.10)	(0.09)
District's average poll tax in 641-1100 (Dinars)	1.19	1.27	1.26	1.27
	(0.14)	(0.13)	(0.13)	(0.13)
=1 if average poll tax high in district in 641-1100	0.42	0.71	0.67	0.73
	(0.49)	(0.45)	(0.47)	(0.47)
Log(urban population) in 300	9.86	10.33	10.26	10.41
	(0.97)	(0.84)	(0.87)	(0.85)
=1 if district on Holy Family route in 400	0.23	0.20	0.21	0.27
	(0.42)	(0.40)	(0.41)	(0.47)
% Villages with Coptic monasteries in 1200	0.03	0.03	0.03	0.04
	(0.03)	(0.03)	(0.03)	(0.03)
=1 if *Autopract* estates in district in 600	0.88	0.94	0.93	0.91
	(0.33)	(0.23)	(0.25)	(0.30)
=1 if Byzantine garrison in district in 600	0.44	0.56	0.55	0.55
	(0.50)	(0.50)	(0.50)	(0.52)
Observations	396	2286	2682	11

Note: Standard deviations are in parentheses.
Source: The 1848-1868 census samples combined with other data sources. The sample is restricted to individuals for whom I observe the poll tax in 641-1100 in their district of origin. See section B in the online appendix for details.

4.2 Findings

Table 6 shows the results on the impact of the poll tax on conversions (equation (9)). I find that individuals whose district of origin faced a higher poll tax in 641-1100 are less likely to be Coptic Christian 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 the pre-641 controls and province fixed effects.

Results on the impact of the poll tax on the Coptic-Muslim occupational differentials (equation (10)) are in Table 7. Panel (7a) shows that compared to their co-religionists in low-tax districts, Copts in high-tax districts are differentially more likely than Muslims to be professionals and bureaucrats (White-Collar1=1). Whereas the Coptic-Muslim gap in the population share of White-Collar1 occupations is positive in low-tax districts, it

C. Coptic–Muslim SES Gap in 1848–1868

B. Percentage of Copts in 1848–1868

A. Average Poll Tax in 641–1100

1st Quartile: −3.36%–6.06%
2nd Quartile: 6.31%–18.64%
3rd Quartile: 21.2%–42.26%
4th Quartile: 44.51%–97.27%
No Copts

1st Quartile: 0%
2nd Quartile: 0.5%–2.27%
3rd Quartile: 2.43%–8.26%
4th Quartile: 8.33%–29.7%

Qahqawa (1.07 Dinar)
Fayum (1.34 Dinar)
Ihnas (1.35 Dinar)
Ashmunayn (1.36 Dinar)
Missing
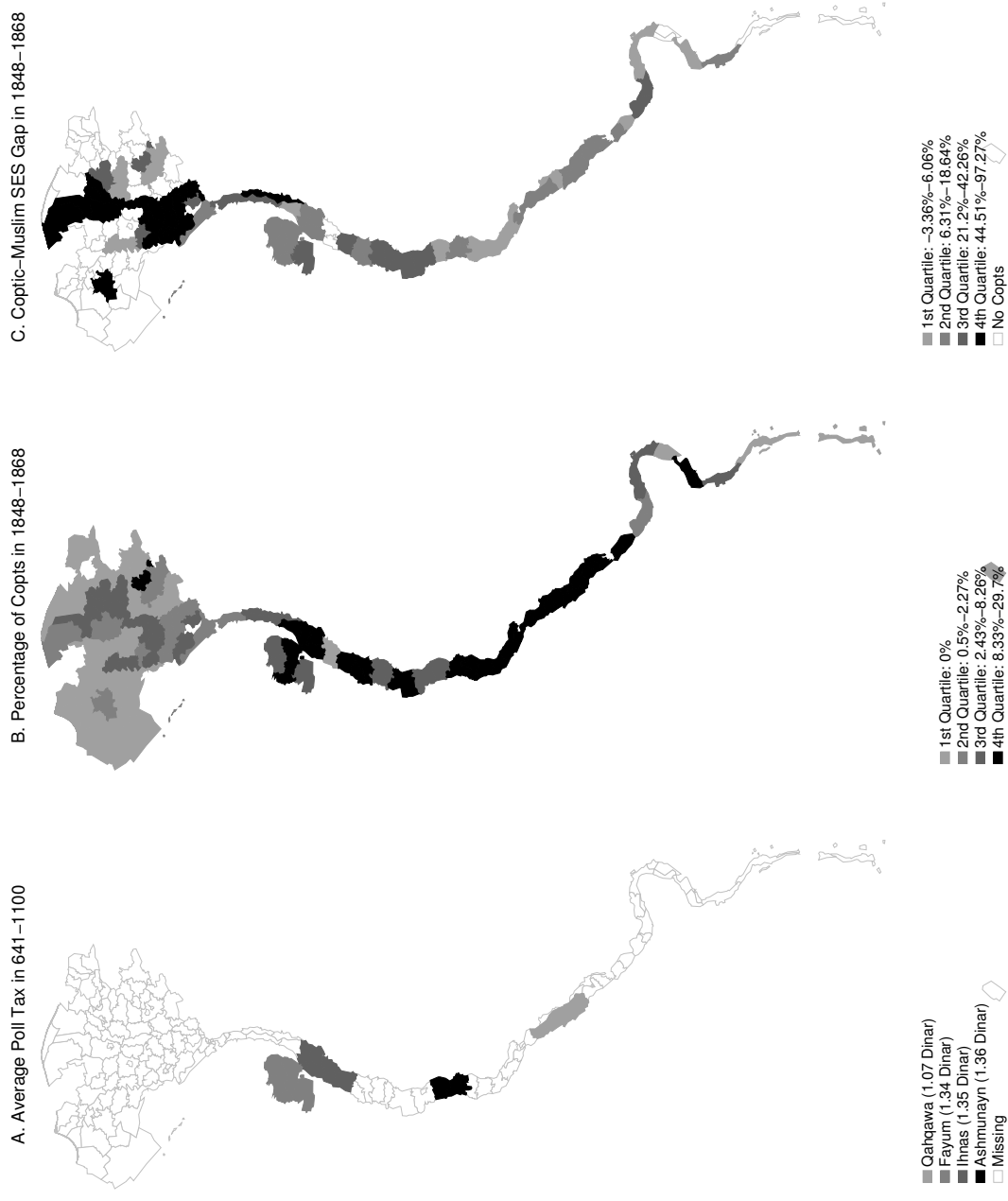
Figure 5: **The Spatial Distribution of the Poll Tax, Copts' Population Share, and the Coptic-Muslim SES Gap**

Notes: The Coptic-Muslim SES gap is the difference between Copts and Muslims in the population share of professionals, high-level bureaucrats, and mid-low bureaucrats (white-collar1 = 1). 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.

Sources: Panel (A) is from the papyri poll tax registers and receipts in 641-1100. Panels (B) and (C) are from the 1848-1868 population census samples. See section B in the online appendix for details.

The Poll Tax in 641-1100 and Copts' Population Share in 1848-1868 - OLS Estimates

Dependent Variable =1 if Coptic Christian

	(1)	(2)	(3)	(4)	(5)
=1 if poll tax high	-0.163***	-0.281**	-0.551*	-0.176***	-0.617*
	(0.043)	(0.099)	(0.275)	(0.030)	(0.320)
Controls urbanization and religiosity?	No	Yes	Yes	No	Yes
Other controls?	No	No	Yes	No	Yes
Province of origin FE?	No	No	No	Yes	Yes
Clusters	11	11	11	11	11
Obs	2682	2682	2682	2682	2682
AR2	0.047	0.058	0.060	0.057	0.075

Notes: Standard errors clustered at the district of origin level are in parentheses.
$*p < 0.10, **p < 0.05, ***p < 0.01$. A constant is included in all regressions.
Source: The 1848-1868 population census samples combined with multiple data sources. See section B in the online appendix for details.

is even greater 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 the artisan, farmer, and unskilled outcomes all have the expected signs but are statistically insignificant. Panel (7b) controls for interactions of the pre-641 controls with the Coptic indicator. Although the standard errors are large because of multicollinearity, the interaction of the poll tax and the Coptic indicator remains positive and statistically significant in the case of the white-collar and artisanal outcomes.

Overall, the results suggest that, compared to Copts in low-tax districts, Copts in high-tax districts are relatively fewer, but differentially better off. They are differentially more likely to be white-collar workers. They are also differentially more likely to be artisans and differentially less likely to be farmers, although the latter results are not always statistically significant. Put differently, the findings indicate that there was an initial positive selection of non-convert Copts on SES, the extent of which varied across districts due to the cross-district variation in the poll tax, and that the initial selection persisted at the district level through 1868.

4.3 Robustness Checks

There are at least four concerns about the OLS estimates. First, the sample for which the papyri tax documents survived may not be representative of Egypt. Second, there may

Table 7: **The Poll Tax in 641-1100 and the Coptic-Muslim Occupational Differences in 1848-1868 - OLS Estimates**

(a) =1 if Average Poll Tax High in District in 641-1100 - No Controls

	(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, Police	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Copt	0.087***	0.003	0.010	-0.005**	0.000	0.092***	-0.029***	-0.055***	0.007	0.151**	-0.061	-0.100*
	(0.014)	(0.015)	(0.024)	(0.002)	(0.000)	(0.015)	(0.001)	(0.014)	(0.010)	(0.049)	(0.039)	(0.048)
Copt * Poll tax	0.074*	0.129***	0.097*	0.003	-0.003*	0.074*	-0.018***	0.073**	-0.032*	0.110	-0.143	-0.063
	(0.039)	(0.034)	(0.044)	(0.002)	(0.002)	(0.040)	(0.004)	(0.024)	(0.015)	(0.137)	(0.166)	(0.057)
District FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	11	11	11	11	11	11	11	11	11	11	11	11
Obs	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
AR2	0.072	0.026	0.016	-0.002	0.001	0.097	0.036	0.018	0.009	0.065	0.056	0.035

(b) =1 if Average Poll Tax High in District in 641-1100 - With Controls

	(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, Police	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Copt	0.875	-1.278	0.928	0.052	-0.007	0.830	-0.294*	-1.859***	2.206***	6.541**	-7.618***	0.150
	(0.606)	(0.973)	(1.019)	(0.044)	(0.029)	(0.564)	(0.153)	(0.351)	(0.055)	(2.723)	(0.272)	(1.882)
Copt * Poll tax	0.349**	0.032	0.439*	0.011	-0.001	0.339**	-0.050	-0.267***	0.406***	1.701***	-2.268***	0.129
	(0.155)	(0.221)	(0.233)	(0.009)	(0.006)	(0.148)	(0.033)	(0.070)	(0.015)	(0.533)	(0.155)	(0.391)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	11	11	11	11	11	11	11	11	11	11	11	11
Obs	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
AR2	0.081	0.026	0.018	-0.003	-0.001	0.111	0.034	0.019	0.011	0.089	0.077	0.037

Notes: Standard errors clustered at the district of origin level are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Source: The 1848-1868 population census samples combined with multiple data sources. See section B in the online appendix for details.

be error in observing the tax in the papyri. Third, there may be unobserved district-level characteristics that are not captured by the set of control variables. Fourth, there may be tax-induced cross-district movement between 641 and 1868. I address each of these issues below. However, due to space limitations, I relegate all results of this section to section C in the online appendix.

4.3.1 Representativeness of the Poll Tax Sample

Papyri tax documents survived for 11 out of 76 districts in rural Egypt, all located in the Nile Valley. This raises a concern about the representativeness of the sample for the whole of Egypt. To address this issue, I employ an alternative proxy of the poll tax that is observed for all 76 districts, a dummy variable that takes the value of one if at least one Arab tribe settled in a district between 700 and 969. This is supported by historical evidence. Table C.1 reveals that individual poll tax payments in 641-1100 are, on average, higher in a *kura* if Arabs settled in that *kura* in 700-969. This is arguably because in *kuras* where Arabs settled, they replaced the Coptic elites as large landholders (Sijpesteijn, 2009). In these *kuras*, I argue, Arabs were likely stricter in enforcing the tax on Copts. By contrast, in *kuras* where Arabs did not settle, Coptic elites remained in power and were likely more lenient in taxation with their fellow Copts. That was manifested in their higher tolerance for (a) Copts paying a zero or a reduced tax and (b) the piling-up of tax arrears. These phenomena, but not their variation across *kuras*, are well documented in history (Morimoto, 1981).[18] Using the full sample with the Arab settlement variable generates similar results with respect to both Copts' population share and the Coptic-Muslim SES gap (see Tables C.2 and C.3).

4.3.2 Error in Observing the Poll Tax in the Papyri

The poll tax in the papyri documents may be observed with error. I address this concern as follows (the results are in Tables C.4 and C.5): (1) Instead of using the average tax, I use an indicator variable that takes the value of one if the median poll tax was high. (2) I drop two *kuras* where the number of taxpayers in the papyri is less than 10. (3) I drop the *kura* of *Qahqawa*, where the papyri come from a different period. (4) Instead

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[18]The poll tax indicator and the Arab settlement indicator are actually identical in the 11 districts for which I observe the poll tax.

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of using a dummy variable indicating districts with a higher-than-average poll tax, I use the actual average and median poll taxes in dinars.

4.3.3 Instrumental Variable (IV) Strategy

To address the potential endogeneity of the poll tax that stems from omitted characteristics of districts that could be correlated with taxation, conversions, and the Coptic-Muslim SES gap, I employ an instrumental variable (IV) strategy. As an IV for the poll tax in equation (9), I use a district's distance to *Arish*, a town close to Egypt's northeastern borders that was the first to be captured by Arabs in 639 due to its proximity to the Arab peninsula. Similarly, I use "Copt × Distance to *Arish*" as an IV for the interaction term in equation (10). The rationale is that Arabs were more likely to settle and thus to enforce a higher tax in the districts that were captured first.

Is the distance to *Arish* an exogenous IV that satisfies the exclusion restriction? The proximity to *Arish*, a small border town, is (arguably) unlikely to be correlated with pre-641 characteristics of districts. Indeed, Table C.6 indicates that urbanization, religiosity, power of Coptic elites, and Byzantine resistance to Arabs in a district are all uncorrelated with its distance to *Arish*. The only exception is that a district's share of villages with at least one Coptic monastery in 1200 is positively correlated with its distance to *Arish*.

The IV estimation results on Copts' population share are shown in Table C.7. The first-stage estimates in panel (C.7b) show that the distance to *Arish* is a strong and relevant IV. The second-stage estimates in panel (C.7a) are negative and larger in absolute value than the OLS estimates. The results on the Coptic-Muslim SES differential are in Table C.8. The first-stage regression in panel (C.8b) shows that "Copt × Distance to *Arish*" is a strong IV. The second-stage estimates in panel (C.8a) reveal that compared to Copts in low-tax districts, Copts in high-tax districts are differentially more likely to be white-collar workers or artisans and differentially less likely to be farmers.

4.3.4 Poll-Tax-Induced Movement across Districts in 641-1868

Another potential source of endogeneity is people's movement across districts between 641 and 1868 in response to cross-district differences in the poll tax. To mitigate this concern, I document that the poll tax had a negative effect on Copts' population share in a district as early as 1200 and 1500, where I use the share of villages with at least one

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Coptic church or monastery in 1200 and 1500 as a proxy of Copts' presence in a district (see Table C.9). These results are actually unsurprising since historians document that the state imposed restrictions on migration in rural Egypt since (at least) 641, and these restrictions lasted until 1857. Perhaps due to labor scarcity, the state used coercion in assigning land to people for cultivation and tax payment, and in military conscription and corvée in public works. All these obligations were decided based on an individual's village of residence, and hence people were not normally allowed to move without a state permit. Morimoto (1981, pp. 113-24) describes the "fugitives" between 641 and 969, those who fled their villages in order to escape their land assignment and tax quota, and the state policies to identify fugitives and send them back to their homes. Historians of Ottoman Egypt (1517-1914) document the same phenomenon.

5 Persistence: Evidence on the Coptic-Muslim Differential Investment in Human Capital

The cross-district evidence suggests that the initial tax-induced positive selection of non-convert Copts persisted at the district level through 1868. Proposition 4 suggests a mechanism that could account for this long-term persistence: the poll tax triggered non-convert Copts to invest more in their children's human capital than converts. Furthermore, if Copts were sufficiently religious in the initial period, one should expect the Coptic-Muslim differential investment in human capital to be greater in high-tax districts than in low-tax districts. In this section, I provide evidence in support of this mechanism. But in the absence of district-level data on each religious group's human capital investment before 1848, the evidence below rests on theory, history, and the 1848-1868 censuses.

The 1848-1868 censuses allow me to observe the Coptic-Muslim differential investment in child's human capital that includes both education and apprenticeship, and to examine if this differential is greater in high-tax districts. To this end, I restrict the census samples to Egyptian local free Coptic and Muslim male children of a rural district of origin who are between 5 and 14 years of age, and I estimate the following OLS regression:

$$childhumancapital_{ij} = \beta_j + \beta_o + \beta_{31}copt_i + \beta_{32}(copt_i \times \tau_j) + (copt_i \times X_j)\beta_{33} + \epsilon_{3ij} \quad (11)$$

where $childhumancapital_{ij}$ is a dummy variable that takes the value of one if male child i of district of origin j is either enrolled in school (mostly elementary religious schools or

kuttabs) or is an apprentice in an artisanal or a white-collar profession. I include in β_o a full set of fixed effects for the occupation of the household head (white-collar, artisan, and farmer) with unskilled worker being the omitted group. The results are shown in Table 8. Columns (1) and (2) show that Coptic households are more likely than Muslims to enroll their children in schools and/or in an apprenticeship (as scribes, weavers, carpenters), and the result holds when controlling for the household head's occupation. More importantly, columns (3) and (4) reveal that relative to Coptic households in low-tax districts, Copts in high-tax districts are *differentially* more likely than Muslims to invest in their children's human capital (the effect in column (3) is not statistically significant). Using "Copt ✕ Distance to *Arish*" as an IV for the interaction term in columns (5) and (6), and using the Arab settlement indicator variable as a proxy for the poll tax in column (7) and (8) both yield a statistically significant effect of the interaction term, except in column (6).[19]

Table 8: **The Poll Tax in 641-1100 and the Coptic-Muslim Difference in Household's Investment in Child's Human Capital in 1848-1868**

Dependent variable =1 if Child is White-Collar Worker, Artisan, or Enrolled in School

	Poll Tax-OLS				Poll Tax-IV		Arab Settlement-OLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Copt	0.154***	0.114***	0.082***	18.905***	0.019	0.045	0.087***	0.057
	(0.035)	(0.035)	(0.022)	(1.396)	(0.074)	(0.052)	(0.031)	(0.036)
Copt * Poll tax			0.085	3.452***	0.235**	0.086	0.151**	0.135*
			(0.094)	(0.256)	(0.097)	(0.092)	(0.073)	(0.074)
Copt * Controls?	No	No	No	Yes	No	No	No	No
HHH occupation?	No	Yes	No	Yes	No	Yes	No	Yes
District FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	75	75	11	11	11	11	75	75
Obs	7551	5979	1407	1096	1407	1096	7551	5979
AR2	0.041	0.108	0.047	0.187			0.045	0.111

Notes: $*p < 0.10, **p < 0.05, ***p < 0.01$. Standard errors clustered at the district of origin level are in parentheses.
Source: The 1848-1868 census samples restricted to Egyptian free local Coptic and Muslim children (between 5 and 14 years) of a rural district of origin with non-missing religion, age, nationality, ethnicity, and district of origin.

Although this evidence comes from 1848-1868, historical evidence suggests that the Coptic-Muslim differential human capital investment precedes the nineteenth century.

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[19]Teachers in Coptic *kuttabs* were also of higher quality. One fifth of teachers in Muslim *kuttabs* in 1848 were blind which likely inhibited their ability to teach orthography.

Medieval Coptic (*kuttabs*) (that were not open to Muslims) were of higher quality than Muslim *kuttabs*. Whereas Muslim *kuttabs* focused on memorizing the Quran, Coptic *kuttabs* taught arithmetic and geometry besides religious subjects in order to train Coptic children for jobs in the bureaucracy (Heyworth-Dunne, 1938, pp. 2-7, 84-92). The transformation of the curriculum of Coptic *kuttabs* from being purely religious before 641 to being (partially) secular occurred at some (unidentified) date during the Middle Ages (Nasim, 1991).[20] Drawing on Mokyr (2002)'s insight, Coptic *kuttabs* shifted to "useful knowledge" before Muslims. Copts during the Medieval period also enrolled their children in apprenticeships in professions that required specialized human capital, such as scribes, carpenters, and tailors (Raymond, 1973, pp. 544-51). In 969-1171, "*the persistence of Coptic administrative personnel* [was due to the fact that] *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).[21]

Finally, it is important to note that Copts' superior investment in human capital, and hence their SES advantage, both persisted after 1868 with the introduction of modern European-style schools, as Copts were faster than Muslims in adopting the new educational system. In 1848, almost all Muslim and Coptic students were enrolled in *kuttabs*. But by 1868, 40 percent of Coptic students shifted to modern schools, all private, as opposed to only 4 percent among Muslim students, all of whom were in public schools. By 1906, almost all Coptic students were enrolled in modern schools, but it took Muslims another half-century (until 1951) to provide modern education to their masses, and hence to reduce their SES disadvantage vis-à-vis Copts (Saleh, 2016).

6 Discussion of Other Theories

There are other theories that could explain (a) the decline in Copts' population share and (b) the formation and/or persistence of the Coptic-Muslim SES gap. I examine some

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[20]A European traveler to Egypt, observed in 1693 that in Coptic *kuttabs* "... *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 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).

[21]Working in the mid-low bureaucracy required a specialized human capital. Lord Cromer, the British consul of Egypt in 1883-1908, noticed that the Coptic accounting system was "*archaic*" and "*incomprehensible to anyone but themselves*" (Tagher, 1951, p. 213).

of these theories below, but I relegate all results to section D in the appendix.

6.1 Theories of the Decline in Copts' Population Share

There are two classes of theories that could account for why Copts shrank into a minority between 641 and 1897: the first traces Egypt's Islamization to demographic factors, whereas the second emphasizes Copts' conversion to Islam.

6.1.1 Demographic Islamization

Conceptually, there are three demographic processes that could have driven Egypt's Islamization between 641 and 1897 (Fargues, 2001): (1) population replacement via Muslims' immigration or Copts' emigration, (2) Muslims' higher birth and/or lower death rates, and (3) intermarriage between Coptic females and Muslim males (opposite scenario is prohibited), which results by law in a Muslim offspring. While these processes may have contributed to Egypt's Islamization, I argue that they are not the main causes.

Population Replacement Arab immigration to Egypt (the largest Muslim immigration wave in Egypt's history) was small compared to Copts' population. In 641, Egypt's population (2.7 millions) was three times that of the Arab peninsula (1 million). Russell (1966) estimates the number of Arab immigrants in 650 by 100,000. Arab immigration subsided after 833 with the shift to slave armies and the simultaneous stoppage of state stipends to Arabs. At the same time, Copts rarely emigrated from Egypt because of their unique denomination that differed from Catholics and Greek Orthodox Christians.

Coptic-Muslim Differences in Fertility and/or Mortality 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, $p = 0.003$), and (b) Copts had higher mortality at younger ages (10-29 or 10-39), but lower mortality at older ages (30-79 or 40-79) (Table D.1).[22]

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[22]Copts' higher fertility is not surprising due to the fact that Copts were richer, since in general the rich in the pre-demographic transition era had higher fertility than the poor. By contrast, mortality differences may be attributable to statistical caveats in the 1848-1868 censuses, namely, age heaping and age exaggeration. Since both are negatively correlated with SES, they are less prevalent among Copts.

Cross-Marriages Cross-marriages were rare as suggested by the dearth of cross-marriage contracts in the papyri in 641-969. The 1848-1868 samples record only two cross-marriages.

6.1.2 Theories of Copts' Conversion to Islam

Suppression of Tax Revolts Copts revolted against rulers between 726 and 768 in protest against high taxes. An old thesis traces Copts' mass conversion to Islam to the violent suppression of these revolts that left Copts demoralized. While this theory may account for (part of) the decline in Copts' population share, it does not fully account for the findings. First, it is not obvious why poor Copts were more likely to convert under this theory, given that the revolts involved both rich and poor Copts. Second, Table D.2 shows that four out of the five revolts that took place during that period were in the Nile Delta. Since all districts for which I observe the poll tax were in the Nile Valley, it is unlikely that the findings are driven by the revolts.

Persecution Another thesis traces Copts' conversion to state persecution and/or anti-Coptic riots. Two early persecution waves took place in 847-861 and 996-1021, but the third wave in 1250-1517 was the largest and the most violent. Although persecution may indeed explain part of the decline in Copts' population share (especially between 1200 and 1500), it does not fully explain the findings. First, it is not clear why persecution and/or riots would target poor Copts. Second, I collected province-level data on the number of Coptic churches that were burned in the anti-Coptic riots of 1321, one of the most violent riots during that period. Out of the 35 churches that were burned, 17 were located in urban Egypt, 8 in the Nile Delta, and only 6 in the Nile Valley. None of the Nile Valley churches were located within the 11 districts for which I observe the poll tax.

Desire to Access Top Governmental Posts Copts often converted to access top state posts that were confined to Muslims. Again, I argue that this theory does not fully account for the findings, despite its historical validity. First, the population share of top state posts was too small to shift the Coptic-Muslim SES gap in favor of Muslims (Table 3). Second, this effect would actually mitigate the Coptic-Muslim SES gap, and, if it were the main cause of conversions, one should expect that Copts are worse off than Muslims.

Appeal of Islam Copts may have been attracted to Islam for spiritual reasons and ideological conversions to Islam certainly did take place. Although it is difficult to disentangle if conversions occurred due to the tax exemption incentive or rather due to a true belief in Islam, I argue that ideological conversions do not fully explain the findings. First, it is not obvious why poor Copts were more likely to convert since Coptic Christianity was, like Islam, (equally) attractive to the poor. Coptic Christianity succeeded in appealing to the poor between 451 and 641, despite being persecuted by the state. Copts were mostly the poor masses who resisted the Byzantines' pressure to convert to the (non-Coptic) *Melkite* church between 451 and 641, leaving the latter to attract only Greeks and Hellenized Egyptian elites. Second, even if valid, this theory would predict that poor Copts were more likely to convert everywhere, but it does not explain why conversions among the poor were more widespread in high-tax districts.

6.2 Theories of the Coptic-Muslim SES Gap

European Legal Structures Issawi (1981) and Kuran (2004a) postulated 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. A recent body of literature illustrated that the theory applies to many non-Muslim minorities in the Ottoman Empire (Artunç, 2015). However, whereas the theory may indeed account for the SES advantage of non-Coptic Christians and Jews in the region (including Egypt), it is less applicable to Copts. First, it does not explain why the Coptic-Muslim SES gap emerged by 969, long before the rise of Europe. Second, the 1848-1868 censuses record the "protégé" status that individuals purchased from European consulates in return for having access to European legal structures. Table D.3 reveals that the share of "protégés" was negligible (<1 percent) among each of Muslims and Copts in both 1848 and 1868. "Protégés" were only sizable among non-Coptic Christians (17-26 percent) and Jews (8-10 percent); the two groups constituted only 6 percent of non-Muslims in Egypt and almost entirely resided in urban Egypt. The inter-group differences in the demand for the "protégé" status are likely due to their occupational differences. While non-Coptic Christians and Jews excelled in commerce; a profession that involved transactions with Europeans where access to European laws mattered, Copts' advantage stemmed from artisanship and mid-low bureaucracy where European laws had less of an influence.

Copts as "Powerless Bureaucrats"   Rulers may have preferred to recruit Copts in the bureaucracy in districts with relatively fewer Copts, in order to mitigate the chance of Muslim rebellion. Since Copts were a small minority in those districts, and hence lacked a local support base, they were less likely to rebel or to support any potential Muslim rebel. Recruiting Copts in the bureaucracy, the argument goes, would be decreasing in their population share, since the threat of Muslim revolt was lower in districts with relatively more Copts. I failed to find evidence in support of this theory. First, it does not explain why Copts were over-represented among artisans (and not only bureaucrats). Second, Copts rarely reached top posts in the bureaucracy that would have given them power over taxpayers in a constituency, but were rather limited to the (often rural) mid-low bureaucracy such as scribes and land tax collectors. Third, Table D.4 shows that the share of Copts in the bureaucracy was, if anything, *increasing* in Copts' population share, controlling for the bureaucracy size. Rural districts with relatively more Copts filled their bureaucracies with relatively more Copts, which suggests that religious affiliation was not a significant determinant of recruitment. Rulers attempted to fill rural bureaucracies with qualified personnel regardless of their religion.

Genetic Differences   Initial Coptic-Muslim genetic differences in (cognitive and non-cognitive) ability, that could have resulted from the positive selection of non-convert Copts, may have persisted due to limited inter-group marriage. Persistent genetic differences could have subsequently led the SES gap to perpetuate. Although I cannot rule out this theory, it is unlikely to account for the persistence of the SES differential because it rests on two questionable assumptions, (1) that differences in ability are attributable to genetics and (2) that SES differences are due to differences in ability. First, to the best of my knowledge, there is no consensus in the genetics literature that genetic differences (and not the environment) are responsible for ability differentials, especially in contexts where there is a dearth of genetic evidence such as Copts and Muslims in Egypt. The only genetic study on Egypt's Copts and Muslims that I am aware of is that of Coudray et al. (2007) who found genetic differences between present-day Copts and Muslims residing in the same village in the Nile Valley, but even there it is unclear if these differences are responsible for ability differentials. Second, occupational attainment in pre-modern Egypt was likely determined by family's investment in human capital (itself a function

of family's SES), rather than by inherited ability. For example, the Coptic-Muslim SES gap declined in the late twentieth century with the expansion of mass modern education in 1951-1953 (Saleh, 2016), which indicates that genetic differences, if any, were less influential in driving the gap.

Human Capital as a Selection Mechanism Inspired by Botticini and Eckstein (2005), one may argue that Coptic Christianity encouraged literacy which pushed Copts with a lower taste for education to convert. This theory is unlikely to hold as there is no literacy requirement under Coptic Christianity. Coptic schools were purely religious in 641 when conversions started. Illiteracy among adult male Copts in 1986 was 34 percent.

Cultural Differences Weber (1905) explained Protestants' SES advantage by their work ethic. Yet, Coptic Christianity shared with the Egyptian Muslim culture (predominantly, Sufi) a mystic outlook on life that attributed materialistic success to metaphysical factors rather than to hard work. Furthermore, the fact that Copts' advantage stemmed from bureaucracy and artisanship, and not from commerce, indicates that Coptic Christianity was not more conducive to Capitalism than Islam.

Minorities' Economic Advantage Kuznets (1960) explained Jews' advantage by a minority's attempt to preserve its identity via specializing in jobs in which it built a tradition. However, this theory does not explain why Copts shrank into a minority, nor does it explain why Copts, as a minority, built a tradition in certain jobs. Jews' economic advantage is also explained by the ban on Jews from practicing certain jobs such as farming. Yet, Copts were not banned from farming (one third of adult employed male Copts in 1848-1868 were farmers). If anything, Copts were banned from top governmental posts, which likely mitigated the gap.

7 Conclusion

Drawing on novel primary data sources, I traced the origins of the superior SES of the Coptic Christian minority in Egypt to the tax system that was imposed upon the Arab Conquest of the then-Coptic Christian Egypt in 641. In particular, 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 that were subject to a higher poll tax in 641-1100 had relatively fewer, but differentially richer, Copts in 1848-1868. Finally, I argued that the persistence of the initial positive selection of Copts is due to Copts' higher investment in human capital, that was itself triggered by the poll tax burden.

The findings open two new areas of research. First, an intriguing feature of the poll tax is that it lied on the wrong side of the Laffer curve in the sense that an increase in the poll tax rate eroded the tax base (via conversions) and thus reduced the total poll tax revenues. Indeed, historians documented that Muslim rulers faced a tradeoff between winning converts and increasing tax revenues. I currently explore (jointly with Jean Tirole) the interaction between conversions and the evolution of taxation in Egypt between 641 and 750. The argument is that this feature of the poll tax led rulers around 750 to impose on converts the higher land tax (*kharaj*), that was initially confined to non-convert Copts. This evolution shaped the canonical form of Islamic taxation since then until 1856. This poll tax feature also generated unconventional dynamics; namely that all conversions took place in the initial period. Second, I plan in the future to examine the formation processes of other non-Muslim minorities (non-Coptic Christians and Jews) in Egypt and other countries of the region. There are unexplored data sources that could help to explore this research question including papyri documents (98 percent of which are still unpublished), sixteenth-century Ottoman tax registers, and Ottoman population censuses in 1891-1914. 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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Appendix for Online Publication

A Proofs of the Conceptual Framework

Proof of Proposition 1 Let $y^*(\tau; r)$ be the threshold level of income at which a Copt is indifferent about conversion to Islam at a given level of religiosity, that is defined by $u(y^*) - u(y^* - \tau) = r$. Copts' population share is given by $pop_{copt} = \int_{y^*}^{\infty} f(y)dy = 1 - F(y^*)$. It follows that:

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

because $u'(.) > 0$ and $u''(.) < 0$.

Proof of Proposition 2

$$\frac{\partial}{\partial \tau} E(y \mid Copt) = \frac{\partial}{\partial \tau} E(y \mid y > y^*) = \frac{\partial}{\partial \tau} \left(\frac{\int_{y^*}^{\infty} y f(y)dy}{1 - F(y^*)} \right) = \frac{f(y^*) \frac{\partial y^*}{\partial \tau}}{1 - F(y^*)} \left[E(y \mid y > y^*) - y^* \right] > 0$$

$$\frac{\partial}{\partial \tau} E(y \mid Muslim) = \frac{\partial}{\partial \tau} E(y \mid y \leq y^*) = \frac{\partial}{\partial \tau} \left(\frac{\int_0^{y^*} y f(y)dy}{F(y^*)} \right) = \frac{f(y^*) \frac{\partial y^*}{\partial \tau}}{F(y^*)} \left[y^* - E(y \mid y \leq y^*) \right] > 0$$

Define the Coptic-Muslim income gap as $\Delta \equiv E(y \mid Copt) - E(y \mid Muslim) = E(y \mid y > y^*) - E(y \mid y \leq y^*)$. It follows that:

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

which could be either positive or negative depending on the income distribution.

The second statement of proposition 2 follows from Jewitt (2004) and $\frac{\partial y^*}{\partial \tau} > 0$.

Proof of Proposition 3 The optimal poll tax rate $t^*(y) = \text{argmax}_t V(y, t)$ satisfies the first order condition:

$$\frac{\partial V}{\partial t} = y \left(1 - G \left(\frac{1}{1-\theta} y^{1-\theta} \left(1 - (1-t)^{1-\theta} \right) \right) \right)$$
$$\times \left[1 - (t - b/y) H \left(\frac{1}{1-\theta} y^{1-\theta} \left(1 - (1-t)^{1-\theta} \right) \right) y^{1-\theta} (1-t)^{-\theta} \right] = 0$$

where $H(x) = \frac{g(x)}{1 - G(x)}$ is the hazard rate. The optimal poll tax is regressive $\left(\frac{dt^*}{dy} < 0 \right)$ if and only if $\frac{\partial^2 V}{\partial t \partial y}(y, t^*(y)) < 0$. This follows from the implicit function theorem:

$$\frac{dt^*}{dy} = \frac{\frac{\partial^2 V}{\partial t \partial y}(y, t^*(y))}{-\frac{\partial^2 V}{\partial t^2}(y, t^*(y))}$$

Because the denominator is positive, the sign of $\frac{dt^*}{dy}$ is determined by the sign of the numerator. Differentiating $\frac{\partial V}{\partial t}$ with respect to y at $\frac{\partial V}{\partial t} = 0$ yields:

$$\frac{\partial^2 V}{\partial t \partial y}(y, t^*(y)) = -y\left(1 - G\left(\tfrac{1}{1-\theta}y^{1-\theta}\left(1 - (1-t)^{1-\theta}\right)\right)\right)$$
$$\times \frac{\partial}{\partial y}\left[(t - b/y)H\left(\tfrac{1}{1-\theta}y^{1-\theta}\left(1 - (1-t)^{1-\theta}\right)\right)y^{1-\theta}(1-t)^{-\theta}\right]$$

Since $-y(1-G) < 0$, it follows that $\frac{\partial^2 V}{\partial t \partial y}(y, t^*(y)) < 0$ if and only if:

$$\frac{\partial}{\partial y}\left[(t - b/y)H\left(\tfrac{1}{1-\theta}y^{1-\theta}\left(1 - (1-t)^{1-\theta}\right)\right)y^{1-\theta}(1-t)^{-\theta}\right]$$
$$= ((1-t)y)^{-\theta}H \times \left[t + y^{1-\theta}(t - b/y)(H'/H)(1 - (1-t)^{1-\theta}) - \theta(t - b/y)\right] > 0$$

A sufficient (but not necessary) condition for this inequality to hold, and so to ensure that $\frac{\partial^2 V}{\partial t \partial y}(y, t^*(y)) < 0$, is that $\theta \leq 1$.

Proof of Proposition 4   A convert invests in human capital if and only if:
$$\delta(1 - \rho)[u(y_H) - u(y_L)] \geq i$$

whereas a non-convert invests in human capital if and only if:
$$\delta(1 - \rho)\int \Delta(r_2, \tau_2)dG(r_2 \mid r_1) \geq i$$

where $\Delta(r_2, \tau_2) \equiv \max\{u(y_H); u(y_H - \tau_2) + r_2\} - \max\{u(y_L); u(y_L - \tau_2) + r_2\}$.

The function $\Delta(r_2, \tau_2)$ is flat in r_2, then increasing and then flat again. Furthermore,
$$u(y_H - \tau_2) - u(y_L - \tau_2) \geq \Delta(r_2) \geq u(y_H) - u(y_L)$$

Therefore investment incentives are larger in the absence of conversion because:
$$\int \Delta(r_2, \tau_2)dG(r_2 \mid r_1) > u(y_H) - u(y_L)$$

Furthermore and using an integration by parts,
$$\frac{\partial(V^+ - V^-)}{\partial r_1} = \delta(1-\rho)\frac{\partial \int \Delta(r_2, \tau_2)dG(r_2 \mid r_1)}{\partial r_1} = \delta(1-\rho)\frac{\partial \int [-\frac{\partial \Delta}{\partial r_2}(r_2, \tau_2)]G(r_2 \mid r_1)dr_2}{\partial r_1} > 0$$

which means that investment incentives are increasing in religiosity.

Finally, an increase in the date-2 poll tax from τ_2 to τ_2' leaves the investment incentive of converts unaltered but shifts that of non-convert Copts via its effect on $\int \Delta(r_2, \tau_2)dG(r_2 \mid r_1)$. Figure A.1 shows the impact of an increase in the date-2 poll tax on $\Delta(r_2, \tau_2)$. Notice that a tax increase shifts to the right the two religiosity cut-offs of conversion at date 2: $r_2^*(\tau_2) = u(y_H) - u(y_H - \tau_2)$ and $r_2^{**}(\tau_2) = u(y_L) - u(y_L - \tau_2)$, where $r_2^*(\tau_2) < r_2^{**}(\tau_2)$. Therefore, as shown in the figure, a tax rise *decreases* the investment incentive for non-convert Copts at lower levels of date-2 religiosity, but *increases* it at higher date-2 religiosity levels. Formally, the impact of an increase in the date-2 poll tax on the investment incentive
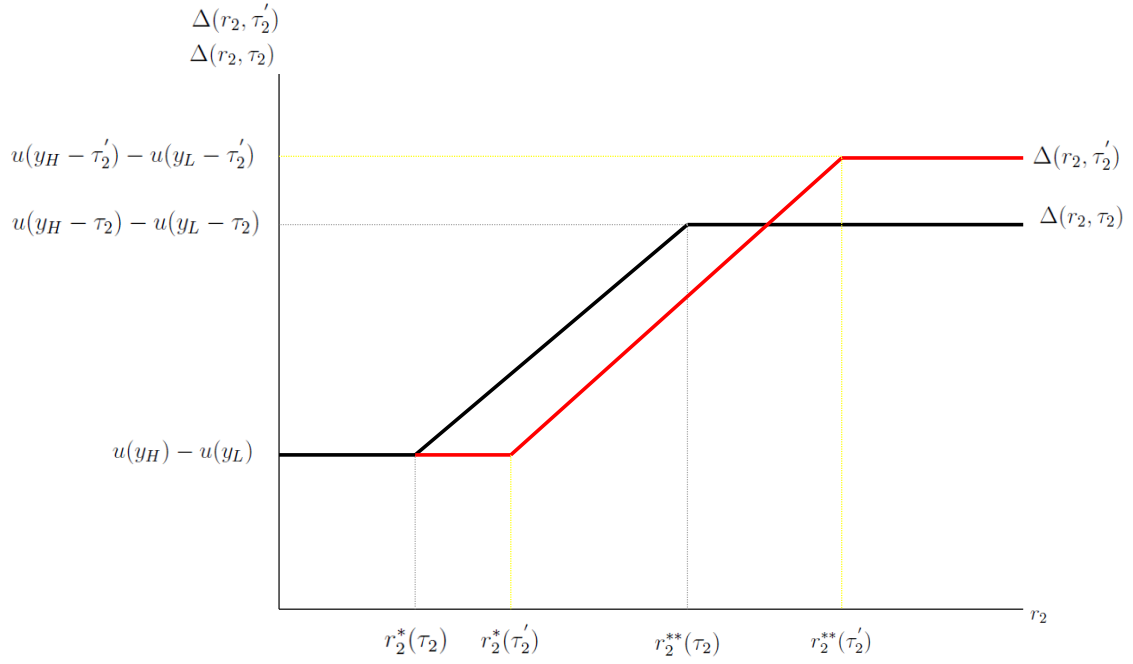
Figure A.1: **The Impact of a Poll Tax Increase on Non-Convert Copts'
Incentive to Invest in Child's Human Capital**

Source: See text.

of non-convert Copts:

$$\frac{\partial}{\partial \tau_2} \int_0^\infty \Delta(r_2, \tau_2) dG(r_2 \mid r_1) = \left(1 - G\left(r_2^{**}(\tau_2) \mid r_1\right)\right) \left(u'(y_L - \tau_2) - u'(y_H - \tau_2)\right)$$

$$- \left(G\left(r_2^{**}(\tau_2) \mid r_1\right) - G\left(r_2^*(\tau_2) \mid r_1\right)\right) u'(y_H - \tau_2)$$

The first term in the previous equation is positive due to the concavity of u, but the second term is negative. To derive a sufficient condition on r_1 such that the impact of the poll tax on non-converts' incentive to invest in human capital is positive, I analyze how this impact varies with r_1:

$$\frac{\partial^2}{\partial \tau_2 \partial r_1} \int_0^\infty \Delta(r_2, \tau_2) dG(r_2 \mid r_1) = -\frac{\partial}{\partial r_1} G(r_2^{**}(\tau_2) \mid r_1) u'(y_L - \tau_2) + \frac{\partial}{\partial r_1} G(r_2^*(\tau_2) \mid r_1) u'(y_H - \tau_2)$$

Since $\frac{\partial G}{\partial r_1} < 0$ because of first-order stochastic dominance, the impact of the poll tax on non-converts' incentive to invest in human capital is increasing in r_1 if and only if:

$$\frac{\frac{\partial}{\partial r_1} G(r_2^{**}(\tau_2) \mid r_1)}{\frac{\partial}{\partial r_1} G(r_2^*(\tau_2) \mid r_1)} > \frac{u'(y_H - \tau_2)}{u'(y_L - \tau_2)}$$

Since the RHS of this inequality is less than 1, it suffices for the inequality to hold

that $\frac{\partial}{\partial r_1} G(r_2^{**}(\tau_2) \mid r_1) < \frac{\partial}{\partial r_1} G(r_2^{*}(\tau_2) \mid r_1)$. This condition holds if:

$$\frac{\partial^2}{\partial r_1 \partial r_2} G(r_2 \mid r_1) = \frac{\partial}{\partial r_1} g(r_2 \mid r_1) < 0 \quad \forall r_2 \in [0, u(y_L)]$$

which ensures that the value of $\frac{\partial G}{\partial r_1}$ at $r_2^{**}(\tau_2)$ is smaller than its value at $r_2^{*}(\tau_2)$ for any feasible $\tau_2 \in [0, y_L]$, given that both r_2^{*} and r_2^{**} must be within $[u(y_H) - u(y_H - y_L), u(y_L)]$. Thus, under this assumption, the impact of the poll tax on non-converts' incentive to invest in human capital is increasing in r_1, which implies that there exists a unique cutoff $\tilde{r}_1 \in [0, \infty[\cup \{\infty\}$ such that $\frac{\partial}{\partial \tau_2} \int_0^\infty \Delta(r_2, \tau_2) dG(r_2 \mid r_1) > 0$ if and only if $r_1 > \tilde{r}_1$.

B   Data Sources

B.1   The 1848 and 1868 Population Census Samples

The 1848 and 1868 population censuses are among the earliest pre-Colonial population censuses from any non-Western country to enumerate all household members, including females, children, and slaves. They contain information on a wide range of variables including place of residence, name, gender, age, relationship to household head, nationality, ethnicity, free/slave status, religion, place of origin, occupation, school enrollment (for male children in cities), and dwelling ownership and type (in cities only). I digitized a nationally representative sample of each census (about 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 the two major cities of Cairo and Alexandria and 1 percent in all the other provinces. Details about the census samples are in Saleh (2013).

For the purpose of this article, I pooled the census samples from both years and restricted the analysis to Egyptian local free Coptic and Muslim employed men of a rural district of origin who are at least 15 years of age with non-missing values on 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:

1. I restricted the sample to "Egyptians," or individuals who are listed in the census manuscripts as *dakhil al-hukuma* (under the control of the Egyptian government). That excludes foreigners including Turks, Levantines, Armenians, Ottoman Greeks,

North Africans, Yemenis, people of the Arab peninsula, Asians, Americans, and Europeans.

2. I further restricted the sample to "locals." That excludes "Egyptians" who are not originally from the Nile Delta or the Nile Valley (north of Nubia), namely, Bedouins, Nubians, Sudanese, and Abyssinians.[23]

3. I restricted the sample to individuals of a rural district of origin. District of origin in the census manuscripts refers to the origin of an individual's family (not necessarily the place of birth). This excludes individuals whose family's place of origin is either major cities (Cairo, Alexandria, Suez, Rosetta, and *Damietta*) or deserts (*Arish* in the Sinai peninsula, *Qusayr* on the Red Sea, and the five oases of the Western desert). This mitigates the potential cross-district movement of an individual's ancestors in 641-1868 under the presumption that most migration was directed towards cities.

In order to construct the occupational outcomes, I first manually translated and coded all the occupational titles in the census manuscripts following the coding of the Historical International Standard Classification of Occupations (HISCO) (Saleh, 2015). I then classified each occupational code into one of nine categories (the largest occupational titles within each category are mentioned in parentheses): (1) professionals (nurse, engineer, physician), (2) high-level bureaucrats (farm supervisor, government official), (3) mid-low bureaucrats (scribe, messenger, bookkeeper, stock clerk), (4) judiciary, military, and police (policeman, military officer, judge, legal delegate), (5) clergy and rural elites (village headman, minister of religion), (6) merchants (working proprietor, auctioneer), (7) artisans (weaver, carpenter, baker, grain miller, dyer, butcher), (8) farmers (farmer, farm worker, livestock worker, gardener, fisherman), and (9) unskilled workers. The first six categories comprise the three white-collar indicators. The full list of occupational titles that fall under each category is available upon request.

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[23]Bedouins (*'orban*) in 1848-1868 are likely (descendants of) Arab tribes that arrived to Egypt during the eighteenth century.

B.2 Christian Churches and Monasteries in 1200 and 1500

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 (1200) who provides a comprehensive list of Christian churches and monasteries in Egypt at the end of the twelfth century, and (2) Al-Maqrizi (1500) who provides a similar list in the fifteenth century.[24] Both sources list locations at the village level (smaller than districts). I matched villages in both sources to villages in 1848-1868 using Ramzi (1954).

I employ this dataset to construct three variables:

1. The share of villages in all Egypt with at least one Christian church or monastery in 1200 and 1500, which I use as an estimate of Egypt's non-Muslims' population share in Figure 4, under the presumption that a village with at least one Christian church or monastery is 100 percent non-Muslim and that a village without any church or monastery is 100 percent Muslim.

2. The share of villages in each district with at least one Coptic church or monastery in 1200 and 1500, which I use as an estimate of a district's Copts' population share in Table C.9.

3. The share of villages in each district with at least one Coptic monastery in 1200, which I use as a proxy for a district's pre-641 generosity of intra-Coptic transfers and I include as a control variable.

The denominator in the three measures above is the number of villages in all Egypt or in each district. This is computed as of 1477 using Ramzi (1954)'s list of pre-1477 and post-1477 villages; itself based on a cadastral survey in 1477 in Ibn-Al-Jay'an (1477). The rationale is to mitigate the concern about the possible emergence of new villages before 1848.

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[24]There are two versions of Abul-Makarim's book. The first is *The Churches and Monasteries of Egypt and Some Neighboring Countries*, edited by Evetts in 1895 and (wrongly) attributed to "Abu-Saleh, the Armenian." This version lists churches and monasteries in the Nile Valley only. The second version that I use in the article is a two-volume book edited by Anba-Samuel in 1984. The first volume includes the missing part on the Nile Delta, whereas the second is a re-publication of Evetts' 1895 book on the Nile Valley. The book is now believed to belong to the twelfth-century Coptic chronicler, Abul-Makarim.

B.3 Religion and Occupations in 641-969

B.3.1 Data Construction

Arabic papyri documents, most of which were discovered since the late nineteenth century in Egypt's dry-climate Nile Valley, remain a mostly unpublished source of information on the micro-level characteristics of the medieval populations of the Middle East, especially Egypt, during the early Arab Caliphate in 641-969. An ongoing research project entitled the Arabic Papyrology Database (henceforth, APD) attempts at the digitization of all the Arabic papyri that were ever published.[25] There are various types of documents in the APD, namely, (1) protocols, (2) legal texts (e.g. marriage and sale contracts), (3) administrative texts (e.g. official letters, lists, and accounts), (4) private texts (e.g. private and business letters), and (5) literary texts.[26]

I used all the papyri documents in the APD in order to construct an individual-level dataset on occupational titles and religious affiliation, where I inferred a worker's religion from his name (converts adopted an Arabic name upon conversion). I included in the sample every male mentioned in any APD document with a non-missing name and occupation.

A few notes on the APD sample are in order:

1. Because the occupational title of "landholding farmer" is almost never mentioned in the APD (a landless farmer, or *'agir*, is explicitly mentioned though), I infer if a male with a non-missing name in the APD land tax registers and receipts is a landholding farmer if he pays a non-zero land tax. The vast majority of farmers in Egypt were landholding farmers who held usufruct rights on land and paid a land tax.

2. Because my objective is to compare the occupational outcomes of Copts versus Egyptian Muslims (converts), ideally I want to exclude non-Egyptian Muslims (Arabs and Turks). For this purpose, I exclude individuals in top government posts,

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[25]Out of more than 150,000 Arabic papyri that were ever *discovered*, only 2,500 documents (less than 2 percent) 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 the published papyri.

[26]Papyrus is a material of writing that was prevalent in Egypt until the administration increasingly shifted to using paper around 969. The APD documents are written on other writing materials besides papyrus including paper, ostracon, woodtable, waxtable, stone, parchment, leather, bone, and textile. All those documents are included in the APD sample.

namely, Caliphs, viceroys, and top government administrators, who are Arabs in 641-833 and Arabs or Turks in 833-969. I am not able though to identify all Arabs since converts hold Arabic names.

3. I restrict the APD sample to papyri documents between 641 and 969 because (a) there are fewer papyri after 969 as paper increasingly replaced papyrus and (b) most conversions took place between 641 and 1200, and so the early Arab Caliphate period in 641-969 is the most important to examine.

4. I infer religious affiliation from names only, and not from any other contextual information (e.g. occupation), in order to not introduce non-random measurement error. Moreover, I only include males with names that are distinctly Muslim or Christian based on the names list in the 1848-1868 census samples and on papyrologists' comments on the papyri.

These procedures result in a final sample of 402 males with religious affiliation and occupational title in 641-969. This is the APD sample that I use in Table 3.

B.3.2 Addressing the Concerns about the APD Sample

There are at least three concerns about the APD sample. First, there is a concern about its representativeness: (a) It is not random on location; 34 percent is from the Nile Valley, 65 percent is from unknown locations (in Egypt), and less than 1 percent is from the (more humid) Nile Delta. (b) It is likely non-random on SES, because it may over-represent males of high SES. Second, I may misidentify Copts, since I cannot tell if a non-Muslim name is Coptic, non-Coptic Christian, or Jewish, and, similarly, I may misidentify converts, since I cannot tell if a Muslim name is (a descendant of) a convert or an Arab/Turkish settler. Third, there is an error in observing occupations as I infer if an individual is a landholding farmer from the incidence of payment of a non-zero land tax.

While it is not possible to rule out these concerns, there are counter-arguments that mitigate each of them:

1. On the first concern, even if the APD sample is mostly from the Nile Valley, the 1848-1868 population census samples reveal that the Nile Valley has a higher Copts'

population share and a smaller, yet still positive and statistically significant, Coptic-Muslim SES difference compared to the Nile Delta. Hence, the APD sample will, if anything, overestimate the true Copts' population share and underestimate the true Coptic-Muslim SES gap. More important, 72 percent of the APD sample is from administrative documents, namely, lists (54 percent) and receipts of payment (18 percent). These are arguably *neutral* documents in which every individual has an equal chance of appearance. The findings in Table 3 do not change if I exclude the remaining 28 percent of the sample that come from contracts (sale, lease, marriage, divorce, and written obligation contracts) and private and business letters. Finally, even if the APD sample is not representative of the occupational distribution of each religious group, it may be still representative of the Coptic-Muslim *difference* in occupational outcomes under the assumption that selection-on-SES is the same within each group.

2. On the second concern, non-Muslims in the APD sample are almost certainly Copts because Copts constituted 96 percent of all Christians in 1200 (based on the dataset on Christian churches and monasteries) and because non-Coptic Christians and Jews rarely settled in the Nile Valley.[27] On the other hand, even if I misidentify Arab/Turkish settlers as Egyptian converts, this would in fact overestimate the share of high-SES workers among converts since Arab/Turkish settlers in 641-969 were more likely to be in high-SES occupations as they were the ruling elite. That would underestimate the true Coptic-Muslim SES differential.

3. On the third concern, the share of males whose occupation is imputed as a land-holding farmer within each religious group is similar to the share of landholding farmers in 1848-1868.

B.4 Papyri Poll Tax Registers and Receipts in 641-1100

I collected information from Greek and Arabic papyri documents on the individual-level annual nominal poll tax payments (in dinars) in 641-1100 ($N = 552$). The location (*kura*)

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[27]Mikhail (2004, p. 134) states that there is no evidence on *Melkites'* (non-Coptic Christians) presence in the Nile Valley in the post-Conquest period. In 1200, 91 percent of non-Coptic (*Melkite* and Armenian) Christian churches and monasteries were in the Nile Delta and in major cities (Cairo, Alexandria, and *Damietta*).
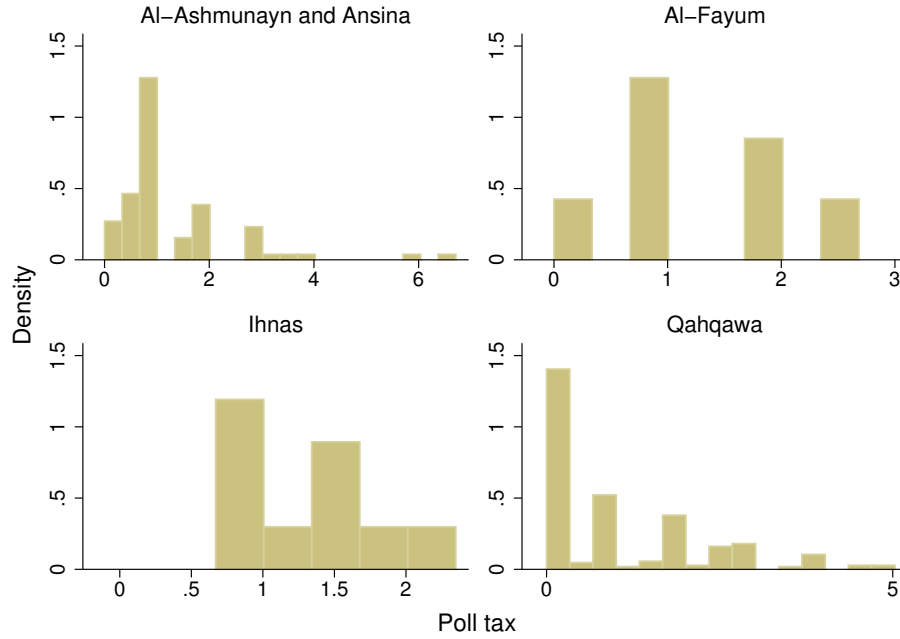
Figure B.1: **Distribution of Poll Tax Payments (Dinar) by *Kura***

Source: Greek and Arabic papyri poll tax registers and receipts in 641-1100.

of the papyri is only available for a smaller sample ($N = 408$) in four *kuras* in the Nile Valley. The data are from two sources:

1. Fragments of the Greek papyri poll tax registers of the *kura* of *Qahqawa* (pre-641, *Aphrodito*) in 703-733 in Morimoto (1981, pp. 67-79).

2. Fragments of the Arabic papyri poll tax registers and receipts in the APD for the *kuras* of *Fayum* (pre-641, *Arsinoe*) in 641-1005, *Ihnas* (pre-641, *Herakleopolis*) in 701-900, and *Ashmunayn* (pre-641, *Hermopolis*) in 731-1100.[28]

I depict the distribution of the poll tax payments by *kura* in Figure B.1.
I use this dataset for two purposes:

1. I compute the average poll tax payment in each *kura* in 641-1100. I use this variable to create a dummy variable that takes the value of one if the average tax in a district is "high" (i.e. greater than the cross-district average).

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[28]There are other Greek poll tax registers and Coptic poll tax receipts in 641-800 that I did not employ in the analysis because they are not translated into English or Arabic.

2. I use poll tax registers from three sub-districts in the *kura* of *Qahqawa* in 703-733 that contain information on both the poll and total land taxes. This is the restricted sample ($N = 230$) that I use in Table 2.

B.5   Arab Settlement in 700-969 and the Pre-641 Controls

1. Data on Arab settlement in 700-969 are from Al-Barri (1992) who traces the destination of the Arab tribes that settled in Egypt between 700 and 969 using information from the Arabic medieval narratives. Destinations of tribes are recorded at the *kura* level. I restrict the analysis to permanent settlement by excluding seasonal migration (*irtiba'*) between 641 and 700.[29]

2. Urban population in 300 is from Wilson (2011, pp. 185-187). These are estimates of the population of Greek cities (metropolis) and the capital of each *nome* (Egypt's administrative units in the Roman period) around 300. Wilson assigns a fixed population for the capitals of all the other *nomes* that are not included in his estimates.

3. The legendary route of the Holy Family is from Anba-Bishoy (1999) and Gabra (2001), which is based on a book attributed to Theophilus, the Patriarch of Alexandria in 385-412. The date of the book is debated though with some scholars dating it to the fifteenth century, which raises the concern that the path may reflect post-641 Coptic traditions. There are two points that mitigate this concern: (a) There is evidence that local beliefs about the journey of the Holy Family, although not the path itself, emerged as early as the Roman period. (b) I use the Holy Family legendary route as a control variable only and I show the results with and without it.[30] The information on the path is at the village level.

4. The share of villages with at least one Coptic monastery in 1200 is from the dataset on churches and monasteries that I described in section B.2.

5. The *autopract* estates in 600 are from Hardy (1931). I restrict the sample to the Nile Valley, as the papyri were less likely to survive in the Delta. The information

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[29] *Irtiba'* refers to Arabs' policy in 641-700 to move during the spring to the Egyptian countryside for grazing their animals. Egyptians were required to provide them with food and shelter (Al-Barri, 1992, pp. 56-60).

[30] The legendary flight of the Holy Family to Egypt is mentioned in Matthew 13.

on the estates is at the *nome* level.

6. Byzantine garrisons in 600 are from Maspero (1912). Locations are mentioned at the village level.

B.6   Mapping *Nomes* and *Kuras* into Districts

Nomes were Egypt's administrative units before 641. Egypt was divided into about 40 *nomes*, 20 in the Nile Valley and 20 in the Nile Delta. After the Arab Conquest, the country was divided into about 50 *kuras*. In 1848-1868, there were 14 provinces in the Nile Valley and Delta with 76 districts. *Nomes* and *kuras* are smaller in surface area than provinces but were larger than districts.

I map *nomes* and *kuras* into districts in 1848-1868 using the 1897 census administrative division, since the 1848 and 1868 censuses do not contain an official list of villages under each district. In the absence of information on the boundaries of *nomes*, I map *nomes* into districts in 1848-1868 as follows. I first compile the full list of *nomes* from Trismegistos; a specialized portal in Egyptian papyri documents between 800 BC and 800 CE. Second, I locate the major towns of each *nome* using the maps of *nomes* in Trismegistos. Finally, I match each district in 1848-1868 to the closest *nome* based on the proximity of the district's chef-lieu to the *nome*'s major towns according to Google maps. Similarly, as we do not know the boundaries of *kuras*, I map *kuras* into districts in 1848-1868 using a similar routine. I first compile the full list of *kuras* from Tousson (1926). Second, I locate the major towns of each *kura* using Ramzi (1954) and Tousson (1926). Finally, I match each district in 1848-1868 to the closest *kura* based on the proximity of the district's chef-lieu to the *kura*'s major towns according to Google maps.

C   Robustness Checks Results

Table C.1: **Does Arab Settlement in 700-969 Explain the Cross-District Variation in the Poll Tax in 641-1100?**

Dependent Variable: Individual-Level Annual Nominal Poll Tax Payment in Dinars in 641-1100

	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	0.290**			0.203	0.214
	(0.133)			(0.985)	(0.960)
Log(urban population) in *kura* in 300		0.131**		0.040	0.032
		(0.062)		(0.468)	(0.515)
=1 if *kura* on Holy Family route in 400			0.285**		0.007
			(0.139)		(0.346)
Observations	408	408	408	408	408
Adjusted R^2	0.007	0.007	0.007	0.005	0.002

Notes: Robust standard errors are in parentheses. A constant term is included in all regressions.
$*p < 0.10, **p < 0.05, ***p < 0.01$.
Source: Papyri poll tax registers and receipts in 641-1100 merged with multiple data sources. See section B for details.

Table C.2: **Arab Settlement in 700-969 and Copts' Population Share in 1848-1868 - OLS Estimates**

Dependent Variable =1 if Coptic Christian

	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement	-0.071**	-0.074***	-0.079**	-0.057***	-0.091***
	(0.029)	(0.028)	(0.036)	(0.020)	(0.026)
Controls urbanization and religiosity?	No	Yes	Yes	No	Yes
Other controls?	No	No	Yes	No	Yes
Province of origin FE?	No	No	No	Yes	Yes
Clusters	76	76	35	76	35
Obs	16641	16641	6792	16641	6792
AR2	0.017	0.017	0.020	0.078	0.053

Notes: Standard errors clustered at the district of origin level are in parentheses.
$*p < 0.10, **p < 0.05, ***p < 0.01$. A constant is included in all regressions.
Source: The 1848-1868 population census samples combined with multiple data sources. See section B for details. The *autopract* indicator is observed for only 35 districts.

Table C.3: **Arab Settlement and the Coptic-Muslim Occupational Differences in 1848-1868 - OLS Estimates**

(a) =1 if Arab Settlement in District in 700-969 - No Controls

	(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, Police	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Copt	0.104***	0.038	0.056*	-0.001	-0.002*	0.107***	-0.022***	-0.045***	0.018	0.212***	-0.158***	-0.110***
	(0.021)	(0.023)	(0.032)	(0.002)	(0.001)	(0.022)	(0.005)	(0.008)	(0.012)	(0.033)	(0.049)	(0.040)
Copt * Arab sett.	0.153***	0.183***	0.151**	-0.002	-0.002	0.157***	-0.004	0.035**	-0.032**	-0.059	-0.037	-0.055
	(0.055)	(0.064)	(0.070)	(0.002)	(0.002)	(0.055)	(0.008)	(0.016)	(0.015)	(0.058)	(0.093)	(0.046)
District FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	76	76	76	76	76	76	76	76	76	76	76	76
Obs	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641	16641
AR2	0.087	0.035	0.028	0.002	0.004	0.116	0.035	0.011	0.017	0.039	0.105	0.060

(b) =1 if Arab Settlement in District in 700-969 - With Controls

	(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, Police	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Copt	0.051	-0.166	-0.060	-0.006	0.026	0.031	-0.092***	-0.125	0.106*	-0.438*	0.157	0.342*
	(0.213)	(0.280)	(0.297)	(0.016)	(0.019)	(0.218)	(0.026)	(0.087)	(0.058)	(0.239)	(0.423)	(0.173)
Copt * Arab sett.	0.098	0.082	0.080	-0.001	-0.003	0.101	-0.018***	0.002	-0.002	-0.122*	0.102	-0.060
	(0.069)	(0.087)	(0.089)	(0.002)	(0.002)	(0.071)	(0.006)	(0.022)	(0.011)	(0.061)	(0.124)	(0.045)
Copt * Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	35	35	35	35	35	35	35	35	35	35	35	35
Obs	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792	6792
AR2	0.062	0.024	0.024	0.001	0.006	0.083	0.047	0.015	0.015	0.063	0.109	0.068

Notes: Standard errors clustered at the district of origin level are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Source: The 1848-1868 population census samples combined with multiple data sources. See section B for details.

Table C.4: The Poll Tax and Copts' Population Share in 1848-1868
Measurement Error in Poll Tax - OLS Estimates

Dependent Variable =1 if Coptic Christian

	Full Sample		Excluding Kuras of Ihnas and Fayum		Excluding Kura of Qahqawa		Full Sample		Full Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
=1 if med. poll tax high	-0.128**	-0.096*			-0.069	-0.057				
	(0.051)	(0.045)			(0.046)	(0.033)				
=1 if av. poll tax high			-0.070	-0.128						
			(0.058)	(0.127)						
Med. poll tax (dinars)									-0.315**	-0.239*
									(0.127)	(0.110)
Av. poll tax (dinars)							-0.573***	-2.723**		
							(0.168)	(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
Clusters	11	11	5	5	8	8	11	11	11	11
Obs	2682	2682	1300	1300	1790	1790	2682	2682	2682	2682
AR2	0.021	0.062	0.005	0.005	0.011	0.032	0.045	0.061	0.019	0.062

Notes: Standard errors clustered at the district of origin level are in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. A constant is included in all regressions.
Source: The 1848-1868 population census samples combined with multiple data sources. See section B for details.

Table C.5: **The Poll Tax and the Coptic-Muslim Occupational Differences in 1848-1868
Measurement Error in Poll Tax - OLS Estimates**

Dependent Variable =1 if White-Collar3

	=1 if Median Tax High		=1 if Average Tax High: Excluding *Kuras* of Ihnas and Fayum	=1 if Median Tax High: Excluding *Kura* of Qahqawa	Average Tax in Dinars		Median Tax in Dinars	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Copt	0.040	-0.961*	0.010	0.082**	-0.349*	-0.461	-0.430	-1.386**
	(0.025)	(0.467)	(0.026)	(0.030)	(0.183)	(0.560)	(0.270)	(0.461)
Copt * Poll tax	0.200*	0.153***	0.042	0.158	0.337*	2.515**	0.477	0.373***
	(0.106)	(0.037)	(0.030)	(0.109)	(0.157)	(0.815)	(0.266)	(0.093)
District FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Copt * Controls?	No	Yes	No	No	No	Yes	No	Yes
Clusters	11	11	5	8	11	11	11	11
Obs	2682	2682	1300	1790	2682	2682	2682	2682
AR2	0.017	0.019	0.009	0.022	0.016	0.018	0.016	0.019

Notes: Standard errors clustered at the district of origin level are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Source: The 1848-1868 population census samples combined with multiple data sources. See section B for details.

Table C.6: **Exogeneity of the Distance to *Arish***

	(1) Log (urban population) in 300	(2) =1 if district on Holy Family route in 400	(3) % Villages with Coptic monasteries in 1200	(4) =1 if *Autopract* estates in district in 600	(5) =1 if Byzantine garrison in district in 600
Dist. to *Arish* (km)	0.0003	-0.0005	0.0002***	-0.0006	-0.0001
	(0.0005)	(0.0003)	(0.0001)	(0.0005)	(0.0003)
Observations	76	76	76	35	76
Adjusted R^2	-0.009	0.015	0.147	0.003	-0.012

Notes: Standard errors are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$. A constant term is included in all regressions.

Source: Multiple data sources. See section B for details.

Table C.7: **The Poll Tax and Copts' Population Share in 1848-1868 - IV Estimates**

(a) Second Stage Regressions - *Dependent Variable =1 if Coptic Christian*

	(1)	(2)	(3)
=1 if poll tax high	-0.215***	-0.374**	-0.592**
	(0.043)	(0.147)	(0.251)
Controls for urbanization and religiosity?	No	Yes	Yes
Other controls?	No	No	Yes
Clusters	11	11	11
KP_LM_pval	0.036	0.075	0.162
KP_Wald_Fstat	30.408	10.230	1264.182
AR_Wald_pval	0.000	0.004	0.047

(b) First Stage Regressions - *Dependent Variable =1 if Poll Tax High*

	(1)	(2)	(3)
Dist. to *Arish* (km)	-0.005***	-0.002***	-0.001***
	(0.001)	(0.001)	(0.000)
Controls for urbanization and religiosity?	No	Yes	Yes
Other controls?	No	No	Yes
Observations	2682	2682	2682

Notes: Standard errors clustered at the district of origin level are in parentheses.
$*p < 0.10, **p < 0.05, ***p < 0.01$. A constant term is included in the estimation and is partialled out in both stages.

Source: The 1848-1868 census samples combined with multiple data sources. See section B for details.

Table C.8: **The Poll Tax and the Coptic-Muslim Occupational Differences in 1848-1868 - IV Estimates**

(a) 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 Bureau-cracy	=1 if Mid Bureau-cracy	=1 if Judiciary, Military, Police	=1 if Clergy, Rural Elite	=1 if Merchant	=1 if Artisan	=1 if Farmer	=1 if Unskilled
Copt	0.067**	-0.001	-0.001	-0.005**	0.001	0.071**	-0.028***	-0.040*	0.001	0.057	0.058	-0.114**
	(0.029)	(0.018)	(0.030)	(0.002)	(0.001)	(0.031)	(0.002)	(0.024)	(0.013)	(0.120)	(0.135)	(0.048)
Copt * Poll tax	0.118***	0.138***	0.121**	0.003	-0.005***	0.120***	-0.020***	0.040*	-0.017	0.312*	-0.401**	-0.032
	(0.045)	(0.045)	(0.055)	(0.002)	(0.002)	(0.046)	(0.004)	(0.022)	(0.017)	(0.162)	(0.174)	(0.063)
Clusters	11	11	11	11	11	11	11	11	11	11	11	11
KP_LM_pval	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
KP_Wald_Fstat	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740	46.740
AR_Wald_pval	0.033	0.034	0.085	0.274	0.005	0.031	0.001	0.183	0.358	0.047	0.024	0.645

(b) First Stage Regression - *Dependent Variable is Copt * Poll Tax High Indicator*

Copt	3.088***
	(0.335)
Copt * D. Arish	-0.006***
	(0.001)
Observations	2682

Notes: 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. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

Source: The 1848-1868 census samples combined with multiple data sources. See section B for details.

Table C.9: **The Poll Tax and Copts' Population Share in 1200 and 1500 - OLS Estimates**

Dependent Variable is the Share of Villages with at Least One Coptic Church or Monastery in Each District in 1200 or 1500

	1200				1500			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
=1 if poll tax high	-0.011	-0.049			-0.164**	0.060		
	(0.056)	(0.159)			(0.058)	(0.182)		
=1 if Arab settlement			-0.047	-0.043			-0.077***	-0.072***
			(0.045)	(0.051)			(0.027)	(0.024)
Controls?	No	Yes	No	Yes	No	Yes	No	Yes
Observations	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

Notes: Robust standard errors are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$. A constant is included in all regressions.

Source: Data on churches and monasteries in 1200 and 1500 combined with other data sources. See section B for details.

D Results on Testing Other Theories

Table D.1: **Estimating Adult Mortality from the 1848-1868 Census Samples**

Age Group	Copts				Muslims			
	Estimated Size in 1848	Estimated Size in 1868	Estimated Life Expectancy (Method 1)	Estimated Life Expectancy (Method 2)	Estimated Size in 1848	Estimated Size in 1868	Estimated Life Expectancy (Method 1)	Estimated Life Expectancy (Method 2)
0-9	90,740	117,801	NA	NA	1,148,827	1,458,614	NA	NA
10-19	32,981	51,600	41.45	42.9	377,685	603,264	43.44	44.82
20-29	33,290	52,466	44.59	44.59	406,293	622,071	49.08	48.73
30-39	40,100	36,657	30.44	32.2	457,208	481,535	32.97	32.65
40-49	27,031	26,187	25.46	24.72	348,101	360,926	25.9	23.79
50-59	15,325	25,345	22.61	21.02	243,063	288,588	21.83	19.98
60-69	11,406	12,595	17.67	16.1	171,180	195,387	16.88	13.53
70-79	7,849	10,899	11.52	9.03	99,442	111,561	12.26	8.68
80+	7,094	5,107	NA	NA	125,336	78,559	NA	NA

Notes: The handbook of the United Nations Population Division (2002, pp. 5-20) outlines a methodology for estimating adult mortality from any two consecutive censuses that are separated by an interval of x years, where x is a multiple of 5. The methodology 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 methodology, the synthetic survival ratio, calculates the growth rate of each age cohort in order to make the methodology applicable to any census interval, i.e. not necessarily a multiple of 5. I applied the two methods to the census samples of 1848 and 1868, in order to estimate the 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 the two methodologies; ideally, the interval should be around 5 or 10 years, (b) I do not have 100-percent samples of the two censuses and so there is a sampling error in estimating the size of each age cohort, and (c) there is a problem of age misreporting; in particular, age heaping and age exaggeration, which is typical in historical censuses and even contemporary censuses in developing countries. Age misreporting is likely correlated with SES and may thus vary in a non-random way across religious groups, where Muslims are more likely than Copts to misreport their true age. In order to mitigate age misreporting, I defined age groups in intervals of 10 years instead of 5 years.
Source: The 1848 and 1868 population census samples.

Table D.2: **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	Stricter tax enforcement, higher tax rate, uniform tax regardless of income	Copts
750	Nile Delta	Heavy taxation and general suffering	Copts; Arabs revolted to overthrow the Umayyads
753	Nile Delta	Reorganizing the tax system	Copts
768	Nile Delta	Abbasids' fiscal reforms	Copts

Notes: I excluded ten tax revolts that erupted in 783-866 (nine of which were in the Nile Delta) because both Muslims and Copts participated in these revolts and, thus, they were likely motivated by other reasons.
Sources: Morimoto (1981, pp. 145-72) and Mikhail (2004, pp. 195-211).

Table D.3: **"Protégés" by Religious Group in 1848 and 1868**

Muslims		Copts		Non-Coptic Christians		Jews	
1848	1868	1848	1868	1848	1868	1848	1868
0.003%	0.076%	0.016%	0.069%	17.080%	25.705%	7.756%	10.446%

Notes: Non-Coptic Christians are primarily Greeks, Levantines, and Armenians.
Source: The 1848 and 1868 population census samples.

Table D.4: **Testing the "Powerless Bureaucrat" Hypothesis**
Dependent variable is indicated on the top of each column

	Share of Copts within mid-low bureaucrats			Number of Coptic bureaucrats per Muslim bureaucrat	
	(1)	(2)	(3)	(4)	(5)
Copts' population share	2.445***	2.277***	2.282***	30.046**	27.325**
	(0.379)	(0.369)	(0.317)	(12.446)	(10.711)
Number of bureaucrats		0.012***	0.013***		
		(0.002)	(0.002)		
Controls?	No	No	Yes	No	Yes
Observations	59	59	59	50	50

Notes: Regressions are weighted by district's population. A constant is included in all regressions. $*p < 0.10, **p < 0.05, ***p < 0.01$. Standard errors are in parentheses. Controls include log(urban population) in 300 and the Holy Family legendary route indicator.
Source: The 1848-1868 census samples aggregated to the district level and combined with multiple data sources. See section B for details.

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