Muslims and Minorities: Religion and City Growth in the Ottoman Empire

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Preliminary: Please do not distribute.

Abstract

Using a dataset of population estimates of cities in the period 1600 to 1910, this paper examines the relationship between the religious composition of Ottoman cities' populations and their economic performances. From 1800, cities with higher proportions of Christians and Jews grew quicker than others, a reversal of the trend between 1600 and 1800. Results from instrumental variable regressions are broadly similar to OLS estimates, suggesting the effect is causal. As such, it was only in the final years of the Empire that religious diversity brought an economic advantage to cities. This break in trends in 1800 is difficult to reconcile with explanations of Muslims' economic under-performance which revolve around limitations of Islamic law (e.g Kuran 2011), which were largely overcome in the mid-nineteenth century.

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1 Introduction

The "rise of the West" (McNeill, 1992) in the later half of the second millennium was in relation to the Muslim world a reversal of fortunes. In the 10th century and perhaps as late as the 13th (Kuran, 1997), the Muslim world was more economically and scientifically advanced than Christendom. It is a matter of debate by which date the West had gained a decisive advantage[1], but that it eventually did is clear. It has been long observed that, whilst the Middle Eastern economy as a whole stagnated (at least in relative terms), the region's religious minorities (Christians and Jews) came, by the 19th century, to dominate both its commercial and financial activities. This, perhaps, added credence to the idea that what "went wrong" (Lewis, 2001) for the Middle East was to do with Islam itself, helping justify an Orientalist view which saw Muslims as suffering from a "fundamental incapacity for trade, commerce and economic rationality" (Said, 2007).

More convincingly, Kuran (2004) has related the difference in economic outcomes between the Ottoman Empire's Muslims and religious minorities to Sharia, Islam's legal code. The Ottoman Empire, which from 1300 began to occupy the area commonly understood as the Middle East, inherited a system of legal pluralism known as the Millet system (Abu Jaber, 1967). This system gave Christians and Jews a choice of legal jurisdictions — *dhimmi* (a convenient Arabic term translated as 'non-Muslim(s)') could arbitrate their disputes in Christian or Jewish communal courts according to their religious affiliation. In addition, capitulations (agreements between the Ottoman Empire and European states) meant that dhimmi could become protégés of foreign powers and in doing use consular courts applying Western law. Around the turn of the 19th century rapidly increasing numbers did so (Kuran, 2010, p.201). In light of this essentially pluralistic legal system, that dhimmi came to dominate trade and finance can be seen as evidence that Sharia limited opportunities for Muslims and thus, perhaps, was responsible for "holding back the Middle East" (Kuran, 2010).

Citing a lack of aggregate statistics, Kuran uses somewhat piecemeal data from judicial and trade records to demonstrate the "ascent of religious minorities" (Kuran, 2004) and to argue that the timing thereof coincided with the West's commercial transformation in the 18th and 19th centuries. It was at only at this point, Kuran argues, that Sharia started to impinge on economic opportunities — in particular, the continued simplicity of business partnerships kept "enterprises

[1] For example, Pomeranz (2001) espouses the revisionist view that it was not until the 18th century that the divergence began.

small and ephemeral" which "inhibited economic modernisation in the Middle East" (Kuran, 2003).

This paper aims to provide a systematic empirical examination of the economic effects of religious affiliation in the Ottoman Empire, and in doing so provides a test of parts of Kuran's argument. In particular, I examine sizes of Ottoman cities in the period 1600-1910; city sizes, I argue in section 3, are a reasonable proxy of general economic development. I exploit the variation in religious composition across cities to look for a causal impact of religious affiliation on cities' growths. I find economically and statistically significant effects which indicate that cities with a higher proportion of dhimmi residents grew quicker from around 1800 onwards. There is no evidence however that suggests that cities with higher dhimmi population shares were more economically productive before the turn of the 19th century. I thus conclude, as per Kuran, that the ascent of religious minorities was indeed a late phenomenon. As such, I provide evidence against earlier explanations of dhimmi's success including western favouritism of minorities, Muslim's supposed cultural aversion to commerce or reluctance to engage in borrowing/lending at interest, which fail to account for this timing (Kuran, 2004, p.483).

Intriguingly, I find no evidence that the *Tanzimat* reforms, which beginning in 1839 gradually diminished the role of Sharia, giving Muslims access to a French-inspired commercial code in 1850, did anything to suppress this rise: by 1910 the impact of dhimmi population share on city sizes is at its most significant, both economically and statistically. That the marginalisation of Sharia did nothing to improve the lot of more predominantly Muslim cities could be interpreted as suggesting that it was not Sharia which was responsible for their initial disadvantage after all. In section 7 I argue that this interpretation would be premature, and provide a number of ways in which the data could be reconciled with the hypothesis that Sharia provided Muslims with an economic disadvantage after the turn of the 19th century. I would however tentatively suggest that the effects of Tanzimat (or lack thereof) should receive more attention in any explanations that attribute the economic ascent of dhimmi, or the relative economic descent of the Middle East more generally, to Sharia.

I have constructed a dataset consisting of population estimates of 48 Ottoman cities. Figure 1 provides an illustrative impression of the "ascent of minorities" by comparing the evolution in city sizes between those cities with a dhimmi population share exceeding the median and the rest of the sample. Between 1800 and 1910 dhimmi-rich cities grew quicker than their dhimmi-poor counterparts — both overall and between each time period. In section 4 I use regressions in a generalised difference-in-difference framework to control for various other variables that, due to correlation with cities' dhimmi population shares, could account for the pattern shown in Figure 1. In sections 5 and 6 I attempt to account for the distribution of religious minorities throughout the cities and show instrumental variable regressions which go some way to allaying concerns about reverse causality.

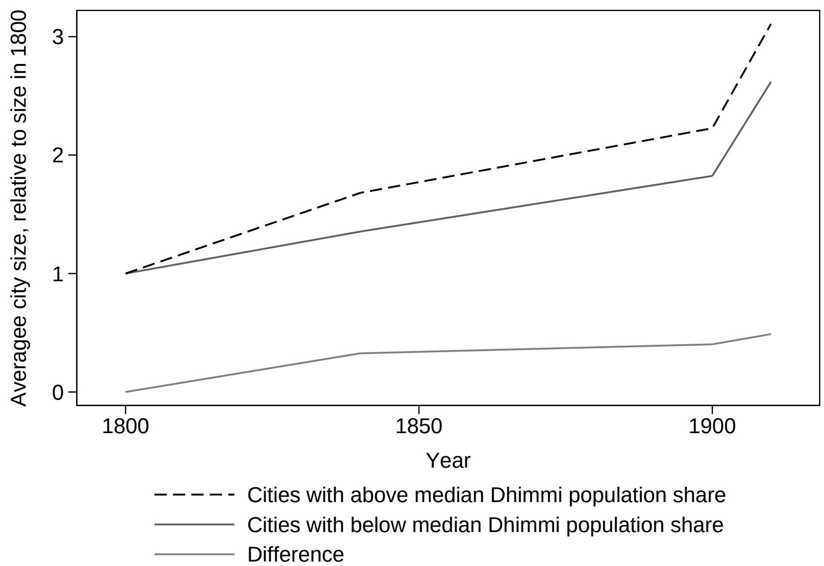

Figure 1: Growth of cities after 1800

Kuran (1997) summarises a literature which looks at the impact of Islam, but not specifically Islamic law, on historical economic outcomes. More recently Rubin (2011) argues that the interplay between political and religious power prohibited the Middle East from overcoming interest restrictions and limited interpersonal exchange; compared to Christendom, the relationship between political and religious authority was undermined much later and institutions developed accordingly. In empirically investigating economic effects of Islam this paper follows cross country studies including that of Barro and McCleary (2003), who find that economic growth is negatively correlated with the share of a countries population which reports itself as being Muslim.[2] In looking for an effect of religion on city sizes, taken to proxy for economic development, it follows Cantoni (2010). Whilst that paper investigates a hypothesis that relates religiously transmitted

[2]There is no reason to believe the results presented in this paper have any validity outside the unique institutional context from which they likely derive.

culture to economic outcomes, this paper investigates a hypothesis that relates religious law to economic outcomes. As such, it also relates to a large strand of literature which attributes variations in economic outcomes to variations in legal systems. La Porta et al. (2008) provides a review of this literature — a literature which has largely ignored Sharia, despite its historical status as one of the world's major legal systems.

2 Historical background

2.1 Sharia and progress

Sharia (literally "path") is Islam's legal code, derived predominantly from the Qur'an (the word of God as revealed to Muhammad) and the Sunna (the exemplary practices of Muhammad).[3] The code concerns itself with matters both secular and religious, temporal and spiritual, governing the lives of Muslims in terms of their relationship with God, their neighbours and a state applying Sharia principles. As such, it regulates (or, at least, regulated) Muslims' contracts and commercial activity, including a well known prohibition on riba (interest or usury). Sharia was first systematised in the late 8th and early 9th centuries, resulting in legal texts based on the Qur'an and Sunna. Various schools of law emerged (both Sunni and Shia), including the Hanafi school, whose principles the Ottoman state adhered to, even whilst allowing judges to follow other schools of jurisprudence.[4]

The argument that Sharia restricted progress is by far from recent. Rifa'a Badawi Al-Tahtawi, who between 1826 and 1831 served as an Imam (religious leader) of an educational mission in Paris, documented on his return to Egypt what he considered France's advancements in technology, science and political institutions. He concluded that "it [is] necessary to adapt [...] Sharia to new circumstances" (Hourani, 1983). In a series of papers, Timur Kuran has recently revisited the theme.Kuran (2003) argues that it was Sharia's restrictions on organisational forms that were decisive — in particular, Sharia never evolved the concepts of joint-stock incorporation or legal personhood, and the extent of limited liability mechanisms was minimal[5], concepts that from the

[3] I am grateful to for comments received from an acquaintance who is knowledgeable on the nature and history of Sharia.

[4] In addition, and either in accordance with Sharia or concerning matters not within its scope, a customary law known as the Kanun developed through promulgation by the Sultans. This dealt with state institutions and the imposition of taxes, amongst other things.

[5] Hillman (1997) describes two liability limiting mechanisms in early Islamic law. The first was a "licensed

late 18th century were increasingly put to use in the West and by the Ottoman Empire's dhimmi traders.

2.2 The Ottoman Empire and religious diversity

The Ottoman Empire existed between 1390 and 1922, emerging from a small chiefdom in the north-west of Anatolia and surviving until its partition by Entente Powers after the end of the First World War, the Empire having allied with the Central Powers through the Turco-German Alliance. A series of wars in the Empire's formative years saw it expand in all directions, taking in the Balkans, eastern European states, Maghreb and the Arab lands. The area that came to be occupied by the Ottomans was ethnically and religiously heterogeneous, and remained so throughout the Ottoman period. So although the Empire's ruling dynasty descended from Oguz Turks, who had converted to Sunni Islam in the tenth century, and whose early Sultans included the honorific Ghazi ("victorious soldier of Islam") in their official titles, Islam was not the essence of the Ottoman Empire. Large numbers of Greek Christians joined the empire's military during its expansion, and Christianity remained the majority religion in Greece and the Balkans after their conquests. There were sizeable Jewish and Armenian and Greek Christian communities in cities in the Anatolian heartland as well as the Arab provinces. Meanwhile, in predominantly Christian areas, the Muslim population was significant.[6] In the eyes of one historian, the Ottoman empire was a "multi-ethnic, multi-religious enterprise that relied on inclusion for its success" (Quataert, 2005, p.2).

2.3 Economic performance of religious minorities

Kuran (2004) provides numerous examples demonstrating the dhimmi domination of trade and finance towards the end of the empire's existence. In mid-19th century Beirut, 90% of import-export trade was being carried by dhimmi, although these only accounted for 55% of the population (Labaki, 1998). In Alexandria, only two of seventy-two 'merchant houses' belonged to Muslims

slave" relationship. A business was formed through a master engaging a slave (merchant) to engage in trade. The slave carried out commercial activities, including borrowing, but the merchant was solely responsible for any claims and the master not held liable. The second was the qirad, in which a merchant took money from an investor for business purposes. Profits were evenly divided between the merchant and the investor, but the investor was unable to share his risk with the merchant.

[6] Around 500,000 Muslims left Greece when the Greeco Turkish population exchange took place in 1923, close to 10% of the population (Friedman, 2006).

(Issawi, 1982). Zandi-Sayek (2011) emphasises the role of diversity in the rapid 19th century expansion of the port of Izmir.

There is evidence to suggest that this bifurcation was new to the 19th century. At the end of the 18th century, Muslims accounted for around 60% of those Ottoman using Istanbul's port to import or export goods (Panzac, 1996). Jennings (1973) analyses cases involving credit in the 17th century Islamic courts of Kayseri. In around 80% of cases the lender was a Muslim — almost exactly the same proportion of the city's population which was Muslim. However Raymond (1984) emphasises the role of Jews in Tunis and Christians in Aleppo in those cities earlier growths.

2.4 Legal pluralism: the Millet System and Capitulations

Whilst Sharia provided law for the empire's Muslim population, the Millet system historically provided it for the empire's Christians and Jews. Millets were confessional communities of dhimmi, who were granted, in accordance with Sharia, a considerable degree of legal autonomy: whilst criminal matters remained under jurisdiction of the Sharia courts, millets could self adjudicate in personal, social and economic affairs. As well as Jews, Christian confessions including Greek and Syrian Orthodoxy and the Armenian Apostolic Church were organised as millets and so were able to exercise their own law. However, parties could also chose to have their disputes heard by Sharia courts.

The capitulations also came to provide jurisdictional choice to dhimmi. These were agreements between the Ottoman Empire and western powers granting concessions to foreigners carrying out trade within the empire. These agreements, similar to treaties in status, existed at least between the Ottoman state and Austria, France, Great Britain and Russia. Initially, the numbers benefiting from these concessions were small. However, capitulatory rights were gradually extended to include the empire's own Christians and Jews. Initially, this seems to have been a revenue generation scheme for ambassadors. By paying to obtain status as a dragoman (interpreter) dhimmi could exempt themselves from the poll tax which was otherwise due. In Aleppo in 1793, around 1500 dhimmi merchants had acquired this status — when checked, only six of these were actually working as dragomans (Sonyel, 1991). A further right of capitulatory powers was to provide protected or 'protégé' status to Ottoman subjects; by obtaining a patent from an ambassador or consul, Ottoman dhimmi could receive the same privileges as foreigners. The exact numbers of dhimmi who took protégé status is not known, but the numbers were significant. At the turn of the 19th century, Russia had granted this status to 120,000 dhimmi and Austria to 200,000. In taking protégé status, dhimmi avoided the poll tax, but also gained access to consular courts applying western law to commercial disputes (Shaw and Shaw, 1977, p.246). The capitulatory regime thus served to expand the set of judicial choices available to dhimmi, providing them access to western law and thus to western organisational forms (Kuran, 2010).

2.5 Tanzimat

Tanzimat ('reorganisation') was a wide ranging reform program enacted in the mid-19th century, aimed at modernising the empire and securing its continued existence. As part of this, "citizenship [was to replace] the communal model of societal organization" (Iskander, 2009) and protégés were to be brought back under the jurisdiction of the Ottoman state. The Rose Garden decree of 1839 is normally taken as the start of the Tanzimat period.[7] This decree (reaffirmed in 1856) promised institutional equality for Ottoman subjects regardless of their religion, both in terms of rights and obligations. This involved a marginalisation of Sharia: heavily influenced by the French legal system, a new penal code was drawn up in 1840. Perhaps of particular relevance, given Kuran's arguments about organisational forms, a new commercial code (Kanunname-i Ticaret) was introduced in 1850, based on the French commercial code of 1807. This gave Muslims access to more advanced organisational forms, and allowed the first Muslim-owned joint stock company, the Oirket-i-Hayriye marine transportation company, to be founded in 1851 (Kuran, 2010, p.97). New, secular courts (nizamiyya) staffed by judges trained in secular law were created, and by 1868, when a Ministry of Justice was created, Sharia was limited to personal matters: family, inheritance, gift and foundations.

3 Data

3.1 City sizes as a proxy for economic development

The rate of urbanisation in a polity is a strong indicator of economic development, both before and after industrialisation. In fact, it might be more accurate to say that urbanisation *is* economic development. In a Malthusian two-sector model, changes in total urban factor productivity are

[7] Some reforms towards equality were actually under way by 1829, when a clothing law removed the visible sartorial distinction between Muslims and dhimmi (Quataert, 2005, p.66).

(after an adjustment period) wholly reflected in urban population. With the use of both cross-sectional and time-series data, Acemoglu et al. (2002) demonstrate the historical relationship between urbanisation and per capita income both before and after industrialisation. Henderson (2000) reports that the modern cross country coefficient of correlation between GDP per capita and urbanisation is close to 1.

Given the paucity of historical population data on a sub-national level, using historical urbanisation rates as a proxy for historical GDP limits the unit of analysis to countries or states. In order to benefit from a more institutionally homogeneous sample and to examine the effects of variation within that sample, it is natural to turn to city sizes themselves in order to analyse the effects of various historical treatments.

The expectation is that, all other things being equal, those cities experiencing quicker growth do so because of faster rising productivity.[8] So, although compared to urbanisation rates the theoretical relationship between city sizes and productivity is more complex[9], and the present day relationship clearly less good, studies such as Acemoglu et al. (2005), Dittmar (2011) and Cantoni (2010) have used city sizes to examine the economic effects of various treatments: Acemoglu et al. (2005) examines the differential growth of port cities that come to be engaged in Atlantic trade, Dittmar (2011) shows that cities adopting the printing press in the 1400s grew quicker in subsequent centuries, whilst Cantoni (2010) looks for effects of the adoption to Catholicism on city populations in the Holy Roman Empire. This study is in the same vein.

For Istanbul, one of the cities in my sample, it is possible to demonstrate the relationship between productivity and population using real wage data compiled by Özmucur and Pamuk (2002) together with population data from Bosker et al. (forthcoming) and Behar (2003). For thirteen years in the period 1600 to 1910, both real wage and population estimates are available: these are depicted in Figure 2. A strong relationship is evident, with higher population correlated with higher real wages.[10] The correlation is statistically significant at the 3.3% level.

[8] Migration between urban centres would be one reason for expecting this to be the case. This relationship would also hold in a standard two sector (agricultural/urban) model if cities had non-overlapping 'catchment areas' of rural regions from which workers could migrate.

[9] De Vries (1984) discusses city sizes and their relationship with economic development.

[10] As such, there is little evidence of a Malthusian relationship in this time period.

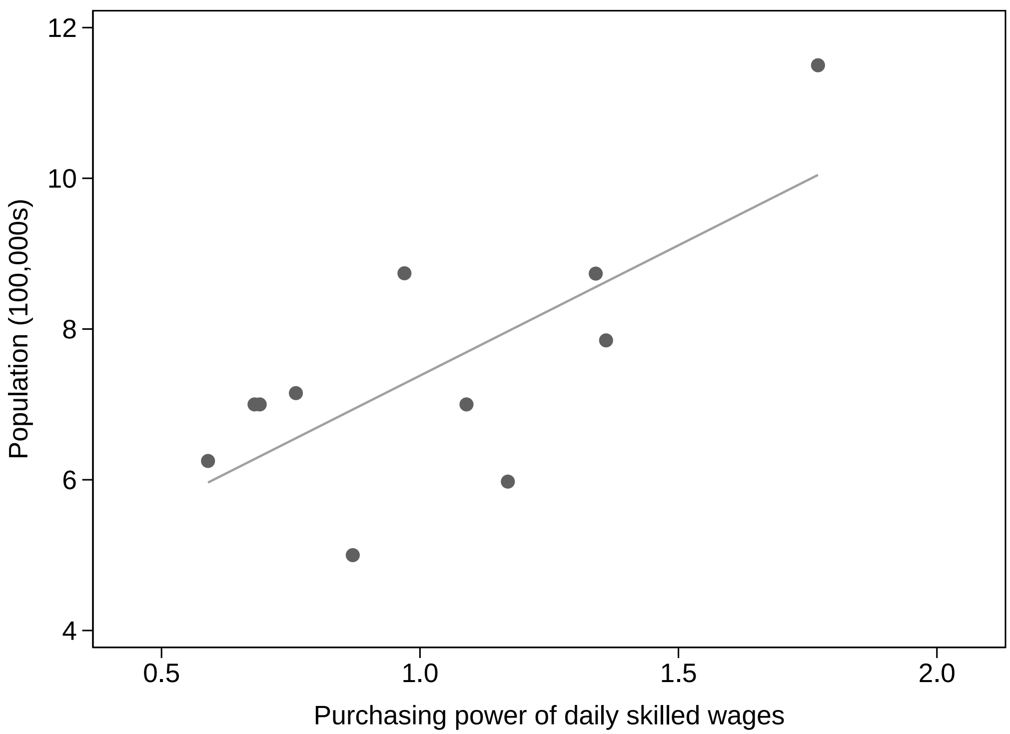

Figure 2: Relationship between real wages for skilled workers and population in Istanbul

3.2 City size data

In order to examine the relationship between urban growth and the religious composition of those urban populations, I have constructed a panel containing data on populations of Ottoman cities in the period 1600 to 1910. This period has been chosen to maximise cross-sectional sample size whilst providing as many periods of observation as possible after Tanzimat.

By 1600, the Empire's expansion was largely complete and all cities in the sample had been conquered. I exclude 1920 — by this date only those cities in modern day Turkey and Iraq still belonged to the empire and significant and sometimes forced population movements had taken place.

The panel includes data on populations around the years 1600, 1700, 1800, 1840, 1900 and 1910. Data for the years 1600, 1700 and 1800 is primarily extracted from a new dataset by Bosker et al. (forthcoming)[11] which uses as sources Chandler and Fox (1974) and Behar (2003), amongst others. Data for the remaining periods is sourced from Behar (2003), Bairoch et al.

[11] I am very grateful to the authors for sharing this dataset with me.

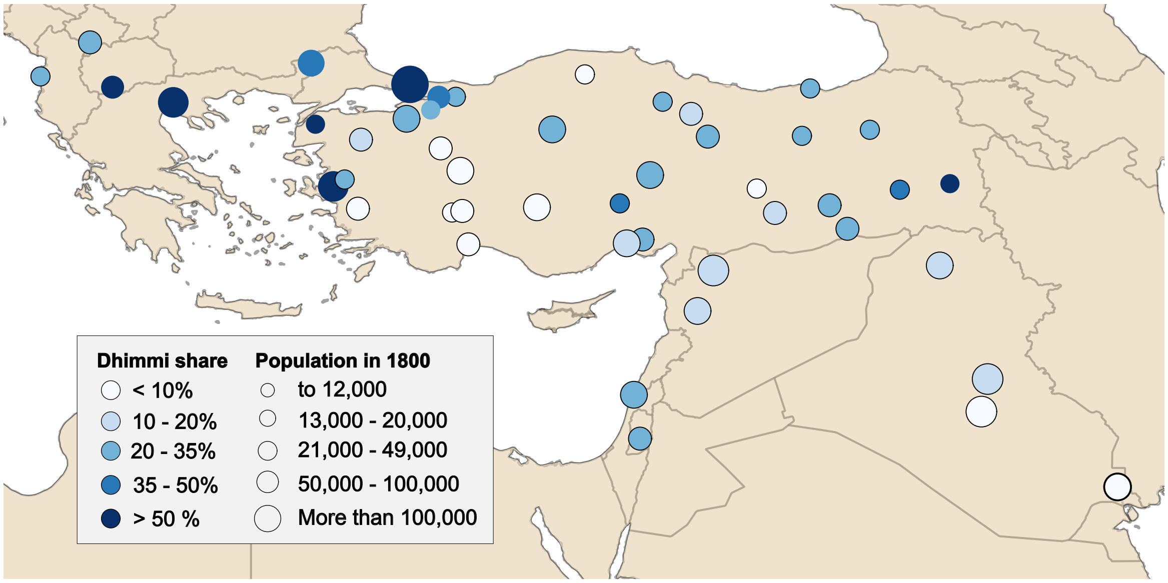

Figure 3: Cites in the dataset, their sizes in 1800 and their dhimmi population shares

Modern day country borders indicated. City of Tripoli (modern Libya) is off map. Dhimmi share refers to non-Muslim proportion of a city's population as reported by late Ottoman era censuses, as described in section 3.

(1988) and from Populstat, an online repository of historical demography[12]. No single source is able to provide anything approaching a complete cross section of observations in any single year. Because of this, any observations of city sizes reported in the years 1831-1849 are assigned to the year 1840, between 1890 and 1900 to the year 1900 and between 1906 to 1911 to the year 1910.

In order that the area covered is as institutionally homogeneous as possible, I exclude cities which were not under direct Ottoman rule throughout the period. This means most cities in modern day Greece, Bulgaria and Romania are excluded. Egyptian cities are likewise excluded: Egypt was from 1798 to 1801 occupied by France and between from 1867 to 1914 Egypt was an autonomous Ottoman vassal state. Finally, cities are only included in the dataset if, at some point in the period between 1600 and 1800 (inclusive) they reached a population of 10,000. This is a criterion Bosker et al. (forthcoming) apply in the construction of their dataset — since I make use of this data, it applies to my panel too. The panel is unbalanced. Figure 3 shows the geographical distribution of cities in the dataset, their sizes in 1800 and the share of their populations that was Christian or Jewish as measured in the 19th century by Ottoman censuses.

[12]Descriptions of all variables are given in Appendix A.

3.3 Religious composition of urban populations

This study aims to uncover a relationship between a city's growth and its religious composition. Whilst city sizes are mostly observable throughout the time period of interest, data regarding dhimmi population shares that approaches comprehensiveness only becomes available in the mid-19th century, when the first Ottoman censuses were carried out. Summary statistics from the censuses begun in 1831, 1881 and 1906 are made available in Karpat (1985). However, even at this relatively late period data is still patchy. None of these three censuses is able to provide data on all the cities in my sample. For many cities, dhimmi population share is reported only in one of these censuses, in others in two or three. I therefore construct a variable which, for each city, accords to the average dhimmi population share reported in each of the three censuses and take this to represent the average value of a city's dhimmi population share in the 19th century. For some cities, data is not available for any period; I am forced to drop these from the sample.[13]

The consequences of the lack of data on cities' dhimmi population shares in earlier periods are discussed in section 4.

3.4 Descriptive statistics

Figure 3 has shown the geographical distribution of cities in my sample and their religious composition. It shows that those cities with a higher proportion of non-Muslim inhabitants tend to be at a lower longitude and higher latitude. Given the sample, this is equivalent to being closer to Europe and further from Mecca, the birthplace of Islam and its holiest city.

Table 1 shows the relationship between dhimmi population share and various other covariates. Aside from the latitude and longitude relationships already visible in Figure 3, cities with higher dhimmi population shares tend to be further from ports and further by sea from Venice, the nearest European port. Dhimmi population share is positively correlated with city size in 1600 (p-value of 7.6%), not in 1800 but again in 1910 (p-value of 3.5%). Finally, cities with a higher proportion of dhimmi residents were first conquered by Islamic rulers at a later date.

[13] These are Antep (modern day Turkey), Antioch (Turkey), Damascus (Syria), Gjirokaster (Albania), Marash (Turkey), Medina (Turkey), Nicosia (Cyprus), Shkodër (Albania), Skopje (Macedonia) and Voskopoje (Albania).

Table 1: Summary statistics

	Min	1600	1800	1910	Lat	Long	Port	Venice	Conquest
Minorities	1								
ln(size 1600)	0.39*	1							
ln(size 1800)	0.14	0.87*	1						
ln(size 1910)	0.35*	0.77*	0.72*	1					
Latitude	0.37*	−0.029	−0.17	−0.068	1				
Longitude	−0.33*	−0.026	0.0060	0.090	−0.39*	1			
Distance to Port	−0.28*	0.021	0.12	−0.018	−0.45*	0.69*	1		
Naval distance to Venice	−0.19	0.069	−0.088	0.10	−0.19	0.60*	0.14	1	
Date of Muslim Conquest	0.33*	0.11	0.033	−0.0012	0.74*	−0.56*	−0.40*	−0.37*	1

Note: Sample consists of 48 cities. * indicates correlation is significant at the 10% level.

4 Empirical strategy and regression results

4.1 Dhimmi population shares

The aim of my empirical strategy is to uncover a causal relationship between a city's religious composition and its growth. Ideally, I would have observations through time of each city's size and the religious affiliations of its residents. However, there is no comprehensive cross sectional data on cities' dhimmi population shares before the Ottoman administration started conducting censuses in the mid-19th century. I thus use the fact that, although the proportion of non-Muslims in a city (and so the proportion of its inhabitants subject to Sharia) is evidently not a totally time invariant statistic, the proportion of a city's population that is Christian or Jewish is correlated across time periods — religion is a characteristic that is largely transmitted across generations and the existence of identifiably Christian and Jewish quarters with long histories in a number of Ottoman cities provides suggestive evidence that the religious composition of a cities populations had some constancy across time. Section 5 provides more concrete evidence. So most simply, we might assume that the dhimmi population share fluctuates across time around an underlying time-invariant level:

$$dhimmi_{i,t} = dhimmi_i + \omega_{i,t} \qquad (1)$$

$dhimmi_{i,1800s}$ (for which data is available) would then provide a noisy measure of $dhimmi_i$ and can replace the unknown $dhimmi_{i,t}$ in all periods. To the extent that $\omega_{i,t} = dhimmi_{i,t} - dhimmi_i$

is uncorrelated with any economically relevant factors and with $dhimmi_i$ itself, this situation is akin to one of classical measurement error, which is well known to bias estimation towards zero.[14] So, in my main specifications, I replace the variable $dhimmi_{i,t}$ with its 19th century figure in all time periods and treat this as a time invariant city characteristic:

$$dhimmi_i = dhimmi_{i,1800s} \tag{2}$$

If equation (1) is the true data generating process and the assumptions on the error term hold, this should at worst lead to type II errors. However, a priori more likely than (1) is that $dhimmi_{i,t}$ follows an autoregressive process:

$$dhimmi_{i,t} = dhimmi_{i,t-1} + \omega_{i,t} \tag{3}$$

As long as $\omega_{i,t}$ is small, measures of $dhimmi_{i,t}$ will be correlated across time, and the replacement in (2) will still allow me to identify an effect of dhimmi minority share in periods before the 1800s. However, it is conceivable that for any given i changes in $dhimmi_{i,t}$ across periods are a response to changes in economic performance (which, proxied by city size, is my dependent variable).[15] In other words, there is potential for reverse causality. I have two approaches to dealing with this endogeneity problem — these are the subject of section 6. In the first, I use pre modern data on dhimmi population shares as opposed to more recent census data — data which cannot be endogenous to later economic outcomes. Secondly, I use an instrumental variable strategy. The first stage, I argue, isolates a time invariant and thus necessarily exogenous component of the dhimmi population share. These approaches broadly corroborate the findings of the ordinary least square regressions in this section, suggesting that the regressions below represent a causal relationship from dhimmi population shares to city growth and not the reverse.

4.2 Baseline specification

My basic regression model is a differences-in-differences setup of the following form:

$$\ln(u_{i,t}) = \sum_{\tau \in T} \alpha_\tau \cdot dhimmi_i \cdot I_\tau + \boldsymbol{\gamma} \cdot \boldsymbol{X}_{i,t} + x_i + \chi_t + \mu_{i,t} \tag{4}$$

where $u_{i,t}$ is the size of city i in year t. $dhimmi_i$ takes the value of $dhimmi_{i,1800s}$ as per equation (2). The set T includes all years in the dataset, except one omitted year. Each I_τ is a

[14] Monte Carlo simulations confirm this intuition in this setting.

[15] For example, this would be the case if either dhimmi or Muslims faced lower costs of inter-urban migration.

dummy variable that takes the value of one if $t = \tau$ and zero otherwise. x_i and χ_t are city and time fixed effects respectively. $\boldsymbol{X}_{i,t}$ is a set of controls. Each α_τ is a coefficient of interest, capturing the effect of $dhimmi_i$ on log city size in period τ relative to the omitted year, conditional on time and city fixed effects and other any covariates.[16]

Regression results are reported in Table 2. Regressions in Panel A use 1600, the first year of the sample, as the omitted year. The regression reported in column (1) does not include any controls beyond city and year fixed effects. The estimated coefficients of α_t have a minimum at 1800 — with the exception of the estimate for α_{1900}, coefficients decrease until reaching this minimum and increase afterwards, almost reaching zero by 1910. This suggests that a city's dhimmi population was a negative influence on city growth in the period 1600-1800 and positive thereafter, with the total cumulative influence between 1600 and 1910 close to zero.

The use of city specific fixed effects means that these estimates are not biased by any economically relevant city characteristics that correlate with $dhimmi_i$ as long as these have a constant effect on city size. However, estimates in column (1) will suffer from missing-variable bias if these factors have time varying effects. For example, changing transport costs or patterns of trade might mean that geographical location had an effect on city size that varied across periods. Controlling for these effects requires including interaction terms between year dummies and the city characteristic into the matrix of controls $\boldsymbol{X}_{i,t}$, such that $\boldsymbol{\gamma} \cdot \boldsymbol{X}_{i.t}$ expands to include terms such as $\sum_{\tau \in T} \gamma_{1,\tau} \cdot Control_i \cdot I_\tau$.

Column (2) reports a regression which introduces three geographical controls: latitude, longitude and 'port potential', a binary variable that takes a value of one if a city is on the coast zero otherwise.[17] Now, estimates for α_t, the interactions between $dhimmi_i$ and the year dummies, decrease continually until 1800 and increase afterwards. $\hat{\alpha}_{1900}$ and $\hat{\alpha}_{1910}$ are further from $\hat{\alpha}_{1800}$ than in the baseline specification without controls, i.e the effect on dhimmi on city sizes post-1800 becomes stronger once geography is controlled for. This suggests that Dhimmi share is higher in cities whose geographical location is disadvantageous in this period.

Column (3) replaces the latitude and longitude controls with economically relevant geographical covariates for which latitude and longitude might be proxying. Latitude is strongly correlated (p-value of less than 1%) with the distance via sea from a city's nearest port to Venice (the nearest European port; if a city is a port itself, this variable takes the value of the nautical distance from

[16] A log-log specification does not substantially change any results.

[17] I use port potential rather than a city's actual port status in order to avoid potential endogeneity.

Table 3: Ordinary Least Square Estimates

	Dependant variable is log city size, $\ln(u_{i,t})$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Flexible setup, year 1600 as omitted year							
Dhimmi · 1700	-0.220	-0.249	-0.473				
	(0.621)	(0.967)	(0.813)				
Dhimmi · 1800	-1.220	-1.242	-1.459				
	(0.756)	(1.139)	(0.933)				
Dhimmi · 1840	-0.548	-0.580	-0.964				
	(0.727)	(1.060)	(0.943)				
Dhimmi · 1900	-0.703	-0.288	-0.329				
	(0.867)	(1.306)	(1.194)				
Dhimmi · 1910	-0.486	-0.163	-0.185				
	(0.894)	(1.315)	(1.156)				
Panel B: Flexible setup, year 1800 as omitted year							
Dhimmi · 1600	1.220	1.242	1.459	0.482	1.488	1.510*	1.822**
	(0.756)	(1.139)	(0.933)	(0.875)	(0.936)	(0.849)	(0.721)
Dhimmi · 1700	1.000*	0.993	0.986	1.280	0.954	0.990	0.859
	(0.564)	(0.732)	(0.690)	(0.991)	(0.704)	(0.714)	(0.867)
Dhimmi · 1840	0.672	0.661	0.496	0.600	0.346	0.420	0.218
	(0.426)	(0.549)	(0.523)	(0.596)	(0.560)	(0.529)	(0.554)
Dhimmi · 1900	0.517	0.954	1.131*	1.086*	1.153*	1.435	0.309
	(0.356)	(0.666)	(0.614)	(0.603)	(0.618)	(0.991)	(0.765)
Dhimmi · 1910	0.733	1.079*	1.275**	1.407***	1.186**	0.893	0.588
	(0.457)	(0.585)	(0.524)	(0.475)	(0.518)	(0.665)	(0.365)
Panel C: Structured setup, year 1800 as omitted year							
Dhimmi · Pre1800 · Trend	-0.553	-0.591	-0.737	-0.276	-0.277	-0.753*	-0.903**
	(0.344)	(0.521)	(0.440)	(0.424)	(0.429)	(0.390)	(0.325)
Dhimmi · Post1800 · Trend	0.457	0.876*	1.112**	1.085**	1.074**	1.067	0.445
	(0.333)	(0.507)	(0.462)	(0.443)	(0.447)	(0.655)	(0.441)
p-value $\alpha_{pretrend} = \alpha_{posttrend}$	0.08	0.11	0.01	0.03	0.03	0.02	0.02
Controls Lat/Long/Port	N	Y	N	N	N	N	N
Controls Distances	N	N	Y	Y	Y	Y	Y
Controls ln(Size) in 1600	N	N	N	Y	N	N	N
Excludes observations 1840-1849	N	N	N	N	Y	N	N
Excludes cities new in 1800	N	N	N	N	N	Y	N
Balanced subsample	N	N	N	N	N	N	Y
Cities	48	48	48	48	48	35	21
Observations	231	231	231	231	205	188	126

Note: The dependent variable is log city size. Fixed time and city effects are included in all regressions.Rows with labels such as Dhimmi · 1600 report estimates for interactions between dhimmi population share and year dummies, i.e estimates for α_t. Columns (3)-(6) include controls for time variant effects of distance to nearest port, to London and nautical distance to Venice. Column (5) excludes observations in the period 1840-1849, which are otherwise assigned to the year 1840. Column (6) excludes cities which first enter the sample in 1800. Standard errors, clustered on cities, are reported in brackets. * indicates significance at the 10% level, ** at 5% and *** at 1%.

the city itself to Venice) and the greatest circle distance to London. Given the geographical location of the sample, the later can be seen as a general measure of proximity to European centres. Longitude is correlated with the same distances and, in addition, with the distance from a city to its nearest port. The pattern of coefficients reported in column (3) matches that of the previous two columns: log city sizes were negatively influenced by dhimmi until 1800 and positively thereafter; suggesting a break in trends and a 'rise of minorities' from 1800.

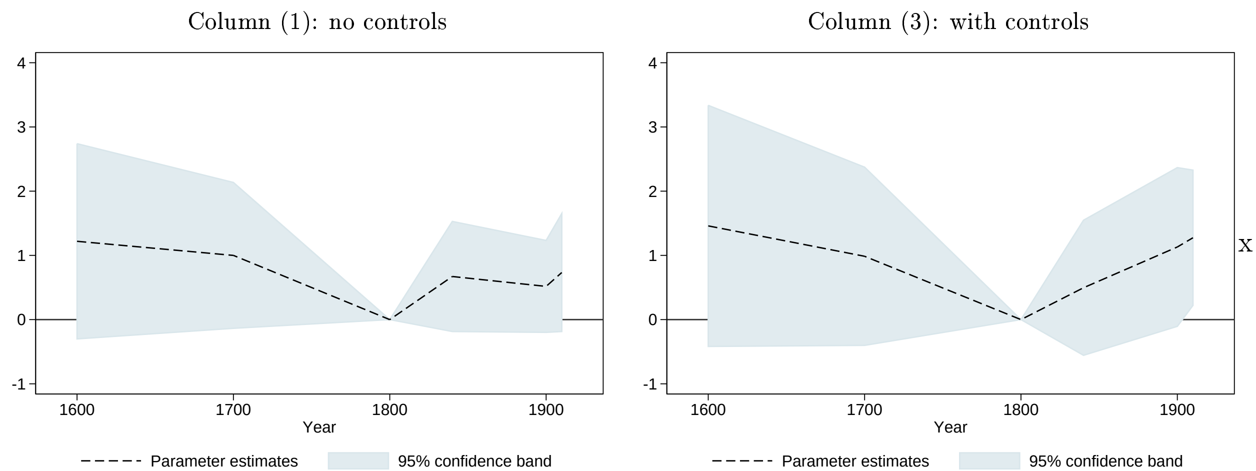

Figure 4: Parameter estimates and 95% confidence band for estimations in Table 3, Panel B, Columns (1) and (3).

The first three columns of Panel B repeat the regressions reported by Panel A, but with 1800 rather than 1600 as the omitted year. The estimates from columns (1) and (3) are depicted in Figure 4. The main effect of choosing 1800 rather than 1600 as the omitted year is to shift the entire distribution of interaction terms upwards; were the panel balanced this would be the only effect. The coefficient on α_t now represents the differential effect of dhimmi population share on a city's size in period t relative to its size in 1800. In the specification without controls, only $\hat{\alpha}_{1700}$ shows statistical significance. Once the full set of controls are introduced in Column (3), estimates for α_{1900} and α_{1910} are both statistically significant, at 7.2% and 1.8% levels respectively. The estimate of α_{1910} is 1.275, indicating that a city with a completely dhimmi population would have grown 250% relative to a city with a completely Muslim population between 1800 and 1910, and a city with a 50% dhimmi population nearly 90% relative to the same thing. The trends of estimates — downward to 1800 and upwards after — is again evident, although with the addition of geographical controls pre-1800 coefficients are no longer significant, either jointly or individually (p-value for a test of significance of α_{1600} is 12.5%).

Column (4) includes cities' log-sizes in 1600 in the set of controls. As already reported in section 3, cities' dhimmi population shares are correlated with city sizes in 1600 but not by 1800. This raises the possibility that the pattern of pre-1800 coefficients is representing reversion to the mean rather than an differential effect of dhimmi on city sizes. Including a city's log-size in 1600 as a control is a means of controlling for any long run convergence dynamics. For 14 cities in the sample, no size is reported for the year 1600; in these cases I assume a population of 5000 when constructing the control variable. $\hat{\alpha}_{1600}$ is now considerably smaller, and far from statistical significance, but other coefficients are largely unaffected. The post-1800 coefficients are strongest in this specification.

As described in section 3, any reports of city sizes in the years 1831 to 1849 are assigned to the year 1840 in my panel. Thus, all observations assigned to 1840 are made before the introduction of the commercial code in 1850, but not before Tanzimat started in 1839. Column (5) reports a regression that excludes any observations made between 1839 and 1849. If the coefficient on the interaction with 1840 was now negative, it would suggest the break of trends happened after, and perhaps in response to, the introduction of Tanzimat in 1839. In fact, the coefficient is smaller but still positive, and the trend in coefficients is still visible. The standard error is increased significantly.

Column (6) and Column (7) report regressions of two different subsamples, in both cases controlling for geography as per column (3). The regression reported in column (6) is carried out on a subsample that excludes all cities which enter the whole sample at 1800, i.e. those cities which first reach the inclusion threshold of 10,000 in that year. If many small cities entered the sample at 1800 and these cities had a different distribution of dhimmi to the whole sample, the post-1800 results already presented could be being driven by the difference in growth patterns between older and newer cities. In fact, the mean dhimmi share for cities which enter the sample in 1800 is 26.7%, compared to 24.6% for the rest of the sample, which already alleviates some of the concern. The subsample for column (6) consists of 35 cities. Standard errors on post-1800 interaction coefficients are increased over the baseline specification, but point estimates remain very similar.

Column (7) reports regression using a balanced subsample which excludes all cities for which population observations are missing in any period. Unbalanced panels are in general not problematic for difference-in-difference regressions, but estimates could in theory suffer from selection bias. The balanced subsample includes only 21 cities. In this subsample, estimates of the post-1800 interaction terms are slightly lower and no longer show statistical significance. However, point estimates are of a similar magnitude and sign to the baseline regression.

In Panel C I impose more structure on the model, with regressions of the form

$$\ln(u_{i,t}) = \alpha_{pretrend} \cdot dhimmi_i \cdot Pre1800_t \cdot Trend_t + \alpha_{posttrend} \cdot dhimmi_i \cdot Post1800_t \cdot Trend_t + \boldsymbol{\gamma} \cdot \boldsymbol{X}_{i,t} + x_i + \chi_t + \mu_{i,t} \tag{5}$$

$Pre1800_t$ and $Post1800_t$ are dummy variables that take values of zero or one depending on whether t is less than or greater than 1800. $Trend_t$ is defined as (t - 1800), and so is positive for $t > 1800$ and negative for $t < 1800$. This structured model thus assumes that there are two linear time trends through which describe dhimmi population share impacts log city sizes, one from 1600 to 1800, captured by $\alpha_{pretrend}$ and one from 1800 to 1910, captured by $\alpha_{posttrend}$.

Across all specifications, $\hat{\alpha}_{posttrend}$ is positive and, in regressions that control for geography and make use of the full sample, statistically significant from zero. Although $\hat{\alpha}_{pretrend}$ is negative across all specifications, the estimated effect is only statistically different from zero in restricted samples. However, in all specifications either the post-1800 trend interaction is statistically significant from zero or the null hypothesis that pre- and post-1800 trends are equal can be rejected.

5 Historical and geographical determinates of cities religious compositions

Being able to interpret the regression results as reported in the previous section as showing a causal influence of dhimmi population share on city sizes depends on dependent on two key conditions being met:

(i) The dhimmi population share in a given city is positively correlated across time

(ii) That component which is unexplained by correlations with earlier periods is not correlated with differential city growth: i.e dhimmi population share is not endogenous to economic outcomes

In this section, I use data from multiple time periods to show that the first of these conditions is met and explain geographical and historical determinants of this component of $dhimmi_{i,t}$. The second condition is the subject of section 6.

5.1 Relevance

Regressions in section 4 have already shown that a city's dhimmi population share as measured towards the end of the Ottoman empire has explanatory power as early as 1600 and until 1910. This in itself suggests that condition (i) is met, but it is possible to conceive of other explanations. For example, regressions in section 4 would also be consistent with dhimmi population shares in the period 1600-1800 being *inversely* related to those in period 1800-1910. This makes a further examination expedient.

Table 4: Relationships between dhimmi population shares through time

	Correlations		OLS		Flogit	
	1881	1906	1881	1906	1881	1906
Dhimmi 1600s	0.54**	0.41	0.44**	0.40	0.39**	0.36**
Dhimmi 1831	0.70***	0.60**	0.59***	0.59***	3.23***	2.56*
Dhimmi 1881		0.90***		0.88***		4.87***

Note: The first two columns report correlations between observations of a city's Dhimmi population share in two different time periods. Each cell in the columns labelled 'OLS' reports the result of an Ordinary Least Squares regression of the form $Dhimmi_{t1} = \beta_0 + \beta_1 Dhimmi_{t2} + \mu$, where the dependent variable is indicated by the column label and the independent by the row. The same holds for 'Flogit' regressions, but in these regressions the fractional logit estimator by Papke and Wooldridge (2006) is used rather than OLS. * indicates significance at the 10% level, ** at 5% and *** at 1%.

The first two columns of Table 4 report correlations between cities' dhimmi population shares as reported in each of the Ottoman censuses of 1831, 1881 and 1906 as well as by 16th century information. The later consists of hearth tax records as reported by Barkan (1970) and other information as per city specific lemmas in the *Encylopedia of Islam* (1960-2005).[18] Significant correlations exist across time, with the correlations closer to one and more strongly significant

[18] 16th century data is available for only eighteen cities in my sample, data from 1831 only nineteen. The overlap covers only five cities; the (insignificantly positive) relationships between 1831 and 16th century dhimmi shares are therefore not reported. The 1881 census reports on all cities bar five, the 1906 all cities bar nine.

the closer in time the observations are made. The only statistically insignificant relationship is between $dhimmi_{1906}$ and $dhimmi_{1500s}$, but this only just misses the 10% threshold, with a significance level of 12.7%. Regressions reported in the following two columns, labelled 'OLS', posit causal relationships between variables, with each cell reporting the result of a regression of the type:

$$dhimmi_{i,1881} = \beta \cdot dhimmi_{i,1500s} + u_i$$

The pattern of regression results is the same as of the correlations, with all but one regression showing significance at at least the 5% level. Finally, I take into account the fractional nature of the variables by running a fractional logit regression as per Papke and Wooldridge (1996). Estimates are not directly comparable to ordinary least square (OLS) estimates, but again the pattern is repeated, with all relationships now showing statistical significance. Table 4 thus supports the intuition that, due to intergenerational transmission of religion and the relative immobility of populations, the religious composition of cities is correlated across long time periods, suggesting identification condition (i) is met.

Also encouraging for condition (i) is the strong positive correlation between my measure of a city's dhimmi population in the 19th century and the year in which a city was first conquered by a Muslim ruler (2% and 1% significances for OLS and fractional logit regressions respectively): the later a city was conquered, the higher its share of dhimmi. The mean year of conquest is 1003 AD and the latest 1501 AD, suggesting a high degree of persistence of religious affiliation across very long time periods.

5.2 Muslim conquests and geography

As shown in column (1) of Table 5, the spread of Islam throughout cities in the sample has a clear geographic determinate, consistent with the historical record. In 622 CE Muhammed, the last prophet of Islam, left Mecca and arrived in Medina, cities both now part of modern Saudi Arabia; this was the beginning spread of Islam. By 762, eighteen of the cities in my sample had been conquered by the early Caliphates; these are cities in modern day Israel, Iraq, Syria and south eastern Turkey, cities in the south of the sample. Beginning in the 11th century, Islam was then spread westwards into Anatolia and eastern Europe, first by Seljuk Turks and finally by the Ottomans. Consistent with this history, both latitude and longitude (themselves correlated) are highly significant determinates of the year of Muslim conquest (joint p-value of 0.00%).

Table 5: Impact of geography

	(1) Muslim Conquest	(2) Dhimmi 1500s	(3) Dhimmi 1800s	(4) Dhimmi 1500s	(5) Dhimmi 1800s
Latitude	0.0643***			0.0160	0.0193*
	(0.0129)			(0.0132)	(0.00668)
Longitude	-0.0131**			-0.00635	-0.00567
	(0.00503)			(0.00532)	(0.00363)
Muslim Conquest		0.327**	0.214***		
		(0.147)	(0.0798)		
N	48	18	48	18	48

Note: $Dhimmi_{1800s}$ refers to a variable defined as the average of a city's Dhimmi share as reported by the Ottoman censuses of 1831, 1881 and 1906. $Dhimmi_{1500s}$ refers to a variable constructed from 16th century hearth tax records and other sources. Robust standard errors are reported in parentheses. * indicates significance at the 10% level, ** at 5% and *** at 1%.

Columns (2) and (3) report regressions of the year of Muslim conquest on dhimmi population share in the 1500s and late-Ottoman period. In both cases the relationship is significant at least the 5% level: the process of 'Islamisation' was most complete in those cities where it started earliest.[19] Applying a Hausman test to the two models does not lead to a rejection of the null hypothesis that the effect of the year of Muslim conquest on dhimmi population share is the same in the two models (p-value of 41%).

The impact of a city's latitude and longitude on the timing of Islamic conquest, and of that timing on dhimmi population shares in both the 16th and 19th centuries, suggest that a city's latitude and longitude might have had an effect on the city's religious makeup that was persistent through the period. Columns (4) and (5) report regressions of latitude/longitude on dhimmi population shares in the 16th and 19th centuries respectively. Although standard errors are very large for regressions on the 16th century data, the estimated coefficients in the two models are of the same signs and similar sizes. A Hausman test does not lead to a rejection of the null hypothesis that latitude and longitude have the same effect on cities' dhimmi population shares in both periods, but given the large standard errors in one model, the test does not have much power. The p-value of a test of joint significance of latitude and longitude on the 19th century

[19] See Speros Vryonis (1971) on the process of Islamisation of formerly Christian cities.

dhimmi population share is 1.2%.

6 Potential endogeneity

That cities' dhimmi population shares are strongly correlated across time does not rule out endogeneity. The relatively low R^2 of a regression of $dhimmi_{i,1881}$ on $dhimmi_{i,1500s}$, around 29%, suggests other factors also had significant effects on the distribution of minority populations towards the end of the Ottoman empire — if these factors include economic outcomes then the estimates of section 4 would suffer from bias due to endogeneity. This section investigates, firstly by using earlier data on dhimmi population shares, which can not be endogenous to later economic outcomes, and secondly with instrumental variable regressions.

6.1 Use of 16th century dhimmi shares as independent variable

The regressions in section 4 made the following replacement

$$dhimmi_i = dhimmi_{i,1800s}$$

Table 6 and 5 show the results of regressions where the observations of dhimmi population share made in the 16th century are used to form the (assumed) time invariant city characteristic $dhimmi_i$ instead:

$$dhimmi_i = dhimmi_{i,1500s}$$

Since it is difficult to imagine how a city's dhimmi minority share as measured in the 16th century can be endogenous to economic outcomes several hundred years later, regressions, again of the type

$$\ln(u_{i,t}) = \sum_{\tau \in T} \alpha_\tau \cdot dhimmi_i \cdot I_\tau + \boldsymbol{\gamma} \cdot \boldsymbol{X}_{i,t} + x_i + \chi_t + \mu_{i,t}$$

should not suffer from any endogeneity bias, at least in the later periods. The year 1600 is again used as the omitted year, as per Panel A of Table 3. The sample size is now very small, consisting of only 18 cities. Column (1) reports regressions without controls other than city and year fixed effects. Point estimates are close to zero, including those of 1700 and 1800, again suggesting that between 1600 and 1800 cities with higher dhimmi population shares fared no better than more predominantly Muslim cities. Column (2) controls for latitude, longitude and port potential, whilst column (3) again replaces latitude and longitude controls with economically relevant factors for which latitude and longitude might be proxying. These controls increase standard errors considerably. The coefficient on the interaction with year 1800 is higher than for the year 1700, but the coefficients are not significantly different (p-value 19.1%) and the coefficient on the 1840 interaction is again close to zero. However, the interaction term on the year 1900 is positive and significantly different from both zero and from the 1840 estimate (p-value of 9.8%). Further, it of a similar size to the main regressions of section 6. The estimate of α_{1910} is lower and no longer significantly different from zero, but is also not significantly different from α_{1900} (p-value of 44%).

So, conditional on geography, these estimates suggest that cities measured as having higher dhimmi population shares in the 16th century grew quicker after 1840, and not persistently before then. These regressions thus again suggest that the 'ascent' of minorities was a late phenomenon and one that seems to have been little affected by Tanzimat; in fact, in these regressions, the effect of dhimmi population share on city sizes is only visible *after* Tanzimat has begun.

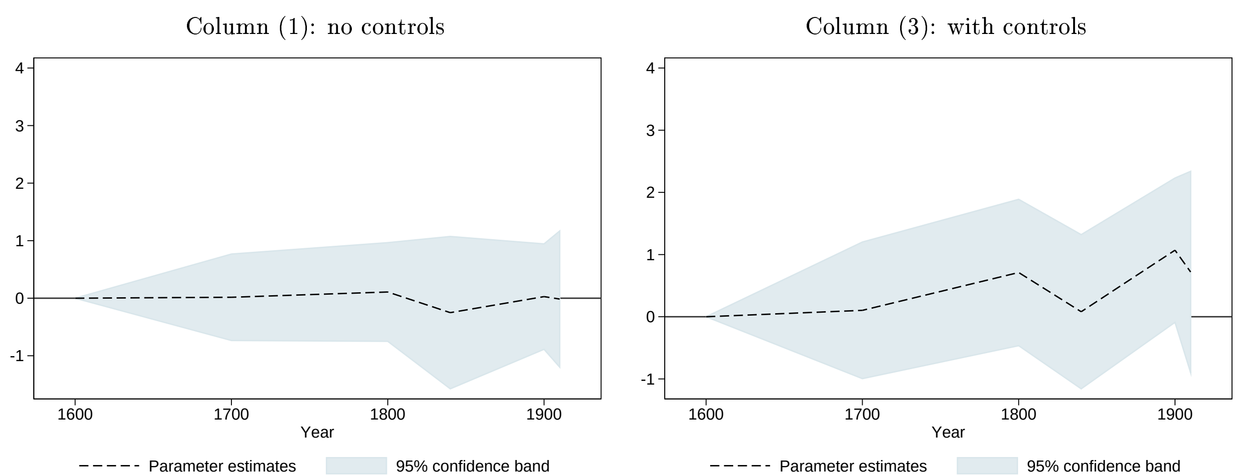

Figure 5: Parameter estimates and 95% confidence band for estimations in Table 6, Panel B, Columns (1) and (3).

6.2 Instrumental variable regressions

Section 5 argued for a chain of causality accounting for the geographic distribution of dhimmi populations as follows:

$$\text{Latitude/Longitude} \Rightarrow \text{Year of Muslim Conquest} \Rightarrow \text{Dhimmi 1500s} \Rightarrow \text{Dhimmi 1800s}$$

Table 6: OLS regressions with 16th century dhimmi population share

	Dependant variable is log city size		
	(1)	(2)	(3)
Dhimmi · 1700	0.0163	0.0472	0.103
	(0.356)	(0.564)	(0.520)
Dhimmi · 1800	0.108	0.644	0.711
	(0.406)	(0.579)	(0.558)
Dhimmi · 1840	-0.251	0.000389	0.0809
	(0.627)	(0.624)	(0.588)
Dhimmi · 1900	0.0279	0.530	1.071*
	(0.434)	(0.460)	(0.550)
Dhimmi · 1910	-0.0146	0.688	0.720
	(0.560)	(0.622)	(0.767)
Controls Lat/Long/Port	N	Y	N
Controls Distances	N	N	Y
Cities	18	18	18
Observations	99	99	99

Note: The dependent variable is log city size. 1600 is the omitted year. Fixed time and city effects are included in all regressions. Rows with labels such as Dhimmi · 1600 report estimates for interactions between dhimmi population share and year dummies, i.e estimates for α_t. Column (2) includes controls for time variant effects of distance to nearest port, to London and nautical distance to Venice. Standard errors, clustered on cities, are reported in brackets. * indicates significance at the 10% level, ** at 5% and *** at 1%.

This suggests that it might be possible to use latitude and longitude as instruments for $dhimmi_i \equiv dhimmi_{i,1800s}$.[20]. An instrumental variable needs to fulfil two criteria: first, it must be correlated with $dhimmi_i$ conditional on other covariates in the main model. This is the (testable) endogeneity condition. Secondly, the instrument must not be correlated with the error term in the second stage regression, i.e. the instrument should not effect $\ln(u_{i,t})$ except through those covariates already included in the model. This is the exclusion restriction and, with a single instrument, is not testable. However, by taking both latitude and longitude as instruments for $dhimmi_i = dhimmi_{i,1800s}$ there are more instruments than there are endogenous variables, allowing for overidentification tests to be carried out. Under the null hypothesis of an overidentification test the instruments are jointly valid, in the sense they meet the exclusion restriction. Here, rejecting the null hypothesis of the overidentification test would mean rejecting the hypothesis that latitude and longitude affect economic outcomes only through their influence on dhimmi population share, conditional on controls.

I concentrate on identifying two trends, one from 1600 to 1800 and one from 1800 to 1910, as per Panel C of Table 3. This minimises the number of independent variables and so maximises the strength of instruments.[21] The instrumental variable regression framework (without controls other than city and fixed year effects) is as follows, with the first two equations part of the first stage and the third equation corresponding to the second stage of a two stage least squares (2SLS) instrumental variable regression:

$$A_{i,t} = x_i + \chi_t + \psi \cdot Pre1800_t \cdot Trend_t \cdot Lat_i + \phi \cdot Pre1800_t \cdot Trend_t \cdot Long_i + \upsilon_{i.t} \qquad (6)$$

$$B_{i,t} = x_i + \chi_t + \theta \cdot Post1800_t \cdot Trend_t \cdot Lat_i + \vartheta \cdot Post1800_t \cdot Trend_t \cdot Long_i + \eta_{i,t} \qquad (7)$$

$$\ln(u_{i,t}) = x_i + \chi_t + \alpha_{pretrend} \cdot \widehat{A_{i,t}} + \alpha_{posttrend} \cdot \widehat{B_{i,t}} + \mu_{i,t} \qquad (8)$$

x_i and χ_t stand for city and year fixed effects respectively. $Pre1800_t$ and $Post1800_t$ are dummy variables taking values of zero or one depending on whether t is greater or less than 1800 and $Trend_t$ is defined as (t - 1800), as per OLS regressions.

Column (1) of Table 7 repeats the OLS estimates from column (3), Panel C of section 4 for comparison. This regression controls for each city's port potential, distance to the nearest

[20]An alternative would be to instrument for $dhimmi_i = dhimmi_{i,1800s}$ with $dhimmi_{i,1500s}$ This however reduces the sample to the eighteen cities for which data on $dhimmi_{i,1500s}$ is available and results in underidentification, with first stage F statistics of around 0.10.

[21]Instrumental variables with a full set of $dhimmi_i$/year interactions are reported in Table B.1 and visualised in Figure B.1.

port, nautical distance to Venice and greatest circle distance to London. Column (2) shows the instrumental variable regression with latitude and longitude instrumenting for $dhimmi_i$, with no included instruments other than fixed effects. The null hypothesis of the overidentification test can be rejected at the 10% level, indicating that the exogeneity condition is not met. However, once the set of other geographical controls is included, as in Column (3), the null of the overidentification test can no longer be rejected at any conventional level of significance. This suggests that the set of controls might be adequate in controlling for economically relevant factors correlated with latitude and longitude, which would result in a valid instrument. Encouragingly, point estimates for $\alpha_{pretend}$ and $\alpha_{posttrend}$ are of the same sign and similar magnitude to the baseline ordinary least squares estimates, even though they are no longer significant. That the point estimates are further from zero in the instrumental variable regression compared to the OLS then indicates that the OLS are biased towards zero, as per classical measurement error. Absent of measurement error, the downward bias of OLS estimates could be taken to suggest that a city's dhimmi population share reduced in response to growth. In any case, the direction of bias in OLS estimates does not give cause to doubt that the parameter estimates in section 4 represent the true signs of model parameters. The low F statistics of the first stage regressions indicates that the instruments are weak. With weak instruments, overidentified instrumental variable regressions are biased towards the ordinary least square estimates, with the bias greatest the weaker the instruments (Angrist and Pischke, 2008, p.153): the results from IV regressions reported could be underestimating the true effect of dhimmi population share on city growth.

Column (4) reports the same regression as column (3) but using the Limited Information Maximum Likelihood (LIML) estimator rather than Two Stage Least Squares (2SLS). In the case of weak instruments and overidentified regressions, LIML estimates are less biased than 2SLS (Angrist and Pischke, 2008, p.155); if the estimates (or standard errors) from LIML and 2SLS estimators differed considerably this would indicate that the weak-instrument bias was considerable. In fact, point estimates and standard errors are relatively similar across both estimation techniques. As a final check, column (5) reports a regression using the strongest individual instrument, latitude. This regression is just identified and so the 2SLS estimator is not biased, even in the case of weak instruments. Point estimates are similar to the baseline OLS regression.

The main difference, then, between OLS and IV estimates is the inflation of standard errors that IV brings. Across all specifications, the p-value of an endogeneity test is high. This can

Table 7: Instrumental Variable regressions

	OLS	2SLS		LIML	2SLS
	(1)	(2)	(3)	(4)	(5)
	lnpop	lnpop	lnpop	lnpop	lnpop
Dhimmi · Pre1800 · Trend	-0.737*	-0.934	-0.922	-0.965	-0.872
	(0.439)	(0.616)	(0.766)	(0.936)	(0.886)
Dhimmi · Post1800 · Trend	1.112**	0.106	1.685	1.806	1.264
	(0.461)	(1.314)	(1.610)	(1.959)	(1.423)
p-value overidentification test		0.09	0.26	0.28	
F-stat first stage		3.80	3.37	3.37	1.11
p-value test of joint significance geographical controls	0.02		0.01	0.01	0.00
p-value test of endogeneity of instrumented variables	.	0.75	0.95	0.95	0.98
p-value test $\alpha_{pretrend} = \alpha_{posttrend}$	0.00	0.52	0.25	0.32	0.29
Controls Distances/Port	Y	N	Y	Y	Y
Instrumented by Latitude	N	Y	Y	Y	N
Instrumented by Longitude	N	Y	Y	Y	Y
Observations	228	228	228	228	228
Cities	48	48	48	48	48

Note: The dependent variable is log city size. Fixed time and city effects are included in all regressions. All columns except column (2) include controls for time variant effects of a city's distance to its nearest port, to London and nautical distance to Venice. Standard errors, clustered on cities, are reported in brackets. * indicates significance from zero at the 10% level, ** at 5% and *** at 1%.

normally be taken to suggest that the instrumented variables (here interaction terms between trends and cities' dhimmi population shares) can be treated as exogenous, i.e. that an OLS regression does not suffer from considerable endogenous bias. However, with weak instruments these tests have little power, and so should be treated with some caution. Nonetheless, the results reported in Table 7 are encouraging, with nothing to suggest that the OLS regressions in section 4 are not representing a causal effect. If anything, results from OLS regressions might be underestimating the true causal impact of dhimmi population share on city growth.

7 Interpretation and conclusion

Much existing evidence points to the fact that Middle Eastern Christian and Jews came to dominate commerce and finance towards the end of the Ottoman period. Consistent with this evidence, I have shown statistically significant effects of dhimmi population share on city sizes in the late 19th century.

I have found no evidence to suggest that cities with a higher share of non-Muslims grew any quicker than other cities before 1800; in fact, the evidence points (weakly) to the reverse. Taking city sizes as a proxy for more general economic performance, this suggests that dhimmi were as a whole not more economically productive than Muslims before the turn of the 19th century. Accounts of dhimmi's later success should be able to account for this earlier pattern, making, for example, cultural arguments more difficult to sustain.

Kuran argues that it was around 1800 that dhimmi started exercising their jurisdictional choices in favour of western law, allowing them the use of more advanced organisational forms than those available in Sharia; that it is as this around point that cities with higher proportions of religious minorities start growing quicker lends credence to his argument that it was the availability of these organisational forms that accounted for their superior economic performance. However, whilst results presented show that after around 1800 cities with a higher share of non-Muslims grew quicker, it is only by 1900 that the effect can be identified with a degree of certainty, after western law (including a French style commercial code in 1850) was made available to Muslims as part of Tanzimat. It appears, then that the marginalisation of Sharia through Tanzimat did nothing to dampen the economic out-performance of Muslim-rich cities by dhimmi-rich cities. This could be taken to indicate that Sharia was not, in fact, the reason for dhimmi's economic dominance. I am cautioned against drawing this conclusion for a number of reasons.

Firstly, Kuran claims that inexperienced judges dealing with a new legal code in fact served to increase legal uncertainty for Muslims, as a result, the 'ascent' might have continued into the late 20th century.

Secondly it might be that, by 1910, not enough time had elapsed for Muslims' increased opportunity set to be evident in city sizes. In the context of institutional reform in the Germany brought about by French occupation, Acemoglu et al. (2011) find a lag of around 60 years before reforms impact on urbanisation rates. If the same lag applied to the Ottoman introduction of the commercial code in 1850, effects on city sizes would not be seen until after 1910, which is the last the year in which I observe city sizes.

Thirdly, even after the introduction of the French-style commercial code, joint-stock companies did not benefit from "entity shielding" (Kuran, 2010, p.98). Entity shielding protects a company's assets from claims on its owners. The lack of entity shielding for unincorporated joint-stock companies is in contrast, for example, to British corporation law to which some dhimmi protégés had access (Harris, 2000). Hansmann et al. (2006) argues that entity shielding serves to reduce investor risk and thus aids capital accumulation. As such, Muslims might have remained legally disadvantaged compared to dhimmi until a corporation law was introduced in 1908 (Kuran, 2010, p.99).

Fourthly, by the time Tanzimat impacted, dhimmi might have gained a decisive first mover advantage, having already come to dominate various commercial sectors.

Finally, the city size data is in fact consistent with a positive impact of Tanzimat on Muslims' commercial opportunities if the Tanzimat reforms were applied more quickly or more effectively in cities with higher dhimmi populations. Assume as per the Kuran hypothesis that, pre Tanzimat, dhimmi outperformed Muslims, an advantage that resulted from their ability to use Western organisational forms for their commercial transactions. Those Muslims most aware of the benefits of these organisational forms would be those in dhimmi-rich cities, and so demand for the implementation of the French-imported commercial code would have been strongest in those same cities. These cities would, collectively, be more experienced with the new organisational forms and perhaps have readier access to European judges. Thus, Tanzimat might have benefited Muslims in dhimmi-rich cities more than Muslims in dhimmi-poor cities, where the new organisational forms would have been more novel and the benefits less clear. The effect of the marginalisation of Sharia would then be to enhance the advantage of dhimmi-rich cities, not by benefiting dhimmi over non-dhimmi but by benefiting Muslims in dhimmi-rich cities over Muslims in dhimmi-poor cities. Distinguishing between this hypothesis and the more obvious hypothesis that the abolishment of Sharia had no effect on the relative productivity of Muslims and dhimmi would require post-Tanzimat data on a finer level than cities, data which has so far proved elusive but could provide the basis for future work.

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A Appendix - Variable descriptions

Variable	Description
City size	Population of city. For the years 1600-1800 data is primarily sourced from Bosker et al. (forthcoming); additional observations in this period are from Chandler (1987), Behar (2003) and Tamdoğan (2008). Data around the years 1840, 1900 and 1910 is sourced from Behar (2003) and Populstat.
16th century dhimmi population share	Proportion of city's population that is non-Muslim, measured at some point in the 16th century. Calculated from hearth tax records as reported by Barkan (1970) and various other sources as reported by city specific lemmas in the *Encylopedia of Islam* (1960-2005).
19th century dhimmi population share	Variable constructed from data from Ottoman censuses begun in 1831, 1881 and 1906 as reported by Karpat (1985). For each city, the variable takes the average value of the dhimmi population shares calculated from each of the three censuses. Where only one of the three censuses reports on a city, the dhimmi population share according to that census is taken, where two censuses report, dhimmi population shares according to those two censuses are averaged. Censuses provide populations of religious communities for cites or for central sanjaks, administrative areas which are taken to accord with the city.
Latitude	City's Latitude in Decimal degrees, from Bosker et al. (forthcoming).
Longitude	City's Longitude in Decimal degrees, from Bosker et al. (forthcoming).
Port potential	Binary variable taking the value of one if the city's coordinates are within 5 kilometres of the coast and zero otherwise. Own calculation.
Distance to port	Greatest circle land distance from city to its nearest port, measured in kilometres Own calculation.

Nautical distance to Venice	Nautical distance from city's nearest port (or, if the city is a port itself, the city) to Venice. Calculated with http://www.portworld.com/map/
Distance to London	Greatest circle distance from city to London, measured in kilometres Own calculation.
Muslim Conquest	Year, divided by 1000, in which city, or surrounding area, first came under rule of a Muslim ruler. Information obtained from city specific lemmas in the Encyclopaedia of Islam.

B Appendix - Instrumental variable regression results

Table B.1: Instrumental Variable regressions with full set of interaction terms

	OLS	2SLS		LIML	2SLS
	(1)	(2)	(3)	(4)	(5)
	lnpop	lnpop	lnpop	lnpop	lnpop
Dhimmi · 1600	1.456	1.850	2.036	2.216	2.056
	(0.930)	(1.306)	(1.557)	(2.002)	(1.836)
Dhimmi · 1700	0.990	1.298	1.116	1.209	0.642
	(0.690)	(1.103)	(1.598)	(1.926)	(1.279)
Dhimmi · 1850	0.522	0.0778	1.684	2.000	0.578
	(0.516)	(1.578)	(1.498)	(2.013)	(1.607)
Dhimmi · 1900	1.131*	-0.0308	1.964	2.144	1.124
	(0.612)	(1.768)	(2.005)	(2.453)	(1.871)
Dhimmi · 1910	1.277**	0.381	1.935	2.101	1.582
	(0.522)	(1.312)	(1.447)	(1.804)	(1.406)
p-value overidentification test		0.32	0.69	0.71	
F-stat first stage		1.11	1.49	1.49	0.40
p-value test of joint significance geographical controls	0.01		0.00	0.00	0.00
p-value test of endogeneity of instrumented variables		0.93	0.89	0.89	0.99
Controls Distances	Y	N	Y	Y	Y
Instrumented by Latitude	N	Y	Y	Y	N
Instrumented by Longitude	N	Y	Y	Y	Y
Observations	231	231	231	231	231
Cities	48	48	48	48	48

Note: The dependent variable is log city size. Fixed time and city effects are included in all regressions. Rows with labels such as Dhimmi · 1600 are interactions between dhimmi population share and year dummies, i.e estimates for α_t. All columns except column (2) include controls for time variant effects of a city's distance to its nearest port, to London and nautical distance to Venice. Standard errors, clustered on cities, are reported in brackets. * indicates significance from zero at the 10% level, ** at 5% and *** at 1%.

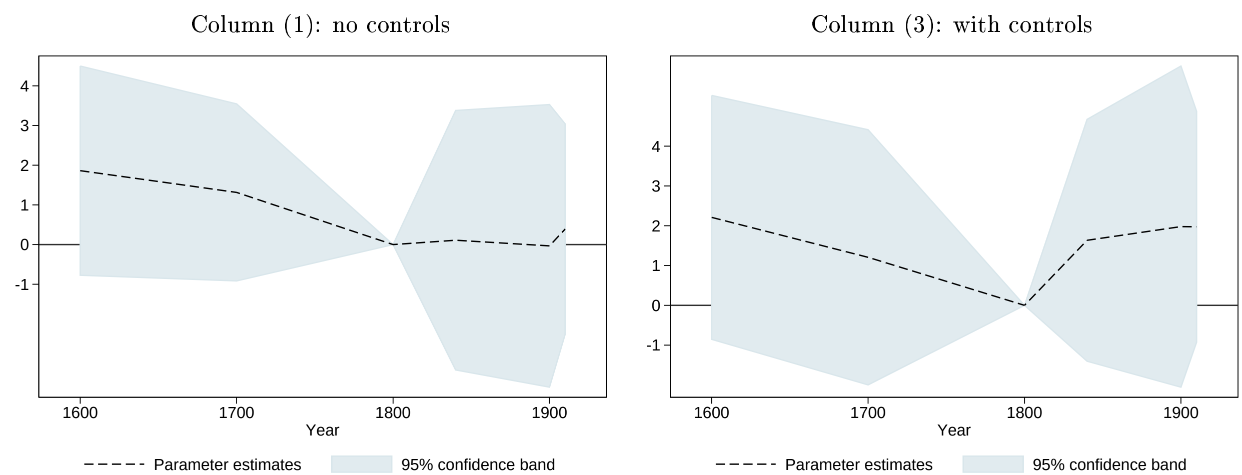

Figure B.1: Parameter estimates and 95% confidence band for estimations in Table B.1, Columns (1) and (3).