Taxing Unwanted Populations: Fiscal Policy and Conversions in Early Islam

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Abstract

Hostility towards a population, whether on religious, ethnic, cultural or socioeconomic grounds, confronts rulers with a trade-off between taking advantage of population members' eagerness to maintain their identity and inducing them to "comply" (conversion, quit, exodus or any other way of pleasing the hostile rulers). This paper first analyzes the rulers' optimal mix of discriminatory and non-discriminatory taxation, both in a static and an evolving environment. It thereby derives a set of unconventional predictions. The paper then tests the theory in the context of Egypt's conversion to Islam after 641 using novel data sources. The evidence is broadly consistent with the theoretical predictions.

Keywords: Islam, poll tax, Laffer curve, hostile taxation.

JEL numbers: H2, N45, Z12.

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"Muhammad was sent as a prophet and not as a tax collector."

Umar II, Caliph of the Arab Umayyad Empire from 717 to 720

1 Introduction

Hostility toward populations on the grounds of their religious, ethnic, linguistic, cultural, economic, or sexual-orientation identity is commonplace. At the core of this paper is a basic conflict faced by rulers in the treatment of these unwanted populations, between extracting members' willingness to pay for keeping their identity and inducing them to lose it (convert, quit the organization or the country...). For instance, populist governments face a trade-off between pandering to their constituency's hostility toward rich entrepreneurs and executives and risking their moving activities abroad. This dilemma can also be found in organizations such as corporations, universities or political parties, as management may be torn between reducing the influence of individuals or groups standing in the way of the management's policy, and the loss and disruption that their departure would create. More dramatically, the persecution of Jews by Nazi Germany reflected the regime's revealed preference for expressing its strong hostility toward the minority over the substantial cost inflicted on the country by the Jewish exile to the United States and other countries, and the international opprobrium.[1] [2]

Our lead application is the aftermath of the Arab conquest of the then-Coptic Christian Egypt in 641 CE. From 641 until 750, the Arab Caliphate introduced a tax system that provided incentives to Egypt's Copts to convert to Islam.[3] Taxation consisted of both a discriminatory tax, levied on non-Muslims and removed upon the taxpayer's conversion to Islam, and a non-discriminatory (uniform) one that was paid regardless of the taxpayer's religion. The discriminatory tax was made of a poll tax on non-Muslim free adult males. In addition, non-Muslim landholders were subject to a land tax rate

1. Moser et al. (2014) analyzed the cost to Nazi Germany of the emigration of Jewish scientists to the US.

2. In modern economies, taxes can be targeted less explicitly toward minorities. For instance, the 1942 one-off Varlik Vergisi (wealth) tax in Turkey was imposed on all citizens' fixed assets, such as land, building owners, real estate brokers, businesses, and industrial enterprises. While on paper a non-discriminatory tax, it affected most severely Jews, Greeks, Armenians, and Levantines, who controlled a large portion of the economy (Artunc and Agir, 2017).

3. This tax system was in fact introduced to all the conquered territories of the Arab Caliphate. It was also applied to Muslim-ruled territories in South and Southeast Asia. We limit ourselves in this paper to Egypt because it is where the papyrological records on the tax system under the Early Arab Caliphate survived.

(*kharaj*) that was higher than the uniform land tax rate (*ushr*) on Muslim landholders (the latter tax rate may have been equal to zero). By 750, the Caliphate, supported by jurists, increased the uniform land tax rate from the *ushr* to the *kharaj*, and from that date on the discriminatory tax equated with the poll tax. This "new" Islamic tax system was then enforced since 750 until 1856, when the poll tax on non-Muslims was finally abolished.

Saleh (2017) documented that because the poll tax (the discriminatory tax from 750 to 1856) was highly regressive, *poorer* Copts were more likely to convert to Islam, holding Copts' religiosity constant.[4] This led Copts to shrink into a better-off minority by 1200, and the consequent Coptic-Muslim socioeconomic gap persisted through the nineteenth century. The current paper attempts to expand the analysis by understanding the determinants of both the discriminatory and uniform taxes from the viewpoint of the Arab Caliphate. The taxation of unwanted populations is by and large unexplored territory, both theoretically and empirically. The paper first analyzes optimal taxation by a ruler/dominant group who is hostile to a population. It then uses the model to analyze the co-evolution of the Islamic tax system and Egypt's conversion to Islam between 641 and 1200.

Theory We first develop an optimal taxation framework of independent interest. Its theoretical novelty resides in the ruler's preferences. The normative public finance and political economy literatures both assume that the public decision-maker at least partly internalizes the welfare of, or values the votes of all constituencies; at worst the ruler has a neutral attitude toward a particular constituency. By contrast, we consider an unwanted group. In the language of the Islamic governance of Egypt, we posit the ruler is hostile to those holding Coptic beliefs. Alternatively, regardless of affinity considerations, the ruler may have intrinsic or extrinsic (formal or informal incentives provided by the caliphate) motivations to increase the number of conversions to Islam.

In our framework, the ruler levies both a uniform tax and a discriminatory (unwanted-population-specific) tax. We derive the conditions under which the discriminatory tax falls on the wrong side of the Laffer curve. Umar II's citation at the beginning of the

4. The poll tax was imposed in three lump-sum amounts of 1, 2, and 4 dinars based on the skill level of occupations: unskilled manual, skilled manual, and white-collar occupations. Despite the three-bracket system, the poll tax rate per dinar of income was sharply decreasing in income.

paper illustrates the trade-off between rent extraction and non-material incentives; the Caliph called for more conversions at the cost of a lower tax revenue, suggesting that public finances were on the wrong side of the Laffer curve.[5]

This specificity produces a rich set of unconventional insights. For example, the ruler taxes more his favored group, the more hostile he is toward the unwanted group. Relatedly, the uniform and the discriminatory taxes are under some conditions complements rather than substitutes; consequently, a relaxation of a cap on the uniform tax lead to an increase in the discriminatory tax.

Other testable predictions describe how the choice of taxes and the unwanted population's compliance level (in our lead example, conversion to Islam) vary with the population's socio-demographic characteristics (income and religiosity), the rulers' preferences (religiosity), the cost of collecting the discriminatory and non-discriminatory taxes, and the budgetary needs. We further show that the need to prevent revolts lowers both the discriminatory and non-discriminatory taxes, even when the marginal potential rebel renounces his identity (is a convert) and therefore is not affected by the discriminatory tax.

Looking at the dynamics of optimal taxation, we then show that the uniform tax, but not necessarily the discriminatory tax, may increase over time for four different reasons: (a) the budgetary need increases and this increase is absorbed by the uniform tax; (b) the rulers become more hostile over time (by contrast, the uniform tax remains constant if the rulers become more tolerant over time, an asymmetric response); (c) there is some possibility that the rulers be chased out of power (out of the country), creating an option value for remaining in the unwanted population; (d) the threat of rebellion weakens over time since past converts only economize on the uniform tax but not on the discriminatory tax when the rebellion succeeds (they have lower incentives to participate in a rebellion).[6]

Empirics The model suggests the following determinants of the discriminatory and uniform tax rates and conversions: (1) religiosity of tax authorities, (2) budgetary needs, (3) Copts' religiosity, (4) threat of rebellion, (5) uncertainty about Caliphate's rule, and (6) Copts' marginal utility of income. We provide two pieces of evidence on the effects of

5. Note that "prophet" in Arabic means that Muhammad was sent by God to convert people to Islam.
6. The last result, suggesting a dynamic "divide-and-conquer" strategy, is of broad interest and can be applied to a broad array of political strategies.

these determinants on tax rates and conversions: (1) local-level cross-sectional evidence where we exploit the geographic variation in poll and *kharaj* tax rates (which were the discriminatory and uniform taxes respectively, starting from 750) and conversions within Egypt under the early Arab Caliphate, and (2) country-level qualitative evidence that attempts to explain the increase in the uniform tax rate circa 750.

The local-level evidence is based on novel primary data sources. We constructed an individual-level dataset on poll and *kharaj* tax payments per person from Egypt's papyrological tax records in 641-1100. Conversions between 641 and 1200 are measured at the village level by the presence of Coptic churches and monasteries in 1200. We proxy for the religiosity of local tax authorities by Arab settlement in 700-969 under the presumption that constituencies that received Arab tribes witnessed greater Arab (Muslim) penetration into the local tax administration (hence, more religious authorities), compared to Coptic-administered areas. Copts' religiosity in a given constituency is captured by its being located (or not) on the legendary route of the Holy Family during its biblical visit to Egypt, and Copts' marginal utility of income by a constituency's urban population circa 300. We argue that the remaining determinants: budgetary needs, threat of rebellion, and uncertainty about Caliphate's rule, are unlikely to vary locally.

We estimate a separate set of OLS regressions for each outcome: poll tax, *kharaj* tax, and conversions, on the aforementioned determinants. To address the potential endogeneity of Arab settlement, we employ distance to the point of entry of the Arab army into Egypt during the conquest as an instrumental variable for settlement. The analysis is subject to a major caveat, though: the poll (*kharaj*) tax records survived for only 4 (respectively 7) out of 42 *kuras*, Egypt's administrative units in 641-1036. While there is little that we can do to address this caveat, there are two points to make here. First, this is a general limitation of papyrological evidence in ancient and medieval history where the papyri usually survived in a handful of areas (mostly in Egypt's dry-climate Nile Valley), but this cost has to be weighed against the benefit of employing factual administrative records from the period instead of (often) subjective historical narratives. Second, conversions (churches) are observed for all 42 *kuras*.

Our findings are broadly consistent with the model predictions. First, consistent with the model predictions, we document that taxpayers in *kuras* where Arabs settled in 700-969 faced, on average, higher poll and *kharaj* taxes per person in 641-1100, and that villages in these *kuras* were less likely to have at least one Coptic church or monastery in 1200 (more conversions). Importantly, the positive effect of Arab settlement on the uniform (*kharaj*) tax is consistent with the optimal discriminatory (poll) tax being on the wrong side of the Laffer curve. Second, consistent with the model, we find that taxpayers in *kuras* that lied on the legendary path of the Holy Family paid a higher poll tax per person in 641-1100. Third, we fail to find evidence on the model prediction of a negative effect of urban population circa 300 on conversions (the coefficient is positive and statistically insignificant). The findings are robust to using *kharaj* per unit of land in 1375 and 1477 and Coptic churches and monasteries in 1500, as alternative measures of the *kharaj* tax and conversions.

The model explains the increase in uniform tax rate starting from 750 by an increase in Caliph's religiosity and/or budgetary needs, and/or by a decrease in the threat of rebellion and/or uncertainty about Muslim rule. The country-level evidence documents the evolution of (proxies for) the four variables between 641 and 847. However, the evidence is qualitative because (1) we observe tax rates and conversions at only a few scattered points in time that do not allow an econometric analysis (see section 2), and (2) the tax reform was a Caliphate-wide one-time policy change. The evidence suggests that the tax reform is attributable to the decline in uncertainty about Caliphate's rule and the threat of rebellion. As attacks by neighboring empires and major civil wars within the Caliphate both declined, the Caliphate became more daring to increase the uniform tax on Muslims. Although the reform resulted in tax revolts that now included both Muslims and Copts, the success of the violent suppression of these revolts allowed the new tax system to survive until the nineteenth century.

Related literature The paper is related to a few strands of literature. It differs from the optimal taxation literature in at least two ways: the optimality of being on the wrong side of the Laffer curve and the hysteresis effects associated with exit from the tax base. Relative to the economics of discrimination literature, the paper shares with Becker (1957)'s theory of discrimination the feature that decision-makers have a distaste for minority membership: Becker's employers (or their majority employees) are assumed to derive a lower utility from minority employees at the same productivity and wage. Similarly, the ruler here dislikes minority presence in the tax base. The theory of taste-based discrimination however is developed in a competitive labor market (actually, one of Becker's key insight was to show that for a given productivity, majority and minority wages are equalized whenever the fraction of employers with a taste for discrimination is smaller than some threshold), while our ruler acts as a monopolist. Glaeser (2005) analyses the economics of hatred, but from a very different angle: he looks at the majority politicians' incentives to spread negative information about a minority. The majority members can choose to verify the veracity of this information, can decide to protect themselves against the minority and also vote for or against the majority politician. Neither the optimal tax mix nor the dynamic implications of discriminatory treatments are examined in that literature.

Acemoglu (2006) is a rare contribution in which rulers have reasons to hurt some constituency. In his model, the ruling elite not only aims at extracting rents from the output of an enterprising middle-class, but also may try to achieve other goals with the tax it levies on the output of the middle-class. First, the elite may itself own firms and taxing the middle-class output discourages middle-class production and reduces the market wage. So the elite may levy a tax on middle-class output in excess of the level that extracts the maximum rent from them. As Acemoglu emphasizes, this result hinges on limited tax instruments, i.e. on the output tax achieving multiple purposes; a tax on labor hired by the middle-class firms could take care of limiting competition for labor. Acemoglu's second reason for the elite's overshooting the peak of the rent-extraction curve is that the middle class might rebel, a rebellion that might be facilitated by financial means at its disposal. That reason is complementary to our section on rebellion, which is based on manpower rather than money; as a consequence, the minority rebels when ill-treated by the majority in this paper, while it rebels when well-treated and therefore empowered in Acemoglu's contribution. Overall, both the rationales for hurting the minority and the focus differ between the two papers.

Our results on the time-decreasing threat of rebellion relate to Dewatripont and Roland (1992)'s seminal work on gradualism. These authors consider an environment in which a government wants to reduce a firm's labor force, and for that must make an offer that is preferred by a majority of workers to a given status-quo. The government does not know individual workers' outside options, and so faces a trade-off: Massive redundancies might yield rapid efficiency gains, but at a great budgetary cost (there is a shadow cost of public funds). Dewatripont and Roland show that, with two periods, it is possible for a government to obtain a majority vote for a reform that intertemporally hurts majority interests. Some voters expect to lose in comparison to the status quo if the initial reform is rejected. It is then possible for the government to include this second-period minority in its first-period majority, and use it to hurt another group of workers who become the first-period minority. There are a number of differences between their framework and ours. First, their model exhibits negative selection (and associated Coasian dynamics) rather than positive selection. Second, converts in our model can still be taxed in the future, while workers who have accepted the exit bonus disappear from the game in their paper. Third, a Copt's ability to convert does not hinge on other Copts' decisions, while a worker's ability to quit depends on the approval of the government package by a majority of other workers. Finally, Dewatripont and Roland's planner is benevolent and in no case hostile to the population whose status it is trying to alter.

Our paper shares with the literature on the taxation of externalities and internalities (e.g. tobacco or pollution) the property that taxes will be on the wrong side of the Laffer curve. This literature however does not study issues related to the tax structure and to the specific dynamics of taxation and rebellion under ratcheting of compliance (apostasy, costly return...); it also cannot guide the empirical evidence obtained in this paper.

A large literature studies optimal taxation with non-utilitarian welfare functions (e.g. Fleurbaey and Maniquet (2011)). Saez and Stantcheva (2016) derive optimal taxation in an environment that is not necessarily welfarist (in particular, social welfare weights can depend on individual or aggregate characteristics which do not enter individuals' utilities). Their focus is on allowing various considerations, such as counterfactuals (what would have happened in the absence of taxes?), horizontal equity, libertarianism, equality of opportunity concerns, and poverty alleviation, to matter per se, independently of their consequences on the taxpayers' utility. Much work has also been devoted to investigate the impact of altruism on optimal taxation (e.g. Diamond (2006), Farhi and Werning (2010), and Kaplow (1995)). These two literatures investigate neither the taxation of unwanted populations, nor its dynamic evolution as unwanted population members convert or leave the country.

The paper contributes to the literature on the economics of religion (Barro and McCleary, 2003; Botticini and Eckstein, 2005; Becker and Woessmann, 2009; Chaudhary and Rubin, 2011; Michalopoulos et al., 2017) and the relative roles of political and religious authorities in shaping population's religious beliefs in order to establish legitimacy for their rule (Chaney, 2013; Belloc et al., 2016; Rubin, 2017). Instead of focusing on the impact of religious beliefs on economic outcomes, our paper demonstrates how the Islamic tax system affected the *formation* of religious groups via inducing conversions to Islam (although not necessarily triggering changes in religious beliefs). This tax system was probably established in order to increase the legitimacy of the Caliphate by pursuing its Islamic mission of winning converts.

The paper contributes to a century-long debate on the historiography of taxation and conversions under the early Arab Caliphate. Whereas Muslim jurists claimed that the canonical Islamic tax system that exempts Muslims from the poll tax but forces them to pay the (higher) *kharaj* land tax has *always* existed since Muhammad's lifetime (before 632), there is a general consensus among Western historians (Wellhausen, 1902; Becker, 1902; Bell, 1910; Grohmann, 1932; Morimoto, 1981; Simonsen, 1988; Frantz-Murphy, 2004) (but not Dennett (1950)) that the system was introduced during the eighth century and that Muslims paid a lower (even zero) land tax before then. Within the latter viewpoint, it was suggested that the eighth-century tax reform was the Caliphate's response to the trade-off between winning converts and maximizing tax revenues. According to Sijpesteijn (2013, p. 189), "*the question is now whether the Muslim authorities would have had reasons to start levying these* [higher land] *taxes on Muslims in the first quarter of the second century AH* [mid eighth century CE]. *The answer lies in the early Umayyad fiscal system and the problems it faced trying to ensure a continuous source of fiscal income while simultaneously serving the Muslim mission to win converts.*" Our paper attempts to provide theoretical and empirical grounds to the viewpoint that both Islamic taxation and conversions evolved endogenously. In this respect, our paper contributes to another long-standing, yet more controversial, debate on the impact of discriminatory taxation on conversions in early Islam. Inspired by major papyri discoveries from early Islamic Egypt, pioneering historians such as Wellhausen (1902), Becker (1902), Bell (1910), and Grohmann (1932) emphasized the tax incentive of conversions under the early Arab Caliphate. Their theory triggered fierce debates among later historians, though, and the question is thus far unresolved.

More generally, the paper is connected to the institutional literature in the economic history of the Middle East. Certain Islamic institutions, such as the Islamic trust (*waqf*) and inheritance, have been criticized for causing the relative economic stagnation of the region (Kuran, 2004, 2012). Although explaining the emergence of institutions is a major topic in the institutional economics literature (Greif, 1994), it received less attention in the literature on the Middle East, which usually treats Islamic institutions as exogenous assuming that they have always existed since the beginning of Islam. Our paper attempts to endogenize the Islamic tax system and explain its historical formation.

2 Historical background

2.1 Islamization of Egypt, Greater Syria, and Iraq

Following Prophet Muhammad's death in 632, the Rashidun and Umayyad Arab caliphates that ruled from 632 to 750 initiated a series of conquests that captured the Persian Empire and the southern and eastern parts of the Byzantine Empire. On the eve of the Arab conquests, all local populations of the conquered territories were non-Muslims (a large Christian majority and a small Jewish minority).[7] During the centuries that followed, non-Muslims shrank from 100 percent of the local population to 7 percent in Egypt in 1848-1868, and 9 percent in Greater Syria and 5 percent in Iraq in 1580. Courbage and Fargues (1997)'s estimates of non-Muslims' population share in Egypt, Greater Syria, and Iraq, along with Saleh (2017)'s estimates for Egypt, are shown in Figure 1. The figure reveals that non-Muslims shrank into a minority by 900.

Historical evidence indicates that Islamization of the Middle East was mostly driven by voluntary conversions of the local population to Islam rather than by coercion or demographic factors including population replacement via Arab immigration and local populations' emigration, fertility and mortality differences between Muslims and non-Muslims, and inter-marriages between Muslim males and non-Muslim females (Saleh, 2017). Therefore, from now on we use the two words "Muslims" (who in principle include both Arabs and converts) and "converts" interchangeably. Conversion to Islam was

7. Christians of the region belonged, for the most part, to "heretical" Oriental Orthodox non-Chalcedonian Christian denominations, that split from the Roman Church at the Council of Chalcedon in 451: Egypt's Christians mostly followed the Coptic Church; Greater Syria's Christians, the (Jacobite) Syriac Church, and Iraq's Christians, the Nestorian Church. Chalcedonian denominations that remained loyal to the Roman Church formed small Christian minorities in these territories: the *Melkites* in Egypt and the *Maronites* in Greater Syria (Courbage and Fargues, 1997).

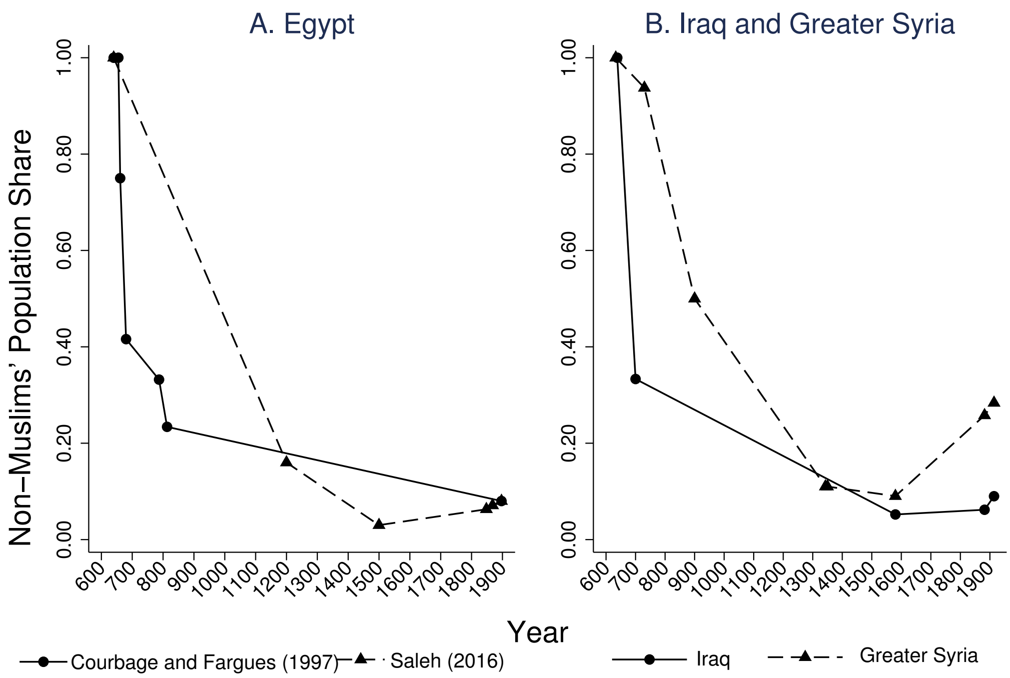

Figure 1 – **Non-Muslims' Population Share in 632-1914**

Sources: Courbage and Fargues (1997) and Saleh (2017).

automatically transmitted across generations (i.e. being a Muslim was an "absorbing state") owing to three Islamic laws: (a) apostates are sentenced to death, (b) the offspring of a Muslim male is automatically Muslim, and (c) Muslim females may only marry Muslim males.

2.2 Islamic taxation

Taxation in 632-750 To provide incentives to the conquered populations to convert to Islam, Arabs introduced a tax system that provided tax exemptions to converts.[8] Between 632 and 750, free non-Muslim adult males paid a poll tax (*jizya*), an annual per head cash tax; furthermore, non-Muslim *landholders* paid an annual land tax (*kharaj*) that was assessed as a lump-sum amount per *feddan* (= 6,368 square meters) of landholdings that varied by crop and was paid in cash and/or kind. By contrast, Muslims were exempted from the poll tax, and Muslim landholders paid a reduced land tax (var-

8. Taxes were collected locally and sent to the capital of each territory (e.g. Egypt, Greater Syria, and Iraq), where part of the revenues was forwarded to the Caliphate's capital (Medina in 632-661, Damascus in 661-750, and Baghdad, Cairo, and Istanbul (among other capitals) from 750 onwards).

iously called tithe, *ushr*, *zakat*, *sadaqa*) that was assessed at a percentage of yield (5 or 10 percent) that varied by land quality and paid in cash and/or kind. Due to the lack of papyrological evidence on the *ushr* tax before 750, it has been argued that Muslim landholders paid no land tax before 750 (Sijpesteijn, 2013, pp. 181-99).[9]

There were two important differences between *kharaj* and *ushr* taxes. First, whereas the *ushr* tax rate had an upper bound that was decided by *Hadith* (prophet's sayings), the *kharaj* tax rate was decided by either the terms of a treaty (and thus had an upper bound) in territories that were annexed by the Arab Caliphate by a peace treaty, or by Caliph's will (and thus had no upper bound) in territories that were annexed by military force. According to Frantz-Murphy (2004), Egypt belonged to the "treaty" territories. Second, landholders' rights differed between *kharaj* and *ushr* land.[10] (Non-Muslim) landholders of *kharaj* land, who were in principle tenants paying *kharaj* as rent to the state, held *usufruct* rights on land that were (a) renewable upon payment of the *kharaj*, (b) inheritable upon state approval, (c) tradable among non-Muslims only (Sijpesteijn, 2009, p.126), and (d) non-eligible to be turned into *waqf* (a form of non-taxable charitable trust). To the contrary, (necessarily Muslim) landholders of *ushr* land enjoyed full private ownership rights which were (a) permanent, (b) inheritable without state intervention, (c) tradable among Muslims only, and (d) eligible to be turned into *waqf*.

To sum up, the discriminatory tax in 632-750, i.e. the difference in net taxes between non-Muslims and Muslims was equal to the poll tax plus the (positive) difference between the *kharaj* and *ushr* land tax rates. The uniform tax, which was imposed on both non-Muslims and Muslims, was equal to the *ushr* tax, which might have been equal to zero.

9. We abstract here from two other types of taxes. First, we abstract from the miscellaneous taxes that were imposed on non-Muslims only in 632-750 because they were extended to Muslims after 750. In 632-857, the miscellaneous taxes were irregular ad-hoc taxes collected for specific uses such as military expenses, lodging for officials, governor's expenses, the village overhead expenses, and public projects. In 857-1171, the tax base expanded for the first time (beyond the poll and land tax) to include non-land property such as pasture, weir, and 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. Second, we abstract from the military conscription on Muslims (a non-pecuniary tax), because it was in return for a state (cash and in-kind) stipend and was abolished from 833 on with the Caliphate-wide shift to recruiting imported slave soldiers in the army instead of conscripting the local Muslim populations. To the best of our knowledge, there were no other differential taxes between non-Muslims and Muslims.

10. Caliph Umar I (reigned from 634 to 644) prohibited Arabs from confiscating land in conquered territories. Consequently, the vast majority of land remained in the hands of the local non-Muslim populations (Sijpesteijn, 2013, p.81), on which the *kharaj* land tax was levied. Only the public domain and royal (Byzantine or Persian) land was confiscated by, and distributed among Arabs (Dennett, 1950, p.69), on which the *ushr* land tax was levied.

Tax reform in 750 Conversions to Islam in 632-750 caused the tax base and, hence, tax revenues to fall (see Figure 2). In order to increase the tax base, the state introduced several tax reforms during that period including (a) levying the poll tax on monks, local elites, and fugitives, who were initially exempted,[11] (b) imposing the *kharaj* land tax on churches and monasteries, which were also initially exempted,[12] and (c) imposing the *ushr* land tax on Arabs, who were initially exempted due to their political power. Furthermore, certain local governors attempted to deter conversions to Islam by imposing the poll and *kharaj* land taxes on converts, although these reforms were reversed by Caliphs.

But starting from 750, the *canonical* Islamic tax system was established. Under the new system, the land tax on Muslims was raised from the *ushr* to the *kharaj* rate, and Muslims were now allowed to purchase *kharaj* land from non-Muslims. Jurists adopted a historical narrative that denied the existence of peace treaties in most of the conquered territories, including Egypt, thus justifying removing any upper bound on the *kharaj* tax rate. Consequently, from that date on the discriminatory tax equated the poll tax, until the latter tax was finally abolished in 1856, and the uniform tax, the *kharaj* land tax, was decided upon Caliph's will.[13] Landholders of *kharaj* land, whether Copts or Muslims, enjoyed *usufruct* rights but not full private property rights on their landholdings.[14] However, the *ushr* tax continued to be imposed on certain elite Muslim landholders, who enjoyed full private property rights on their landholdings. The unification of the land tax rate only occurred in 1891.

Tax rates Figure 3 shows the long-term trend of the *de jure* nominal annual poll tax for low-, middle-, and high-income brackets. In 641-750, the poll tax was 1 dinar on average. Starting from 750, the *de jure* poll tax was imposed in three lump-sum amounts per person of 1, 2, and 4 dinars on the poor, middle, and rich respectively, but was regressive in wages (Saleh, 2017). The *de jure* tax remained almost stable from 750 to

11. Fugitives are those who deserted their tax place of residence in order to evade taxation.

12. These initial tax exemptions were likely due to the persistence of pre-Islamic Persian and/or Byzantine tax administrative traditions.

13. The exact date of the tax reform is uncertain. Wellhausen (1902) and Becker (1902) date the tax reform to the first half of the eighth century (738-748), whereas Morimoto (1981) pushes it forward to the late eighth century (775-785). The earliest *surviving* Muslim jurist book that outlined the new tax system is Abu-Yusuf (1979) that was written around 786. However, Abu-Yusuf's tax system was probably enforced earlier and in fact may have been first introduced by his teacher, Abu-Hanifa (699-767).

14. The vast majority of farmers in rural Egypt in the 1848 and 1868 population censuses were *kharaj* landholders. Sharecroppers and wage agricultural workers (who were landless farmers) constituted a tiny percentage.

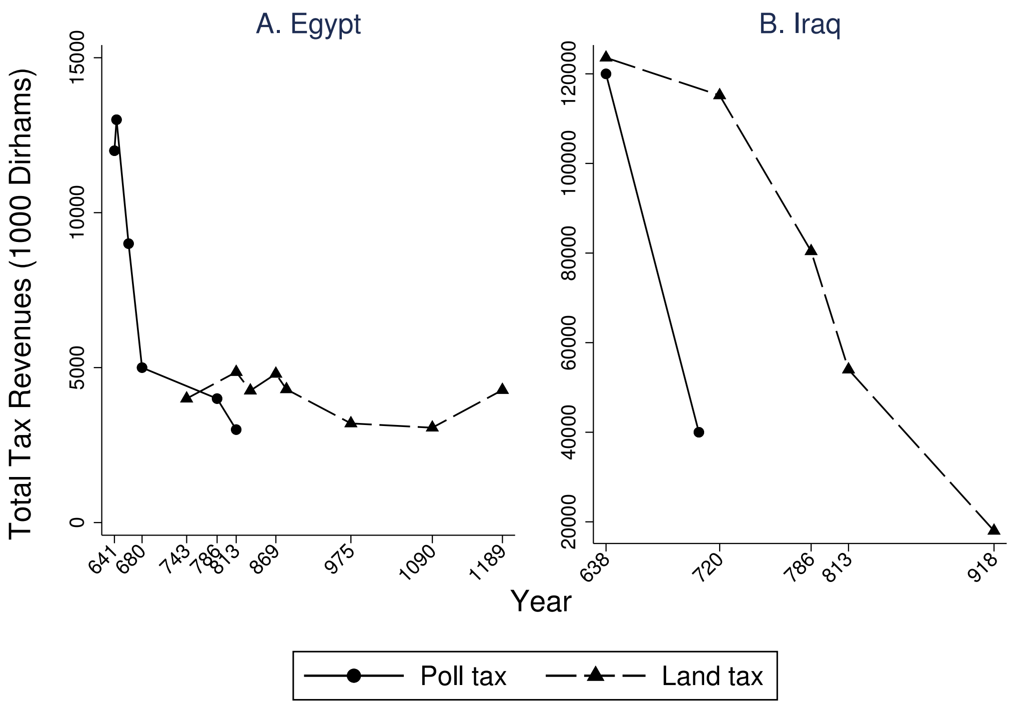

Figure 2 – **Total Poll and Land Tax Revenues in 638-1189**

Source: Courbage and Fargues (1997).

1000, increased slightly between 1101 and 1300, before it declined in 1301-1500 (perhaps due to the Black Death shock). Evidence on the *real* poll tax rate per person (in kilograms of bread) and the poll tax rate per dinar of income in Saleh (2017) reveals that the poll tax burden declined over time, and became negligible after 1250. Figure 4 shows that the *ushr* land tax rate was constant over time (by Islamic jurisprudence), whereas the *kharaj* land tax (that was collected in cash, kind, or both) fluctuated at the discretion of tax authorities. The *kharaj* rate (adding up both the cash and in-kind components) was higher than the *ushr* rate.

Tax administration Tax assessment and collection were delegated to the local authorities of each *kura*. In 641-720, Arabs left taxation in the hands of existing Coptic rural elites. But starting from 720, they started to penetrate the local tax administration by increasingly appointing Arabs as headmen of *kuras* (Morimoto, 1981, pp. 66-91; 175-81). In response to a series of tax revolts between 726 and 866 (first by Copts, then by both Copts and Muslims), they resorted around 900 to tax farming (Sijpesteijn, 2009) that

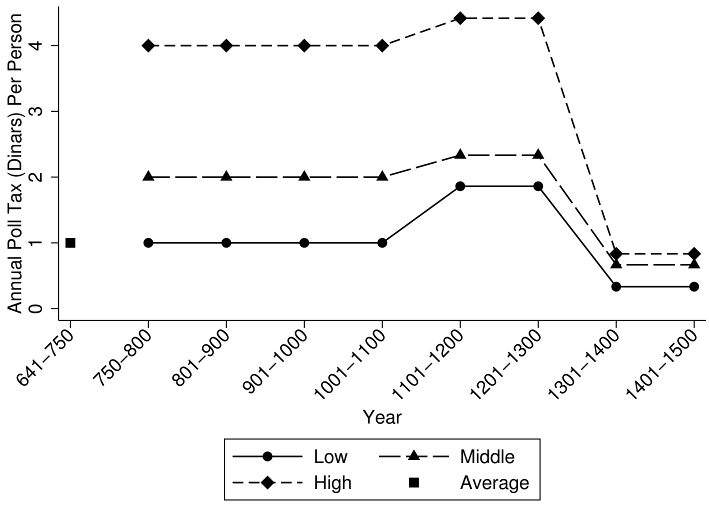

Figure 3 – **Poll Tax Rate Per Person in 641-1500**

Notes: Dinar weighs 4.25 grams of gold.
Sources: Ibn-Abdul-Hakam (1974) in 641-750 (according to Morimoto (1981)'s interpretation), jurists' handbooks in 750-1100 (Abu-Yusuf, 1979; Al-Qadi Al-Nu'man, 1963), officials' handbooks in 1101-1500 (Ibn-Mamati, 1991; Al-Qalqashandi, 1914).

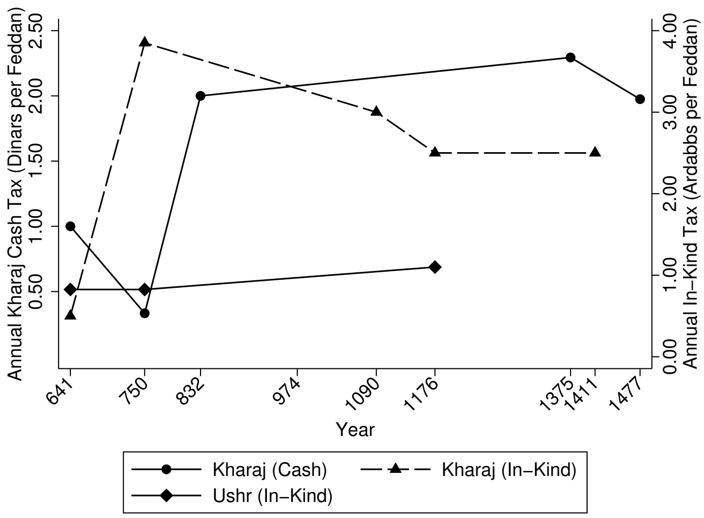

Figure 4 – ***Kharaj* and *Ushr* Land Taxes in 641-1477**

Notes: 1. One dinar equals 4.25 grams of gold. 2. One *ardabb* equals 70 kilograms. 3. One *feddan* equals 6,368 squared meters. 4. Figures for the in-kind *kharaj* and *ushr* taxes are for wheat. 5. I assume an average yield of 11 *ardabbs* of wheat per *feddan* using Ibn-Mamati (1991).
Sources: Secondary medieval narratives in 641 and 832 (Agapius, 1910; Ibn-Abdul-Hakam, 1974; Al-Maqrizi, 1500) according to Morimoto (1981)'s interpretation, jurists' handbooks in 750 and 974 (Abu-Yusuf, 1979; Al-Qadi Al-Nu'man, 1963), officials' handbooks in 1090, 1176, and 1417 (Ibn-Mamati, 1991; Al-Qalqashandi, 1914), and cadastral surveys in 1375 and 1477 (Ibn-Al-Jay'an, 1477).

remained in effect until 1813. Under that system, the state contracted out the tax collection of each *kura* to individuals (Morimoto, 1981, pp. 231-3), who, in 1171-1813, were often high-ranked military officers. Papyrological tax records reveal that the enforcement of the poll and *kharaj* taxes, the discriminatory and uniform taxes starting from 750, both varied across *kuras* in 641-1100. We lack papyrological evidence on the *ushr* tax, the uniform tax before 750, though, and so we do not know if its enforcement indeed varied locally, let alone if it was enforced at all.

3 Theory

3.1 Basic version

Copts' religious preferences. There is a mass 1 of Copts. Copts care about remaining Copts and about money. They are heterogeneous in their willingness to pay for remaining Copts. Let $\theta \in (-\infty, +\infty)$ denote their per-period willingness to pay for being Copt, distributed according to some smooth cumulative distribution $F(\theta)$ and density $f(\theta)$; one expects the mass to be concentrated primarily in the positive domain ($\theta > 0$). Let us assume that the hazard rate of the distribution is monotonic (a property that is satisfied by most familiar distributions): $d(f(\theta)/[1-F(\theta)])/d\theta > 0$.

Taxes. For notational simplicity, we assume equal land holdings, so each Copt holds one unit of land (each piece of land yields the same output y). λ is the non-discriminatory land tax paid by all Copts, whether they convert or not (later, we will assume that λ is constrained at the *ushr* level so as to better account for the pre-750 taxation). τ is the extra cost imposed on non-converts (empirically, this discriminatory tax exceeds the poll tax by the difference between the *kharaj* tax and the *ushr* tax until 750, but for the purpose of the model we will call it simply "poll tax").

Let

$$U(\theta) \equiv \begin{cases} -\lambda & \text{for a convert} \\ \theta - \lambda - \tau & \text{for a non-convert} \end{cases}$$

denote the gross utility of type θ (we can ignore the fixed output y from land here).

A Copt converts if and only if $\theta < \theta^* = \tau$. The number of converts is therefore $F(\tau)$ and the revenue from the poll tax paid by non-converts is

$$R(\tau) = \tau[1 - F(\tau)].$$

The monotone hazard rate assumption implies that the revenue function is strictly quasi-concave. Let $\tau^m \equiv \arg\max\{R(\tau)\}$ denote the revenue-maximizing, monopoly tax. We will say that the poll tax is on the "wrong side of the Laffer curve" if $\tau > \tau^m$. In this region, an increase in the poll tax reduces tax revenue.

Ruler's objective function. We posit that the ruler's objective function is quasi-linear [15] in the uniform tax λ; the ruler's preferences with respect to conversions are expressed by a function $V(\theta^*)$, where $V(\theta^*)$ will be assumed shortly to be increasing over the "relevant range":

$$W(\theta^*) = V(\theta^*) - \lambda. \tag{1}$$

Comparing two rulers with respective preferences V_1 and V_2, we define:

Definition 1 *Ruler 1 is said to be more religious than ruler 2 if* $V_1'(\theta^*) > V_2'(\theta^*)$ *for all* θ^*.

We assume that the ruler maximizes W subject to raising a budget B for the Caliphate $\lambda + R(\tau) \geq B$, which will be binding at the optimum:

$$\lambda + R(\tau) = B. \tag{2}$$

The objective function can then be rewritten as

$$W(\theta^*) = V(\theta^*) + R(\theta^*) - B.$$

We will assume that $V + R$ is strictly quasi-concave.

Intrinsic and extrinsic motivation example. To illustrate the model, we provide a lead example in which the ruler may care about conversion both because of his hostility toward the minority or because he is incentivized by the Caliphate to achieve conversions. On the

15. The theory can be extended to a non-linear objective function, but at the expense of further assumptions on marginal rates of substitution among taxes.

one hand, the Muslim ruler may feel antipathy towards someone with Coptic convictions. On the other hand, regardless of affinity considerations, the ruler may care about whether the unwanted population member remains Copt or converts to Islam for extrinsic (formal or informal incentives provided by the Caliphate) motivations. We are agnostic about the relative strengths of the empathy and conversion-performance factors, and so we allow both to enter the ruler's objective function. Letting $U(\theta)$ denote type θ's utility, $1-\delta(\theta)$ denote the weight of type θ in the ruler's welfare function (so $\delta(\cdot) \gtrless 0$ is a discrimination factor) and c denote a psychological or incentive cost c for the ruler per non-convert, the ruler's welfare is

$$V = \int_{-\infty}^{+\infty} [1-\delta(\theta)]U(\theta)dF(\theta) - c[1-F(\theta^*)], \tag{3}$$

where θ^* is the willingness to pay above which a Copt keeps his religion.

In this lead example,

$$V(\theta^*) = \int_{\theta^*}^{+\infty} [1-\delta(\theta)](\theta-\theta^*)dF(\theta) - c[1-F(\theta^*)].$$

Normalize weights to be equal to 1 on average:

$$E[\delta(\theta)] \equiv \int_{-\infty}^{+\infty} \delta(\theta)dF(\theta) = 0,$$

and assume that $\delta' \geq 0$, that $\delta(+\infty) > 1$ (hostility assumption) and, for purely technical reasons, that $\delta(+\infty) \leq \bar{\delta}$ for an arbitrarily large $\bar{\delta}$. A utilitarian ruler would exhibit $\delta(\theta) = 0$ for all θ and $c = 0$ (and would choose $\tau = 0$). W is strictly quasi-concave for example if $f' \geq 0$. [16]

We can compare two rulers "1" and "2", corresponding to two different costs c_1 and c_2, and weighting functions $\delta_1(\cdot)$ and $\delta_2(\cdot)$ such that

$$E[\delta_1(\theta)] = E[\delta_2(\theta)] = 0.$$

16. The second-order condition for concavity is $-1-(\tau-c)\frac{f'(\tau)}{f(\tau)} - \delta(\tau) \leq 0$. At a solution of the first-order condition (see section 3.2), the second-order condition for strict quasi-concavity

$$1+\delta(\tau^*) + \frac{f'(\tau^*)}{f(\tau^*)}\frac{\int_{\tau^*}^{\infty}\delta(\theta)dF(\theta)}{f(\tau^*)} > 0.$$

A sufficient condition for $W''(\tau^*) < 0$ is $f'(\tau^*) \geq 0$.

Definition 1′ *In the intrinsic and extrinsic motivation illustration, ruler 1 is said to be more religious (in the Muslim sense) than ruler 2 if there exists* θ_0 *such that* $\delta_1(\theta) < \delta_2(\theta)$ *for* $\theta < \theta_0$ *and* $\delta_1(\theta) > \delta_2(\theta)$ *for* $\theta > \theta_0$ *and if* $c_1 > c_2$.

Definition 2′ *In the intrinsic and extrinsic motivation illustration, for a given cutoff* θ^*,

(*i*) *the ruler is hostile to non-converts* $[\theta^*, +\infty)$ *if the average discrimination factor among non-converts exceeds 1 (or equivalently the average weight put on non-converts is negative):* $\int_{\theta^*}^{\infty} \delta(\theta) dF(\theta)/[1 - F(\theta^*)] > 1$

(*ii*) *the ruler is hostile to the marginal non-convert if* $\delta(\theta^*) > 1$ *(a stronger condition than the previous one), and wants to discriminate against this marginal member if* $\delta(\theta^*) > 0$.

Note the distinction between "being hostile to" (wanting to harm) and "discriminating against" (putting lower-than-average weight on the group or person, without necessarily being hostile). The latter concept is familiar from the political economy literature.

Discussion of the model

(a) *Alternative proselytic strategies.* Could the ruler benefit from replacing a discriminatory tax by an alternative approach such as coerced conversions? Given his ignorance of individual preferences, his ability to reach his goals is constrained by incentive compatibility, the fact that more religious Copts are necessarily the less likely to convert. A straightforward generalization of the analysis in Stokey (1979) and Riley and Zeckhauser (1983) for our model shows that the ruler obtains his highest welfare through a discriminatory tax, and so there is no restriction involved in assuming this particular approach to inducing conversions.

(b) *Pressure from social norms, network externalities.* When contemplating becoming a Muslim, a Copt may take into account not only his own preferences (θ) and the material incentive (τ), but also the resulting perception of his choice within the Copt community. Suppose [17] that the potential convert has image concerns $\mu M^+(\theta^*)$ if he does not convert and $\mu M^-(\theta^*)$ if he does, where θ^* is the threshold type and $\mu \geq 0$ is a parameter of intensity of image concerns. $M^+(\theta^*)$ and $M^-(\theta^*)$ are the upward and downward truncated means (i.e. the expectations of θ conditional on θ being above or below θ^*).

17. Following Bénabou and Tirole (2006, 2013), Besley et al. (2017), Chen (2017) and Jia and Persson (2017).

The cutoff θ^* is then given by

$$\theta^* - \tau + \mu[M^+(\theta^*) - M^-(\theta^*)] \equiv \theta^* - \tau + \mu\Delta(\theta^*) = 0.$$

The variation of the threshold to the discriminatory tax is no longer 1 for 1 if $\mu>0$, and is given by:

$$\frac{d\theta^*}{d\tau} = \frac{1}{1+\mu\Delta'(\theta^*)}.$$

Let us assume that image concerns are not too large, $1+\mu\Delta'(\theta^*)>0$, and so the equilibrium threshold is unique. The analysis is unchanged, except that now

$$W(\theta^*) = V(\theta^*) - [B - R(\tau(\theta^*))].$$

Introducing social pressure adds a few interesting additional insights, though. When conversions are rare, the reputational concern is driven mainly by the strong stigma attached to conversions (and so $\Delta'(\theta^*)<0$). Taxes have a strong impact on the threshold because they not only provide a material incentive for conversion, but also because they release the social stigma attached to conversions. When in contrast there are few Copts remaining, reputational concerns are mainly driven by the social prestige attached to resistance (and so $\Delta'(\theta^*)>0$); the tax impact on the threshold is then less than 1 for 1. [18] More generally, if the distribution $f(\theta)$ is unimodal, the function $\Delta(\theta^*)$ is U-shaped.

The model can also be extended to allow for *network externalities*. Suppose that (ignoring social norms) individuals put positive weight e_k (for externality) on the size of their religious community where k indexes the community ($k = C$ for Copts and $k = M$ for Muslims). Then the threshold is given by:

$$\theta^* - \tau + e_C[1 - F(\theta^*)] \equiv e_M F(\theta^*).$$

Provided that the network externality parameters e_k are not too large (so as to avoid indeterminacy), $\frac{d\theta^*}{d\tau}>1$.

When individuals are affected by a social norm or a network externality as just described, the revenue function must be written as $R(\tau(\theta^*))$, where $\tau(\theta^*)$ is the inverse

18. One can go further in the elasticity analysis by assuming that $\Delta''(\theta^*)>0$ (a hypothesis for which Jia and Persson (2017) find supporting evidence in a different context).

function. Whether the V function is affected by social norm or externality considerations depends on its foundations; in the lead example, the V function is unchanged if the ruler is extrinsically motivated, but not if he is intrinsically motivated. The overall analysis carries over provided that the welfare function remains quasi-concave.

3.2 Optimal tax structure

The first-order condition for ruler welfare maximization is

$$V'(\theta^*) + R'(\theta^*) = 0.$$

The uniform tax is then given by $\lambda^* = B - R(\theta^*)$. The strict quasi-concavity of the welfare function implies that $\tau^* > \tau^m$ if and only if $V'(\tau^m) > 0$.

Next, suppose that the uniform tax is subject to a binding cap[19] $\lambda \leq \bar{\lambda} < \lambda^*$. The cap on the uniform tax implies a floor on discriminatory tax revenue: $R(\tau) \geq B - \bar{\lambda}$. If $V'(\tau^m) > 0$, the strict quasi-concavity of the revenue and objective functions implies that the constrained optimum, τ^{**}, satisfies $\tau^m \leq \tau^{**} < \tau^*$.

Finally, let us look at the impact of ruler religiosity on taxation. If ruler 1 is more religious than ruler 2 in the sense of Definition 1, then for all θ^*, $V_1'(\theta^*) > V_2'(\theta^*)$ and so if $V_k'(\tau^m) > 0$ $(k = 1, 2)$, $\tau_1^* > \tau_2^*$ and $\lambda_1^* > \lambda_2^*$.

Proposition 1 ***(being on the wrong side of Laffer curve and implications)***

(i) The optimal discriminatory tax τ^* is on the wrong side of the Laffer curve if and only if $V'(\tau^m) > 0$. The optimal uniform tax is given by $\lambda^* = B - R(\tau^*)$.

Suppose that $V'(\tau^m) > 0$. Then:

(ii) If initially the land tax is constrained to be lower than its optimal level, the discriminatory tax is also smaller than the optimal level in the absence of constraint on the land tax.

(iii) A more religious ruler taxes both converts and non-converts more heavily: $\tau_1^* > \tau_2^*$ and $\lambda_1^* > \lambda_2^*$.

19. We focus on this case rather than the case of a floor ($\lambda \geq \underline{\lambda}$) because of the empirical evidence. As we note, the transformation of the *ushr* tax into a *kharaj* enabled rulers to raise λ, which suggests that the *ushr* tax acted as a cap rather than as a floor.

Lead example. In the lead example, the ruler's first-order condition is:

$$\tau^* - c = \left[\int_{\tau^*}^{\infty} \delta(\theta) dF(\theta)\right] / f(\tau^*) > 0. \tag{4}$$

Let us compare the optimal poll tax and the monopoly poll tax. The optimal poll tax is on the wrong side of the Laffer curve if and only if

$$\tau^* = c + \frac{\int_{\tau^*}^{\infty} \delta(\theta) dF(\theta)}{f(\tau^*)} > \tau^m = \frac{1 - F(\tau^m)}{f(\tau^m)}.$$

This inequality is satisfied if c exceeds some non-negative threshold.[20] To see how much antipathy is needed in the absence of extrinsic incentives, assume that $c = 0$. When $c = 0$, the optimal poll tax is on the wrong side of the Laffer curve if and only[21] if the ruler is hostile to non-converts at the revenue maximizing level τ^m:

$$M_\delta^+(\tau^m) \equiv \frac{\int_{\tau^m}^{\infty} \delta(\theta) dF(\theta)}{1 - F(\tau^m)} > 1,$$

where $M_\delta^+(\cdot)$, the truncated mean of δ, is an increasing function. More generally, the condition writes

$$c > [1 - M_\delta^+(\tau^m)]\tau^m;$$

sufficient conditions for this are $c > \tau^m$ or that the ruler is hostile to non-converts $[\tau^m, +\infty)$. Then the discriminatory tax τ is on the wrong side of the Laffer curve: $R'(\tau^*) < 0$.

Social norms, network externalities

Proposition $1'$ ***(social norms, network externalities)***

(i) *The conversion rate $F(\theta^*)$ is invariant to the existence of a social norm (i.e., to the intensity μ of image concerns), as the ruler optimally augments the tax by an*

20. It is satisfied for $c \geq \tau^m$. Furthermore, revealed preference implies that τ^* is non-decreasing in c.

21. Let $H(\tau) \equiv \frac{1-F(\tau)}{f(\tau)}$ and $K(\tau) \equiv H(\tau)M_\delta^+(\tau)$, where $M_\delta^+(\tau) \equiv E[\delta(\theta)|\theta \geq \tau]$ is a strictly increasing function of τ. We have, letting $M_\delta^+(\tau_1) \equiv 1$ (τ_1 is uniquely defined), $K(\tau) - H(\tau) = H(\tau)[M_\delta^+(\tau) - 1] > 0$ for $\tau > \tau_1$ and < 0 for $\tau < \tau_1$ τ^m is the unique solution to $\tau^m = H(\tau^m)$; from the monotonicity of the hazard rate, $\tau > H(\tau) \Leftrightarrow \tau > \tau^m$ and $\tau < H(\tau) \Leftrightarrow \tau < \tau^m$.

So suppose that $\tau^m > \tau_1$. Then $\tau^m - K(\tau^m) < 0$. Because the function $\tau - K(\tau)$ starts negative and for τ going to ∞ is positive, the unique solution to $\tau^* - K(\tau^*) = 0$ exceeds τ^m. Conversely, when $\tau^m < \tau_1$, $\tau^m - K(\tau^m) > 0$ and so $\tau^* < \tau^m$.

amount equal to the perceived image benefit of remaining Copt:

$$\tau^* = \theta^* + \mu[M^+(\theta^*) - M^-(\theta^*)].$$

(ii) *Under network externalities, the optimal discriminatory tax satisfies*

$$\tau^* = \theta^* + [e_C[1 - F(\theta^*)] - e_M F(\theta^*)].$$

In contrast with the case of a social norm, the cut-off is in general not invariant to the presence of network externalities:

$$\theta^* + 2[e_C[1 - F(\theta^*)] - e_M F(\theta^*)] = c + \frac{\int_{\theta^*}^{\infty} \delta(\theta) dF(\theta)}{f(\theta^*)}.$$

The proof of Proposition 1 can be found in the online Appendix. The difference in the conclusions for social norms and network externalities comes from the impact on efficiency of moving the cutoff θ^*. Image is a positional good ($F(\theta^*)M^-(\theta^*) + [1 - F(\theta^*)]M^+(\theta^*) \equiv E(\theta)$) and so altering the cutoff has no direct efficiency consequence. Furthermore passing through the image benefit ($\mu[M^+(\theta^*) - M^-(\theta^*)]$) into the discriminatory tax keeps the cutoff constant. In contrast, the overall network externality,

$$e_C[1 - F(\theta^*)]^2 + e_M[F(\theta^*)]^2$$

varies with the cutoff unless $e_C[1 - F(\theta^*)] = e_M F(\theta^*)$. Efficiency requires making the bigger group even bigger (for $e_C = e_M$, say) and so the optimal cutoff in general depends on the existence of community externalities.

Copt religiosity

Let us index religiosity in the following way. The distribution of willingnesses to remain copt is $F(\theta - r)$, and so a higher r corresponds to an increase in religiosity. Here we will make a slightly stronger assumption on the distribution F by assuming that the density f is log-concave (from Prekova's theorem, a sufficient condition for a monotonic function taking value 0 at one of the bounds of its support to be log-concave is that its derivative is log-concave): $(f'/f)' \leq 0$. We focus on the lead example which is explicit about how V depends on the distribution F.

Proposition 2 ***(impact of Copt religiosity on taxation)*** *In the lead example, suppose that f is log-concave and that at the optimum the ruler discriminates against the marginal member of the non-convert population. Then a marginal increase in Copt religiosity implies an increase in the discriminatory tax τ.*

Proof: The first-order condition is:

$$\frac{\partial W}{\partial \tau} = f(\tau^* - r)\left[-(\tau^* - c) + \int_{\tau^*}^{\infty} \delta(\theta)\frac{f(\theta - r)}{f(\tau^* - r)}d\theta\right] = 0.$$

The log-concavity of f, together with the fact that $\delta(\theta) > 0$ for all $\theta \geq \tau^*$ implies that the term in brackets is increasing in r. Thus if $\partial W(\tau^*(r), r)/\partial\tau = 0$, $\partial W(\tau^*(r), r+\varepsilon)/\partial\tau > 0$ for $\varepsilon > 0$ and small. And so τ^* must increase as r increases. ■

The increase in Copt fervor induces the ruler to increase the discriminatory tax, but it may well lead to a decrease in the non-discriminatory tax. Indeed, when the ruler is driven solely by extrinsic motivation in the lead example, it can be shown that $\frac{d\lambda^*}{dr}<0$.[22] This brings us to the following remark.

Remark. *When V, but not R, depends on a parameter ξ such that $\frac{\partial^2 V}{\partial\theta^*\partial\xi}>0$ and $V'(\tau^m,\xi)>0$,*[23] *then an increase in ξ leads to an increase in both taxes. This is the case for instance if ξ measures the ruler's religiosity or hostility. As we just saw, this positive co-variation need not hold if the parameter ξ affects the revenue as well, as shown by the Copt religiosity example.*

Copt income

Suppose that agent θ's utility is $\theta x - \alpha(\lambda + \tau x)$ (where x is 1 if the agent remains Copt and 0 otherwise). The parameter α is a proxy for the marginal utility of income. The cutoff is then $\theta^* = \alpha\tau$.

The ruler's objective function is:

$$V(\theta^*) + \tau[1 - F(\alpha\tau)] = V(\theta^*) + \frac{R(\theta^*)}{\alpha}$$

Assuming that this objective function is strictly quasi-concave, that $V'' + \alpha R''$ is bounded

22. Under the monotone hazard rate condition, $0<\frac{d\tau^*}{dr}<1$ and R increases with r despite the increase in the poll tax.

23. Note that τ^m does not depend on ξ if R does not.

away from 0,[24] and that the optimum is on the wrong side of the Laffer curve, then $d\theta^*/d\alpha > 0$.

Then one can check that $\frac{d\tau^*}{d\alpha} = \frac{d\theta^*/d\alpha}{\alpha} - \frac{\theta^*}{\alpha^2}$. So $d\theta^*/d\alpha$ is small if R' is small (the discriminatory tax is close to the peak of the Laffer curve). Similarly, $\frac{d\lambda^*}{d\alpha} = \frac{R(\theta^*)}{\alpha^2} - \frac{R'(\theta^*)}{\alpha}\frac{d\theta^*}{d\alpha} > 0$ if R' is small.

Proposition 3 ***(Copts' income)*** *Assume that the optimal discriminatory tax is on the wrong side of the Laffer curve. Then the higher the Copts' marginal utility of income, the more conversions take place under optimal taxation. Furthermore, if the curvature of the ruler's objective function is bounded away from 0, then as long as the discriminatory tax is not too far away from the peak of the Laffer curve, the discriminatory tax (resp. the uniform tax) decreases (resp. increases) with the Copts' marginal utility of income.*

3.3 Legitimacy

One obvious concern for rulers is the threat of rebellion. This concern may impact which tax scheme is selected. We capture the Copts' possible revolt in a simple way. We assume that a successful rebellion kicks the Muslims out of power and so taxes are no longer sent to the Caliphate. Revolting costs $\rho > 0$ to each rebel. The revolt is successful if and only if $1 - F(\hat{\theta})$ Copts rebel,[25] an assumption that reflects the fact that the gain from rebellion, $G(\theta)$, is weakly increasing in θ and so the most religious Copts are also the most eager to rebel:

$$G(\theta) = \begin{cases} \lambda + \theta & \text{for} \quad \theta \leq \tau \\ \lambda + \tau & \text{for} \quad \theta \geq \tau. \end{cases}$$

Assuming away coordination problems so that a rebellion indeed occurs whenever at least $1 - F(\hat{\theta})$ are willing to incur cost ρ if they know the rebellion will succeed, the no-revolt

24. In the lead example, this means that there exists $\varepsilon > 0$ such that:

$$-[2 - \alpha[1 - \delta(\tau)]]f(\tau) - \frac{f'(\tau)}{f(\tau)} \int_{\tau}^{\infty} [\alpha\delta(\theta) + 1 - \alpha]dF(\theta) \leq -\varepsilon < 0.$$

25. Assuming that the success of a revolt depends only on the number of rebels ignores some other determinants of a successful rebellion, such as the homogeneity of the rebel population or its financial capability.

constraint for the ruler is:

$$G(\hat{\theta}) = \lambda + \min\{\tau, \hat{\theta}\} \leq \rho. \tag{5}$$

We are interested in situation in which the Caliphate's demand B in the absence of revolt would trigger a revolt and is therefore infeasible: that is, we look at parameters such that the Caliphate's budgetary demand is constrained by the possibility of revolt (that is, $\rho < \min\{\lambda^* + \hat{\theta}, \lambda^* + \tau^*\}$). To this purpose, we start from a cost level ρ that creates no rebellion under the optimal policy and lower it so that the no-rebellion constraint becomes binding. We can consider two cases, depending on the level of the two taxes λ^* and τ^* in the absence of possibility of rebellion:

(a) *Marginal rebel is a convert:* $\hat{\theta} < \tau^*$

In this case (in which the revolt must have a large scale to be successful), the no-revolt constraint, which is binding, is

$$\lambda + \hat{\theta} = \rho < \lambda^* + \hat{\theta}.$$

Thus, λ must be decreased, which implies that the discriminatory tax must be decreased as well: $\tau < \tau^*$. The ruler lowers a tax that is not levied on the marginal rebel.

(b) *Marginal rebel is a non-convert:* $\hat{\theta} > \tau^*$

The no-revolt constraint, which is binding, is then

$$\lambda + \tau = \rho < \lambda^* + \tau^*.$$

Again, both taxes must be decreased.

Proposition 4 ***(revolt-constrained public finance)*** *Suppose that the no-revolt optimum* (τ^*, λ^*) *is on the wrong side of the Laffer curve* ($V'(\tau^m)>0$) *and reduce the cost of rebellion* ρ *so that the no-revolt constraint becomes binding* (ρ *lies below* $\lambda^* + \hat{\theta}$ *if the marginal rebel is a convert and below* $\lambda^* + \tau^*$ *otherwise). Legitimacy requires lowering both the discriminatory and the non-discriminatory taxes, even when the marginal rebel is a convert, who therefore does not pay the discriminatory tax.*

Next, consider the following extension: Suppose that initially the land tax is bounded above at some level $\lambda \leq \bar{\lambda} < \lambda^*$. The discriminatory tax must therefore be kept at a low level so as to bring revenue. If an innovation lifts the ceiling on the land tax, then the discriminatory tax can be raised as well. This increase in both taxes broadens the set of Copts who might rebel. It also changes the composition of Copts by increasing the fraction of converts. Both effects suggest that converts are increasingly involved in rebellion as the tax on land becomes less constrained.[26] We will come back to this point as revolts initially included non-converts and later brought converts or board as well.

3.4 Dynamics of conversion and the land tax

Next, we extend the analysis of the basic model to a multi-period context. We assume that unwanted population exit is definitive. Jewish intellectuals who left Germany for the United States did not come back once politics in Germany returned to normal. Individuals who convert to Islam and their children cannot reassume their previous religion by fear of apostasy. Even quits in organizations are rarely reversed. Absorbing exit implies a fair amount of hysteresis of the impact of public policies. We investigate the dynamics of taxation and its structure assuming that the ruler cannot commit to a policy.

Due to apostasy, there is no returning to the Coptic religion once converted. The poll tax τ_t is levied on Copts who have not yet converted to keep "consuming" the Coptic religion at date t. One may wonder whether, once the least religious Copts have converted and the remaining Copt population is more religious than the initial one, the ruler might be tempted to raise the poll tax, with implications for the land tax.

Suppose that there are two periods, $t = 1, 2$ (the results extend to an arbitrary number of periods). The discount factor is β. The ruler faces date-t budgetary need B_t at date t. This budgetary need is taken to be deterministic, but the analysis can be extended to a random need. The ruler cannot use capital markets to smooth the budgetary need over time, which seems a reasonable assumption in our context.

Let us first note that Copts in equilibrium behave myopically (as if $\beta = 0$):

$$\theta_t^* = \max\{\tau_t; \theta_{t-1}^*\}$$

(using the convention that $\theta_0^* = -\infty$ so that there is no constraint at date 1). This

26. Modeling this properly requires extending the model so that revolts occur on the equilibrium path (to this purpose one can make $\hat{\theta}$ uncertain for the rulers, or introduce idiosyncratic level of ρ -which might even be negative for some Copts, who might rebel on purely adversarial grounds and not only not to pay taxes or to remain Copt.)

property is trivially satisfied at date 2, the last period of the game. To see that $\theta_1^* = \tau_1$, note that at date 2 the ruler will never choose a poll tax below θ_1^* and so there is no option value for the marginal type from not converting: the ruler's date-2 payoff for $\tau_2 < \theta_1^*$ is $V_2(\theta_1^*) + \tau_2[1 - F(\theta_1^*)]$ and therefore is strictly increasing in τ_2. We therefore can write the ruler's intertemporal welfare as:

$$W_t(\tau_t; \theta_{t-1}^*) = V_t(\max\{\tau_t; \theta_{t-1}^*\}) + \tau_t[1 - F(\max\{\tau_t; \theta_{t-1}^*\})] - B_t$$

denote the date-t welfare and $\sum_{t=1}^{2} \beta^{t-1} W_t(\tau_t; \theta_t^*)$ the overall welfare. The new expression for the revenue accounts for the apostasy constraint $\theta_t^* \geq \theta_{t-1}^*$. For example, in the lead example, $V_t(\tau_t; \theta_{t-1}^*) \equiv \int_{\max\{\tau_t; \theta_{t-1}^*\}}^{+\infty} [1 - \delta_t(\theta)](\theta - \max\{\tau_t; \theta_{t-1}^*\}) dF(\theta) - c_t[1 - F(\max\{\tau_t; \theta_{t-1}^*\})]$.

A key observation is that as long as myopically optimal policies (in which both the ruler and the Copts behave as if $\beta = 0$) lead to more conversions over time, then the equilibrium of the dynamic conversion game is the sequence of myopically optimal policies.[27] Intuitively, the apostasy constraint is then non-binding. More precisely, we will consider the myopically optimal policy given by $\{\lambda_t^*, \tau_t^*\}$ where

$$\tau_t^* \equiv \arg\max_{\{\tau\}} \{W_t(\tau)\}$$

and $\lambda_t^* = B_t - R(\tau_t^*)$.

Proposition 5 ***(dynamics of conversion and land tax)*** *In the following cases, the outcome is the same as with myopic principal(s) and myopic agents and so the outcome* $\{\lambda_t, \tau_t\}_{t=1,2}$ *satisfies:*

(i) If nothing changes between the two periods (stationary case), then the equilibrium involves a constant poll tax and land tax (τ^*, λ^*)*. All conversions occur at date 1.*

(ii) If the budgetary need B *increases from date 1 to date 2* $(B_2 > B_1)$*, then the budget increase is met solely through an increase in the non-discriminatory tax:* $\tau_t = \tau_2^* = \tau_1^*$ *for* $t \in \{1, 2\}$ *(all conversions again occur at date 1) and* $\lambda_t = \lambda_t^*$ *for* $t \in \{1, 2\}$ *with* $\lambda_2^* = \lambda_1^* + (B_2 - B_1)$*.*

27. We refer to Tirole (2016) for an analysis of games with positive selection in a general principal-agent context, including for cases in which the "apostasy constraint" is binding. We here content ourselves with stating new results.

(iii) If date-2 rulers are more pious than date-1 rulers ($V_2'(\theta^*) > V_1'(\theta^*)$ for all θ^*) keeping B constant ($B_2 = B_1$), then a) $\tau_2 = \tau_2^* > \tau_1 = \tau_1^*$ there will be conversions at both dates, and b) $\lambda_2 = \lambda_2^* > \lambda_1 = \lambda_1^*$: the land tax is increased at date 2. By contrast, if the date-2 rulers are less religious than the date-1 rulers, then there is ratcheting: $\lambda_2 = \lambda_1 = \lambda_1^*$ and $\tau_2 = \tau_1 = \tau_1^*$: date-2 taxes are set at the preferred levels of the date-1 rulers.

These properties are corollaries of Proposition 1. For example, for part (iii), recall that a more religious ruler imposes a higher discriminatory tax and a higher land tax as well. So the apostasy constraint is not binding as the marginal convert at date 1 knows that he would anyway strictly prefer to convert at date 2 if he does not convert at date 1.

The asymmetric responses to an increase and a decrease in the rulers' religiosity may surprise the reader. Suppose that the date-1 rulers are more religious and that they expect the date-2 rulers to keep the same fiscal policy. Then they choose their preferred policy. But will the date-2 rulers follow that policy? Because converts cannot convert back, there is no new conversion as long as the poll tax is no larger than the first-period one; while the date-2 rulers would like to have more revenue from the poll tax and fewer conversions, there is no way back. So over the date-2 rulers' preferred policy range, both the land tax and the poll tax are non-distortionary. The date-2 rulers however prefer the highest poll tax in that range as long as $\frac{\partial V_t}{\partial \tau_t} > 0$ as we assumed, because this poll tax is paid by citizens with lower welfare weight while the land tax is paid by all.[28] So indeed the date-2 rulers reluctantly, but optimally keep up the same policy.

Uncertainty about Muslim rule

Keeping the two-period framework, suppose that at date 1, there is probability x that the Muslim rulers will be evicted and so taxes destined to the Caliphate will not be in force at date 2. Everything else is kept constant across periods. The uncertainty about the Muslim rule makes Copts more reluctant to convert as they are losing an option value. Letting (λ_2, τ_2) denote the date-2 tax vector if the Muslim rule continues at date 2, the

28. Otherwise– if $\delta(\theta) = 0$ for all θ– there is a continuum of optimal allocations between the land tax and the poll tax, including the one considered here.

payoffs are

$$U(\theta) = \begin{cases} -\lambda_1 - \beta(1-x)\lambda_2 \text{ for a (date-1) convert} \\ -\lambda_1 + (\theta - \tau_1) + \beta\left[x\theta + (1-x)\max\{0, \theta - \tau_2\} - (1-x)\lambda_2\right] \text{ for a non-convert.} \end{cases}$$

We look for an equilibrium in which the apostasy constraint is not binding $\theta_2^* \geq \theta_1^*$. In this case, the date-1 cutoff θ_1^* is given by:

$$(1 + \beta x)\theta_1^* = \tau_1.$$

The ruler solves [29]

$$\max_{\{\theta_1^*, \theta_2^*\}} [V(\theta_1^*) + R_1(\theta_1^*) - B] + \beta x V(\theta_1^*) + \beta(1-x)[V(\theta_2^*) + R_2(\theta_2^*) - B].$$

The revenues are

$$R_1(\theta_1^*) \equiv [(1 + \beta x)\theta_1^*][1 - F(\theta_1^*)],$$

and

$$R_2(\theta_2^*) \equiv \theta_2^*[1 - F(\theta_2^*)] = R(\theta_2^*).$$

Simple computations show that $\theta_1^* = \theta_2^* = \theta^*$: the apostasy constraint $(\theta_2^* \geq \theta_1^*)$ is indeed not binding.

Proposition 6 ***(option value under uncertain Muslim rule)*** *Under uncertainty about Muslim tenure, all conversions occur at date 1 and the magnitude of conversions is the same as in the absence of uncertainty* $(x = 0)$*. In contrast, for constant budgetary needs, the land tax increases over time:* $\lambda_2 = \lambda_1 + \beta x R(\tau^*)$*. The poll tax decreases over time:* $\tau_1 = (1 + \beta x)\tau_2$.

Intuitively, the possibility that the Muslim rulers be chased out of the country creates an option value when remaining Copt. This implies that the demand for remaining Copt is more inelastic at date 1 and so the rulers can collect a fair amount of money from the poll tax. This explains the opposite dynamics of the poll and land tax revenues.

The dynamics of rebellion: time-decreasing resistance

29. We write the program as if the rulers committed at date-1 to their date-2 policy conditionally on staying in power. But it is easy to check that the outcome is the same in the absence of commitment over (λ_2, τ_2).

Finally, let us look at the dynamic generalization of the legitimacy model developed in the previous section: It takes $[1-F(\hat{\theta})]$ to topple the Muslim rule, and the individual cost of doing so is ρ. We naturally assume that $\rho<\lambda^* + \tau^*$, otherwise the ruler would never account for a possible rebellion. Individuals are atomistic and by themselves cannot alter the outcome, and so they do not rebel at date 1 whenever $\lambda_1 + \tau_1 \leq \rho$.

Let us first assume that the marginal rebel is a convert, and so in the static model the land tax is constrained to be such that $\lambda = \hat{\lambda}$ where $\hat{\lambda} + \hat{\theta} = \rho$ (see section 3.3). Suppose that at date 1 the Muslim ruler sets taxes $\lambda_1 = \hat{\lambda}$ and $\hat{\tau}_1$ such that $\hat{\lambda} + R(\hat{\tau}_1) = B$. This tax scheme is the best that can be achieved from the point of view of date 1 without generating a rebellion. At date 1, $F(\hat{\theta})$ convert.

The key observation is that at date 2, the converts will not participate even in a successful rebellion as long as $\lambda_2 \leq \rho$, because at that point of time they already have abandoned their Coptic religion. So there is less resistance to taxation. The no-rebellion constraint at date 2, $\lambda_2 \leq \rho$ is therefore looser than the date-1 no-rebellion constraint. This implies that

$$\lambda_2 = \min\{\rho, \lambda^*\} \quad \text{and} \quad R(\tau_2) = B - \lambda_2.$$

So if $\lambda^* \leq \rho$, the ruler obtains his first-best welfare at date 2 and a fraction $F(\theta^*) - F(\hat{\theta})$ convert at date 2. In contrast, if $\lambda^*>\rho$, then $\lambda_2 = \rho \geq \lambda_1$ and $R(\tau_2) = B - \rho \leq R(\tau_1)$. The fraction of new converts is then smaller than $F(\theta^*) - F(\hat{\theta})$.

Next, suppose that the marginal rebel is a non-convert. At date 1, taxes are given by $\lambda_1 + \tau_1 = \rho < \lambda^* + \tau^*$ and $\lambda_1 + R(\tau_1) = B$. Assuming that the discriminatory tax is on the wrong side of the Laffer curve, $\lambda_1 < \lambda^*$, $\tau_1 < \tau^*$ and $\theta_1 < \hat{\theta}$. In contrast with the other case, the no-rebellion constraint is not relaxed at date 2: $\lambda_2 + \tau_2 \leq \rho$, and so $\lambda_2 = \lambda_1$ and $\tau_2 = \tau_1$. There are no new conversions at date 2.

Proposition 7 ***(conversions weaken resistance over time)***

(i) *Suppose that in the static analysis the marginal rebel is a convert. The no-rebellion constraint becomes looser over time, as converts have less to gain from a rebellion than non-converts. Both taxes increase between the two dates as the resistance of converts is weaker than that of non-converts. There are new conversions at date 2. In particular, if the rebellion cost ρ belongs to $(\lambda^*, \lambda^* + \tau^*]$, the date-1 taxes are $(\lambda_1, \tau_1) = (\hat{\lambda}, \hat{\tau})$ and the date-2 taxes are $(\lambda_2, \tau_2) = (\lambda^*, \tau^*)$.*

(ii) If the marginal rebel in the static analysis is a non-convert, the no-rebellion constraint is equally binding in the two periods and taxes are constant over time. All conversions occur at date 1.

Remark *As we earlier noted, the absence of uncertainty precludes the existence of actual (on-the-equilibrium-path) revolts. Introducing some uncertainty about the value of ρ or $\hat{\theta}$ in general leads to a positive probability of an on-the-equilibrium-path revolt. While a full treatment of this lies outside the scope of this paper, a few interesting points can be made. First, while the converts' willingness to revolt is reduced by their inability to convert back, their goals become more aligned: their incentive to rebel comes from economizing the uniform tax, and their heterogeneity in religiosity is no longer relevant; so the converts rebel en masse if they rebel at all. Second, at date 1, all potential rebels are Copts; at date 2, some of the rebels may well be Muslims as well.*

Costly reform of tax institutions.

Finally, recall that the Egyptian tax system was initially constrained by a cap on the uniform tax (the land tax levied on Muslims- the *ushr*-, unlike the *kharaj*, was set exogenously: the Prophet had set it at a fixed 10% rate). The reform removing this constraint happened only about a century after the invasion, when rulers changed the tax system so as to be able to levy the *kharaj* on converts. Why did the rulers not give themselves more degrees of freedom right away? The following corollary offers a possible explanation for the delay. This explanation will not require the introduction of a fixed cost of reforming the tax system to eliminate this constraint, even though the existence of such a cost is reasonable as going against the Prophet's recommendation was presumably costly.

Suppose that, in the absence of constraint on the tax system, at date 1, (a) the marginal rebel is a convert: $\lambda_1 + \hat{\theta} = \rho \leq \lambda_1 + \tau(\lambda_1)$, where$\lambda + R(\tau(\lambda)) \equiv B$; and (b) the tax system is on the wrong side of the Laffer curve: $R'(\tau(\lambda)) < 0$ or equivalently $\tau(\lambda)$ is an increasing function; and (c) reintroducing the constraint on the tax system, the latter is non-binding: $\lambda_1 \leq \lambda_u$ where λ_u is the *ushr* rate. So there is no gain of removing the cap constraint at date 1. Let us assume that $\lambda_u < \rho$.

Now suppose that in the absence of both the rebellion constraint and a cap on the uniform tax, the optimum is (λ^*, τ^*) (which solves $\max\{W(\tau)\}$ and satisfies $\lambda + R(\tau) = B$). One has $\lambda_1 < \lambda^*$ and $\tau_1 < \tau^*$. If $\lambda_1 < \lambda_u < \lambda^*$, there is a strict gain at date 2 for the ruler to remove the cap on the uniform tax, while there was none at date 1.

Given that at date 1 Copts with religiosity $\theta \leq \hat{\theta}$ have converted at date 1, there is no rebellion at date 2 provided that $\lambda_2 \leq \rho$. The tax reform enables the ruler to implement $\lambda_2 = \min\{\lambda^*, \rho\}$.[30]

Corollary 1 ***(delayed tax-system reforms due to time-decreasing resistance)*** *Because the threat of rebellion constrains the uniform tax and this threat is reduced over time as the benefit from rebelling decreases with conversion, a cap on the uniform tax may not initially constrain optimal taxation, but do so later on. Hence tax reforms may be delayed even if the cost of modifying the tax system is small.*

To sum up, we have provided four possible reasons for why the land tax, but not necessarily the poll tax, may increase over time: a) the budgetary need increase is absorbed by the non-distortionary land tax; b) the Muslim rulers may become more religious over time (by contrast, the land tax remains constant if the Muslim rulers become less religious over time, an asymmetric response); c) there is some possibility that the Muslim rulers be chased out of the country; d) the threat of rebellion weakens over time as past converts, while still economizing on the land tax when the rebellion succeeds, no longer benefit from being able to remain Copt (they have lower incentives to participate in a rebellion).

4 Empirics

The empirical evidence on the predictions of the model comes from Egypt, where the vast majority of papyrological tax records under the early Arab Caliphate were discovered. We first specify the testable predictions of the model. We then present the local-level evidence, where we exploit the geographic variation within Egypt in tax rates and conversions. Next, we discuss the country-level evidence, where we document the evolution in 641-850 of (proxies for) the determinants of the uniform tax rate increase circa 750. Both pieces of evidence are broadly consistent with the predictions of the model. However, given the data limitations, our findings remain suggestive and their interpretation rests on theory and history.

30. One must check that date-1 converts indeed behave myopically. The option value of remaining Copt can be positive only if the agent remains Copt at date 2, i.e. if $\theta > \tau_2$. But $\theta \leq \hat{\theta} = \tau_1 < \tau_2$.

4.1 Empirical predictions of the model

Table 1 lists the empirical predictions of the model under the assumption that tax authorities are sufficiently religious so that the optimal discriminatory tax lies on the wrong side of the Laffer curve. Holding else constant, more religious tax authorities are expected to levy higher discriminatory and uniform taxes and to induce more conversions to Islam among Copts. An increase in budgetary needs is met by increasing the uniform tax but should have no impact on the discriminatory tax rate and conversions. By contrast, an increase in uncertainty about Muslim rule, by making the demand for Coptic Christianity less elastic, results in increasing the discriminatory tax rate and decreasing the uniform tax but should have no impact on conversions. If tax authorities are hostile towards the marginal Copt, more religious Coptic populations face a higher discriminatory tax rate. Under further assumptions, they also face a lower uniform tax rate and witness fewer conversions to Islam. A taxpaying population that poses a higher threat of rebellion is expected to face lower discriminatory and uniform tax rates and to witness fewer conversions to Islam. We expect poorer Coptic populations (thus, higher marginal utility of income) to witness more conversions. Under further assumptions, they should face a lower discriminatory tax rate and a higher uniform tax rate. Finally, we predict that if there is a cap on the uniform tax, both the uniform and discriminatory taxes will be lower and there will be fewer conversions.

By contrast, if the optimal discriminatory tax lies on the right side of the Laffer curve we expect certain predictions to be reversed. The first key observation here is that more religious tax authorities will levy a *lower* uniform tax. Second, if the marginal rebel is a convert, more rebellious populations will face a *higher* discriminatory tax and will witness *more* conversions. Third, a cap on the uniform tax will result in a *higher*, not lower, discriminatory tax and thus *more* conversions.

4.2 Local-level evidence

The local-level evidence exploits the cross-*kura* variation in tax rates and conversions. We focus on the effects on taxation and conversions of three exogenous parameters in the model: (1) religiosity of tax authorities, (2) Copts' religiosity, and (3) Copts' income. We are not able though to provide local-level evidence on the effects of four further param-

Table 1 – **Empirical predictions of the model when on wrong side of Laffer curve**

Shaded cells mean that the result does not hold if on right side of Laffer curve†

Regressors	Religiosity of tax authorities (V')	Budget (B)	Uncertainty about Muslim rule (x)	Copts' religiosity (r)††	Threat of rebellion	Copts' marginal utility of income (α)	Cap on uniform tax ($\lambda \leq \bar{\lambda}$)
Effect on discriminatory tax (τ^*)	+	0	+	+	−	− (?)	−
Effect on uniform tax (λ^*)	+	+	−	− (?)	−	+ (?)	−
Effect on % converts ($F(\theta^*)$)	+	0	0	− (?)	−	+	−
Local-level proxies	Arab settlement	N/A†††	N/A	Holy Family visit	N/A	(−) Urban population	N/A
Country-level proxies	1. Caliph does not hold palace music and drinking parties 2. # religious - # secular buildings	Battles initiated by Caliphate	1. Attacks by neighboring empires 2. Caliphate's major civil wars 3. Nile shocks	N/A	1. Attacks by neighboring empires 2. Caliphate's major civil wars 3. Nile shocks	Nile shocks	Pre-750 period

Source: See text.

Notes:

† It is reversed. For the threat of rebellion, the impact on τ^* and $F(\theta^*)$ is ambiguous if the marginal rebel is a non-convert.

†† In lead example, when ruler discriminates against the marginal member of the non-convert population.

† † † N/A means that we are not able to test this prediction empirically.

eters: (4) budgetary needs, (5) uncertainty about Muslim rule, (6) threat of rebellion, and (7) cap on uniform tax, because these factors, we argue, are unlikely to vary locally. First, while the budget raised from each *kura* depended on its population size, the budget *per capita* likely did not vary across *kuras*, once we hold other variables constant, such as Copts' income and religiosity. Second, as the Nile Valley and Delta lacked natural barriers, all *kuras* were subject to Arabs' central authority in the post-641 capital, *Fustat* (currently, south of Cairo), and hence they likely faced the same level of uncertainty about Arabs' staying in power. The main exceptions here are frontier towns that switched hands between empires, such as Aswan at the southern border with Nubia, and Alexandria that was retaken by the Byzantines in 645 before it was reoccupied by Arabs. These towns are *not* included in the empirical analysis, though. Third, even though local Coptic elites of a given *kura* could have resisted Arabs passively via being adopting a more lenient tax policy with their Coptic taxpayers, they were not able to pose threat of active rebellion that would drive Arabs out of power, unless they coordinated with Coptic elites in other *kuras*. Indeed, all tax revolts that did take place involved multiple *kuras*. Fourth, the cap on the uniform tax, *ushr*, was imposed universally on all *kuras*, and in fact throughout the whole Caliphate.

4.2.1 Data

Religiosity of tax authorities We proxy for the religiosity of local tax authorities by a dummy variable that takes value 1 if at least one Arab tribe settled in a *kura* between 700 and 969 based on Al-Barri (1992). Arab settlement arguably captures the degree of penetration of Arabs (Muslims) into the local tax administration of each *kura*. In *kuras* where Arabs settled, they replaced local Coptic elites as large landholders and tax administrators (Sijpesteijn, 2009). Consequently, these *kuras* faced more religious tax authorities, at the *extensive* margin, compared to *kuras* where Arabs did not settle and Coptic elites thus remained in charge of the tax administration. However, we do not have a measure of religiosity among Arab tax administrators, i.e. at the *intensive* margin.[31]

31. We are not able to use the difference between the number of religious and secular buildings (as in Chaney (2013)) as a measure of religiosity of tax authorities at the local level, because data on religious and secular buildings are mostly from a later period (post 1169) and, more importantly, are *not* representative of *kuras* outside Cairo. Chaney (2013) uses this dataset at the country level.

Copts' religiosity We proxy for Copts' religiosity before 641 by a dummy variable that takes value 1 if it is believed, according to Coptic traditions, that a *kura* (or village, depending on the empirical specification) has been visited by the Holy Family during its legendary flight to Egypt. The list of villages that lie on this legendary route is recorded in Anba-Bishoy (1999) and Gabra (2001); both sources are based on a book that is attributed to Theophilus, the patriarch of Alexandria in 384-412 (Mingana, 1931). However, since the book's date is debated with some scholars dating it to the post-641 period, this variable must be interpreted with caution.

Copts' income We proxy for Copts' income before 641 by the natural logarithm of the size of urban population circa 300 based on Wilson (2011, pp. 185-187). Urban population is defined as the sum of the population of Greek cities (metropolis) and the capital of each *nome* (Egypt's administrative units in the Roman period). Using urbanization as a proxy for income is standard in the economic history literature, since urban populations were richer on average.

Taxes Data on poll and *kharaj* land tax payments (in dinars) per person come from Egypt's papyrological individual-level tax registers and receipts in 641-1100. We employ Morimoto (1981, pp. 67-79, 85-87) for Greek papyri and the Arabic Papyrology Database for Arabic papyri.[32] Tax papyri are subject to a few caveats, though: (1) The poll (and *kharaj*) tax records survived in only 4 (respectively 7) out of 42 *kuras*, all located in the Nile Valley. (2) Most papyri are dated within a range (e.g. 641-1000), and so it is not possible to distinguish tax rates in 641-750 from the post-750 period. (3) There are no data on the *ushr* land tax rate. (4) *Kharaj* land tax payments are per person and not per unit of land (landholding surface area is seldom recorded), and hence, using these records in the analysis relies on the assumption that *kuras* had the same landholding size distribution. While there is little that we can do to address (1) and (2), we note that the other outcome variable, conversions, is observed for all 42 *kuras*. Regarding (3), the lack of any papyrological evidence on the *ushr* tax in 641-750 may indicate that the tax was not enforced by the state, and may have thus been equal to zero in all *kuras*. To

32. We do not employ two other sets of tax papyri. First, there are other Coptic and Greek poll tax registers and receipts from Egypt in 641-800 that we do not use because they have not been digitized yet. Second, there are poll tax receipts from Nessana in Palestine (Simonsen, 1988) that we do not use because they do not vary within Palestine (they come from only one area).

address (4), we collected village-level data in the Nile Valley on *kharaj* per unit of land from the cadastral surveys of 1375 and 1477 that were conducted under the Mamluk dynasty (1250-1517) and recorded by Ibn-Al-Jay'an (1477). These are the earliest extant cadasters that report *kharaj* per unit of land.[33] Specifically, they record for each village the *'ibra* in *jayshi* dinars per *feddan*, where the *'ibra* is the average *kharaj* tax over 15-20 years, and the *jayshi* dinar is a hypothetical unit of account that is approximately equal to 13.3/20 dinars (Borsch, 2005). Despite the appeal of using the *kharaj* tax per unit of land in 1375 and 1477 as our preferred measure of *kharaj*, it is subject to a perhaps more serious caveat in that it comes from the Mamluk period, a much later period than the early Arab Caliphate. Mamluk tax administration was fundamentally different from the early Arab Caliphate in that Egypt became subject to a tax contracting system (*'iqta'*) with Turkish military officers (Mamluks), not Arabs, being in charge of tax collection in their constituencies. We thus prefer to use *kharaj* per person in 641-1100 as our preferred measure and we only employ *kharaj* per unit of land in 1375 and 1477 only as a robustness check.

Conversions We proxy for conversions at the village level by an indicator variable that takes value 1 if a village had at least one Coptic church or monastery circa 1200 from Abul-Makarim (1200). As a robustness check, we complement this data source with a later list of Coptic churches and monasteries circa 1500 from Al-Maqrizi (1500).

4.2.2 Empirical strategy

Using these novel data sources, we first examine the effects on tax rates and conversions of our local-level proxies of religiosity of tax authorities, Copts' religiosity, and Copts' marginal utility of income. We estimate a separate regression for each outcome rather than a system of simultaneous equations that allows for correlation of the error terms across equations, because each equation is estimated using a different sample. We first treat our regressors as exogenous and estimate the following regression equations

33. Al-Nabulusi reports village-level data for the *kura* of *Fayyum* during the Ayyubid period (1171-1250) on total *kharaj* revenues, among a whole set of miscellaneous taxes, but he does *not* record total area of landholdings, and so it is not possible to compute *kharaj* per unit of land (Cahen, 1956).

using Ordinary Least Squares (OLS):

$$polltax_{ik} = \beta_{10} + \beta_{11} settlement_k + \beta_{12} holyfamily_k + \beta_{13} urban_k + \epsilon_{1ik} \quad (6)$$

$$kharajtax_{ik} = \beta_{20} + \beta_{21} settlement_k + \beta_{22} holyfamily_k + \beta_{23} urban_k + \epsilon_{2ik} \quad (7)$$

$$church_{vk} = \beta_{30} + \beta_{31} settlement_k + \beta_{32} holyfamily_v + \beta_{33} urban_k + \epsilon_{3vk} \quad (8)$$

where the dependent variable in equation (6), $polltax_{ik}$, is the poll tax payment in dinars made by individual i in *kura* k in 641-1100. Similarly, the dependent variable in equation (7), $kharajtax_{ik}$, is the *kharaj* tax payment in dinars made by individual i in *kura* k in 641-1100. The dependent variable in equation (8), $church_{vk}$, is a dummy variable that takes value 1 if there was at least one Coptic church or monastery circa 1200 in village v in *kura* k. As a robustness check, we use the *ibra* (average *kharaj*) in *jayshi* dinars per *feddan* in village v in *kura* k in 1375 and 1477, as an alternative measure of the *kharaj* tax in equation (7). And as another robustness check, we use a village-level dummy variable that takes value 1 if there was at least one Coptic church or monastery circa 1500, as an alternative measure of conversions in equation (8).

There are three regressors of interest. First, $settlement_k$ is a dummy variable that takes value 1 if there was at least one Arab tribe that settled in *kura* k between 700 and 969. Second, $holyfamily_k$ (respectively, $holyfamily_v$) is a dummy variable that takes value 1 if *kura* k (respectively, village v) is believed to have been visited by the Holy Family during its legendary flight to Egypt. Third, $urban_k$ is the natural logarithm of the urban population of *kura* k circa 300.

Standard errors are clustered at the *kura* level, the level at which I observe the three regressors (except for the Holy Family indicator variable in equation (8) which is observed at the (lower) village level). Technically, this is a justifiable level of clustering because it is the level at which the treatments are assigned (Abadie et al., 2017). However, since the number of *kuras* (clusters) where the poll and *kharaj* tax papyri survived is too small, this may bias the standard errors downwards in equations (6) and (7) (Cameron et al., 2008; Cameron and Miller, 2015). The problem of "few clusters" is less of a concern though in equation (8) since I observe the outcome (churches) in all 42 *kuras*. Unfortunately, I am not able to correct for the few clusters bias in equations (6) and (7) by the adjustments that are suggested in the literature, because the regressors do *not* vary among taxpayers within clusters (*kuras*). But to mitigate this concern, I also report the White-Huber robust standard errors in equations (6) and (7), and the robust standard errors clustered at the lower district level (thus, more clusters) in equation (8). As predicted by the literature, these alternative standard errors are mostly larger than the ones clustered at the *kura* level, but in most cases the coefficients retain their statistical significance.

The identification assumption in these OLS regressions is that the cross-*kura* variation in Arab settlement, Holy Family legendary visit, and urban population circa 300 is exogenous to any other underlying factors that may be driving taxation and conversions. This assumption may be violated due to (1) reverse causality: these regressors may have been impacted by Arab taxation and conversions, and (2) omitted variables: the regressors may be correlated with other unobservable pre-641 characteristics of *kuras* that can also account for the variation in tax rates and conversions. We argue that these threats to identification are less likely to arise for the Holy Family legendary route and urban population circa 300. For one, reverse causality is not possible since both variables are observed before 641. For another, both variables were determined by factors that are unlikely to have impacted the Arab fiscal policy and conversions in the post-641 period. The invention of the Holy Family legendary route reflected the religious prominence of certain locations due to their local saints and martyrs and/or their biblical mentions. In a similar vein, the locations and population sizes of capitals of *nomes* and Greek cities *metropolis* during the Roman period were to a large extent randomly picked along the Nile river, regardless of the characteristics of the local populations or the distance to Alexandria, Egypt's capital before 641. We acknowledge that the Holy Family route may have been invented after 641, but this is not a threat to identification per se; it is rather a measurement concern that undermines employing this variable as a measure of pre-641 Coptic religiosity in the analysis altogether. However, this variable is, despite its caveats, the only measure that we are aware of in the historical literature that can capture Copts' religiosity at the local level.

By contrast, Arab settlement in 700-969 is potentially endogenous. On the one hand, there can be reverse causality from taxation and conversions to the subsequent waves of Arab settlement. On the other hand, Arab tribes may have settled in certain *kuras* based on other unobservable characteristics (e.g. availability of grazing land) that may have also affected taxation and conversions. To mitigate this concern, we use an instrumental variable (IV) for Arab settlement: the *kura*'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. The argument is that Arabs were more likely to settle in *kuras* that were closer to *Arish*. Distance to *Arish* is arguably exogenous and satisfies the exclusion restriction, since the proximity to *Arish*, a small border town, is unlikely to be correlated with characteristics of *kuras*. Indeed, Table 2 indicates that distance to *Arish* is uncorrelated with our proxies of Copts' income and religiosity, and two proxies of the power of local elites and the presence of Byzantine garrisons in the late Byzantine period.[34]

Table 2 – **Exogeneity of distance to *Arish***

	(1) Log (urban population) in 300	(2) =1 if *kura* on Holy Family route in 400	(3) =1 if *Autopract* estates in *kura* in 600	(4) =1 if Byzantine garrison in *kura* in 600
Kura's Distance to *Arish* (km)	0.0011	0.0011	-0.0010	0.0004
	(0.0008)	(0.0008)	(0.0007)	(0.0006)
Obs (*kuras*)	42	42	21	42
R^2	0.049	0.049	0.098	0.013

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

4.2.3 Findings

Discriminatory tax The results on the determinants of the poll tax payment per person in 641-1100 are shown in Table 3. Within the four *kuras* for which we have poll tax papyri, taxpayers in *kuras* where Arabs settled in 700-969, and were thus subject to more religious tax authorities, paid on average a higher poll tax in 641-1100 by 0.29 dinar (average poll tax = 1.14 dinar). Taxpayers in *kuras* that lied on the legendary route of

34. These are (1) a dummy variable that takes value 1 if there was at least one *autopract* estate in 600 from Hardy (1931); the *autopragia* status was a privilege granted to large landholders in late Byzantine Egypt allowing them to collect taxes in their constituencies, and (2) a dummy variable that takes value 1 if there was at least one Byzantine garrison in 600 from Maspero (1912).

the Holy Family, and thus had more religious Coptic populations, paid on average 0.29 dinar more in their poll tax obligations. Taxpayers in more urbanized *kuras* (measured during the Roman period) also paid a higher poll tax by 0.13 dinar. The results hold qualitatively when including the three determinants in the same regression (column (4)), but whereas the coefficients on the Holy Family route and urbanization have much smaller magnitudes than when entered separately, the coefficient on Arab settlement retains its magnitude. The IV estimate of the effect of Arab settlement on the poll tax rate is similar in magnitude to the OLS estimate, and the first-stage regression suggests that Arabs were indeed more likely to settle in *kuras* that were closer to *Arish*. However, distance to *Arish* does not strongly predict Arab settlement (F-statistic $<$10). We interpret the positive coefficients on Arab settlement and the legendary route of the Holy Family as consistent with the predictions of the model as specified in Table 1. The theory is indeterminate though with respect to the effect of Copts' income on the discriminatory tax and thus the finding of a positive coefficient on urbanization does not confirm or infirm the model predictions.

Uniform tax The results on the determinants of the *kharaj* tax per person in 641-1100 are shown in Table 4. These results must be interpreted with caution since the *kharaj* tax is measured per person and not per unit of land. Thus, any effects are due to the cross-*kura* variation in both the tax rate per unit of land *and* the landholding size distribution. Assuming that the landholdings distribution is constant across the 7 *kuras* for which we have data on *kharaj*, we find that taxpayers in *kuras* that received Arab tribes in 700-969 paid a higher *kharaj* tax by 2.9 dinars (average *kharaj* tax = 2.69 dinars). We interpret this result as consistent with the prediction of the model on the impact of religiosity of tax authorities, if the optimal discriminatory tax was on the wrong side of the Laffer curve. The results also reveal that taxpayers in *kuras* on the Holy Family route paid 3.32 dinars more in *kharaj* tax, and that *kuras* that were more urbanized paid a higher *kharaj* tax. However, the theory is indeterminate with respect to these two effects (unless we impose further assumptions), and so we do not interpret the results on Copts' income and religiosity as confirming or infirming the model predictions. When we include all determinants in the same regression in column (4), only the coefficient on the Holy Family route retains its magnitude and statistical significance. Using distance to *Arish*

Table 3 – **Determinants of the poll tax in 641-1100**

Dependent variable: Poll tax in dinars per person - Individual-level regressions

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	0.290			0.214	0.285
	(0.004)***			(0.000)***	(0.005)***
	{0.133}**			{0.960}	{0.123}**
=1 if *kura* on Holy Family route		0.285		0.007	
		(0.010)***		(0.000)***	
		{0.139}**		{0.346}	
Log (urban population) in *kura* circa 300			0.131	0.032	
			(0.003)***	(0.000)***	
			{0.062}**	{0.515}	
Obs (individuals)	408	408	408	408	408
Clusters (*kuras*)	4	4	4	4	4
R^2	0.010	0.009	0.010	0.010	
KP Wald F-stat					(8.532)
					{190.839}
Mean dependent variable	1.136	1.136	1.136	1.136	1.136
SD dependent variable	1.236	1.236	1.236	1.236	1.236

Notes: Robust standard errors clustered at the *kura* level are in parentheses. White-Huber robust standard errors are in curly brackets. * p <0.10, ** p <0.05, *** p <0.01. A constant is included in all regressions. The coefficient on *kura*'s distance to *Arish* in the first-stage regression of the Arab settlement dummy variable is − 0.009 (0.003)*** {0.001}***; *kura*-level clustered standard errors are in parentheses, White-Huber standard errors are in curly brackets. KP Wald F-Stat in parentheses corresponds to clustering standard errors at the *kura* level in the first stage, and in curly brackets to White-Huber standard errors.
Source: See text.

Table 4 – **Determinants of the *kharaj* tax in 641-1100**

Dependent variable: Kharaj tax in dinars per person - Individual-level regressions

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	2.893			-1.201	1.945
	(0.617)***			(1.967)	(1.197)+
	{0.900}***			{1.316}	{0.754}***
=1 if *kura* on Holy Family route		3.320		3.248	
		(0.148)***		(0.633)***	
		{1.010}***		{1.065}***	
Log (urban population) in *kura* circa 300			1.357	0.563	
			(0.195)***	(1.129)	
			{0.419}***	{0.731}	
Obs (individuals)	464	464	464	464	464
Clusters (*kuras*)	7	7	7	7	7
R^2	0.047	0.057	0.051	0.058	
KP Wald F-stat					(3.783)
					{24.095}
Mean dependent variable	2.690	2.690	2.690	2.690	2.690
SD dependent variable	6.076	6.076	6.076	6.076	6.076

Notes: Robust standard errors clustered at the *kura* level are in parentheses. White-Huber robust standard errors are in curly brackets. + p <0.15, * p <0.10, ** p <0.05, *** p <0.01. A constant is included in all regressions. The coefficient on *kura*'s distance to *Arish* in the first-stage regression of the Arab settlement dummy variable is − 0.006 (0.003)*** {0.001}***; *kura*-level clustered standard errors are in parentheses, White-Huber standard errors are in curly brackets. KP Wald F-Stat in parentheses corresponds to clustering standard errors at the *kura* level in the first stage, and in curly brackets to White-Huber standard errors.
Source: See text.

as an IV for Arab settlement yields qualitatively similar results as the OLS estimate, but the IV is again a weak predictor of settlement as in Table 3.

Table 5 – **Determinants of conversions in 1200**
Dependent variable = 1 if at least one Coptic church or monastery in village

			OLS		IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	-0.082			-0.077	-0.695
	(0.033)**			(0.033)**	(2.098)
	{0.031}**			{0.032}**	{1.672}
=1 if village on Holy Family route		0.597		0.600	
		(0.081)***		(0.080)***	
		{0.075}***		{0.078}***	
Log (urban population) in *kura* circa 300			-0.022	-0.016	
			(0.026)	(0.029)	
			{0.028}	{0.029}	
Obs (villages)	1817	1817	1817	1817	1817
Clusters (*kuras*)	42	42	42	42	42
Clusters (districts)	75	75	75	75	75
R^2	0.009	0.034	0.001	0.044	
KP Wald F-stat					(0.083)
					{0.155}
Mean dependent variable	0.161	0.161	0.161	0.161	0.161
SD dependent variable	0.368	0.368	0.368	0.368	0.368

Notes: Robust standard errors clustered at the *kura* level are in parentheses and at the district level in curly brackets. * p <0.10, ** p <0.05, *** p <0.01. A constant is included in all regressions. The coefficient on *kura*'s distance to *Arish* in the first-stage regression of the Arab settlement dummy variable is $-$ 0.000 (0.001) {0.001}; standard errors clustered at the *kura* level are in parentheses and at the district level in curly brackets. KP Wald F-Stat in parentheses corresponds to clustering standard errors at the *kura* level in the first stage, and in curly brackets to clustering at the district level.
Source: See text.

Conversions Table 5 shows the results on the determinants of conversions in 1200. Villages located in *kuras* that received Arab tribes in 700-969, and were thus subject to more religious tax authorities, are less likely to have at least one Coptic church or monastery in 1200 by 8 percentage points (average = 0.16), compared to *kuras* where Coptic elites remained in power. Since all *kuras* were (almost) 100 percent Coptic before 641, the finding suggest that *kuras* where Arab tribes settled witnessed relatively more conversions to Islam among Copts between 641 and 1200. Villages located in *kuras* that lied on the Holy Family route were more likely to have at least one Coptic church or monastery in 1200, i.e. witnessed relatively fewer conversions to Islam. But the effect of urbanization on conversions is not statistically significant. Including all regressors in the same equation in column (4) yields similar results. Using distance to *Arish* as an IV for Arab settlement in column (5) results in an imprecise estimate due to the low predictive power of the IV in the first-stage regression. We interpret the positive effect of Arab settlement on conversions as consistent with the model. The theory is indeterminate, however, with respect to the effect of Copts' religiosity on conversions and so our finding of a positive coefficient neither confirms nor infirms the model. Finally, while the theory predicts a negative effect of Copts' income on conversions, we fail to find supportive evidence of this prediction.

Summary The local-level evidence is broadly consistent with the predictions of the model. Religiosity of tax authorities, as captured by Arab settlement in 700-969, has positive and statistically significant effects on poll and *kharaj* tax rates and conversions, as predicted by the model. More importantly, its positive effect on the *kharaj* tax rate is consistent with the optimal discriminatory tax being on the wrong side of the Laffer curve. Also, as predicted by the model, we find that Copts' religiosity, measured by the legendary route of the Holy Family, has a positive and statistically significant impact on the poll tax rate. However, the effect of Copts' income, measured by urbanization during the Roman period, on conversions is positive and statistically insignificant (the theory predicts a negative effect). Finally, the theory is indeterminate with respect to (a) the effects of Copts' religiosity on the *kharaj* tax and conversions, and (b) the effects of Copts' income on the poll and *kharaj* tax rates, and hence our empirical findings on these effects do not confirm or infirm the model predictions.

4.2.4 Robustness Checks

In this section, we conduct two robustness checks. First, we use *kharaj* per unit of land in 1375 and 1477 as an alternative measure of *kharaj*. Second, we use a list of Coptic churches and monasteries circa 1500 as an alternative measure of conversions.

***Kharaj* per unit of land in 1375 and 1477** Table 6 shows the results on the determinants of *kharaj* per *feddan* in 1375 and 1477. In order to have comparable results to the papyrological evidence on *kharaj* in 641-1100, where all *kuras* are in the Nile Valley, we restrict the analysis to the Nile Valley. Consistent with our findings in Table 4, we document that villages located in *kuras* where Arabs settled in 700-969 faced higher *kharaj* per *feddan* in 1375 and 1477. However, the impact of being located on the Holy Family route does not have a statistically significant effect on *kharaj*, whereas the impact of urbanization is now positive and statistically significant. Including all regressors in column (4) yields qualitatively similar results with the coefficient on Arab settlement retaining its magnitude and statistical significance. The IV estimate of the impact of Arab settlement is larger than the OLS estimate.

Conversions in 1500 We use Coptic churches and monasteries circa 1500 as an alternative measure of conversions. The results, shown in Table 7, are qualitatively similar to the results in 1200, which suggests that the cross-*kura* variation in conversions persisted between 1200 and 1500.

4.3 Country-level evidence

We are not able to examine the determinants of tax rates and conversions over time because we lack time series data on these outcomes: we only observe tax rates and conversions at the country level at scattered points in time (see Figures 1, 3, and 4). However, there is an *observable* outcome of (arguably) great historical significance that our model can help explain: the tax reform of 750 that increased the (uniform) land tax rate on Muslim landholders from the *ushr*/*zakat* to the *kharaj*, and that removed all treaty-based upper ceilings on the *kharaj* that (presumably) existed in certain conquered territories. Our model explains this fiscal policy change by an increase in Caliphs' religiosity and/or budgetary needs, and/or by a decrease in the threat of rebellion and/or uncertainty about Caliphte's rule. In this section, we document the evolution of proxies for these variables from 641 until the end of the First Abbasid Period in 847. We then evaluate if one (or more) of these determinants can account for the tax reform of 750. Nevertheless, since the reform was a Caliphate-wide one-time policy change, it is not possible to formally disentangle the effects of these variables, and we thus rely on theory and history.

4.3.1 Data

We measure *Caliph's religiosity* by two proxies: (1) a dummy variable that takes value 1 if the Caliph ruling in a given year is *not* known for holding palace literary and music parties that involved drinking alcohol with his companions (*munadama*); we

Table 6 – **Determinants of *kharaj* per unit of land in 1375 and 1477**
Village-level regressions - Dependent variable: *'Ibra* per *feddan*

(a) 1375

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	1.698			1.326	3.320
	(0.644)**			(0.458)**	(1.128)***
	{0.472}***			{0.381}***	{0.967}***
=1 if village on Holy Family route		0.097		0.160	
		(0.637)		(0.455)	
		{0.596}		{0.458}	
Log (urban population) in *kura* circa 300			0.778	0.488	
			(0.299)**	(0.214)**	
			{0.275}***	{0.262}*	
Obs (villages)	386	383	386	383	386
Clusters (*kuras*)	18	18	18	18	18
Clusters (districts)	35	35	35	35	35
R^2	0.016	0.000	0.012	0.020	
KP Wald F-stat					(13.483)
					{22.699}
Mean dependent variable	3.741	3.741	3.741	3.741	3.741
SD dependent variable	5.237	5.237	5.237	5.237	5.237

(b) 1477

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	1.318			1.047	3.077
	(0.580)**			(0.441)**	(1.062)***
	{0.436}***			{0.406}**	{0.918}***
=1 if village on Holy Family route		-0.285		-0.234	
		(0.710)		(0.570)	
		{0.671}		{0.578}	
Log (urban population) in *kura* circa 300			0.577	0.350	
			(0.324)*	(0.262)	
			{0.290}*	{0.292}	
Obs (villages)	386	383	386	383	386
Clusters (*kuras*)	18	18	18	18	18
Clusters (districts)	35	35	35	35	35
R^2	0.011	0.000	0.007	0.013	
KP Wald F-stat					(13.483)
					{22.699}
Mean dependent variable	3.156	3.156	3.156	3.156	3.156
SD dependent variable	4.931	4.931	4.931	4.931	4.931

Notes: Sample is restricted to villages in the Nile Valley. Robust standard errors clustered at the *kura* level are in parentheses and at the district level in curly brackets. $*p < 0.10, **p < 0.05, ***p < 0.01$. A constant is included in all regressions. The coefficient on *kura*'s distance to *Arish* in the first-stage regression of the Arab settlement dummy variable in both 1375 and 1477 is − 0.003 (0.001)*** {0.001}***; standard errors clustered at the *kura* level are in parentheses and at the district level in curly brackets. KP Wald F-Stat in parentheses corresponds to clustering standard errors at the *kura* level in the first stage, and in curly brackets to clustering at the district level.
Source: See text.

Table 7 – **Determinants of conversions in 1500**

Dependent variable = 1 if at least one Coptic church or monastery in village

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	-0.034			-0.035	-2.194
	(0.025)			(0.022)+	(7.285)
	{0.018}*			{0.017}**	{5.421}
=1 if village on Holy Family route		0.310		0.309	
		(0.072)***		(0.073)***	
		{0.088}***		{0.088}***	
Log (urban population) in *kura* circa 300			0.002	0.004	
			(0.010)	(0.008)	
			{0.010}	{0.008}	
Obs (villages)	1817	1817	1817	1817	1817
Clusters (*kuras*)	42	42	42	42	42
Clusters (districts)	75	75	75	75	75
R^2	0.008	0.047	0.000	0.055	
KP Wald F-stat					(0.083)
					{0.155}
Mean dependent variable	0.028	0.028	0.028	0.028	0.028
SD dependent variable	0.164	0.164	0.164	0.164	0.164

Notes: Robust standard errors clustered at the *kura* level are in parentheses and at the district level in curly brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A constant is included in all regressions. The coefficient on *kura*'s distance to *Arish* in the first-stage regression of the Arab settlement dummy variable is − 0.000 (0.001) {0.001}; standard errors clustered at the *kura* level are in parentheses and at the district level in curly brackets. KP Wald F-Stat in parentheses corresponds to clustering standard errors at the *kura* level in the first stage, and in curly brackets to clustering at the district level. Source: See text.

rely on Sirhan (1978) for the Rashidun (641-661) and Umayyad (661-750) periods and Abu-Zahw (2012) for the First Abbasid period (750-847), and (2) the difference between the standardized number of religious and secular buildings built in a given year from Chaney (2013). We measure *budgetary needs* by the yearly number of major military battles initiated by the Caliphate against its (non-Muslim) neighboring empires drawing on Mikaberidze (2011). Since it is empirically difficult to disentangle the *uncertainty about Caliphate's rule* from the *threat of rebellion*, we employ three proxies for both variables and we are agnostic about which of the two variables is really captured by these proxies: (1) the yearly number of major military battles initiated by (non-Muslim) neighboring empires against the Caliphate, (2) a dummy variable that takes value 1 if there was a major civil war that threatened the existence of the Caliphate (both variables are based on Mikaberidze (2011)), and (3) a dummy variable that takes value 1 if the Nile level in a given year fell in the top or bottom 5% of the Nile maximum levels in 641-1517 drawing on Chaney (2013). Nile shocks may also capture (the marginal utility of) income since the Nile level determined Egypt's aggregate agricultural output.

4.3.2 Findings

Caliphs' religiosity Figure 5 shows the evolution of our proxies of Caliphs' religiosity. First, the Rashidun and Umayyad Caliphs in 641-750 were less likely to organize palace parties (i.e. were more religious) than their Abbasid successors in 750-847. Put differently, based on this proxy, we fail to find evidence on an increase in Caliphs' religiosity at the time of the tax reform. Second, there is little variation in the difference between religious and secular buildings in 641-847. This is probably due to data limitations since most buildings that are recorded in the historical literature belong to later episodes of Egypt's history. But with this caveat in mind, this variable does not suggest either an increase in Caliphs' religiosity at the time of the reform.

Budgetary needs Figure 6 shows that our proxy of the Caliphate's budgetary needs, the yearly number of military battles that were initiated by the Caliphate against its neighboring empires, in fact *dropped* after 750. This is not surprising as most major conquests of the Caliphate took place during the Rashidun and Umayyad periods. Thus, based on this proxy we do not find evidence on an increase in budgetary needs at the time of the reform.

Uncertainty about Caliphate's rule and threat of rebellion Figure 7 shows our three proxies of the uncertainty about Caliphate's rule and threat of rebellion. First, major military battles initiated by neighboring empires (mostly, the Byzantine empire) against the Caliphate dropped after 750. Although civil wars within the Caliphate continued to take place after 750, they dropped as the Abbasids were able to consolidate their power. By contrast, Nile shocks do not show a change in trend between the two periods. These findings suggest that both uncertainty about Caliphate's rule and the threat of rebellion declined during the eighth century. According to our model, this decrease may account for the tax reform of 750.

Summary We interpret these figures as suggestive of the role of the decline in uncertainty about Caliphate's rule and the threat of rebellion, in driving the increase in the uniform tax rate in 750. Indeed, besides the decline in foreign attacks on the Caliphate and in major civil wars that threatened the Caliphate, the population share of converts increased in 641-750, depressing the threat of rebellion of taxpayers. These factors combined probably made the Abbasid Caliphate more willing to undertake the major reform of increasing the uniform tax rate on Muslims (including both Arabs and converts). Although this resulted in tax revolts in Egypt that now included both Muslims and Copts (see Figure 8), the Abbasids eventually managed to suppress these revolts by violence, and thus kept the new tax system.

5 Conclusion

To be completed.

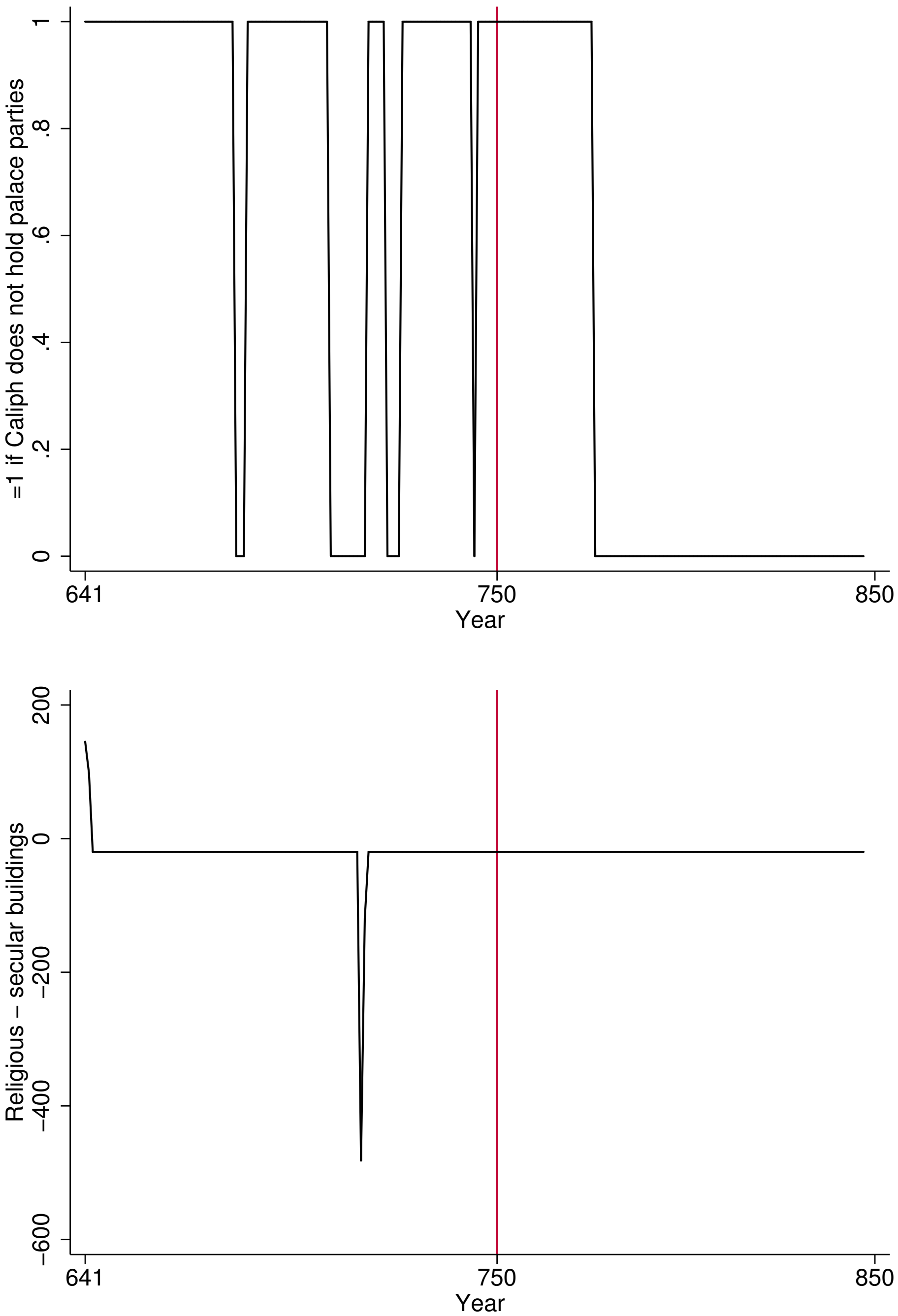

Figure 5 – **Caliphs' religiosity in 641-847**

Source: See text.

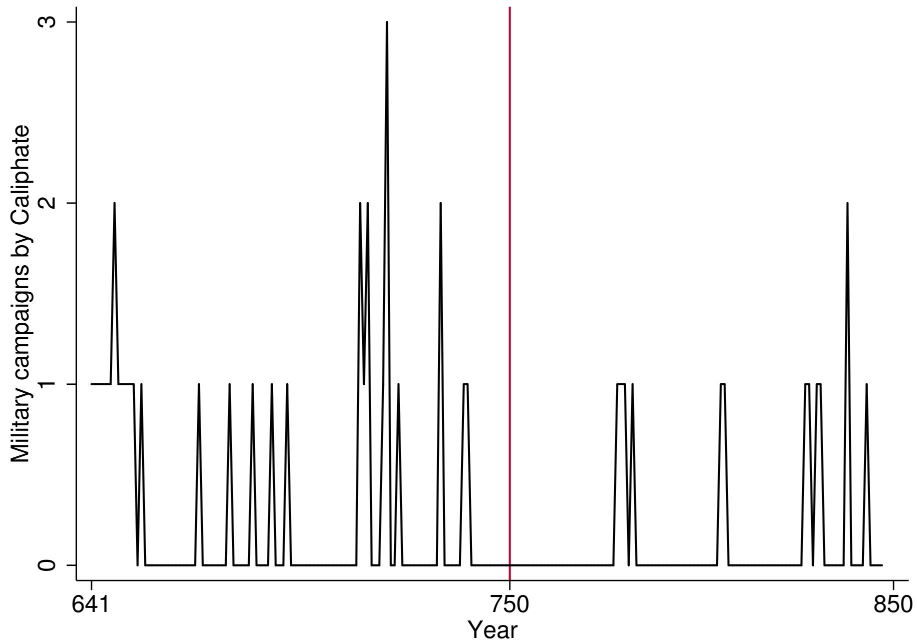

Figure 6 – **Caliphate's budgetary needs in 641-847**

Source: See text.

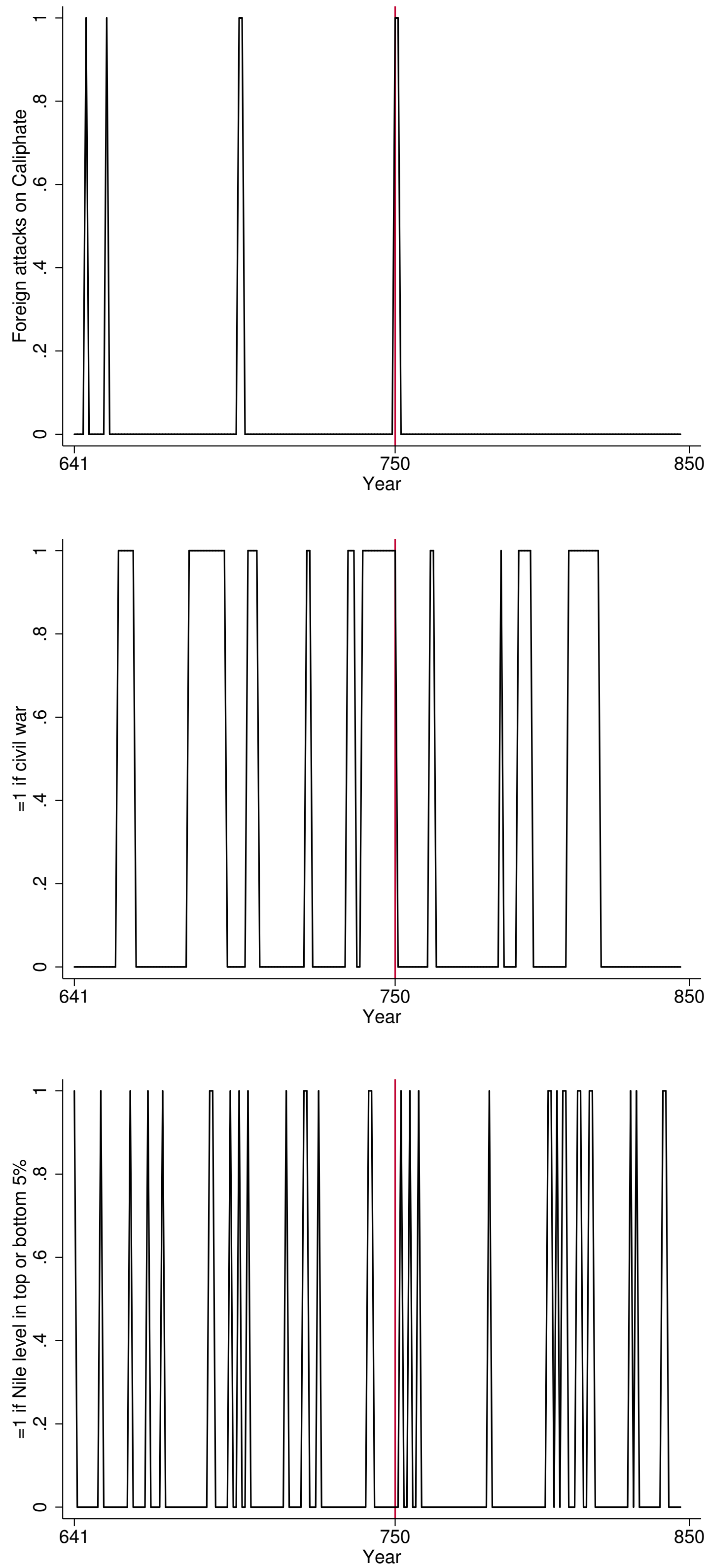

Figure 7 – **Uncertainty about Caliphate's rule and threat of rebellion in 641-847**

Source: See text.

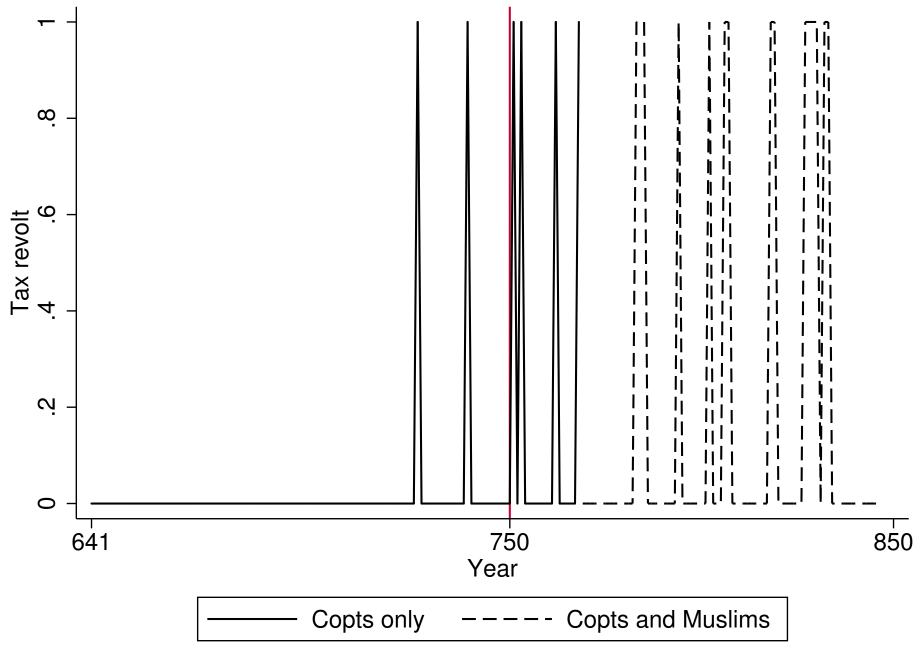

Figure 8 – **Egypt's tax revolts in 641-847**

Source: See text.

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ONLINE APPENDIX

Proof of Proposition 1′

We can subsume the two cases by introducing $B_C(\theta^*)$ and $B_M(\theta^*)$, the image or externality benefits when remaining Copt and when converting.

Let $D(\theta^*) \equiv B_C(\theta^*) - B_M(\theta^*)$ denote the difference. The cutoff is determined by:

$$\theta^* - \tau + D(\theta^*) = 0, \text{ yielding a function } \tau(\theta^*).$$

The ruler's welfare is then

$$W = [\tau(\theta^*) - c][1 - F(\theta^*)] + B_M(\theta^*) + \int_{\theta^*}^{+\infty} [1 - \delta(\theta)][\theta - \theta^*]dF(\theta) - B.$$

The first-order condition is

$$\theta^* - c - \frac{\int_{\theta^*}^{+\infty} \delta(\theta)dF(\theta)}{f(\theta^*)} = \frac{F(\theta^*)}{f(\theta^*)} B'_M(\theta^*) + \frac{1 - F(\theta^*)}{f(\theta^*)} B'_C(\theta^*) - D(\theta^*). \tag{9}$$

For image concerns

$$D(\theta^*) = \mu[M^+(\theta^*) - M^-(\theta^*)],$$
$$B'_M(\theta^*) = \mu \frac{f(\theta^*)}{F(\theta^*)}[\theta^* - M^-(\theta^*)],$$

and

$$B'_C(\theta^*) = \mu \frac{f(\theta^*)}{1 - F(\theta^*)}[M^+(\theta^*) - \theta^*].$$

And so the RHS of (9) is equal to 0.

For network externalities,

$$D(\theta^*) = e_C[1 - F(\theta^*)] - e_M F(\theta^*),$$
$$B'_M(\theta^*) = e_M f(\theta^*),$$

and

$$B'_C(\theta^*) = -e_C f(\theta^*).$$

The RHS of (9) is equal to

$$2[e_M F(\theta^*) - e_C[1 - F(\theta^*)]].$$