Taxing Unwanted Populations: Fiscal Policy and Conversions in Early Islam

Mohamed Saleh* Jean Tirole*

July 5, 2018

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, hostile taxation, Laffer curve, legitimacy.

JEL numbers: H2, N45, Z12.

*Toulouse School of Economics and Institute for Advanced Study in Toulouse, Manufacture des Tabacs, 21 Allée de Brienne, Building F, Toulouse Cedex 6, F - 31015, FRANCE. This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 669217 - ERC MARKLIM). Financial support from the ANR-Labex IAST is also gratefully acknowledged. We are grateful to participants in the 2017 IAST History Workshop, Sciences Po Paris-IAST Political Economy Conference, the 2017 Africa Meeting of the Econometric Society, UCLA, Berkeley, Stanford, Chicago, UC-Irvine Conference on "Identity, Cooperation, and Conflict," AALIMS-Princeton Conference on "Political Economy of Muslim Societies," UC-Davis, Santa Clara University, the SIOE Montréal congress and the Econometric Society Meeting at the ASSA 2018. We are grateful to Ran Abramitzky, Robert Barro, Dora Costa, Barry Eichengreen, James Fenske, Roberto Galbiati, Avner Greif, Emir Kamenika, Timur Kuran, Thomas Piketty, Giacomo Ponzetto, and Emmanuel Saez, for their very helpful comments. We thank Paul-Henri Moisson, Norhan Muhab, Roxana Pozo, Iman Sami, and Manal Zahran, for their excellent research assistantship.

"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

1.1 Motivation and main insights

Hostility toward populations on the ground 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, assimilate, 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 economic and moral cost inflicted on the country by the holocaust and the Jewish exile to the United States and other countries. [1]

Our lead application is taxation in 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. [2] 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

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

2. The tax system was in fact introduced to all the conquered territories of the Arab Caliphate and, later on, to all Muslim-ruled territories in South and Southeast Asia. We limit ourselves to Egypt, because it is where the papyrological records on taxation under the Early Arab Caliphate survived. We focus on Copts, rather than other non-Muslim groups in Egypt: Jews and non-Coptic Christians, who were also subject to the same (discriminatory) tax system, because Copts constituted the vast majority of Egypt's population on the eve of the Arab conquest.

land tax rate (*kharaj*) that was initially higher than the uniform land tax rate (*ushr*) on Muslim landholders. By 750, the Caliphate, supported by jurists, increased the uniform land tax paid by converts from the *ushr* rate to the *kharaj* rate, and from that date on the discriminatory tax equated with the poll tax. The reformed tax system was enforced from 750 until 1856, when the poll tax on non-Muslims was finally abolished. Saleh (2018) documented that because the poll tax (the discriminatory tax from 750 to 1856) was regressive, *poorer* Copts were more likely to convert to Islam, holding Copt religiosity constant.[3] This led Copts to shrink into a better-off minority by 1200, and the consequent Coptic-Muslim socioeconomic gap persisted through the nineteenth century, due to group restrictions on access to skills.

This paper is inspired by two intriguing puzzles for the history of taxation under the early Arab Caliphate. First, was the discriminatory tax on the downward-sloping, "wrong" side of the Laffer curve? Umar II's citation at the beginning of the 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 indeed on the wrong side of the Laffer curve.[4] Furthermore, historians have long noted that discriminatory tax revenues declined between 641 and 750, although the tax rate remained constant, possibly because the tax base was shrinking due to conversions to Islam (Figure A.1 in the Online Appendix). Yet, we lack a theoretical framework that allows us to test this hypothesis empirically. Second, why did the Caliphate increase the uniform land tax on converts starting only around 750? If this was meant to compensate for the decline in discriminatory tax revenues, why did Caliphs have to wait for more than a century and tolerate a decline in revenues before engaging in this reform?

Theory We first develop an optimal taxation framework of general interest. Its theoretical novelty resides in part 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 allow for unwanted groups. In the language of the Islamic governance of Egypt, the ruler may be hostile to

3. 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 decreasing in income (Saleh, 2018).

4. Note that "prophet" in Arabic means that Muhammad was sent by God to convert people to Islam.

those holding Coptic beliefs. Alternatively, regardless of affinity considerations, the ruler may have extrinsic (formal or informal incentives provided by the caliphate) motivations to increase the number of conversions to Islam.

In our framework, the ruler optimally 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. This specificity produces a rich set of insights, including simple but unconventional ones. Most importantly, when on the wrong side of the Laffer curve the ruler taxes more his favored group, the more hostile he is toward the unwanted group (or more religious in the Muslim sense), but the result is reversed when on the upward-sloping, "correct" side of the Laffer curve. 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 leads 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). 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). [5] The last result is particularly interesting as it exhibits natural dynamics in an otherwise completely stationary environment.

5. 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.

Empirics We first introduce econometric evidence that is based on exploiting the geographic variation within Egypt under the early Arab Caliphate in determining our three main outcomes: poll and *kharaj* tax rates and conversions. We focus on one key insight of the model, which allows us to test if the optimal discriminatory tax was on the wrong side of the Laffer curve: Because of their religious fervor, more religious tax authorities will impose a higher discriminatory tax on the unwanted population, in order to induce more conversions. Being on the wrong side of the Laffer curve, however, the consequent fall in discriminatory tax revenues will necessitate an increase in uniform tax in order to meet a fixed budgetary target.

The 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 non-presence of Coptic churches and monasteries in 1200. Our main regressor is religiosity of local tax authorities, which we measure 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 Copt-administered areas. We attempt to control for Copt religiosity in a given constituency by a dummy variable indicating a location on the legendary route of the Holy Family during its biblical visit to Egypt, and for Copt income by urban population circa 300. We argue that the remaining determinants in the model: budgetary needs, threat of rebellion, uncertainty about Caliphate rule, and the cap on the uniform tax, are unlikely to vary locally. We first estimate a separate set of OLS regressions for each outcome: poll tax, *kharaj* tax, and conversions. Then, 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, and a dummy variable indicating bordering desert land, as instrumental variables for settlement.

The analysis is subject to a few caveats, though. First, unlike conversions (churches) which we observe for all Egypt, tax papyri survived for only 4 out of 42 *kuras*, Egypt's administrative units in 641-1036. Second, most papyri are dated within a period, such as a century or longer, which forces us to date all tax papyri between 641 and 1100, without being able to disentangle the pre-750 tax papyri from the post-750 period. Third, *kharaj* tax is measured per person and not per unit of land, and thus confounds local variation

in landholding distribution with variation in tax rate. To mitigate these concerns, we re-estimated the effects on conversions in 1200 within the tax papyri *kuras*, and we obtained similar results to those for the full sample (see below). We also provide additional evidence on the effects of Arab settlement on taxation, by examining its impact on total tax revenues, using village-level data from a cadastral survey in 1375, which we observe in all 42 *kuras*. Finally, we note that this is a general limitation of papyrological evidence in ancient and medieval history where 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. The ongoing rapid growth in papyri digitization will probably expand our knowledge of the early Arab Caliphate, instead of relying on (often) subjective historical narratives.

Our findings are broadly consistent with the optimal discriminatory (poll) tax being on the wrong side of the Laffer curve. We document that taxpayers in *kuras* where Arabs settled in 700-969 paid, on average, a higher poll tax by 25% relative to the average poll tax. Villages in these *kuras* were more likely to have no Coptic churches or monasteries by 1200 (more conversions in 641-1200) by 12 percentage points (14% of the average). The results imply that Arab-settled *kuras* had lower poll tax revenues per capita, despite the higher poll tax, by 9 percent relative to the average. Furthermore, we document that taxpayers in these *kuras* paid a higher *kharaj* tax per person by 15% relative to the average. This suggests that the two taxes were complements: local tax authorities used *kharaj* tax, paid by both converts and non-converts, to compensate for the decline in poll tax revenues. Because we cannot rule out that the effect on *kharaj* per person may be driven by local differences in landholding distribution, we also document that state valuations of village total tax revenues per unit of taxable land in 1375 are not associated with Arab settlement. This is arguably consistent with *kharaj* tax being used to offset the decline in poll tax revenues, leaving total tax revenues unaltered.

Finally, we introduce country-level evidence to explain the delayed increase in uniform land tax circa 750. The model explains the increase in the uniform tax by an exogenous increase in Caliph religiosity and/or budgetary needs, an exogenous decrease in uncertainty about Muslim rule, and/or the endogenous decline in the threat of rebellion due to conversions. To evaluate these alternative explanations, we document the evolution of (proxies for) the four variables between 641 and 847. However, our evidence is qual-

itative, because we observe tax rates and conversions at only a few scattered points in time, and because the tax reform was a Caliphate-wide one-time policy change. The evidence suggests that the tax reform is attributable to decline in both uncertainty about Caliphate rule and threat of rebellion. As attacks by neighboring empires and civil wars within the Caliphate both subsided, the Caliphate became more daring to increase the land tax on Muslims. Historical evidence further suggests that the reform was delayed until 750, because converts took over a century to become a significant share of Egypt's population. Although the reform resulted in tax revolts that now included both Muslims and Copts, the success of the violent suppression of these revolts by the mid-ninth century allowed the reformed tax system with its higher land tax on converts, to survive until the nineteenth century.

1.2 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 the minority, but values its 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) analyzes 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. By contrast, we study optimal taxation. 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 (Greif and Tadelis, 2010; 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), which was probably in order to increase the Caliphate legitimacy.

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 had *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 provides theoretical and empirical support to the latter viewpoint. Our local-level evidence from Egypt suggests that more religious local tax authorities levied a higher poll tax, thus triggering more conversions, but the decline in poll tax revenues was offset by an increase in *kharaj* tax. Furthermore, our country-level evidence suggests that the eighth-century tax reform was likely driven by a decline in the threat of rebellion (due to conversions), and in the uncertainty about Muslim rule.

We also contribute to another long-standing, and more controversial, debate on the impact of discriminatory taxation on conversions in early Islam. Inspired by major papyri discoveries from early Islamic Egypt, pioneering work by historians such as Wellhausen (1902), Becker (1902), Bell (1910), and Grohmann (1932) emphasized the tax incentive of conversions. Their theory triggered fierce debates among later historians, though, and the question is thus far unresolved. While Saleh (2018) provided evidence on the impact of the poll tax on conversions, our paper argues further that both taxation and conversions were outcomes of characteristics of local tax authorities and taxpayers.

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 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).[6] During the centuries that followed, non-Muslims shrank from 100 percent of the local population in Egypt to 7 percent in Egypt in 1848-1868, and 9 percent in Greater Syria and 5 percent in Iraq in 1580. Further estimates for Egypt suggest that non-Muslims shrank into a minority by 1200.[7]

Historical evidence indicates that Islamization of the region was mostly driven by voluntary conversions of the local populations 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, 2018). Hence, from now on we use the two words "Muslims" (who in principle include both Arabs and converts) and "converts" interchangeably. Conversion to Islam was 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.

6. 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).

7. Figure A.2 in the Online Appendix depicts the non-Muslim population share in Egypt, Greater Syria, and Iraq. For Egypt, Courbage and Fargues (1997)'s estimates in 641-800 are based on the total poll and land tax revenues assuming complete tax enforcement, while Saleh (2018)'s estimates in 1200 and 1500 are based on the share of Egypt's villages that had at least one Christian church or monastery, and in 1848 and 1868 on Egypt's population census samples.

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 (variously 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 actually 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 *de jure ushr* tax rate had an exogenously determined upper bound that was decided by *Hadith* (prophet's sayings), the *de jure kharaj* tax rate was decided by either the terms of a peace treaty (and thus had an exogenous upper bound) in territories that were annexed by the Caliphate by a treaty, or by Caliph's will (and thus had no exogenous upper bound) in territories that were annexed by military force. According to Frantz-Murphy (2004), Egypt belonged to the "treaty" territories.[10] Second, landholders' rights differed between *kharaj* and *ushr* land.[11] (Non-Muslim) landholders of *kharaj* land, who

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).

9. We abstract here from two other types of taxes. First, we abstract from miscellaneous taxes that were imposed on non-Muslims only in 632-750 but were extended to Muslims after 750. In 632-857, 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 though 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 because it was abolished starting 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. The actually enforced *kharaj* that we observe in the Egyptian papyri varied locally. See the discussion of the tax administration at the end of this section and Section 4.2.1.

11. 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,

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.

Tax reforms in 750 Conversions to Islam in 632-750 caused the tax base and, hence, tax revenues throughout the Caliphate to fall (Figure A.1 in the Online Appendix). In order to increase the tax base, the Caliphate introduced several tax reforms during that period including (a) levying the poll tax on monks, local elites, and fugitives, who were initially exempted,[12] (b) imposing the *kharaj* land tax on churches and monasteries, which were also initially exempted,[13] 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 via two reforms. First, the *de jure* 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. Second, jurists removed any treaty-based upper bound on *kharaj* rate, by denying the historical existence of peace treaties in most of the conquered territories, including Egypt. 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.[14] Landholders of *kharaj* land, whether Copts or Muslims, enjoyed

p. 69), on which the *ushr* land tax was levied.

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

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

14. 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

usufruct rights but not full private property rights on their landholdings.[15] However, the (lower) *ushr* rate 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.

***De jure* Tax rates** Figure A.3 in the Online Appendix shows the long-term trend of the *de jure* nominal annual poll tax. 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, 2018). The *de jure* poll tax remained almost stable from 750 to 1000, increased slightly between 1101 and 1300, before it declined in 1301-1500, possibly due to the Black Death shock. By contrast, the *de jure real* poll tax rate per person and the *de jure* poll tax rate per dinar of income both declined over time, and became negligible after 1250, because the nominal tax did not increase, the purchasing power of the dinar declined, and nominal wages increased (Saleh, 2018).[16] Figure A.4 in the Online Appendix shows that the *de jure ushr* land tax rate was constant over time (by Islamic jurisprudence), whereas the *de jure kharaj* land tax (that was collected in cash, kind, or both) fluctuated at the discretion of tax authorities. The *de jure kharaj* rate (adding up both the cash and in-kind components) was higher than the *de jure ushr* rate.

Tax administration and *actually enforced* tax rates Tax assessment and collection were delegated to the local authorities of each *kura*. In 641-720, Arabs everywhere left taxation in the hands of existing Coptic rural elites. But from 720 on, 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

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).

15. 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.

16. A full analysis of the reasons for this decline lies beyond the scope of the paper because it took place after our period of study. However, an additional (possible) explanation, besides the Black Death epidemic, is that the Caliphate increased over time the uniform tax base, by introducing new miscellaneous taxes on items other than land and religious affiliation (Saleh, 2018), to the extent that it may have hit taxpayers' maximum ability to pay, thus leaving little room to increase the discriminatory tax.

to tax farming (Sijpesteijn, 2009) that 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. Egyptian tax papyri in 641-1100 reveal that the actually enforced poll and *kharaj* taxes, the discriminatory and uniform taxes starting from 750, could be higher or lower than the *de jure* ones because different tax rates could be decided locally, and because enforcement was not always perfect. However, the actually enforced tax rates that we observe in the papyri are equal to the *de jure* ones on average.[17] We lack evidence on the actually enforced *ushr* tax, the uniform tax before 750, though, and so we do not know whether its enforcement indeed varied locally, let alone whether 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). 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

17. The average poll tax payment in the papyrological poll tax registers and receipts in 641-1100 is 1.5 dinar ($N = 552$; $SD = 3.7$), which is close to the average *de jure* poll tax of 1-2 dinars, assuming that most taxpayers belonged to the low and middle brackets. Furthermore, the *de jure* poll tax in 1101-1856 in Figure A.3 in the Online Appendix are from officials' handbooks, which are roughly equal on average to the actual poll tax amounts (paid by Jews) that are observed in the Cairo Geniza (Goitein, 1963, p. 286). Papyrological *kharaj* tax records in 641-1100 indicate that the *kharaj* payment was on average 1.32 dinar per *feddan* of land ($N = 27$; $SD = 1.02$), which is close to the *de jure kharaj* rate of 1 dinar in 641-750.

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 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 [18] in the uniform tax λ; the ruler's preferences with respect to conversions are expressed by a function $V(\theta^*)$:

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

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

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

18. 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.

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

Intrinsic and extrinsic motivation lead example. To illustrate the model, we provide a lead example in which the ruler cares about conversions either because he feels antipathy towards someone with Coptic convictions, or because he faces formal or informal incentives for inducing conversions provided by the Caliphate. 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) [19] and c denote a psychological or incentive cost c for the ruler per non-convert, the ruler's welfare is (up to a constant)

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

Normalize weights to be equal to 1 on average:

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

and assume that $\delta' \geq 0$ 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 $f' \geq 0$. [20]

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

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

Definition 1′ *In the intrinsic motivation illustration, ruler 1 is said to be more religious*

19. While type θ is unobservable by the ruler, the latter's feelings toward converts may well depend on the truncated distribution of types, as we depict. High θ converts are likely to have limited religious fervor and to pay lip-service to their new Muslim faith. Whether these considerations are at play in historical examples is a question for future research.

20. 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 $f'(\tau^*) \geq 0$.

(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 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?[21] 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 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[22] that the potential convert has image concerns $\mu M^+(\theta^*)$ if he does not convert

21. This does not mean that forced conversions cannot result from our model. Consider the European-African slave trade (suggested to us by Itzchak Tzachi Raz); Europeans force-converted Africans to Christianity, arguing that they were saving their souls from eternal hell (the Africans' actual utility obviously differed from the Christians' perception of it). Forced conversions can be understood in the following way in our model: due to their "benevolent" intent, Christians had a very high utility of conversion (a high c), and so the solution may have been a corner solution with all converting to Christianity (an outcome equivalent to forced conversion). Of course for this to hold, either there must be an upper bound on the support of θ, or the Africans' wealth was limited so that they could not pay a large τ, or both.

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

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^*). The cutoff θ^* (or alternatively the tax $\tau(\theta^*)$ that induces 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 and $\tau(\theta^*)$ well-defined. The analysis is unchanged, except that now

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

Introducing social pressure adds a few interesting additional insights, though. If the distribution $f(\theta)$ is unimodal, the function $\Delta(\theta^*)$ is U-shaped. When conversions are rare, the reputational concern is driven mainly by the strong stigma attached to conversions (and so $\Delta'(\theta^*)<0$). The discriminatory tax has a strong impact on the threshold because it not only provides a material incentive for conversion, but it also releases 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 discriminatory tax impact on the threshold is then less than 1 for 1. [23]

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

23. 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).

equilibrium 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 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.

(c) *Discrimination through non-price instruments.* We observed that in our model, a simple pool tax is the optimal instrument for the ruler to discriminate against an unwanted minority. In practice because such direct discrimination may be prohibited, we observe more indirect forms of discrimination, such as neighborhood-based access to public goods, ethnicity-based patronage and incendiary rhetoric. Glaeser and Shleifer (2005) describe such forms of discrimination in 20th century US, staging an Irish-catholic/Anglo-Saxon-protestant conflict in Boston and a black/white conflict in Detroit. In both examples, the mayor induced over the years substantial migration of the minority out of the city, reinforcing the incumbent's political power;[24] Glaeser and Shleifer call this the "Curley effect," after the name of a Boston mayor who was in power for most of the 1913-1951 period. A direct, ethnic or race-based tax discrimination being prohibited by the federal government, the ruler's hostility toward the minority shifted to presumably less efficient forms of utility extraction. The paper also documents Robert Mugabe's tactic in Zimbabwe, which led to substantial migration by white farmers.

Our model can accommodate such non-price instruments. The Online Appendix demonstrates how for instance racial slurs and patronage can be modeled through our $V(\theta^*) + R(\theta^*)$ framework. In both illustrations the optimal policy always lies on the wrong side of the Laffer curve.

3.2 Optimal tax structure: basic comparative statics

The first-order condition for ruler welfare maximization is

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

24. Migration then reduces resistance to the ruler over time because of the majoritarian electoral system. By contrast, our time-decreasing resistance in Section 3.4 will be based on a reduced stake for the converts.

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 $V'(\tau^m) > 0$.[25]

Lead example: Under extrinsic motivation, the optimal discriminatory tax *always* lies on the wrong side of the Laffer curve: $\max_{\{\tau\}}\{(\tau - c)[1 - F(\tau)] - B\}$ yields an optimal tax exceeding the level that maximizes $\tau[1 - F(\tau)]$.[26]

By contrast, under *intrinsic motivation*, the discriminatory tax lies on the wrong side of the Laffer curve if and only if at τ^m the ruler is hostile to non-converts: Maximizing $\int_\tau^\infty \{[1 - \delta(\theta)](\theta - \tau)dF(\theta) - [B - R(\tau)]\}$ yields an optimum to the right of τ^m if and only if the derivative of the first term in the maximand is positive at τ^m, or $M_\delta^+(\tau^m) \equiv \frac{\int_{\tau^m}^\infty \delta(\theta)dF(\theta)}{1-F(\tau^m)} > 1$ (the ruler is hostile to non-converts). More generally, the condition writes $c > [1 - M_\delta^+(\tau^m)]\tau^m$.

Next, suppose that the uniform tax is subject to a binding cap[27] $\lambda \leq \bar{\lambda} < \lambda^*$. 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 $\tau^m \leq \tau^{**} < \tau^*$. If $V'(\tau^m) < 0$, then the reverse inequalities hold: $\tau^* < \tau^{**} \leq \tau^m$.

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 (for all θ^*, $V_1'(\theta^*) > V_2'(\theta^*)$), then $\tau_1^* > \tau_2^*$. If furthermore $V_2'(\tau^m) \geq 0$, $\lambda_1^* > \lambda_2^*$.[28]

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

(i) The optimal discriminatory tax τ^* is on the wrong side of the Laffer curve if and

25. $\tau^* > \tau^m$ implies that $V'(\tau^m) + R'(\tau^m) = V'(\tau^m) > 0$, and conversely.

26. As Giacomo Ponzetto suggested to us, this intrinsic motivation modeling, properly reinterpreted, also covers the design of "sin taxes" (O'Donoghue and Rabin, 2006). Consider a hyperbolic consumer with present bias parameter β (and otherwise no discounting). Consumption today brings immediate benefit b drawn from distribution $G(b)$ in $[0, \infty)$ and fixed delayed cost c. Let $F(\theta) \equiv G(\theta + \beta c)$. Given a sin tax τ for consumption, the cutoff is $\theta^* = b + \beta c = \tau$. So $R(\theta^*) \equiv \theta^*[1 - F(\theta^*)]$. And paternalistic preferences can be expressed as $\int_{\tau+\beta c}^\infty (b - c)dG(b) = \int_{\theta^*}^\infty [\theta - (1 - \beta)c]dG(\theta) \equiv V(\theta^*)$. The optimal cutoff, given by $(1 - \beta)c = \frac{1-F(\theta^*)}{f(\theta^*)}$, lies on the wrong side of the Laffer curve. The equivalent of apostasy in this case would correspond to a permanent withdrawal: once the individual has stopped consuming, she will stop consuming in the future regardless of realized benefits of consumption; this is a strong assumption in this context.

27. 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.

28. One has $V_1'(\tau_2^*) + R'(\tau_2^*) > V_2'(\tau_2^*) + R'(\tau_2^*) = 0$. The strict quasi-concavity of the objective function then implies that $\tau_1^* > \tau_2^*$.

only if $V'(\tau^m) > 0$. *The optimal uniform tax is given by* $\lambda^* = B - R(\tau^*)$.

(ii) Suppose that $V'(\tau^m) > 0$. *Then, if initially the land tax is constrained to be lower than its optimal level, the discriminatory tax is also smaller than its optimal level in the absence of constraint on the land tax.*

(iii) A more religious ruler on the wrong side of the Laffer curve taxes both converts and non-converts more heavily: If $V_1'(\cdot) > V_2'(\cdot)$, $\tau_1^* > \tau_2^*$ *and if furthermore* $V_2'(\tau^m) \geq 0$, *then* $\lambda_1^* > \lambda_2^*$.

The results in parts (ii) and (iii) of Proposition 1 are reversed if the optimal policy lies on the correct side of the Laffer curve: A cap on the land tax *increases* the discriminatory tax; and a small increase in ruler religiosity *reduces* the tax burden on converts.

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 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 cutoff 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, like other missing proofs, 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

We must here focus on the lead example, which is explicit about how V depends on the distribution F, while the general formulation is not. 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.

Proposition 2 ***(impact of Copt religiosity on taxation)*** *In the lead example:*

(i) When the ruler is extrinsically motivated, an increase in Copt religiosity (a) increases the discriminatory tax, (b) lowers the conversion rate, and (c) reduces the uniform tax.

(ii) When the ruler is intrinsically motivated and provided that f is log-concave[29] *and that at the optimum the ruler discriminates against the marginal member of the non-convert population, a marginal increase in Copt religiosity implies an increase in the discriminatory tax.*

Proof:

(i) Under extrinsic motivation, the ruler solves $\max_{\{\tau\}}\{(\tau - c)[1 - F(\tau - r)]\}$ and so at the optimum $0<\frac{d\tau}{dr}<1$ (using the log-concavity of $1-F$), and so the tax increases and the conversion rate, $F(\tau - r)$ decreases with r. Finally, the land tax is $\lambda = B - \tau[1 - F(\tau - r)]$ and so, using the first-order condition, $\frac{d\lambda}{dr} = f(\tau - r)[c\frac{d\tau}{dr} - \tau] < 0$ as $\frac{d\tau}{dr} < 1$ and $\tau > c$.

(ii) The first-order condition is:

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

The log-concavity of f, together with the fact that $\delta(\theta) > 0$ for all $\theta \geq \tau^*$ implies that the

29. 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: $(f'/f)' \leq 0$.

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. ■

Remark. *When V, but not R, depends on a parameter ξ such that $\frac{\partial^2 V}{\partial\theta^*\partial\xi}>0$ and $V'(\tau^m, \xi)>0$,*[30] *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

Our comparative statics with respect to Copt income are more patchy. Suppose that agent θ's utility is the small-tax linear approximation $\theta x - \alpha(\lambda + \tau x)$ (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 $\theta^* = \alpha\tau$. We further assume that the function V is independent of α (which is the case for extrinsic motivation).

The ruler's objective function, assumed strictly quasi-concave, is then: $V(\theta^*) + \tau[1 - F(\alpha\tau)] = V(\theta^*) + \frac{R(\theta^*)}{\alpha}$. This yields:[31]

Proposition 3 ***(Copt income)*** *Suppose that preferences are $\theta x - \alpha(\lambda + \tau x)$ and that V does not depend on α.*

(i) When the optimal discriminatory tax is on the wrong side (resp. correct side) of the Laffer curve, the higher the Copts' marginal utility of income, the more (resp. fewer) conversions take place under optimal taxation.

(ii) 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 the choice of taxes. We capture the Copts' possible revolt in a simple way. We assume

30. Note that τ^m does not depend on ξ if R does not.
31. To prove (i), note that $d\theta^*/d\alpha = R'/\alpha[\alpha V'' + R'']$. To prove (ii), use $d\theta^* = \alpha d\tau + \tau d\alpha$.

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.[32] The revolt is successful if and only if at least $1 - F(\hat{\theta})$ Copts rebel,[33] 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 constraint for the ruler is:[34]

$$G(\hat{\theta}) = \lambda + \min\{\tau, \hat{\theta}\} \leq \rho. \tag{4}$$

We are interested in situation in which the policy that would be optimal in the absence of revolt would trigger a revolt and is therefore infeasible: $\rho < \min\{\lambda^* + \hat{\theta}, \lambda^* + \tau^*\}$. 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, which is the only tax paid by converts, must be decreased, which implies that,

32. Another source of legitimacy that was suggested to us by Timur Kuran is that the Caliphate recruited converts in the army and rewarded them with a state (cash and in-kind) stipend (see footnote 9). However, while this theory may hold in other parts of the Caliphate, it was less applicable to Egypt whose Muslim army in 641-750 was "small and largely composed of the conquerors of the country and their descendants" (Kennedy, 2013, p. 19).

33. 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.

34. We assume that V does not depend on ρ. Even if the ruler internalizes the agents' utility, there is no rebellion cost on the equilibrium path; and anyway the internalization does not call for allowing a rebellion.

on the wrong side of the Laffer curve, the discriminatory tax must be decreased as well: $\tau < \tau^*$. The ruler lowers a tax that is not levied on the marginal rebel. By contrast, on the correct side of the Laffer curve, the discriminatory tax is increased.

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

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

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

Both taxes must be decreased, regardless of which side of the Laffer curve the unconstrained optimum lies. [35]

Proposition 4 ***(revolt-constrained public finance)*** *Legitimacy always requires lowering the non-discriminatory tax* ($\hat{\lambda} < \lambda^*$) *when the no-revolt optimum* (τ^*, λ^*) *is on the wrong side of the Laffer curve. Legitimacy then requires lowering the discriminatory tax* ($\hat{\tau} < \tau^*$)*, even when the marginal rebel is a convert, who therefore does not pay it tax. By contrast, if the no-revolt equilibrium is on the correct side of the Laffer curve, the discriminatory tax is increased if and only if the marginal rebel is a convert.*

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. [36] 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

35. Because $\rho - \tau + R(\tau) = B$, $d\tau/d\rho = 1/[1 - R'] = 1/[F + \tau f]$.

36. 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 an idiosyncratic level of the cost of rebellion 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.)

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. The cutoff θ_t^* must satisfy: $\theta_t^* \geq \theta_{t-1}^*$ (apostasy constraint). We investigate the dynamics of taxation and its structure assuming that the ruler cannot commit to a policy.

The poll tax τ_t is levied on Copts who have not yet converted and so 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.[37] 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 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 date-t welfare as:

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

and $\sum_{t=1}^{2} \beta^{t-1} W_t(\tau_t; \theta_t^*)$ is the intertemporal welfare.

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 poli-

37. This budgetary need is taken to be deterministic, but the analysis can be extended to a random need.

cies.[38] 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, equal to the static levels (τ^*, λ^*)*. All conversions occur at date 1.*

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

(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) if* $V_1'(\theta_1^*) \geq 0$*, then* $\lambda_2 = \lambda_2^* > \lambda_1 = \lambda_1^*$*: 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. 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

38. 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.

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, because this poll tax is paid by citizens with lower welfare weight while the land tax is paid by all. So indeed the date-2 rulers reluctantly, but optimally keep up the same policy.

Uncertainty about Muslim rule: the option value of remaining copt

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 now losing an option value. Letting (λ_2, τ_2) denote the date-2 tax vector if the Muslim rule continues at date 2, the 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 [39]

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

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

39. 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).

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

Finally, let us look at the dynamic generalization of the legitimacy model developed in the previous section: It takes $[1 - F(\hat{\theta})]$ rebels to topple the Muslim rule, and the individual cost of doing so is ρ.

A key insight is that the incentive to rebel decreases over time, as depicted in Figure 1. Earlier converts' gain from a successful rebellion is limited to the uniform tax and no longer includes the preservation of their foregone identity. As Proposition 7 below shows, this implies that the ruler may raise taxes over time in an otherwise fully stationary economy. Assume for expositional conciseness that agents are myopic ($\beta = 0$); for instance, each generation cares about its own welfare, but apostasy implies that conversions apply to future generations. We further focus on the case in which the discriminatory tax lies on the wrong side of the Laffer curve in the static environment. While specific results hinge on these assumptions, the point that resistance decreases over time is fully general.

Proposition 7 ***(conversions weaken resistance over time)*** *Assume that agents are myopic, that the optimal static tax* $\hat{\tau}$ *lies on the wrong side of the Laffer curve in the static model and that* $\rho < \lambda^* + \tau^*$ *(otherwise there would not be a threat of rebellion).*

(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

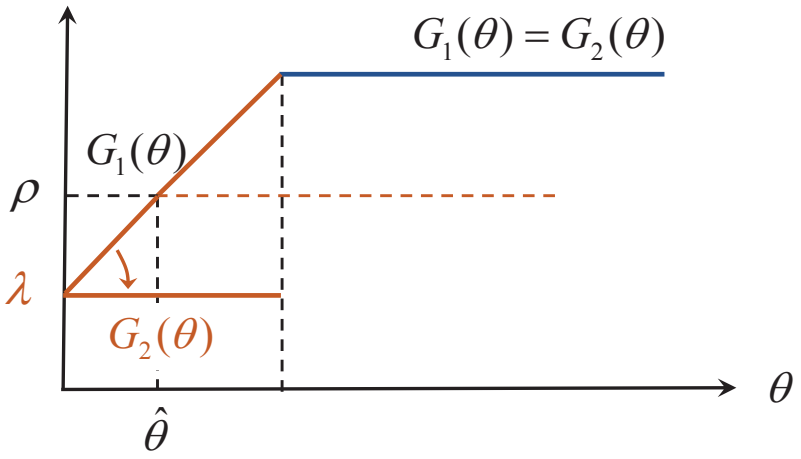

Figure 1 – $G_t(\theta)$ = **date-t gain from a successful rebellion at date t.**

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.

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.*

4 Empirics

Empirical evidence on the model comes from Egypt, where the vast majority of tax papyri under the early Arab Caliphate were discovered. In this section, 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 in Egypt, noting that similar evolutions may have occurred elsewhere since the 750 tax reform was enforced throughout the whole Caliphate. Both pieces of evidence are broadly consistent with the predictions of the model. However, given the tax papyri limitations and the qualitative nature of our country-level evidence, our findings remain suggestive and their interpretation rests on theory and history.

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. An increase in uncertainty about Muslim rule, by making the demand for Coptic Christianity less elastic, results in increasing the discriminatory tax and decreasing the uniform tax,

but should leave conversions unaffected. If tax authorities are driven solely by extrinsic motivation, more religious Copts face a higher discriminatory tax rate and witness fewer conversions to Islam, but the effect on the uniform tax is ambiguous. However, if tax authorities are driven by intrinsic motivation, an increase in Copt religiosity increases the discriminatory tax only under additional assumptions, and has ambiguous effects on both the uniform tax and conversions. A taxpaying population that poses a higher threat of rebellion is expected to face lower discriminatory and uniform taxes, and to witness fewer conversions to Islam. Under restrictive assumptions on ruler objective function and Copt utility, we expect poorer Copts, who have a higher marginal utility of income, to witness more conversions. If we further assume that the optimal discriminatory tax is in the neighborhood of the peak of the Laffer curve, poorer Copts will 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.

If the optimal discriminatory tax lies on the correct side of the Laffer curve, a few predictions may be reversed, though. The first key insight here is that more religious tax authorities will levy a *lower* uniform tax. Second, more rebellious populations will face a *higher* discriminatory tax and will witness *more* conversions, if the marginal rebel is a convert (but the effects will *not* be reversed if the marginal rebel is a non-convert). Third, poorer Copts with a higher marginal utility of income will witness *fewer* conversions (under the same restrictive assumptions on ruler objective function and Copt utility). Finally, a cap on the uniform tax will result in a *higher*, not lower, discriminatory tax and thus *more* conversions.

Overall, two key insights of the model can be tested for the history of taxation under the early Arab Caliphate. First, by examining the impact of ruler religiosity on taxes and conversions, we are able to test whether the optimal discriminatory tax was on the wrong side of the Laffer curve. Second, the model offers four possible reasons for why the uniform tax, but not necessarily the discriminatory 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 uniform 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

Table 1 – **Empirical predictions of the model when on wrong side of Laffer curve**
Light shaded cell means that the result is reversed if on correct side of Laffer curve
Dark shaded cell means that the result may be reversed if on correct side of Laffer curve
N/A means that we are not able to test this prediction empirically due to insufficient data availability

Regressors	Religiosity of tax authorities (V')	Budget (B)	Uncertainty about Muslim rule (x)	Copt religiosity (r)	Threat of rebellion†	Copt 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. Standardized # religious buildings − standardized # 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:

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

†† In lead example, for extrinsic motivation; or in the case of intrinsic motivation, when f is log-concave and at the peak of the Laffer curve the ruler discriminates against the marginal member of the non-convert population.

††† In lead example, when the ruler is driven solely by extrinsic motivation.

†††† Under restrictive assumptions (small-tax linear approximation and V independent of marginal utility of income). For the effect on τ^* and λ^*, assume further that optimum is in the neighborhood of the peak of the Laffer curve.

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).

4.2 Local-level evidence

The local-level evidence attempts to test whether the optimal poll tax was on the wrong side of the Laffer curve. For this purpose, we exploit the cross-*kura* variation in religiosity of tax authorities, tax rates, and conversions, in Egypt under the early Arab Caliphate. While we attempt to control for proxies of Copt religiosity and income, we are not able to proxy for budgetary needs, uncertainty about Muslim rule, threat of rebellion, and the cap on uniform tax, at the local level. However, these variables, we argue, are unlikely to vary locally. First, total budgetary need was decided by the central government in Egypt's capital (*Fustat*, currently in southern Cairo), in order to pay the tribute to the Caliphate, and to finance the salaries of Egypt's top officials, the army, the police, the judiciary, and the bureaucracy. The required budget was then distributed across *kuras* depending on population size. Therefore, while budgetary need per capita varied over time due to macro-level shocks in financial needs at the Caliphate or Egypt levels (e.g., wars), it was unlikely to vary across *kuras*, since it was not raised to finance local public goods. Second, all *kuras* likely faced the same beliefs about Arab tenure. Because the Nile Valley and Delta lacked natural barriers, all *kuras* were subject to Arab central power in *Fustat*. The main exceptions here are frontier cities that switched hands between empires, such as Aswan at the southern border that was constantly under the threat of Nubians, and Alexandria that was threatened by the Byzantines. These frontier *kuras* are *not* included in the empirical analysis, though. Third, even though local Coptic elites of a given *kura* may have resisted Arabs passively via adopting a more lenient tax policy towards Coptic taxpayers in their constituencies, they were not able to pose a threat of active (militant) rebellion that could drive Arabs out of power, unless they coordinated with elites in other *kuras*. Indeed, all tax revolts that did take place in Egypt involved multiple *kuras*. Fourth, the *de jure* cap on the uniform tax before 750, the *ushr* rate, was imposed universally on all *kuras* in Egypt, and in fact throughout the whole Caliphate. After 750, the cap on the *kharaj* tax was removed universally.

4.2.1 Data

Conversions Our first outcome is conversions, which we measure at the village level by a dummy variable that takes value 1 if a village did not have any Coptic church or monastery circa 1200 based on the Coptic medieval chronicle, Abul-Makarim (1200). Using this variable presumes that if the vast majority of the population in an area converted to Islam, its (Coptic) churches and monasteries would be either demolished or transformed into mosques. Figure C.1 shows the spatial distribution of this variable at the district level, i.e. the share of villages in each district that did not have any Coptic church or monastery in 1200. According to this measure, converts were already in the majority by 1200: the median district had 86% of its villages without any church or monastery (mean = 84%). But there was spatial heterogeneity; for example, conversions were more widespread in eastern Delta.

Discriminatory and uniform taxes The second and third outcomes are poll and *kharaj* tax rates, the discriminatory and uniform taxes respectively starting from 750. We collected individual-level data on poll and *kharaj* land tax payments in dinars per person from Egypt's papyrological tax registers and receipts in 641-1100. We employed Morimoto (1981, pp. 67-79, 85-87) for Greek papyri and the Arabic Papyrology Database for Arabic papyri. We excluded tax papyri from unknown locations, because we are not able to match them to *kuras*.[40]

Tax papyri are subject to a few caveats. First and foremost, poll (and *kharaj*) tax records survived in only 4 (respectively, 8) out of 42 *kuras*, and about 95% of tax records come from two *kuras*, both located in the Nile Valley: *Ashmunayn* and *Qahqawa*, respectively known before 641 as *Hermopolis* and *Aphrodito*. Furthermore, we excluded *kharaj* tax records from 4 *kuras* with fewer than 4 records, and dropped 9 observations in *Ashmunayn* with *kharaj* payment outliers (> 15 dinars per person). Figure C.1 in the Online Appendix shows the location of *kuras* with tax records in the final sample. All 4 *kuras* with poll tax records, and 3 out of 4 *kuras* with *kharaj* records, are in the Nile

40. We do not employ two other sets of tax papyri. First, there are other Coptic and Greek poll tax registers and receipts in 641-800, mostly from the same *kuras* as in our sample, that we do not use because they have not been digitized yet. Second, there are poll tax receipts from Nessana in Palestine (Simonsen, 1988), which we do not use because they do not vary within Palestine (they come from a single location).

Valley.[41] Both the small number of *kuras* with tax papyri, and their concentration in the Nile Valley, raise a natural concern about the representativeness of tax papyri. While we are not able to increase the number of *kuras* with tax papyri, there are three remarks that bolster our confidence in our tax papyri sample: (1) Tax papyri survived in certain areas but not others due to exogenous factors: the dry climate preserved the papyri of the Nile Valley, and historical accidents uncovered papyri in specific locations.[42] (2) We estimated the effects of tax authorities' religiosity on conversions in 1200 within *kuras* with poll and *kharaj* tax papyri, and the results are similar to those for the full sample, thus lending support to the national representativeness of the two tax papyri samples (see Section 4.2.3). (3) We provide additional evidence on the effect of tax authorities' religiosity on taxation, by examining a fourth outcome: state valuations of total tax revenues per unit of taxable land in 1375, which we observe for all 42 *kuras* (see below).

The second caveat about tax papyri is that because most papyri are dated within a range (e.g. 641-1000), it is mostly not possible to distinguish between the pre- and post-750 periods, with the exception of *Qahqawa* whose records all belong to the pre-750 period. And even in this case, we had to pool *Qahqawa* records with other *kuras*, and date them between 641 and 1100, in order to have sufficient variation across *kuras*.[43] Third, there are no data on *ushr*, the uniform tax paid by converts before 750. However, this may be due to the fact that the tax was not enforced by the state, and may have thus been equal to zero in all *kuras*. Fourth, *kharaj* 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 distribution. Figure C.2, which shows the frequency histogram of individual tax payments by *kura*, suggests that this is a plausible assumption. The distribution of poll and *kharaj* tax payments is skewed to the right in all *kuras*. Furthermore, in *Ashmunayn* and *Qahqawa*,

41. Excluded *kuras* with *kharaj* tax payments are *Dalas wa Abu-Sir* ($N = 2$), *Ihnas* ($N = 2$), and *Aswan* ($N = 1$) in the Nile Valley, and *Basta* ($N = 1$) in the Nile Delta. Including these *kuras* in the analysis yields similar results. We chose 15 dinars per person as an upper bound on *kharaj*, because this is the maximum payment in *Qahqawa*, the *kura* with the largest sample size. Including these outliers gives us stronger results, though.

42. Tax papyri of *Aphrodito* (*Qahqawa*), which has the largest number of observations in our sample, were discovered in 1901 by farmers who were digging a well. Papyri were then distributed among farmers, and the remaining documents ended up in museums including the British Museum.

43. There is a concern here that pre-750 *kharaj* payments in *Qahqawa* are part of the discriminatory tax on non-converts (= poll tax + *kharaj* - *ushr*), while the post-750 *kharaj* records in other *kuras* are the post-750 uniform tax paid by both non-converts and converts. However, the average *kharaj* payment is very similar across *Qahqawa*, *Damsis*, and *Fayum*, which suggests that the *kharaj* on Copts before 750 was close in magnitude to the *kharaj* paid by both non-converts and converts after 750.

poll tax payments range from 0 to 8, and *kharaj* tax payments from 0 to 15, but the ranges are smaller in other *kuras* due to their smaller sample size. *Ashmunayn* has, on average, higher poll and *kharaj* tax payments than *Qahqawa*.[44]

Total tax revenues Because of tax papyri limitations, we provide further evidence on the effects on taxation from examining a fourth outcome, total tax revenues. We collected village-level data on state valuations of total tax revenues (*'ibra*) per unit of taxable land from the cadastral surveys of 1375 and 1477. These were estimates made by the state to evaluate the "tax worth" of each village when assigned to tax contractors, usually, military officers. A village's tax worth included all its tax revenues: poll tax, *kharaj* tax, and all other miscellaneous taxes (Rabie, 1972, pp. 45-56). Tax contractors paid this price in advance to the state, and were residual claimants of the actual tax revenues (which we do not observe). Conducted under the Mamluks (1250-1517) and recorded by Ibn-Al-Jay'an (1477), the 1375 and 1477 cadasters are the earliest extant data sources on estimated total tax revenues and taxable area of every Egyptian village. Village tax worth (*'ibra*) is recorded in *jayshi* dinars; a hypothetical unit of account that is approximately equal to 13.3/20 dinars (Borsch, 2005). Although these estimates come from a later period, they can be arguably used as a proxy for *actual* tax revenues under the early Arab Caliphate, because tax valuations were sticky over time. First, village-level correlation between *'ibra* per unit of taxable land in 1375 and 1477 is 0.92, although a century had elapsed between the two cadasters. Furthermore, village-level data on taxable area in 1375 and 1477 come from the earlier 1315 cadaster (whose *'ibra* data did not survive) and were not updated. Second, state valuations were based on village past actual tax revenues according to the last cadaster; these cadasters (and their updates) were exceedingly rare, though, taking place once every century, due to their high cost.[45]

Religiosity of tax authorities Our main regressor is the religiosity of local tax authorities, which we proxy for at the *kura* level 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 extent of penetration of Arabs (Muslims) into the

44. Al-Nabulusi reports village-level data for *Fayum* under the Ayyubids (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 from this source (Cahen, 1956).

45. Ramzi (1954) lists only 5 cadasters (*rawk*) that took place in Egypt between 641 and 1315 in the following years: 729, 869, 1079, 1177, and 1298. Tax papyri belong to the first three cadasters.

local tax administration of each *kura*. In *kuras* where Arabs settled, they replaced local Coptic elites as large landholders, tax administrators, and *kura* headmen (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.[46] Figure C.1 shows the locations of Arab tribes. Arabs were more likely to settle in eastern and western Nile Delta than in central Delta, and in the northern Nile Valley than in the south.

Control variables We control for Copt religiosity and income before 641, as suggested by our model. As a proxy for Copt religiosity, we use a dummy variable that takes value 1 if it is believed, according to Coptic traditions, that a village was visited by the Holy Family during its legendary biblical flight to Egypt. The list of villages that lie on this 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. We still prefer to include it as a control variable for two reasons. First, the invention of the route likely reflected pre-Islamic local traditions of religious prominence of certain locations, due to their saints and martyrs or their biblical mentions. Second, even if (part of) the route was invented after 641, this variable is, despite its caveats, the only measure that we are aware of in the historical literature that can capture Copt religiosity at the local level. As a proxy for Copt income, we employ the natural logarithm 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 during the Roman period). Using urbanization as a proxy for income is standard in the economic history literature, since urban populations were richer on average.

46. We are not able to use the standardized 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 *not* representative of *kuras* outside Cairo.

4.2.2 Empirical strategy

We first examine the effects on tax rates and conversions of religiosity of tax authorities (Arab settlement), controlling for Copt religiosity and income. We estimate a separate regression for each outcome.[47] We first treat Arab settlement as exogenous, and estimate the following regressions using Ordinary Least Squares (OLS):

$$conversions_{vk} = \beta_0^1 + \beta_1^1 settlement_k + X_k\beta_2^1 + \epsilon_{vk}^1 \tag{5}$$

$$tax_{ik} = \beta_0^2 + \beta_1^2 settlement_k + X_k\beta_2^2 + \epsilon_{ik}^2 \tag{6}$$

$$taxrevenues_{vk} = \beta_0^3 + \beta_1^3 settlement_k + X_k\beta_2^3 + \epsilon_{vk}^3 \tag{7}$$

where $conversions_{vk}$ is a dummy variable that takes value 1 if there was not any Coptic church or monastery circa 1200 in village v in *kura* k; tax_{ik} is the poll or *kharaj* tax in dinars paid by individual i in *kura* k in 641-1100, $taxrevenues_{vk}$ is state valuations of total tax revenues per unit of taxable land in 1375. The main regressor is $settlement_k$; a dummy variable that takes value 1 if at least one Arab tribe settled in *kura* k between 700 and 969. The vector X_k includes: (1) a dummy variable indicating if *kura* k (village v in the conversions regression) is believed to be visited by the Holy Family during its biblical flight to Egypt, and (2) the logarithm of urban population of *kura* k circa 300.

Standard errors are clustered at the *kura* level, the level of aggregation of our main regressor, Arab settlement. However, since the number of *kuras* (clusters) with poll and *kharaj* tax papyri is only 4, this may bias the standard errors downwards in equation (6). This is less of a concern though in equations (5) and (7), where we have all 42 *kuras*. Unfortunately, we are not able to correct for the few clusters bias by the adjustments that are suggested in the literature, because Arab settlement does *not* vary among taxpayers within *kuras*. But in order to estimate the size of the (downward) bias, we also report standard errors clustered at the (lower) district level (thus, more clusters) in equations (5) and (7), and White-Huber robust standard errors in equation (6). As predicted by the literature, these alternative standard errors are mostly bigger than those clustered at

47. We do not estimate a system of simultaneous equations that allows for correlation of error terms across equations, because each equation is estimated using a different sample.

the *kura* level, but in most cases the coefficients retain their statistical significance.

The identification assumption in the OLS regressions is that the cross-*kura* variation in Arab settlement is exogenous to baseline characteristics of *kuras*, which may be driving both conversions and taxation. This assumption may be violated due to (1) reverse causality: Arab settlers may have chosen areas with higher taxes or larger convert populations, and (2) omitted variables: Arab tribes may have settled due to other unobservable pre-641 characteristics of *kuras* that can also account for variation in conversions and taxes, such as availability of grazing land. To mitigate this concern, we employ an instrumental variable (IV) strategy, where we predict Arab settlement in the first stage from the following regression:

$$\begin{aligned} settlement_k = \; & \alpha_0 + \alpha_1 DistancetoArish_k + \alpha_2 BorderDesert_k \\ & + \alpha_3 (DistancetoArish_k \times BorderDesert_k) + X_k \alpha_4 + v_k \end{aligned} \tag{8}$$

where $DistancetoArish_k$ is *kura*'s distance to *Arish*, a town in Sinai 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 (Arab conquest was by land); $BorderDesert_k$ is a dummy variable that equals 1 if a *kura* borders desert land, which includes all *kuras* in eastern and western Delta and the Nile Valley. While we are able to use both variables and their interaction term as IVs in equations (5) and (7), where we observe all 42 *kuras*, we are only able to use $DistancetoArish_k$ as an IV (and without the vector X_k) in equation (6), due to the small number of *kuras*. Online Appendix Figure C.1 reveals that Arabs were more likely to settle in *kuras* closer to both *Arish* and desert land. For one, proximity to *Arish* largely determined the extent to which Arabs were willing to travel, although there were exceptions to this rule.[48] For another, Arabs preferred *kuras* that bordered desert land, where they could practice hunting and horse riding, in addition to having a similar environment to the Arab peninsula (Al-Barri, 1992, pp. 56-57). For this reason, *kuras* in central Delta were less attractive to Arabs.

We argue that both distance to *Arish* and bordering desert are valid IVs. They are both exogenous, because they are determined by geography. And they arguably satisfy the exclusion restriction; proximity to *Arish*, a small border town, and bordering desert land, are each unlikely to be correlated with other characteristics of *kuras*, if we control for Copt income and religiosity.

48. Regardless of distance to *'Arish*, Arabs were more likely to settle closer to frontier towns such as *Aswan* in the south and Alexandria in the north. Arabs were more likely to settle in western Delta than in central Delta, which is closer to *'Arish*, arguably due to its proximity to desert land.

4.2.3 Findings

Conversions We start with analyzing the effects of religiosity of local tax authorities on conversions. Table 2 shows that villages located in *kuras* that received Arab tribes in 700-969 were less likely to have at least one Coptic church or monastery in 1200 by 8 percentage points (10% of average probability), compared to *kuras* where Coptic elites remained in power. Since all *kuras* were (almost) 100 percent Copt before 641, the finding suggests that *kuras* where Arabs settled witnessed relatively more conversions to Islam between 641 and 1200. Although Arab settlers had a mechanical effect on Islamization (Arabs were Muslims), historical evidence suggests that Arab immigration to Egypt was tiny relative to the Coptic population (Saleh, 2018). 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 column (4) and using an IV strategy in column (5) both yields similar results; the first-stage regression in column (6) yields strong predictions (F-statistic >10). We interpret the positive effect of Arab settlement on conversions as consistent with the model (Table 1). The theory is indeterminate, however, with respect to the effects of Copt religiosity and income, and so our findings neither confirm nor infirm the model.[49] Finally, to evaluate the representativeness (or lack thereof) of *kuras* with poll and *kharaj* tax papyri, we estimated the effects on conversions in 1200 within these *kuras* only. We obtain similar results to the full sample (Online Appendix Table C.3).

Discriminatory tax The results on poll tax per person in 641-1100 are shown in columns (1)-(5) of Table 3. Within the 4 *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 (25% of average poll tax), than those in *Qahqawa* where Arabs did not settle and Coptic elites remained in charge of tax administration. Furthermore, we find that taxpayers in *kuras* that lied on

49. Estimating the effects on conversions in 1500, measured using Al-Maqrizi (1500)'s list of Coptic churches and monasteries, yields similar results but the effects of Arab settlement are weaker (Online Appendix Table C.1). This is likely because (a) Arabs were no longer tax administrators under the Mamluk state (1250-1517), as fiscal administration was transferred to tax contractors who were mostly military leaders; in fact Arab settlement subsided since the ninth century as they lost their privilege as a military aristocracy to Turks, and (b) conversions between 1200 and 1500 were driven by causes other than taxation (and religiosity of local tax authorities), including Mamluk state persecution of Copts.

the legendary route of the Holy Family, and thus had more religious Coptic populations, paid 25% more of the average poll tax obligation. Taxpayers in more urbanized *kuras* (measured circa 300) also paid a higher poll tax by 0.13 dinar (11% of the average poll tax). 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* (although distance to *Arish* does not strongly predict Arab settlement; F-statistic <10). We interpret the positive coefficients on Arab settlement and the Holy Family route as consistent with the predictions of the model in Table 1. The theory is indeterminate though with respect to the effect of Copt income on the discriminatory tax, and hence the finding of a positive coefficient on urbanization does not confirm or infirm the model predictions.

Uniform tax The results on *kharaj* tax per person in 641-1100 are shown in columns (6)-(10) of Table 3. These results must be interpreted with caution since *kharaj* is measured per person, and not per unit of land. Thus, any effects are attributable to cross-*kura* variation in both *kharaj* rate per unit of land *and* distribution of landholdings. Assuming that landholding distribution is constant across the 4 *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* per person by 0.7 dinar (32% of average *kharaj*). We interpret this result as consistent with the model prediction 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 0.8 dinars more in *kharaj* tax (39% of average *kharaj*), and that *kuras* that were more urbanized during the Roman period paid a higher *kharaj* tax by 0.3 dinar (15% of average *kharaj*). However, the theory is indeterminate with respect to these two effects (unless we impose further assumptions), and so we do not interpret the effects of Copt income and religiosity, as confirming or infirming the model predictions. When we include all three regressors in the same regression in column (9), the coefficients on Arab settlement and the Holy

Table 2 – **Religiosity of tax authorities and conversions to Islam**
Dependent variable = 1 if no Coptic church or monastery in village in 1200

	OLS				IV Second Stage	IV First Stage
	(1)	(2)	(3)	(4)	(5)	(6)
=1 if Arab settlement in *kura* in 700-969	0.082			0.077	0.115	
	(0.033)**			(0.033)**	(0.058)**	
	[0.031]**			[0.032]**	[0.049]**	
=1 if village on Holy Family route		-0.597		-0.600	-0.599	0.056
		(0.081)***		(0.080)***	(0.078)***	(0.076)
		[0.078]***		[0.078]***	[0.077]***	[0.068]
Log (urban population) in *kura* circa 300			0.022	0.016	0.011	0.090
			(0.026)	(0.029)	(0.028)	(0.043)**
			[0.028]	[0.029]	[0.028]	[0.045]**
Kura's Distance to *Arish* (km)						0.015
						(0.005)***
						[0.004]***
=1 if *kura* borders desert						4.836
						(1.204)***
						[0.896]***
=1 if borders desert × Dist. *Arish*						-0.017
						(0.005)***
						[0.004]***
Obs (villages)	1817	1817	1817	1817	1817	1817
Clusters (*kuras*)	42	42	42	42	42	42
Clusters (districts)	75	75	75	75	75	75
R^2	0.01	0.03	0.00	0.04		
KP Wald F-stat					(16.89)	
					[21.80]	
Mean dep. var.	0.84	0.84	0.84	0.84	0.84	0.75

Notes: Robust standard errors clustered at the *kura* level are in parentheses and at the district level in brackets. * p <0.10, ** p <0.05, *** p <0.01. A constant is included in all regressions.
Source: Village-level data on Coptic churches and monasteries constructed from Abul-Makarim (1200).

Family route retain their magnitude and statistical significance, but the coefficient on urbanization becomes negative. Using distance to *Arish* as an IV for Arab settlement yields qualitatively similar results as the OLS estimate, but the IV is a weak predictor of settlement, which results in large standard errors in the second stage. Finally, we note that if *kharaj* per person captures cross-*kura* variation in landholding distribution, rather than tax rate per unit of land, it will serve as a proxy for wealth of landholders. In this case, the results would suggest that richer *kuras* were more likely to attract Arab settlers, to lie on the Holy Family route, and to have a larger urban population circa 300.

Table 3 – **Religiosity of tax authorities and tax rates in 641-1100**

	Poll tax in dinars per person					*Kharaj* tax in dinars per person				
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) IV	(6) OLS	(7) OLS	(8) OLS	(9) OLS	(10) IV
=1 if Arab settlement in 700-969	0.290			0.214	0.285	0.656			0.726	0.306
	(0.004)***			(0.000)***	(0.005)***	(0.168)**			(0.000)***	(0.355)
	[0.133]**			[0.960]	[0.123]**	[0.276]**			[0.529]	[0.292]
=1 if *kura* on Holy Family route		0.285		0.007			0.780		1.215	
		(0.010)***		(0.000)***			(0.022)***		(0.000)***	
		[0.139]**		[0.346]			[0.298]***		[0.530]**	
Log (urban population) circa 300			0.131	0.032				0.298	-0.518	
			(0.003)***	(0.000)***				(0.057)**	(0.000)***	
			[0.062]**	[0.515]				[0.126]**	[0.187]***	
Obs (individuals)	408	408	408	408	408	451	451	451	451	451
Clusters (*kuras*)	4	4	4	4	4	4	4	4	4	4
R^2	0.01	0.01	0.01	0.01		0.01	0.02	0.02	0.02	
KP Wald F-stat					(8.53)					(3.34)
					[190.84]					[36.90]
Mean dep. var.	1.14	1.14	1.14	1.14	1.14	2.02	2.02	2.02	2.02	2.02

Notes: Standard errors clustered at the *kura* level are in parentheses; White-Huber robust standard errors are in brackets. + p <0.15, * p <0.10, ** p <0.05, *** p <0.01. First-stage regression of column (5) is $\hat{settlement}_k = constant + -0.009 \quad (0.003)^{***} \quad [0.001]^{***} \quad DistancetoArish$, and of column (10) is $\hat{settlement}_k = constant - 0.007 \quad (0.004)^{*} \quad [0.001]^{***} \quad DistancetoArish$. A constant is included in all regressions.
Source: Individual-level poll and *kharaj* tax payments in 641-1100 from Greek and Arabic papyri in Morimoto (1981, pp. 67-79, 85-87) and the Arabic Papyrology Database. Sample is restricted to tax payments in papyri with a known *kura*. We excluded 4 *kuras* with < 4 *kharaj* observations, and we dropped 9 outlier *kharaj* payments (> 15 dinars per person) in *Ashmunayn*.

Total tax revenues Given the limitations of the tax papyri evidence, we introduce additional evidence on the effects on state valuations of village total tax revenues (*'ibra*) per taxable *feddan* in 1375, which are observed for all 42 *kuras*. Table 4 shows the results.[50] As we discussed in Section 4.2.1, although coming from a later period, these valuations were based on past actual tax revenues, and can thus be used as a proxy for actual total tax revenues under the early Arab Caliphate. We find no association between Arab settlement in 700-969 and total tax revenues per unit of taxable land. The coefficient of Arab settlement is both small in magnitude relative to the mean and statistically insignificant. This suggests that the land tax was used to offset fluctuations in poll tax revenues. Being on the Holy Family route and urbanization during the Roman period both have positive and statistically significant effects on total tax revenue per unit of taxable land.

Table 4 – **Religiosity of tax authorities and total tax revenues**
Dependent variable: State valuation of total tax revenues per unit of land in 1375

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	-0.093			-0.195	-0.398
	(0.311)			(0.314)	(0.376)
	[0.281]			[0.288]	[0.321]
=1 if village on Holy Family route		0.975		0.874	0.874
		(0.436)**		(0.449)*	(0.450)*
		[1.073]*		[0.414]**	[0.413]**
Log (urban population) in *kura* circa 300			0.418	0.431	0.460
			(0.282)+	(0.284)+	(0.292)+
			[0.250]*	[0.250]*	[0.257]*
Obs (villages)	1543	1539	1543	1539	1539
Clusters (*kuras*)	40	40	40	40	40
Clusters (districts)	71	73	71	71	71
R^2	0.00	0.00	0.01	0.01	
KP Wald F-stat					(16.29)
					[20.64]
Mean dep. var.	3.45	3.45	3.45	3.45	3.45

Notes: Standard errors clustered at the *kura* level are in parentheses and at the district level in brackets. * p <0.10, ** p <0.05, *** p <0.01. State valuation of village tax worth (*'ibra*) is in *jayshi* dinars (≈13.3/20 dinars) per *feddan* (= 6,368 square meters) of taxable land. A constant is included in all regressions.
Source: Village-level data on *'ibra* per *feddan* from the 1375 cadastral survey in Ibn-Al-Jay'an (1477).

50. Results for total tax revenues in 1477 are similar (Online Appendix Table C.2).

Discussion The econometric evidence is broadly consistent with the model. Religiosity of tax authorities, as captured by Arab settlement in 700-969, has positive and statistically significant effects on poll tax and conversions. Using the model's notation, ruler religiosity in *kura* 1 that received Arab settlers (e.g., *Ashmunayn*) is greater than in *kura* 2 that did not (e.g., *Qahqawa*), *ceteris paribus*: $V_1'(\theta^*)>V_2'(\theta^*)$. The difference in discriminatory tax revenues per capita between *kuras* 1 and 2 is $R(\tau_1)-R(\tau_2)=\tau_1[1-F(\tau_1)]-\tau_2[1-F(\tau_2)]$. Evaluating this difference using the predicted values of Copt population share and poll tax from the IV regression results in Tables 2 and 3 yields: $[1.36\times(1-0.87)]-[(1.07\times(1-0.75)]=-0.09$. This implies that the optimal poll tax lied on the wrong side of the Laffer curve; *kura* 1, where Arab settlers imposed a higher poll tax, had *lower* poll tax revenues per capita by 0.09 dinar (9% relative to the average), due to more extensive conversions among its Coptic population.[51] The positive effect of Arab settlement on *kharaj* tax per person suggests that tax authorities compensated for the decline in poll tax revenues by taxing Muslims more heavily, although the effects are attributable to differences in both landholding distribution and *kharaj* per unit of land; our IV estimates in Table 3 suggest that $\lambda_1 L_1-\lambda_2 L_2=2.24-1.94=0.3$, where L is average landholding per person in *kura*. To mitigate the caveat that we do not observe *kharaj* per unit of taxable land, we further examine the effect of religiosity of tax authorities on estimated total tax revenues per unit of taxable land in 1375. We observe no effect, suggesting that local tax authorities employed the uniform tax to compensate for changes in discriminatory tax revenues in order to meet a fixed budgetary need. Notice that this null result rules out an alternative interpretation of Arab settlement that postulates that state capacity in tax collection was higher in *kuras* where Arabs settled. If higher state capacity is what drives the positive effects of Arab settlement on both poll and *kharaj* taxes in Table 3, we should observe a positive effect on total tax revenues as well, which is not what we find. Finally, as predicted by the model, we document that Copt religiosity, measured by the legendary route of the Holy Family, has a positive and statistically significant impact on the poll tax rate. However, the theory is indeterminate with respect to (a) the effects of Copt religiosity on *kharaj* tax and conversions, and (b) the effects of Copt income, and hence

51. Extrapolating the findings to the continuous case, the elasticity of discriminatory tax revenues per capita with respect to tax authorities' religiosity is: $\frac{V'(\theta^*)}{R(\tau)}\times\frac{\partial R(\tau)}{\partial V'(\theta^*)}=\frac{V'(\theta^*)}{\tau[1-F(\tau)]}\times\frac{\partial\tau[1-F(\tau)]}{\partial V'(\theta^*)}=\frac{V'(\theta^*)}{\tau[1-F(\tau)]}\times\{\frac{\partial\tau}{\partial V'(\theta^*)}\times[1-F(\tau)]+\frac{\partial[1-F(\tau)]}{\partial V'(\theta^*)}\times\tau\}$. Evaluating this elasticity using the IV point estimates in Tables 2 and 3 at the sample means of Arab settlement, poll tax, and Copt population share yields: $\frac{0.75}{1.14\times0.16}\times\{0.29\times0.16+(-0.12)\times1.14\}=-0.37$.

our empirical findings on these effects do not confirm or infirm the model predictions.

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 (Online Appendix Figures A.2, A.3, and A.4). However, there is an *observable* outcome of (arguably) great historical significance that our model can help explain: the Caliphate-wide tax reform of 750 that increased the (uniform) land tax rate on Muslim landholders from the *ushr* to *kharaj* rate, and that removed all treaty-based upper ceilings on *kharaj* that (presumably) existed in certain conquered territories including Egypt. Our model explains this fiscal policy change by an increase in Caliph religiosity and/or budgetary needs, and/or by a decrease in the threat of rebellion and/or reduced uncertainty about Caliphte 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 assess whether 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 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 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).[52] 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). Conceptually, *uncertainty about Caliphate rule* reflects an *external* threat to the Caliphate (outside Egypt) that can alter Egypt's taxpayers' beliefs about

52. Since the numbers of religious and secular buildings are both standardized, the measure controls for the size effect.

the persistence of Muslim rule, whereas the *threat of rebellion* reflects an *internal* threat (within Egypt) that makes taxpayers more likely to rebel in a given year. Nevertheless, it is empirically difficult to disentangle the two variables since an (external) threat to the Caliphate such as a civil war may induce Egyptians to rebel since it weakens the Caliphate's power over its territories. We thus employ three proxies for both variables and are agnostic about which of the two variables is captured by these proxies: (1) the yearly number of major military battles that were 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 Caliphate tenure (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), as taxpayers were presumably more likely to rebel if economic conditions were adverse. [53] We acknowledge that Nile shocks may also capture (the marginal utility of) income, though, since the Nile level determined Egypt's aggregate agricultural output.

4.3.2 Findings

Caliph religiosity Figure C.3 in the Online Appendix shows the evolution of our proxies of Caliph 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 (the standardized number of) 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 C.4 in the Online Appendix 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

53. We are grateful to Roberto Galbiati for his suggestions in this regard.

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 rule and threat of rebellion Figure C.5 in the Online Appendix shows our three proxies of the uncertainty about Caliphate 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. Third, by contrast, Nile shocks do not show a change in trend before and after 750. Thus, based on this proxy we fail to find evidence that the uncertainty about Muslim rule and the threat of rebellion (and economic conditions) declined during the eighth century. Overall, these findings suggest that uncertainty about Caliphate rule and the threat of rebellion of Egyptian taxpayers both declined due to exogenous factors during the eighth century. According to our model, this decrease may account for the tax reform of 750. As foreign attacks on the Caliphate and major civil wars both declined, Egyptian taxpayers believed less in the possibility of the fall of the Caliphate rule, and their threat of rebellion declined. The Abbasids thus dared to increase the uniform tax. Historical evidence suggests that the tax reform was delayed, taking place in 750 instead of 641, because it took more than a century for converts to become a significant share of the population (Sijpesteijn, 2013).

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 daring 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 (Figure C.6 in the Online Appendix), the Abbasids eventually managed to suppress these revolts by violence, and thus kept the new tax system.

5 Conclusion

The paper made two contributions. It first developed a simple model of optimal one-shot and repeated taxation/extraction by a government or a corporation that trades off its hostility towards a group's identity and its reluctance to let exile, conversions or quits erode the contribution base. It provided a set of comparative-statics results (summarized in Table 1) on how discriminatory and non-discriminatory taxes and the erosion of the contribution base are impacted by the ruler's and the governed's identity preferences and marginal utilities of money. Changes in these explanatory variables as well as uncertainty about the ruler's tenure generate interesting fiscal and identity dynamics. The paper identified which results are sensitive to being on the wrong side of the Laffer curve. Finally, it noted that the permanent loss of identity suppresses one's incentive to rebel, and showed that the threat of rebellion against fiscal extraction peters out over time, even when those who have altered their identity stay in the constituency (as is the case for religious conversions).

The second contribution is empirical/historical. The paper considered one particular historical event, the incentivized conversion of Egyptian Copts following the Arab conquest in the 7^{th} century. While the historical context that we considered was most likely similar throughout the whole Arab Caliphate that spanned the current-day Middle East and North Africa region, we focused on Egypt because its dry-climate Nile Valley preserved the best data source on taxation under the early Arab Caliphate, the tax papyri. Building on novel data sources, including tax papyri in 641-1100, data on churches and monasteries in 1200, and proxies for religiosity of tax authorities, and Copt religiosity and marginal utility of income, we first provided local-level evidence, showing that enforcer religiosity increased conversions and both the discriminatory and non-discriminatory taxes, suggesting taxation on the wrong side of the Laffer curve. The discriminatory tax increased with Copt religiosity, as predicted. Then, using proxies for Caliph religiosity, budget needs, uncertainty about Muslim tenure, and threat of rebellion, the country-level evidence allowed us to shed some light on factors that may have triggered the Caliphate-wide 750 tax reform lifting the cap on the non-discriminatory tax. The evidence comes in favor of a reduced threat of rebellion/ higher expected Muslim tenure and against an increase in Caliph religiosity or budgetary needs as drivers of the tax reform. Understanding the determinants of this reform matters not only for its historical significance,

but more importantly because the literature mostly treats Islamic taxation as "Islamic," exogenous, and ahistorical, in the sense that it has always existed since the beginning of Islam. To the best of our knowledge, our paper is a first attempt to endogenize, both theoretically and empirically, a major "Islamic" institution.

The theory can in principle be tested in a variety of historical environments where a discriminatory tax was used to induce taxpayers to change their identity by adopting that of the ruling group, and where the optimal mix of discriminatory and uniform taxes evolved in response to changes in taxpayers' identity composition. Examples of religion-based taxes abound Before Arabs, Romans introduced a poll tax from which citizens were exempted, and eventually Roman citizenship became universal. Jews were taxed throughout European history, starting with Roman Emperor Vespasian's Fiscus Judaicus in the first century CE and lasting in many parts of Europe until the 18^{th} or 19^{th} century During the Reformation, conversion of German cities from Catholicism to Protestantism was partly induced by German rulers' promise to Catholics that they could avoid paying the tithe to the Catholic church once they convert to Protestantism (an option that did not exist before), making it relatively cheaper to switch to Protestantism. And interestingly, the state subsequently introduced a uniform "secular" tax on converted Protestant cities.

In modern economies, taxes can be targeted less explicitly toward unwanted populations. For instance, the 1942 one-off Varlik Vergisi (wealth) tax in Turkey was imposed on all citizens' fixed assets, such as land, buildings, 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, and led to their exodus (Artunc and Agir, 2017). Finally, while the optimal intervention for the ruler is a tax in our paper, it may take other forms in different environments. Communist countries used membership of Communist Party (a form of "conversion") to screen citizens for positions. Local and national governments' policies with respect to the provision of local public goods for migrants (training, housing, bureaucratic hassle, intolerance toward harassment...) would be equally worth of empirical investigation.

While the empirical evidence we presented in the paper is broadly consistent with the theoretical predictions, we also issued a number of caveats associated with data limitations inherent to this historical period, namely the extremely small number of districts where tax papyri survived, and our inability to observe changes in taxation and conversions over

time at a frequency high enough to permit a rigorous econometric analysis. We therefore view this paper as a first step toward further empirical and theoretical studies of optimal taxation with time-persistent status changes and their implications for the tax structure and the dynamics of ruler's legitimacy. We hope that it will stimulate empirical work building on other data sets, which will allow more structural estimations. We leave these promising alleys for research to future work.

References

Abu-Yusuf (1979). *Kitab al-kharaj (The Book of Land Tax)*. Dar Al-Ma'rifa, Beirut.

Abu-Zahw, F. H. M. (2012). *Majalis al-lahw fi qusur al-khulafa' fil 'asr al-'abbasi al-awwal (Literary and Music Parties at Caliphs' Palaces during the First Abbasid Period)*. PhD thesis, Al-Najah Al-Wataniya University, Nablus.

Abul-Makarim (1984 [1200]). *tarikh al-kana'is wal adyera (History of Churches and Monasteries)*. Dar-Al-Na'am, Cairo. Anba-Samuel (Ed.).

Acemoglu, D. (2006). Modeling Inefficient Institutions. In Blundell, R., Newey, W., and Persson, T., editors, *Advances in Economic Theory, Proceeding of World Congress 2005*. Cambridge University Press, Cambridge. Chapter 9.

Agapius (1910). Kitab al-'unvan. Histoire universelle écrite par Agapius (Mahboub) de Menbidj. Seconde partie. In Vasiliev, A., editor, *Patrologia Orientalis VIII*. Firmin-Didot et Cie, Paris. pp. 399-547.

Al-Barri, A. K. (1992). *al-qaba'il al-'arabiya fi misr fil qurun al-thalatha al-ula lil hijra (Arab Tribes in Egypt in the First Three Hijri Centuries)*. Egyptian General Book Authority, Cairo.

Al-Maqrizi (2002 [1500]). *al-mawa'iz wal i'tibar fi zhikr al-khitat wal athar (Sermons and Considerations in Examining Plans and Monuments)*, volume 4.1. Al-Furqan Islamic Heritage Foundation, London. A. F. Sayyid (Ed.).

Al-Qadi Al-Nu'man (1963). *da'aim Al-Islam (Foundations of Islam)*, volume 1. Dar Al-Ma'arif, Cairo. A. I. A. Faydi (Ed.).

Al-Qalqashandi (1914). *subh al-a'asha fi kitabat al'insaa' (The Blind's Light in Writing Composition)*, volume 3. Al-Matba'a Al-Amiriya, Cairo.

Anba-Bishoy, P. (1999). *The Flight of the Holy Family to Egypt*. Nubar Printing House, Cairo.

Artunc, C. and Agir, S. (2017). The Wealth Tax of 1942 and the Disappearance of Non-Muslim Enterprises in Turkey. mimeo.

Barro, R. J. and McCleary, R. M. (2003). Religion and Economic Growth across Countries. *American Sociological Review*, 68(5):760–781.

Becker, C. H. (1902). *Beiträge zur Geschichte Ägyptens unter dem Islam*. Verlag Von Karl J. Trübner, Strasbourg.

Becker, G. S. (1957). *The Economics of Discrimination*. University of Chicago Press, Chicago.

Becker, S. O. and Woessmann, L. (2009). Was Weber Wrong? A Human Capital Theory of Protestant Economic History. *Quarterly Journal of Economics*, 124(2):531–596.

Bell, H. I. (1910). *Greek Papyri in the British Museum: Catalogue with Texts*, volume IV: The Aphrodito Papyri. London.

Belloc, M., Drago, F., and Galbiati, R. (2016). Earthquakes, Religion and Transition to Self-Government in Italian Cities. *Quarterly Journal of Economics*, 131:1875–1926.

Besley, T., Jensen, A., and Persson, T. (2017). Norms, Enforcement, and Tax Evasion. mimeo.

Borsch, S. J. (2005). *The Black Death in Egypt and England: A Comparative Study*. University of Texas Press, Austin, TX.

Botticini, M. and Eckstein, Z. (2005). Jewish Occupational Selection: Education, Restrictions, or Minorities? *Journal of Economic History*, 65(4):922–948.

Bénabou, R. and Tirole, J. (2006). Incentives and Prosocial Behavior. *American Economic Review*, 96(5):1652–1678.

Bénabou, R. and Tirole, J. (2013). Laws and Norms. mimeo.

Cahen, C. (1956). Le Régime des Impôts dans le Fayyūm Ayyūbide. *Arabica*, 3(1):8–30.

Chaney, E. (2013). Revolt on the Nile: Economic shocks, religion, and political power. *Econometrica*, 81:2033–2053.

Chaudhary, L. and Rubin, J. (2011). Reading, Writing, and Religion: Institutions and Human Capital Formation. *Journal of Comparative Economics*, 39(1):17–33.

Chen, D. (2017). The Deterrent Effect of the Death Penalty? Evidence from British Commutations during World War I. mimeo.

Courbage, Y. and Fargues, P. (1997). *Christians and Jews under Islam*. I. B. Tauris Publishers, London-New York. J. Mabro (Tr.).

Dennett, D. C. (1950). *Conversion and the Poll Tax in Early Islam*. Harvard University Press, Cambridge, MA.

Dewatripont, M. and Roland, G. (1992). Economic Reform and Dynamic Political Constraints. *Review of Economic Studies*, 59:703–730.

Diamond, P. (2006). Optimal Tax Treatment of Private Contributions for Public Goods with and without Warm Glow Preferences. *Journal of Public Economics*, 90:897–919.

Farhi, E. and Werning, I. (2010). Progressive Estate Taxation. *Quarterly Journal of Economics*, 125(2):635–673.

Fleurbaey, M. and Maniquet, F. (2011). *A Theory of Fairness and Social Welfare*. Cambridge University Press, Cambridge.

Frantz-Murphy, G. (2004). Conversion in Early Islamic Egypt: The Economic Factor. In Conrad, L., editor, *Muslims and Others in Early Islamic Society*. Ashgate, Burlington, VA.

Gabra, G. (2001). *Be Thou There: The Holy Family's Journey in Egypt*. American University in Cairo Press, Cairo.

Glaeser, E. (2005). The Political Economy of Hatred. *Quarterly Journal of Economics*, 120(1):45–86.

Glaeser, E. and Shleifer, A. (2005). The curley effect. *Journal of Law, Economics, and Organization*, 21:1–19.

Goitein, S. (1963). Evidence on the Muslim Poll Tax from Non-Muslim Sources: A Geniza Study. *Journal of the Economic and Social History of the Orient*, 6(3):278–295.

Greif, A. (1994). Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies. *Journal of Political Economy*, 102(5):912–950.

Greif, A. and Tadelis, S. (2010). A Theory of Moral Persistence: Crypto-Morality and Political Legitimacy. *Journal of Comparative Economics*, 38(3):229–244.

Grohmann, A. (1932). Aperçu de Papyrologie Arabe. *Etudes de papyrologie*, 1:23–95.

Ibn-Abdul-Hakam (1974). *Futuhat misr wa akhbaruha (Conquest of Egypt and its History)*. Mu'assasat Dar Al-Ta'awun, Cairo.

Ibn-Al-Jay'an (1898 [1477]). *al-tuhfa al-sanneya bi asmaa' al-bilad al-misriya (The Treasure Book of Names of Egyptian Localities)*. Al-Matba'a Al-Ahliya, Cairo.

Ibn-Mamati (1991). *qawanin al-dawawin (Laws of Administration)*. Madbuli Library, Cairo. A. S. Atiya (Ed.).

Jia, R. and Persson, T. (2017). Ethnicity in Children and Mixed Marriages: Theory and Evidence from China. mimeo.

Kaplow, L. (1995). A Note on Subsidizing Gifts. *Journal of Public Economics*, 58:469–477.

Kennedy, H. (2013). *The Armies of the Caliphs: Military and Society in the Early Islamic State*. Routledge, London and New York.

Kuran, T. (2004). Why the Middle East is Economically Underdeveloped: Historical Mechanisms of Institutional Stagnation. *Journal of Economic Perspectives*, 18(3):71–90.

Kuran, T. (2012). *The Long Divergence: How Islamic Law Held Back the Middle East*. Princeton University Press, Princeton.

Michalopoulos, S., Naghavi, A., and Prarolo, G. (2017). Trade and Geography in the Spread of Islam. *Economic Journal*. forthcoming.

Mikaberidze, A. (2011). *Conflict and Conquest in the Islamic World: A Historical Encyclopedia [2 volumes]: A Historical Encyclopedia*. ABC-CLIO, Santa Barbara, CA.

Mingana, A. (1931). Vision of Theophilus. In *Woodbrooke Studies*, volume 3, pages 1–92. W. Heffer and Sons Limited, Cambridge.

Morimoto, K. (1981). *The Fiscal Administration of Egypt in the Early Islamic Period*. Dohosha, Kyoto.

Moser, P., Voena, A., and Waldinger, F. (2014). German-Jewish Emigres and US Invention. *American Economic Review*, 104:3222–3255.

O'Donoghue, T. and Rabin, M. (2006). Optimal sin taxes. *Journal of Public Economics*, 90:1825–1849.

Rabie, H. (1972). *The Financial System of Egypt: AH 564-741/AD 1169-1341*. Oxford University Press, Oxford.

Ramzi, M. (1994 [1954]). *al-qamus al-gughrafi lil bilad al-misriya min 'ahd qudama' al-misriyin ila sanat 1945 (Geographic Dictionary of Egyptian Localities from the Time of Ancient Egyptians to 1945)*. Egyptian General Book Authority, Cairo.

Riley, J. and Zeckhauser, R. (1983). Optimal Selling Strategies: When to Haggle, When to Hold Firm. *Quarterly Journal of Economics*, 98:267–287.

Rubin, J. (2017). *Rulers, Religion, and Riches: Why the West got rich and the Middle East did not*. Cambridge University Press, Cambridge.

Saez, E. and Stantcheva, S. (2016). Generalized Social Welfare Weights for Optimal Tax Theory. *American Economic Review*, 106(1):24–45.

Saleh, M. (2018). On the Road to Heaven: Taxation, Conversions, and the Coptic-Muslim Socioeconomic Gap in Medieval Egypt. *Journal of Economic History*, 78(2):394–434.

Sijpesteijn, P. M. (2009). Landholding Patterns in Early Islamic Egypt. *Journal of Agrarian Change*, 9(1):120–133.

Sijpesteijn, P. M. (2013). *Shaping a Muslim State: The World of a Mid-Eighth-Century Egyptian Official*. Oxford University Press, Oxford.

Simonsen, J. B. (1988). *Studies in the Genesis and Early Development of the Caliphal Taxation System: With Special References to Circumstances in the Arab Peninsula, Egypt and Palestine*. Akademisk Forlag, Copenhagen.

Sirhan, J. (1978). *Al-musamara wal munadama 'ind al-'arab hatta al-qarn al-rabi' al-hijri (The Boon-Companionship in the Arab World until the 4th Century A.H.))*. PhD thesis, American University of Beirut, Beirut.

Stokey, N. (1979). Rational Expectations and Durable Goods Pricing. *Bell Journal of Economics*, 12:112–128.

Tirole, J. (2016). From Bottom of the Barrel to Cream of the Crop: Sequential Screening with Positive Selection. *Econometrica*, 84(4):1291–1343.

Wellhausen, J. (1927 [1902]). *The Arab Kingdom and its Fall*. University of Calcutta, Calcutta. M. G. Weir (Tr.).

Wilson, A. (2011). City Sizes and Urbanization in the Roman Empire. In Bowman, A. and Wilson, A., editors, *Settlement, Urbanization, and Population*, pages 161–195. Oxford University Press, Oxford.

Online Appendix

A Historical Background: Taxes and conversions

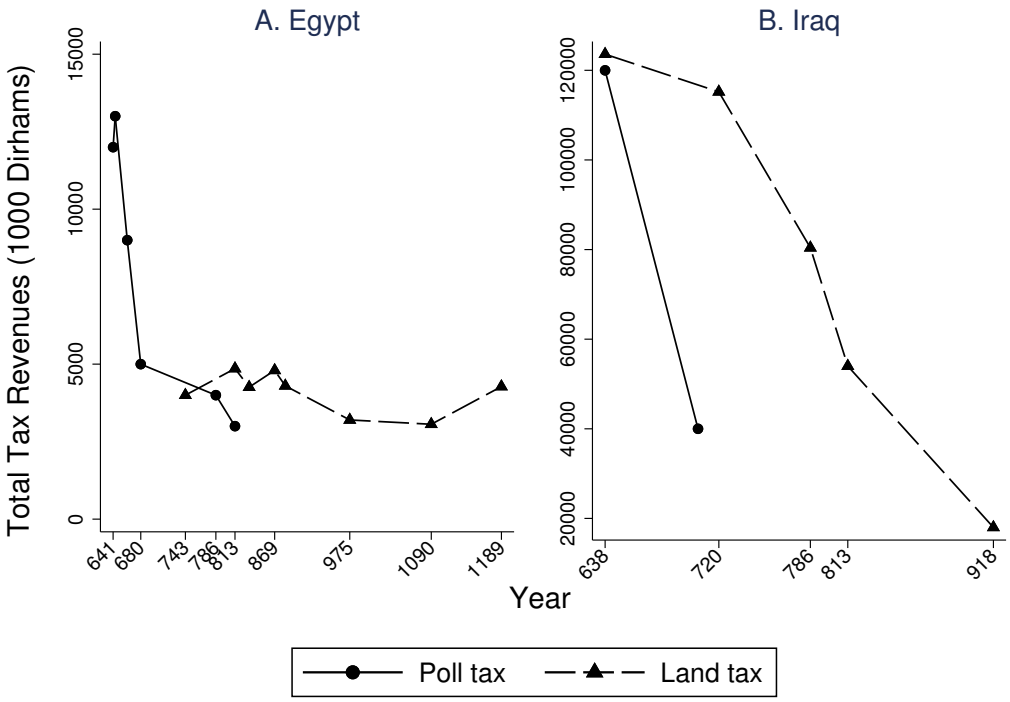

Figure A.1 – **Total poll and land tax revenues in 638-1189**

Source: Courbage and Fargues (1997).

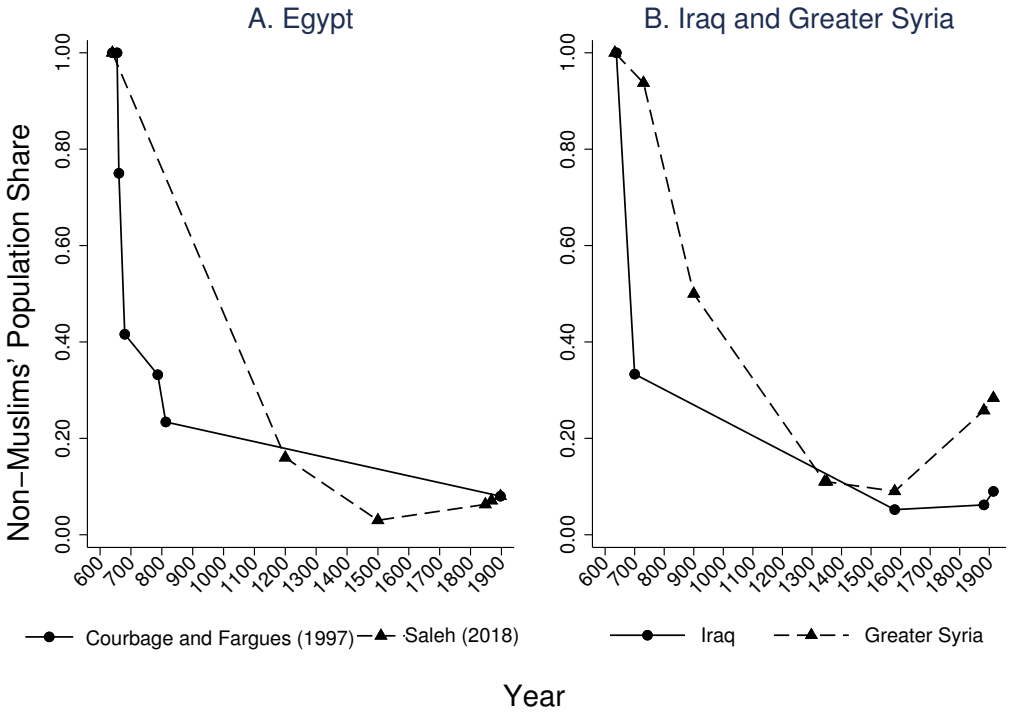

Figure A.2 – **Non-Muslims' population share in 632-1914**

Sources: Courbage and Fargues (1997) and Saleh (2018).

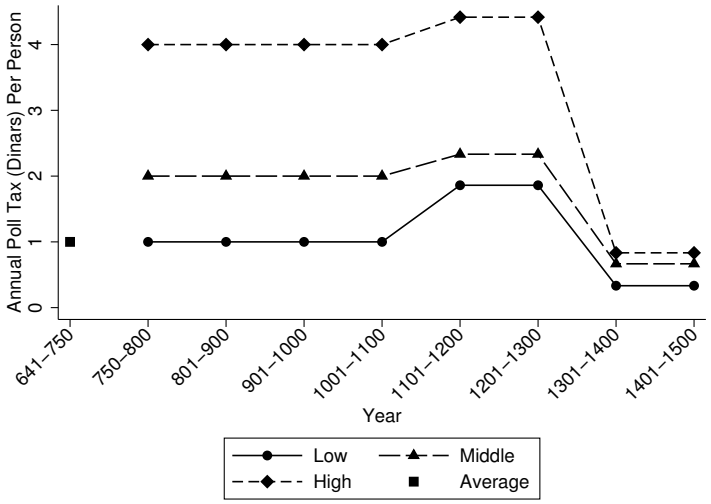

Figure A.3 – ***De jure*** **nominal annual poll tax rate per person in 641-1500**

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).

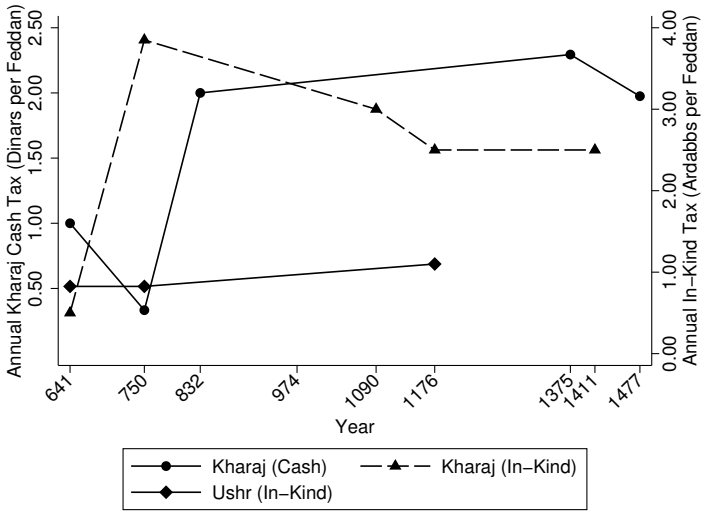

Figure A.4 – ***De jure kharaj* and *ushr* land taxes in 641-1477**

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).

B Theory

B.1 Discrimination through non-price instruments

Consider for instance *racial slurs*. Suppose that the ruler or the majority group has some intrinsic increasing utility $V(s)$ from slur level s. Let $1/\theta$ denote the sensitivity to slurs of minority member $\theta \in (0, \infty)$; normalizing the migration cost to 1, type θ migrates if and only if $\theta \leq \theta^* = s$. Suppose that there are n_1 members of the favored group and n_2 members of the disfavored one, and that public good B is financed through a non-discriminatory tax. Then the tax levied on the disfavored group is $R(\theta^*) = \frac{n_2[1-F(\theta^*)]}{n_1+n_2[1-F(\theta^*)]}$ and so the utility of a ruler who stands only for the majority interests is $W(\theta^*) = V(\theta^*) + R(\theta^*) - B$. Note that the optimal policy always lies on the wrong side of the Laffer curve ($R'(\theta^*)<0$), which is natural since "taxing" the minority through slurs (or violence) brings no revenue.

Next consider *patronage*. Suppose that for each civil service job opening, there are both a majority and a minority candidates. The ruler takes a minority member if and only if her quality advantage is $\theta \geq \theta^*>0$. Let $V(\theta^*)$ denote the patronage benefit for

the majority, an increasing function. The quality of public goods, expressed in monetary terms, is $R(\theta^*)$, a decreasing function. If for instance all citizens must compensate a poor quality of public services by an equivalent increase in private expenditures, then the ruler's welfare, $V(\theta^*) + R(\theta^*)$, can be decomposed into the familiar two terms. Again, the optimal policy always lies on the wrong side of the Laffer curve.

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

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

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 (B.1) 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 (B.1) is equal to

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

B.2 Proofs

Proof of Proposition 7 Let us first assume that in the static model the marginal rebel is a convert, and so the land tax is constrained to be such that $\lambda = \hat{\lambda}$ where $\hat{\lambda}+\hat{\theta} = \rho$ (see proposition 4). Suppose that at date 1 the Muslim ruler sets taxes $\lambda_1 = \hat{\lambda}$ and $\tau_1 = \hat{\tau}$ such that $\hat{\lambda} + R(\hat{\tau}) = B$ and $\hat{\lambda} + \hat{\tau} = \rho$. 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 and therefore are unaffected by an increase in the poll tax. So there is overall 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

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

Because $\lambda_2 > \lambda_1$, $R(\tau_2) < R(\tau_1)$ and so $\tau_2 > \tau_1$ if the optimal tax $\hat{\tau}$ is on the wrong side of the Laffer curve. 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 $F(\theta^*) - F(\hat{\theta})$. When the optimal tax is on the correct side of the Laffer curve, the relaxation of the rebellion constraint also would allow the ruler to raise the non-discriminatory tax, which would enable reducing the discriminatory one (as $R' > 0$). However, the apostasy constraint ($\theta_2^* \geq \theta_1^*$) implies that there is no point reducing the pool tax; so an optimal tax is $\tau_2 = \tau_1$ and $\lambda_2 = \lambda_1$ (the outcome is the same as in the static context).

Next, suppose that the marginal rebel is a non-convert in the static model and so the marginal revel is still affected by both taxes at date 2. 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. The same holds if the optimal tax is on the correct side of the Laffer curve. ■

Proof of Corollary 1 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 $\lambda_2 = \min\{\lambda^*, \rho\}$.[54] ■

54. 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 $\theta \leq \hat{\theta} = \tau_1 < \tau_2$.

C Empirics

Table C.1 – **Religiosity of tax authorities and conversions to Islam**
Dependent variable = 1 if no Coptic church or monastery in village in 1500

	OLS				IV Second Stage	IV First Stage
	(1)	(2)	(3)	(4)	(5)	(6)
=1 if Arab settlement in *kura* in 700-969	0.034			0.035	0.032	
	(0.025)			(0.022)$^{+}$	(0.023)	
	[0.018]*			[0.017]**	[0.019]*	
=1 if village on Holy Family route		-0.310		-0.309	-0.309	0.056
		(0.072)***		(0.073)***	(0.072)***	(0.076)
		[0.088]***		[0.088]***	[0.087]***	[0.068]
Log (urban population) in *kura* circa 300			-0.002	-0.004	-0.004	0.090
			(0.010)	(0.008)	(0.009)	(0.043)**
			[0.010]	[0.008]	[0.009]	[0.045]**
Kura's Distance to *Arish* (km)						0.015
						(0.005)***
						[0.004]***
=1 if *kura* borders desert						4.836
						(1.204)***
						[0.896]***
=1 if borders desert × Dist. *Arish*						-0.017
						(0.005)***
						[0.004]***
Obs (villages)	1817	1817	1817	1817	1817	1817
Clusters (*kuras*)	42	42	42	42	42	42
Clusters (districts)	75	75	75	75	75	75
R^2	0.01	0.05	0.00	0.06		
KP Wald F-stat					(16.89)	
					[21.80]	
Mean dep. var.	0.97	0.97	0.97	0.97	0.97	0.75

Notes: Robust standard errors clustered at the *kura* level are in parentheses and at the district level in brackets. * p <0.10, ** p <0.05, *** p <0.01. A constant is included in all regressions.
Source: Village-level data on Coptic churches and monasteries in 1500 constructed from Al-Maqrizi (1500).

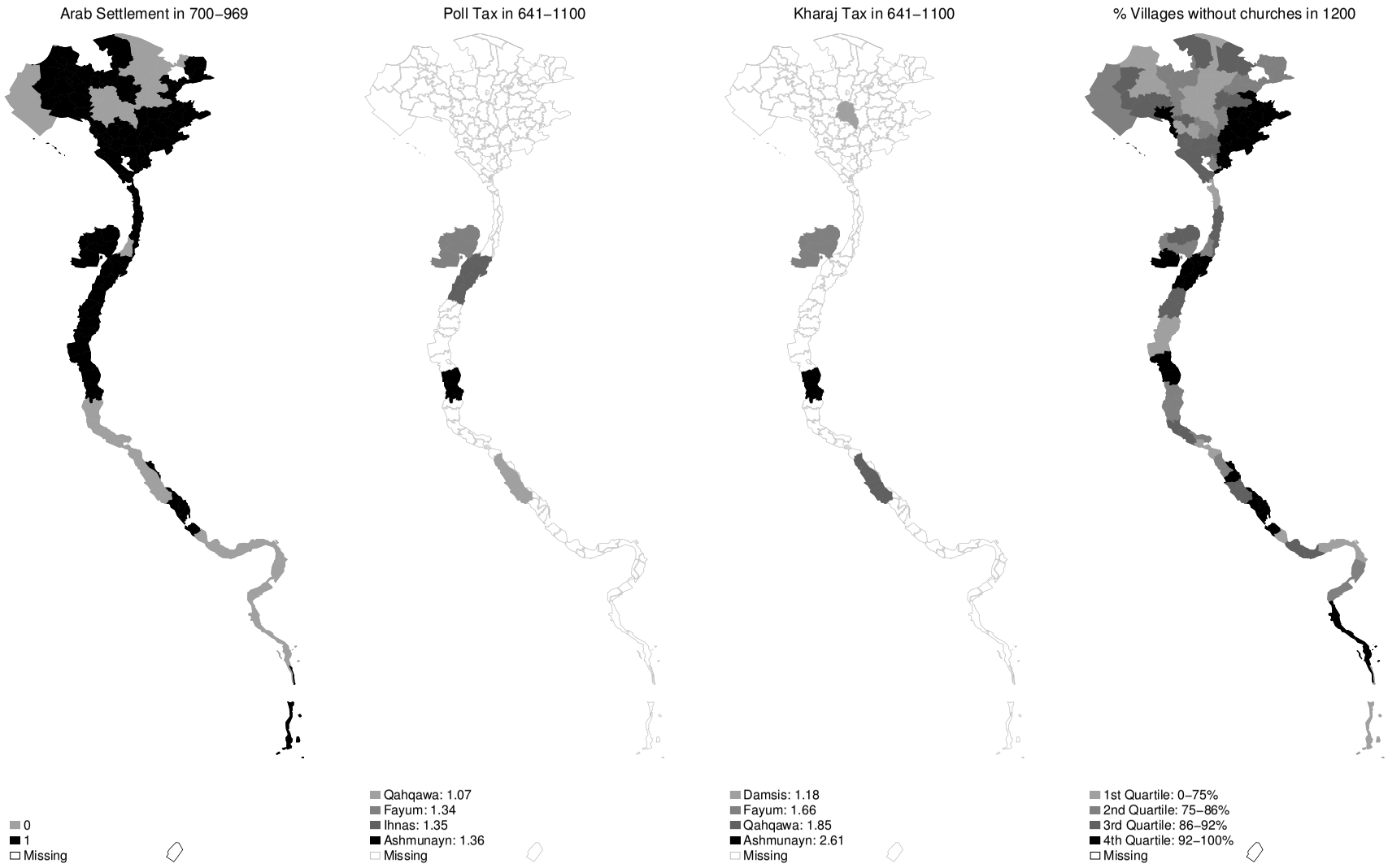

Figure C.1 – Spatial heterogeneity in Arab settlement, taxation, and conversions

Notes: Arab settlement =1 if at least one Arab tribe settled in a *kura* between 700 and 969; poll and *kharaj* taxes are the *kura*-level average tax payment in dinars per person in 641-1100; % Villages without churches is the percentage of villages in a district that did not have any Coptic church or monastery in 1200. Nile Delta refers to the Northern triangle on the map, while the Nile Valley extends all the way down from the south of Delta.
Sources: Arab settlement: Al-Barri (1992); poll and *kharaj* taxes: Morimoto (1981, pp. 67-79, 85-87) and the Arabic Papyrology Database; Coptic churches and monasteries: Abul-Makarim (1200).

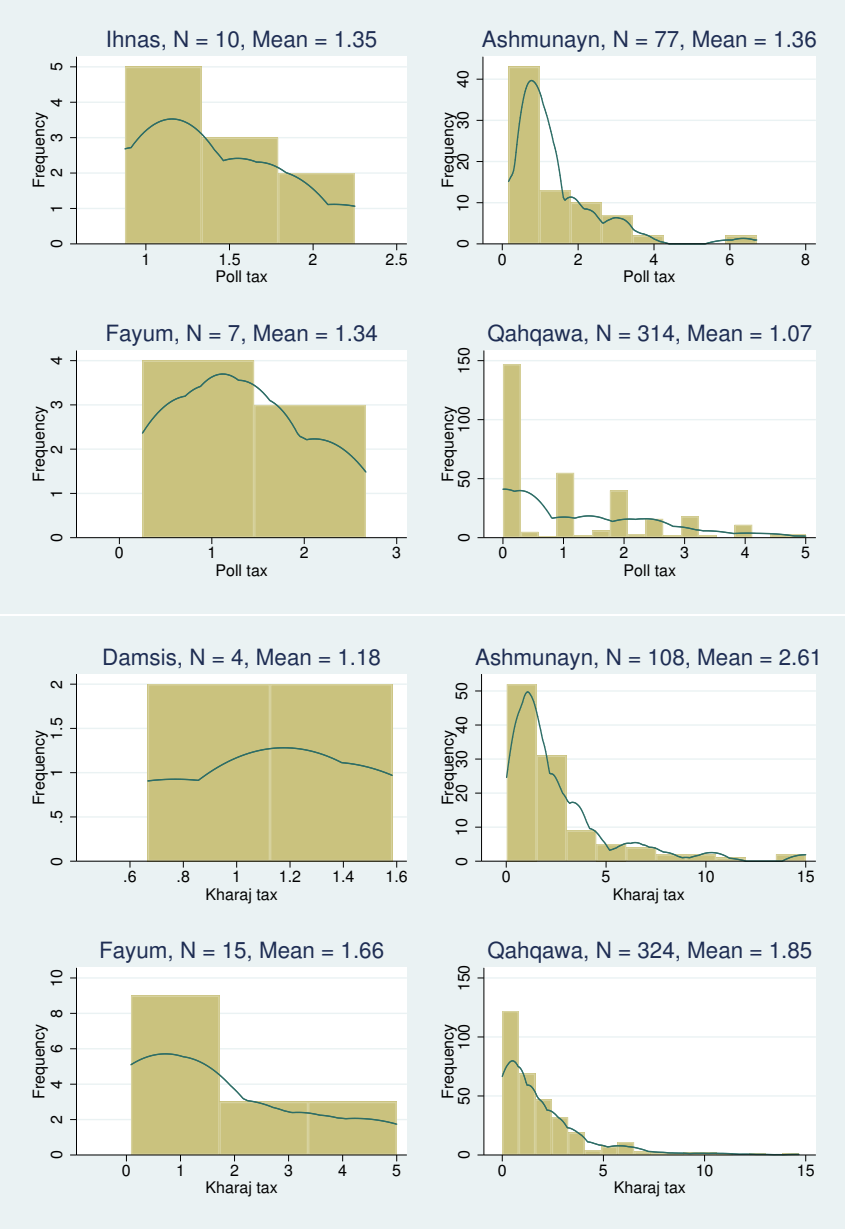

Figure C.2 – **Histogram of poll and *kharaj* tax rates by *kura* in 641-1100**

Notes:

1. Arab settlement is equal to 1 in *Ihnas*, *Ashmunayn*, and *Fayum* and equal to 0 in *Damsis* and *Qahqawa*.
2. Date ranges of poll tax payments are 701-900 in *Ihnas*, 731-1100 in *Ashmunayn*, 641-1005 in *Fayum*, and 703-733 in *Qahqawa*.
3. Date ranges of *kharaj* tax payments are 801-1100 in *Ashmunayn*, 641-1100 in *Fayum*, and 703-733 in *Qahqawa*.

Source: Individual-level poll and *kharaj* tax payments in 641-1100 from Greek and Arabic papyri in Morimoto (1981, pp. 67-79, 85-87) and the Arabic Papyrology Database. Sample is restricted to tax payments in papyri with a known *kura*.

Table C.2 – **Religiosity of tax authorities and total tax revenues**
Dependent variable: State valuation of total tax revenues per unit of taxable land in 1477

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
=1 if Arab settlement in *kura* in 700-969	-0.021			-0.089	-0.238
	(0.267)			(0.268)	(0.333)
	[0.228]			[0.234]	[0.282]
=1 if village on Holy Family route		0.489		0.420	0.420
		(0.454)		(0.467)	(0.466)
		[1.125]		[0.462]	[0.462]
Log (urban population) in *kura* circa 300			0.286	0.290	0.311
			(0.288)	(0.295)	(0.300)
			[0.248]	[0.253]	[0.256]
Obs (villages)	1543	1539	1543	1539	1539
Clusters (*kuras*)	40	40	40	40	40
Clusters (districts)	71	73	71	71	71
R^2	0.00	0.00	0.00	0.00	
KP Wald F-stat					(16.29)
					[20.64]
Mean dep. var.	2.97	2.97	2.97	2.97	2.97

Notes: Standard errors clustered at the *kura* level are in parentheses and at the district level in brackets. * p <0.10, ** p <0.05, *** p <0.01. State valuation of village tax worth (*'ibra*) is in *jayshi* dinars (≈13.3/20 dinars) per *feddan* (= 1.038 acres) of taxable land. A constant is included in all regressions. Source: Village-level data on *'ibra* per *feddan* in 1477 constructed from Ibn-Al-Jay'an (1477).

Table C.3 – **Religiosity of tax authorities and conversions to Islam in *kuras* with tax papyri**

Dependent variable = 1 if no Coptic church or monastery in village in 1200

	Kuras with poll tax papyri					*Kuras* with *kharaj* tax papyri				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
=1 if Arab settlement in *kura* in 700-969	0.152			0.278	0.327	0.224			0.345	0.252
	(0.024)***			(0.122)$^{+}$	(0.227)$^{+}$	(0.032)***			(0.088)**	(0.068)***
	[0.086]$^{+}$			[0.148]*	[0.214]$^{+}$	[0.058]***			[0.140]**	[0.110]**
=1 if village on Holy Family route		-0.506		-0.499			-0.549		-0.629	
		(0.186)*		(0.195)*			(0.083)***		(0.027)***	
		[0.171]**		[0.170]**			[0.054]***		[0.028]***	
Log (urban population) in *kura* circa 300			0.044	-0.063				0.128	-0.069	
			(0.048)	(0.061)				(0.048)*	(0.068)	
			[0.061]	[0.074]				[0.047]**	[0.083]	
Obs (villages)	196	196	196	196	196	193	193	193	193	193
Clusters (*kuras*)	4	4	4	4	4	4	4	4	4	4
Clusters (districts)	11	11	11	11	11	10	10	10	10	10
R^2	0.01	0.07	0.00	0.08		0.07	0.04	0.05	0.12	
KP Wald F-stat					(1.09)					(1.86)
					[2.98]					[5.11]
Mean dep. var.	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Notes: Robust standard errors clustered at the *kura* level are in parentheses and at the district level in brackets. * p <0.10, ** p <0.05, *** p <0.01. A constant is included in all regressions.

Source: Village-level data on Coptic churches and monasteries in 1200 constructed from Abul-Makarim (1200). Sample is restricted to *kuras* with tax papyri.

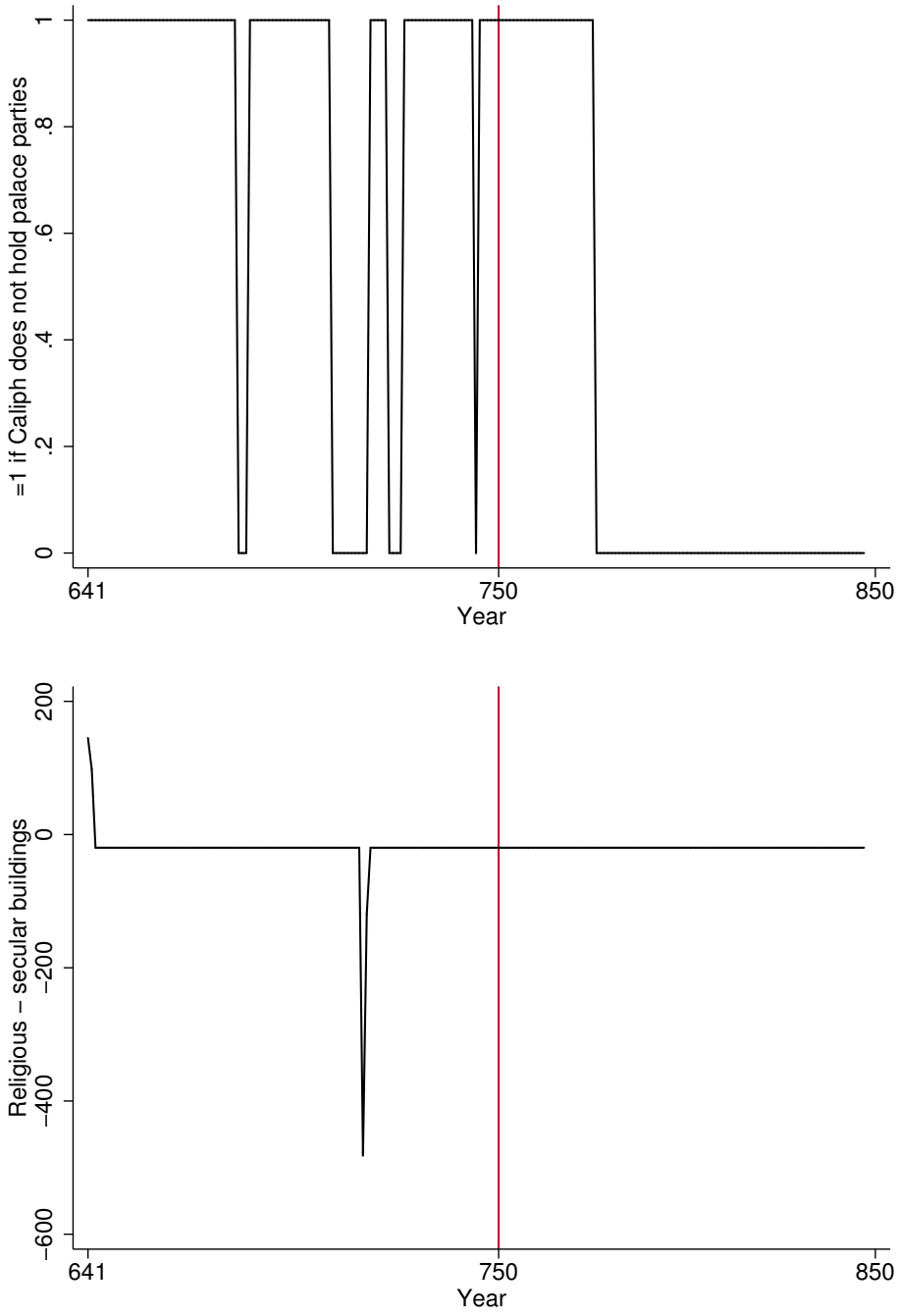

Figure C.3 – **Caliphs' religiosity in 641-847**

Source: See text.

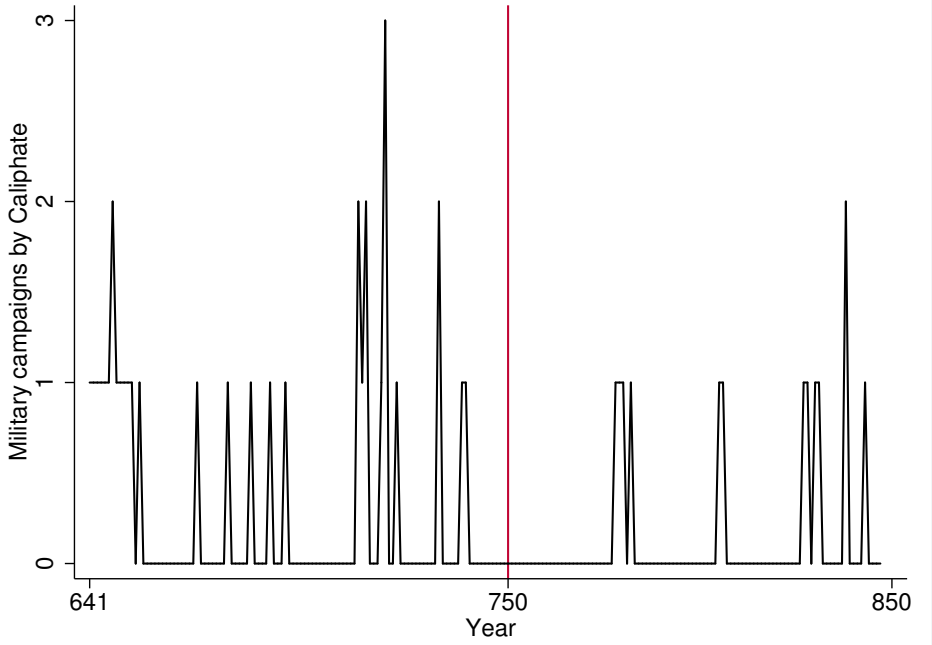

Figure C.4 – **Caliphate's budgetary needs in 641-847**

Source: See text.

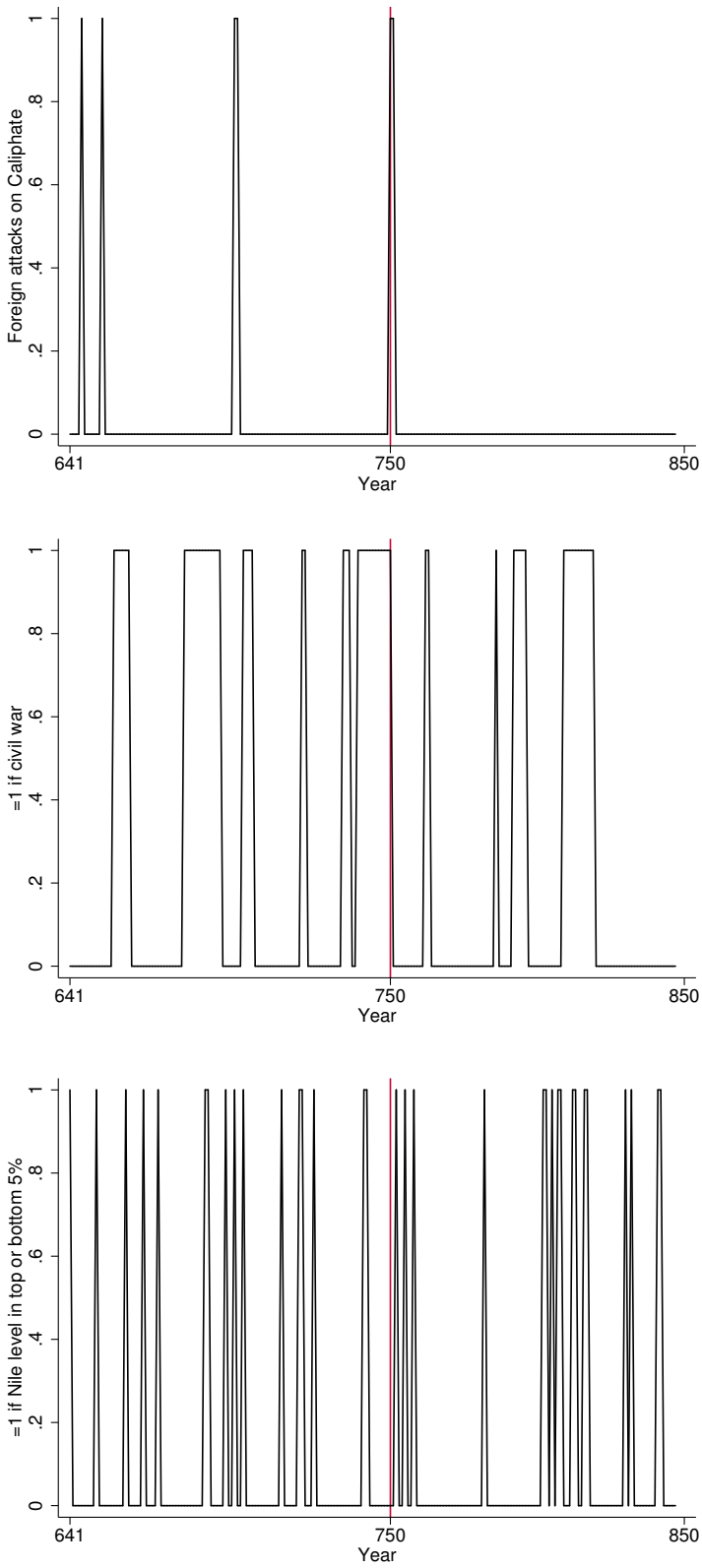

Figure C.5 – **Uncertainty about Caliphate's rule and threat of rebellion in 641-847**

Source: See text.

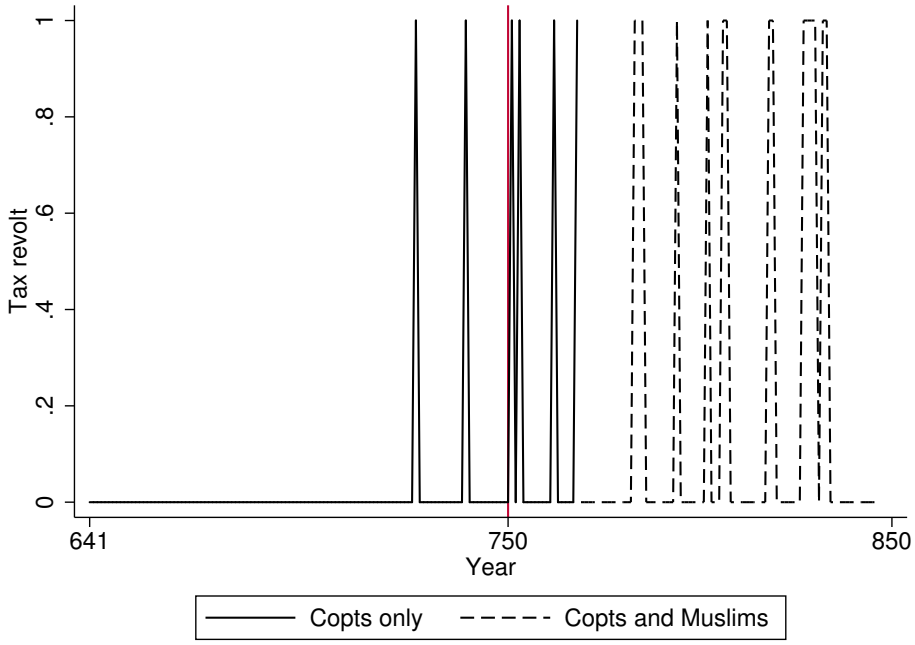

Figure C.6 – **Egypt's tax revolts in 641-847**

Source: See text.