

The Origin of Universities in Europe, 800-1800*

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Abstract

Universities represent the institutional locus of human capital and scientific research. They drive innovation and economic growth (Cantoni and Yuchtman, 2014; Valero and Reenen, 2016; Andrews, 2017) and play an essential role in social and political progress (Hollenbach, Magat and Pierskalla, 2018; Sanborn and Thyne, 2014). When universities first emerged in Europe, from 1200 to 1800, they were the primary supplier of an administrative workforce that could be used to staff increasingly differentiated state bureaucracies. Why and how did universities emerge across Europe?

We collect original data on university creations and closures from 800-1800 and combine these with data on European cities (Bosker, Buringh and van Zanden, 2012) and early-modern state-building (Dincecco and Onorato, 2018; Nüssli, 2011). We find that the most important factors explaining the growth in universities across Europe are demands by both ecclesiastical and secular rulers, as well as an emerging Enlightenment elite. The demand for elite education by secular rulers, however, does not seem to be driven by classic *bellicist* causes, but instead by more domestically oriented efforts at state building.

Key Words: Universities, State-Building, State Capacity, Education

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1 Introduction

European political and economic history has produced many institutional innovations. These institutions – ranging from constitutional rule, parliament, rule of law, and democracy, to the publicly traded stock company – spread to much of the rest of the world, either by voluntary adoption or coercion (Van Zanden, Buringh and Bosker, 2012; Stasavage, 2010; North and Weingast, 1989; Acemoglu and Robinson, 2006; Gelderblom and Jonker, 2004; Gelderblom, Jong and Jonker, 2013).

Another institution that took shape in Western Europe during the Middle Ages and is now dominant across the world is the university. Today, universities represent the institutional locus of human capital and scientific research. They play a crucial role in the political economy of most countries as they drive innovation and economic growth (Cantoni and Yuchtman, 2014; Valero and Reenen, 2016; Andrews, 2017). At the same time, universities play an essential role in social and political progress, e.g., modernization and democratization (Hollenbach, Magat and Pierskalla, 2018; Sanborn and Thyne, 2014). Throughout history, universities have also been crucial institutional innovations in the state-building process. During the Middle Ages, the competition between secular and ecclesiastical rulers slowly increased. At the same time, modern states with their bureaucratic structures began to emerge. These concurrent developments raised the need for institutionalizing the supply of specialized labor. Universities subsequently became the primary venue for training experts in the business of the state, while also supplying governing ideologies that rulers would use to legitimize new forms of rule (and themselves).

In this paper, we explore the historical origins of universities in Europe. Why and how did universities emerge? Which economic, social, and political conditions are most important in explaining the emergence of this particular institutional innovation?

Universities, autonomously from existing political authorities, first emerged around 1200 in Europe, in cities such as Bologna, Paris, and Oxford. These institutions mainly came about to train experts in Roman and canon law (Riddle, 1993). From then on, universities slowly spread throughout the European continent. Which political and socio-

economic factors are responsible for this development? We identify four broad mechanisms that potentially explain the emergence and spread of universities: the rise of urban commercial centers, the demands of ecclesiastical rule, the advent of secular rule, and the early beginnings of Enlightenment thought. We collect original data on university creations and closures from 800-1800 to empirically explore the explanatory power of these different theoretical mechanisms. We combine these data on the number of universities with detailed data on European cities that could have served as potential locations for universities (Bosker, Buringh and van Zanden, 2012) and data on early-modern state-building (e.g., from Dincecco and Onorato 2018 and Nüssli 2011). Our unit of analysis is the city, nested in a state, covering the years 800-1800. We use Bayesian multilevel and classic frequentist fixed effects models to trace the spread of universities over this period.

We find little evidence that the general commercial rise of cities drives the creation of universities. If there is any effect of city size and wealth, it is limited to the set of the largest cities in Europe and later centuries. There is also little evidence that another standard mechanisms of state-building, the demands of engaging in warfare (Tilly, 1990), affects the creation of universities. On the other hand, we find robust evidence that the establishment of universities is related to the demands of ecclesiastical rule, especially after the papal schism of 1378. The finding suggests that universities were crucial tools to support the church. At the same time, the institutions of self-governance in cities and early presence of a printing press are strongly associated with growth in universities. Thus, universities were also used to bolster secular rule. This demand for elite education by secular rulers, however, does not seem to be driven by classic *bellicist* causes, but instead by more domestically oriented efforts at state building. Our findings also imply that not just top-down demands of rulers were responsible for university creations, but that cities and an emerging Enlightenment elite often demanded their conception.

This paper makes several contributions to the literature. We add to the already existing research on the historical origins of institutions by theorizing and empirically investigating the previously understudied origins of universities. Existing work has focused on the historical roots of the rule of law, parliamentary practice, and legal sys-

tems (Van Zanden, Buringh and Bosker, 2012; Stasavage, 2010; North and Weingast, 1989; Acemoglu and Robinson, 2006). This work has mostly neglected universities, although they constitute an essential institutional innovation originating in Western Europe.¹

Second, we contribute to the growing body of work on state-building. Scholarship on state-building has made a lot of effort to understand the macro-historical patterns of the emergence of the modern, centralized state (Tilly, 1990; Herbst, 2000; Gennaioli and Voth, 2015; Abramson, 2017; Acharya and Lee, N.d.; Dincecco, 2015; Karaman and Pamuk, 2013; Besley and Persson, 2011), focusing specifically on warfare as a core causal force and the creation of tax capacity as a key signifier of modern stateness (Levi, 1989; Queralt, 2015). We broaden this debate by also considering the rise of universities as a core aspect of the European state-building process. Universities played a crucial role in the development of modern state machinery, be it via their role in the training of staff for European rulers' increasingly differentiated bureaucracies or as suppliers of legitimizing governing theories. Whereas the small body of existing work on universities is historical in nature (Rüegg, 2004, 2010; de Ridder-Symoens, 1996, 2003), focused on specific regions in Europe (Cantoni and Yuchtman, 2014), or limited in the scope of quantitative analysis (Riddle, 1993), our paper is the first to offer a broad quantitative investigation of university creations through all of Europe from 800–1800.

2 The Origin of Universities

The modern university is an institution that engages in the transfer and certification of human capital and the production of scientific research. Generally, universities also enjoy some autonomy from government interference in the form of academic freedom and secure employment of its staff, though states very substantially in the degree to which this freedom is granted (Grimm and Saliba, 2017). Even though, universities' institutionalized role in modern scientific research really took shape over the course of the 19th century, in response to the Enlightenment and the Industrial Revolution, other core features of universities were present starting in the 12th and 13th century. Riddle

¹There is some disagreement if centers of higher learning in the Middle East during Islam's Golden Age should be classified as universities (Huff, 2003). There is little debate, however, that the European university would become the dominant type in its specific form.

defines the university as "...a corporate entity with some degree of autonomy, teaching a diversity of subjects and typically offering advanced degrees." (Riddle, 1989, p.14). This combination of roles was potent enough so that universities soon displaced any other organizations of higher learning and research, e.g., Royal Academies, and eventually gained a near monopoly over tertiary education. Universities, therefore, ended up shaping the education of elites in most countries.

The first European universities emerged around the year 1200 as replacements for education supplied through monastic and Cathedral schools. The emergence of urban centers in Europe led to more commercialized urban economies and an increasingly complex administration of cities and principalities throughout Europe. All whilst the Catholic church's governance structure also became more complicated. These concurrent developments led to a rising demand for literate individuals trained in Canon and Roman law. Monastic orders that had traditionally been the centers of training for literate experts in ecclesiastical and secular rule in the early Middle Ages, however, embarked on a period of internal reform and retreat from the world. This increasing demand for literate individuals thus went unmet. As a consequence, cathedral schools and growing urban centers became focal points for the academic exchange among Canon law scholars outside of monastic orders. Eventually, Cathedral schools and informal congregations of scholars would formally incorporate as "universities", mirroring existing guild structures, to give an organizational form to their enterprise.

At this point, universities engaged in the training of students in the fields of law, theology, and medicine (later adding the arts). This training was officially certified via the conferring of degrees. Functionally, universities offered an organizational structure for scholars to engage in the exchange of training and degrees for student fees. While the earliest European universities emerged autonomously via the entrepreneurial activities of local scholars, making universities initially independent of secular and church influence, this quickly changed. As early as the 13th century, universities sought official sanctioning by a higher political authority, typically a secular lord or the church, to add value to their degrees, instead of relying solely on reputation. In later centuries, this top-down process became the standard procedure for university creation. The power

to endow universities was then held by either the pope or a powerful secular lord. Receiving official sanction brought important benefits to a university. It allowed for the conferring of degrees that would be automatically recognized by ecclesiastical and secular authorities, creating a path of employment for university students. It also allowed students to retain income from church benefices while at university (Riddle, 1993, p.50). Consequently, this generated a stable demand for the services offered by universities. A second privilege conferred to medieval universities was a limited form of academic freedom, which allowed subjects from different regions of Europe to travel freely for the purposes of furthering their education. This made early universities pan-European institutions that could sell their services broadly. This form of academic mobility would be restricted later on, as states, and by extension universities, became more nationalized. At one point educational access to universities would only be granted to citizens.

As the European state-system crystallized and the modern state emerged as the dominant political form, these states established well-defined national borders and differentiated central state bureaucracies. At the same time universities increasingly institutionalized and became the main suppliers of trained civil servants and producers of secular governance ideologies, which offered legitimacy independently of the church. As the nation state became stronger, universities developed into narrow national institutions created and maintained at the behest of secular rulers. While absorbing the intellectual currents of the Enlightenment and the modern scientific method, the influence and involvement of state authorities in the internal management of universities also grew.

Over the course of the 18th and 19th century, universities across Europe became more rigorous and scientific, fully internalizing the core ideas of the Enlightenment and reflecting the increased importance of the natural and applied sciences. In part, these changes reflected new demands due to the Industrial Revolution. These new demands led to internal reforms and new waves of university creations, culminating in its clearest form in the shape of the modernized German universities of the late 19th century, which would be imitated around the world.²

²There is a parallel history of the spread of universities to other parts of the world, largely because colonial powers saw the need to train a small local elite to staff the colonial state apparatus.

The historical development of the university has been covered fairly well in the literature. Several path-breaking volumes have chronicled the different waves of university creations, the institutional evolution of universities, and their role with respect to the state and society (Rüegg, 2004, 2010; de Ridder-Symoens, 1996, 2003; Cobban, 1975; Haskins, 1957). Research in political science, economics, and economic history has also begun to unpack the effects of universities on various economic and political outcomes. Given that the modern university took on a new relevance and role in the wake of the Industrial Revolution, several studies have tried to ascertain the role of universities for technological innovation and economic growth (Valero and Reenen, 2016; Andrews, 2017; Cantoni and Yuchtman, 2014).³ In political science, research on universities has been part of a larger program on the role of education for politics (Gift and Wibbels, 2014). Most famously, modernization theory (Lipset, 1981) stresses the importance of literacy and broad-based education for the process of modernization and democratization. The link between mass-level education and democratization has been investigated in multiple studies (Sanborn and Thyne, 2014; Gift and Krcmaric, 2017; Benavot, 1996; Acemoglu et al., 2005). Related work has also looked at the relationships between mass- and elite-level education and state capacity (Hong and Paik, N.d.; Green, 1990), nation-building (Bandiera et al., 2017), social trust (Rothstein and Uslaner, 2005), conflict and collective action (Thyne, 2006; Dahlum and Wig, 2017; Dahlum, 2018) or political participation (Croke et al., 2016; Lieberman, Posner and Tsai, 2014; Wantchekon, Klašnja and Novta, 2015; Berinsky and Lenz, 2011; Larreguy and Marshall, 2016). Specific work on universities, however, is scarcer. Recently, several studies have identified effects of universities on democratization and pro-democracy attitudes (Hollenbach, Magat and Pierskalla, 2018; Sanborn and Thyne, 2014; Valero and Reenen, 2016). Most prominently, Ansell (2010; 2006) has investigated the political economy of tertiary education in modern welfare states.

Explicit research on the emergence of universities from a political economy perspective is rare. Most historians emphasize a series of jointly causal and interactive macro-

³It is of note though that there exists a much larger literature on the effects of primary and secondary education on growth (Barro, 1997, 2001; Krueger and Lindahl, 2001).

historical processes, highlighting the rise of urban centers, the differentiation and competition of secular and ecclesiastical rule or intellectual and social changes in the course of the late Middle Ages and the Renaissance as drivers of university creations (Rüegg 2004, 2010; de Ridder-Symoens 1996, 2003 but also see Cantoni and Yuchtman 2014 and Cantoni and Yuchtman 2013). Riddle (1993) develops a more specific political rationale for the emergence and spread of universities. According to Riddle's (1993) argument, universities were more likely to be founded in more politically fractionalized states, i.e., the degree of political fractionalization *within* states is an important predictor of university foundings before 1800.

We draw on these existing explanations and related theories of state-building and the emergence of representative institutions to identify four broad types of mechanisms that might drive university creations: structural economic drivers, the demands of ecclesiastical rule, the demands of secular rule, and the emergence of early Enlightenment thought. In the following sections, we will expand upon each of these mechanisms.

2.1 *Structural economic drivers*

As European cities started to enter a period of economic growth and prosperity in the Middle Ages (Bosker, Buringh and van Zanden, 2012; Bosker and Buringh, 2017), the rise of long-distance, variegated commercial activities required a different type of human capital in cities. While the guilds supplied and regulated the training of skilled artisans, merchants had an increasing need for specialists trained in reading and writing, basic math, book keeping, and Roman and local law. The structure of the university was a convenient and practical way to generate the labor force required to spur further commercial development. At the same time, as these cities grew in size and wealth, they were also increasingly able to allocate sufficient resources to the operation of dedicated centers of higher learning. The relationship between city development and the creation of universities was thus likely operating in both directions. For example, as Cantoni and Yuchtman (2014) argue convincingly, the creation of medieval universities also allowed the advancement of modern commercial contracting techniques that in turn facilitated trade and exchange. We therefore expect that:

H1: City growth is associated with the creation of universities

2.2 The demands of ecclesiastical rule

Medieval European rule was characterized by competition and collaboration of the Catholic church and secular rulers. As opposed to modern nation-states, rulers did not fully concentrate all forms of state power and legitimacy within well-defined borders and a unified bureaucratic apparatus. Instead rulers in large part relied on the Catholic church to supply the necessary charismatic legitimization of their rule.

As such, a dual structure between secular and ecclesiastical rule existed in most European territories. The church and secular rulers operated in separate spheres in some aspects of governance, while cooperating and competing in others. This tension between secular and ecclesiastical rule required the church to maintain a large and specialized bureaucratic apparatus that produced advanced and complex governance ideologies. These principles legitimized the role of the church and sanctioned some forms of secular rule. At the same time, an ecclesiastical bureaucratic apparatus was also needed to collect taxes, control coercive labor arrangements, manage lands and church businesses, even engaging in the production of law and order in directly administered territories, all the while tending to the provision of religious services across thousands of small communities.

Traditionally, the church had relied on Cathedral schools and monasteries to train priests and church administrators. The rediscovery of Roman law in the Middle Ages required the church to produce experts in Canon and Roman law to negotiate the increasing competition with secular rulers. This higher demand for scholastic work, paired with the retreat of several monastic orders from their role as training grounds, led the church to embrace new institutional models for the production of experts in ecclesiastical rule. Universities quickly became a successful model that could be co-opted into the service of the church by offering official Papal sanctioning in exchange for the training of staff. Initially, the church was selective in issuing papal decrees that legitimized universities, wary of losing control over theological teaching. After the Papal schism of 1378, which created competing papal authorities, universities were created more widely across

Europe (Cantoni and Yuchtman, 2014).⁴ Empirically, we expect that the demands for ecclesiastical rule manifest most clearly in cities that host bishop or archbishop seats—the loci of church bureaucracy with a demand for trained experts in ecclesiastical rule:

H2: Cities with bishop or archbishop seats are associated with the creation of universities.

2.3 *The demands of secular rule*

The Medieval and early modern period of Western Europe was also characterized by the slow emergence of secular power in the form of centralized states. As these secular powers emerged, they naturally entered into competition with clerical authority. Tilly (1990) describes the process of violent competition of the many European principalities as a core driver in the creation of modern state institutions, characterized by a complete monopoly over the use of violent means in a well-defined territory, the existence of a centralized bureaucratic apparatus, and the articulation of legitimizing governance ideologies in support of rule. Famously, Tilly (1990) sees war-making as the core propellant of this process, which requires rulers to capture full control over coercive means, modernize their use, and create institutions, in particular institutions for tax collection, to finance war-making. While this *bellicist* approach to state-building has largely focused on the creation of modern bureaucracy and the authority to tax, the logic of the argument extends to the creation of universities. Rulers had a clear need to create universities in order to assure the supply of a well-trained labor force, steeped in Roman law and modern theories of the administrative state. This was important for several reasons. First, growing secular bureaucracies required trained staff that were conversant in Roman and church law and could aid rulers in effectively running increasingly complex state institutions and diplomatic efforts. Second, by creating secular universities that were specialized in the training of law, rulers diminished the reliance on church institutions, tilting the balance of power away from the Catholic church. Third, secular universities allowed rulers to encourage the creation of governing ideologies that justified their rule independent from the church or rival rulers.

⁴From 1309 to 1378 the papacy resided in Avignon, rather than Rome, an arrangement that came to an end in 1378 with the election of an Italian pope (Urban VI). The attempt to return the papacy to Rome was met with the institution of a rival pope in Avignon, manifesting a schism in the church that had important political reverberations throughout Europe.

We expect that the demands of centralized secular rule for territorial states are associated with the creation of universities. Empirically, this should be expressed via higher number of universities in territories engaged in more conflict (*á la* war-making as state-making), more universities in cities that are capital cities of larger political units (with a concentrated demand for administratively trained experts), and cities in territories governed by centralized princely states (De Long and Shleifer, 1993):

H3a: Capital cities, cities nested in states engaged in more conflict, or governed by strong princes experience more university creations.

A different demand-side driver of university education is another form of secular rule that emerged in parallel to top-down absolutist rule: the self-governance of cities and political fractionalization of power. The late Middle Ages and Renaissance period was characterized by different types of secular regimes. Boix (2015) and Stasavage (2014) broadly distinguish between larger territorial princely states and city states that stood in competition with each other for long time periods of European history. Moreover, not every territorial state was characterized by power centralized in the hands of a single ruler. While by 1800 large territorial nation-states had become the dominant political form in Europe, this was the result of long-term competition between different modes of authority. The evolution of princely states to modern, centralized and absolutist states creates one source of demand for university educated experts. A parallel demand was generated by the rise of institutions of self-governance in city-states and cities within princely states. Starting in the early 13th century, urban commercial elites across Europe asserted some autonomy from local lords, creating a varying array of local participatory institutions and, importantly, contributed to the development of parliamentary institutions more generally (Van Zanden, Buringh and Bosker, 2012; De Long and Shleifer, 1993; Acemoglu, Jonson and Robinson, 2005). This institutionalization of self-governance and constraints on princely rule also required the creation of human capital that could be deployed to articulate the needs of parliamentary or city self-governance. At the same time, these institutions of self-governance also contributed to the overall internal political fractionalization of early European polities, generating competing claims to political authority and a need to control the production of knowledge and legitimacy via

universities ([Riddle, 1993](#)):

H3b: City-states and cities with self-governance institutions experience more university creations.

2.4 The emergence of early Enlightenment thought

The final driver of university creations we identify is linked to the Enlightenment. This intellectual revolution had a huge impact on political, cultural, economic, and social development in Europe ([Mokyr, 2010, 2002; Pagden, 2013](#)). The Enlightenment played an important role for the development of the university, at a minimum, by increasing the demand for university education. Enlightenment thought provided challenges to incumbent theological and political theories, e.g., the presence of upper-tail human capital in revolutionary France was associated with more demands for mass education and democratization ([Squicciarini and Voigtländer, 2016](#)). The Enlightenment also laid the groundwork for the scientific revolution, providing universities with new topics to expand their teaching and research portfolio.

While the causes of the Enlightenment are many, the development of the printing press played an enormous role in creating the structural preconditions for Enlightenment thought. Cities with printing presses were able to generate a larger population with upper-tail human capital that propelled the Enlightenment movement. This concentration of human capital, paired with the presence of the book printing technology, created complementary and increasing returns for the creation of universities. Consequently, we expect that university creations are higher in cities that were early adopters of the printing press technology:

H4: Cities that were early adopters of the printing press are more likely to experience university creations.

3 Data and Research Design

In order to empirically investigate the correlates of university creations, we construct a new data set on universities from 800 – 1800. We begin by defining an appropriate unit of analysis. As universities are generally founded in urban agglomerations, we opt for cities, nested in European states, as our unit of analysis.⁵ We use the canonical city data from [Bairoch \(1988\)](#) to define our universe of possible locations in which universities can be founded. These data include all cities that reached a population of over 10,000 at some point in the covered centuries. We construct a panel of city-centuries from 800 to 1800 to cover the core period of early university creations in Europe. In this paper, we forego an analysis of later university creations in the 19th and 20th century because the role of the university changes in this time period. The Industrial Revolution creates a new economic environment with high returns for applied scientific advancements, augmenting the importance of universities. At the same time, the advent of democratic rule and an expanded franchise is tied to a new class of university-educated elites ([Hollenbach, Magat and Pierskalla, 2018](#)) and positions universities in potential opposition to autocratic rulers. This likely changes the underlying dynamics of university creations throughout the 19th and 20th century in comparison to pre-1800.

We draw on an updated version of the [Bairoch \(1988\)](#) data by [Bosker, Buringh and van Zanden \(2012\)](#). [Bosker, Buringh and van Zanden \(2012\)](#) study city growth in Europe and the Middle East and their data provides detailed information on city size, geographic context conditions, and political and religious institutions. We focus on the set of European cities in the data, which gives us 677 unique cities observed over eleven centuries.

We nest these 677 cities in historical European political entities whose territory covered the city location in each respective century. We avoid using modern countries as larger political units in which the cities are nested, due to the post-treatment character of modern country shapes. We take political maps of Europe for each century from [Nüssli \(2011\)](#) and assign each city, based on its coordinates, to the appropriate political unit for

⁵At a minimum this is true for the time period and region that we study.

each century. Each distinct unit in the [Nüssli \(2011\)](#) data receives a unique identifier to allow for the inclusion of fixed or random effects for each specific political unit.

While the [Bosker, Buringh and van Zanden \(2012\)](#) data contains a binary variable for the presence of a university, this measure does not accurately reflect the creation of multiple universities in the same city, the closure of universities, and the presence of some universities originally not recorded in the data. We construct a time-varying count of the number of universities in each city, based on information from historical secondary literature ([Rüegg, 2004, 2010; de Ridder-Symoens, 1996, 2003](#)) and an assortment of university-specific sources.⁶ We use this time-varying count, and a binary dependent variable that takes the value 1 when the count is positive and 0 otherwise, as our outcome variables.⁷

Figure 1 displays the overall count of universities in our sample over time. The plot also marks several important historical moments in Europe: the Papal schism, the Reformation, the signing of the Peace of Westphalia, and the French Revolution. As noted in the historical literature, the first universities were founded around the year 1200. This was followed by a steady increase until the final year in our sample: 1800. We observe a dip in the overall number of universities due to the closure of several universities in the wake of the French Revolution.

Figure 2 shows the distribution of cities in our sample across Europe as orange dots, while those cities that had a university by 1500 (left) or 1800 (right) are shown as green triangles. As one can see, in 1500 universities were most concentrated in what is today Italy, followed by France, Spain and Germany. By 1800, the number of universities has increased significantly and these institutions are spread throughout Western Europe.

To predict the number or presence of universities in each city i , nested in state k , and century t , we rely on a number of geographic and structural control variables, and several measures that capture the effects of our substantive variables of interest.

As control variables we consider the latitude of each city (*Latitude*), a dummy variable

⁶Wikipedia generally offers a fairly detailed account of university histories.

⁷Our time-varying binary variable differs from the variable provided by [Bosker and Buringh \(2017\)](#). There are 152 city-centuries recorded as having a university in the Bosker et al. data that we code as 0, likely due to unrecorded closures of universities, and there are 93 city-century cases in which we record the presence of a university not contained in their data. Our core results do not depend on this difference.

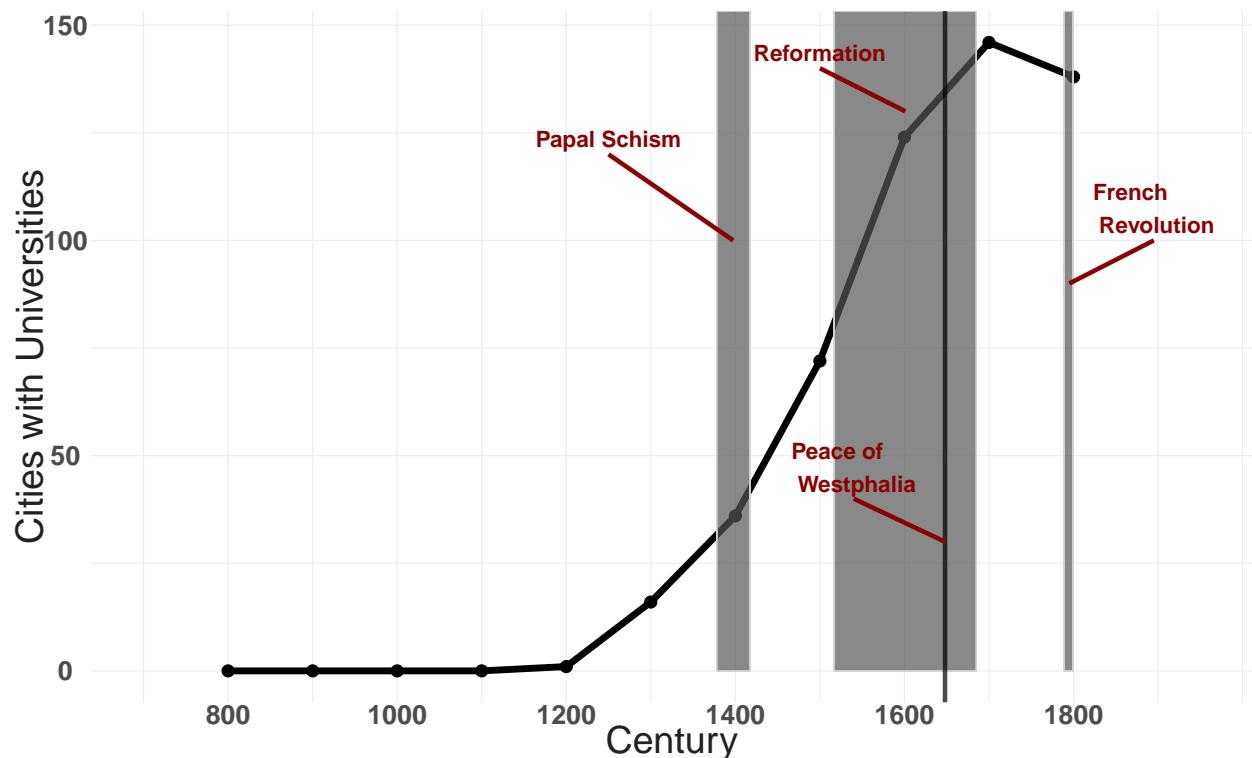


Figure 1: This figure shows the development of universities over time, as well as several important historical moments in Western Europe. The first universities were founded around the year 1200. This was followed by a steady increase until the final year in our sample: 1800. We observe a dip in the overall number of universities, likely due to the closure of several universities in the wake of the French Revolution.

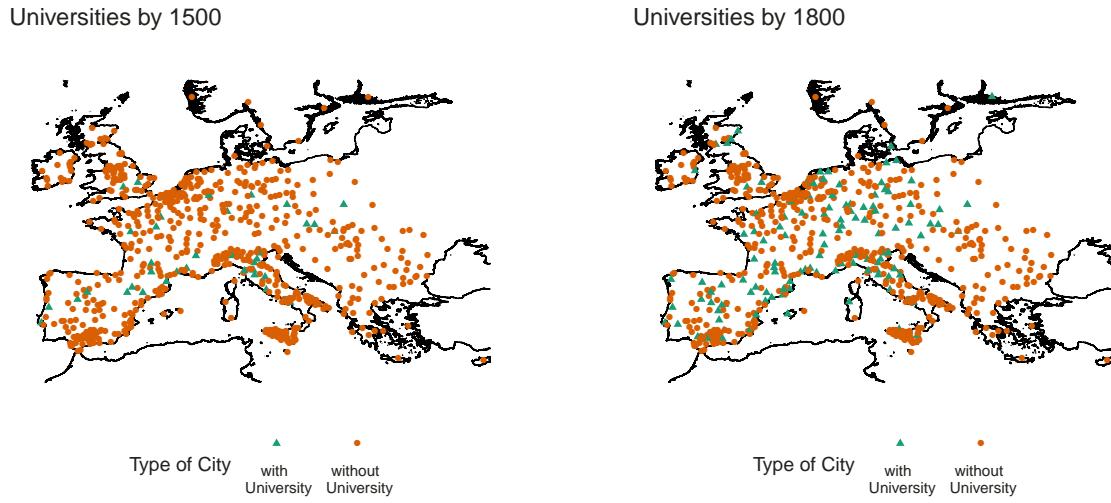


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for cities close to the sea (*Sea*), a dummy variable for cities on rivers (*River*), a dummy variable for cities on hubs of ancient Roman roads (*Roman hub*), a dummy variable for cities on Roman roads (*Roman road*), the elevation level (*Elevation*), and the average soil quality in the vicinity of the city (*Soil Quality*). These geographic variables capture a city's local economic potential via agricultural productivity, long-distance trade, and general transport infrastructure (Acemoglu, Jonson and Robinson, 2005; Findlay and O'Rourke, 2007; Nunn and Qian, 2011). We also include the logged distance to Rome in kilometers (*Distance Rome*) and a dummy variable for Muslim rule (*Muslim*) as controls, since Muslim rulers might have espoused different models of higher learning. All these variables are provided by Bosker, Buringh and van Zanden (2012). Lastly we add a French Revolution dummy for cities under French rule during the time period, to account for the unique closure of universities after 1789 and a dummy variable that identifies early adopters of the Protestant reformation, based on Rubin (2016) (*Early Protestant*). The Protestant reformation empowered secular rulers and led a secularization of universities (Cantoni, Dittmar and Yuchtman, N.d.). While we develop more direct measures

for the demand-side drivers of secular rule, we control for the early adoption of Protestantism, in case there exist independent effects on the process of university creation.

To measure the effect of city growth on university creations (see *H1*), we follow the literature and take population size as a proxy for the level of development (provided by [Bosker, Buringh and van Zanden 2012](#)). We deviate from the literature, however, by converting this measure of population size into a factor variable based on percentiles. Specifically, we code cities as four separate categories: 0 – population size \leq 70th percentile; 1- > 70 and \leq 80th percentile; 2 - > 80 and \leq 90 percentile; and 3 - > 90 percentile. This transformation allows us to avoid logging the population size, especially for cities with small populations that are recorded as zero, and it allows for non-linear effects.

The demand-side effect of ecclesiastical rule (see *H2*) is captured by a dummy variable that takes the value 1 if a city is host to an archbishop or bishop seat (*Bishop*, constructed based on [Bosker, Buringh and van Zanden 2012](#)). Archbishop and bishop seats in a city signify the presence of important church bureaucracy that was needed to actively manage the worldly and spiritual enterprise of the church in a given region.

With regard to *H3a* and *H3b*, we consider a series of complementary measures that capture different aspects of secular rule. First, to represent the effects of war-making, we take data on the location of historical battles from [Dincecco and Onorato \(2018\)](#) and match them to the historical political units from [Nüssli \(2011\)](#). We then count the total number of battles fought on the territory of each political unit in the preceding century as a measure for the overall pressures due to war. This variable is assigned to each city based on our nesting structure (*Conflict*).

To capture demand-side effects of centralized rule independent of war-making, we include a dummy variable for each city that signifies capital city status (*Capital*) and whether the city was governed by an absolutist/despotic state or was a free city (*Prince*, based on [De Long and Shleifer 1993](#)).⁸

With respect to *H3b*, the *Prince* dummy variable already partitions the sample into city-states and princely states. Beyond that, we focus on two forms of self-governance

⁸The designation “free” includes city-states, constitutional regimes or feudal regimes with weak rulers.

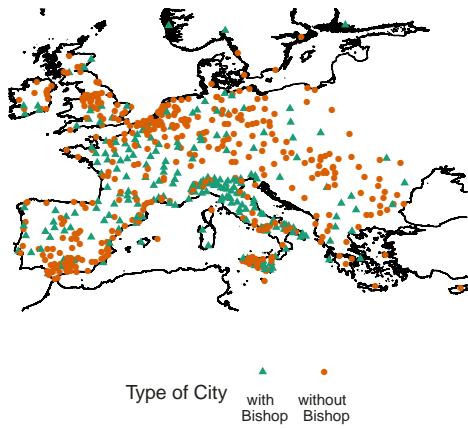
institutions. We include a dummy variable for the presence of any form of communal participatory organizations (*Self-Governance*, see Bosker, Buringh and van Zanden 2012) and a dummy variable that takes the value 1 if cities were able to participate via parliamentary institutions in national decision-making (*Parliament*, based on Van Zanden, Buringh and Bosker 2012).

We identify cities that would become centers of the Enlightenment by using the early adoption of the printing press as a proxy. We rely on data by Rubin (2016) to define a dummy variable for the existence of a printing press in a city by 1500 (*Early Printing Press*).⁹

Figure 3 again visualizes the cities in our sample. This time we mark those cities with self-governance institutions by 1500 (left) and the presence of archbishop or bishop seats in 1500 (right). As one can easily see, a vast majority of cities had a form of self-governance by 1500, especially in central Europe, less so in what is today Great Britain and southern Italy. Bishop seats were less frequent and concentrated especially in what is today Italy, France, and Spain.

⁹The data by Rubin (2016) does not cover all cities in our sample but it is likely that it nonetheless accurately identifies all early locations of the printing press. For our main analysis we assign zeros for the early printing press variable to all cities not originally included in the Rubin data. As a robustness check, we assign missing values instead. None of our findings are affected by this distinction.

Bishop Seats by 1500



Self-Governance by 1500

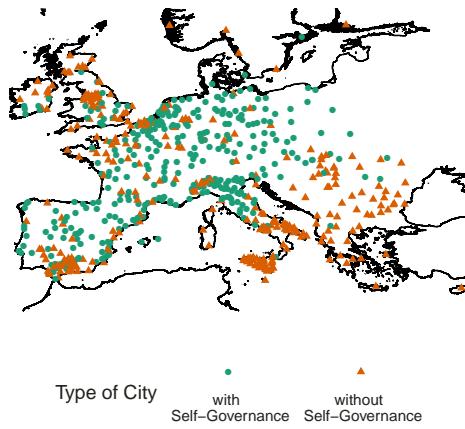


Figure 3: These maps again visualize the cities in our sample. The left map marks cities with self-governance institutions by 1500. The right map shows presence of archbishop or bishop seats in 1500. A vast majority of cities had a form of self-governance by 1500, especially in central Europe, less so in what is today Great Britain and southern Italy. Bishop seats were less frequent and concentrated especially in what is today Italy, France, and Spain.

4 Empirical Analysis

We pursue two complementary estimation approaches to investigate the arguments made above. As our main results, we present estimates from several Bayesian multi-level models. As a robustness check, we add evidence from classic OLS fixed effects models.

4.1 Bayesian Multilevel Models & Results

As a first baseline model we estimate a Bayesian multilevel model with random intercepts for years and cities. Specifically, the estimated model is of the following form:

$$\begin{aligned}y_{i,t} &\sim \mathcal{N}(\nu_{i,t}, \sigma), \nu_{i,t} = \alpha_{k=(i,t)} + \beta' \mathbf{x}_{i,t} \\ \alpha_k &\sim \mathcal{N}(0, \mathbf{V}_k), \mathbf{V}_k = \mathbf{D}(\sigma_k) \boldsymbol{\Omega}_k \mathbf{D}(\sigma_k)\end{aligned}$$

$y_{i,t}$ denotes our dependent variable of interest, a count of open universities in city i at time t .¹⁰ $\mathbf{x}_{i,t}$ is the matrix of covariates and β is a vector of population level effects. We specify Gaussian priors with mean zero and a standard deviation of two for the population level parameters. These are relatively conservative priors, reflecting the expectation of a null effect and somewhat tight variances. α_k are random intercepts for cities and years, which are drawn from a normal distribution with mean zero and covariance matrix V_k . To parameterize the model, the covariance matrix is decomposed into a correlation matrix and a vector of standard deviations. We then specify a default LKJ-prior (Carpenter et al., 2017) on the correlation matrix and a half student-t prior with 3 degrees of freedom on the standard deviations. These are relatively uninformative priors that should allow the data to speak, but are somewhat conservative in that the prior variance on the random intercepts is rather small. We use the default half Cauchy prior on the overall variance parameter σ . The model is estimated using the *brms* package in R (Bürkner, 2017). *brms* uses the Hamiltonian Monte Carlo and no-U-turn samplers

¹⁰Based on our university count, we also create a binary indicator variable for any open university in city i at time t .

implemented in *Stan* (Carpenter et al., 2017) to estimate the models.¹¹

As a first baseline model we include all variables of interest as population level parameters and add random intercepts for both cities and years. Figure 4 shows the median estimate, 90%, and 95% highest posterior density intervals for the population level variables and the variance parameter (The results are also show in numerical form in Table A.1 in the Appendix). Most estimated coefficients are close to zero, with the credible intervals covering a null effect. There are, however, already several notable relationships. First, cities near rivers are slightly more likely to open universities, though the 95% credible interval includes zero. Second, cities that were early adopters of Protestantism are also associated with more universities, in contrast the French Revolution led to a decrease in universities, though the 95% and 90% credible intervals cover zero.

Regarding the four hypotheses outlined above, the simple model presented here delivers mixed results. The categorical measure of city population is an important predictor of the number of universities in a city, but only for very large cities. Only cities with populations above the 80th percentile have a larger number of universities. If we instead include the continuous population variable, we recover a null effect of population size on the university count (Table A.2 in the Appendix). Thus, there is some evidence in line with H_1 , however, the relationship does not seem as simple as generally thought.

The model's result are quite strong with regards to H_2 , the effects of ecclesiastical rule. We recover a strong positive estimate for cities with archbishop or bishop seats and the effect is relatively precisely estimated. The marginal effect of a city being an archbishop or bishop seat is displayed in the left plot in Figure 5. The results are more mixed in terms of H_3 and the relationship with secular rule. We find relatively strong evidence that self-governance institutions (marginal effect displayed in left plot of Figure 5) and participation in parliaments was associated with more universities. At the same time, cities under princely rule were less likely to see growth in universities. With respect to the *bellicist* theories, we find no evidence that cities nested in states that were engaged in

¹¹We estimate each of the presented models by sampling five separate chains for 2500 iterations with a warm-up of 1000 iterations. We assess convergence both using rhat statistics, as well as visually. The rhat values for none of parameters presented are above 1.1.

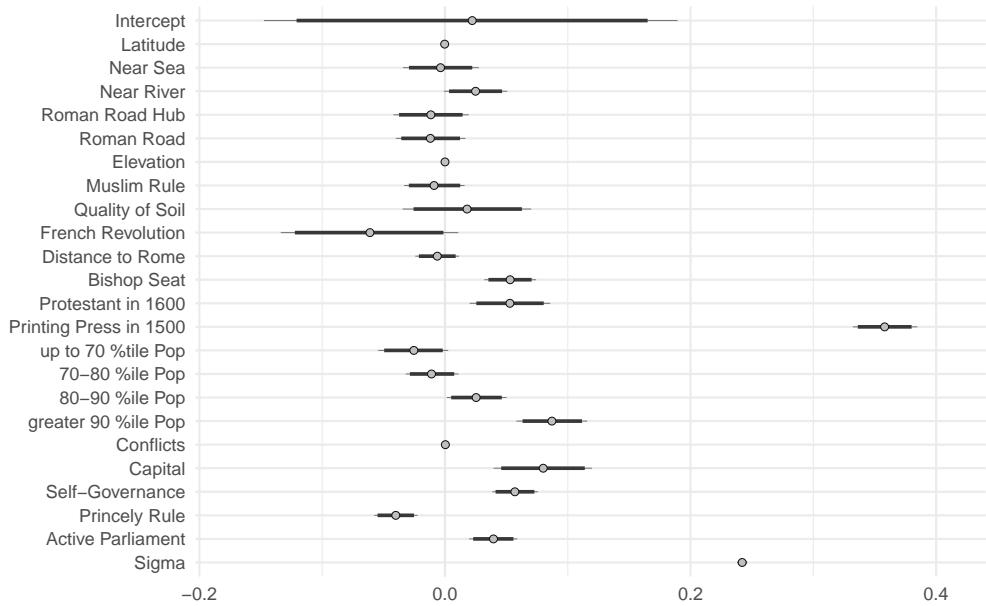


Figure 4: This figure shows the median estimate, 90%, and 95% credible intervals for the population level variables in the multilevel model with random intercepts. The vast majority of effects is estimated to be close to zero and/or the credible intervals cover a null effect. Most notably, we find that bishop seats, Protestantism, very large cities, capitals, cities with self-governance, and those active in parliament are associated with more universities. Princely rule and the french revolution are estimated to be negatively associated with university creation. The strongest effect is that of the printing press. A city with a printing press in 1500 had almost 0.4 more universities than those without.

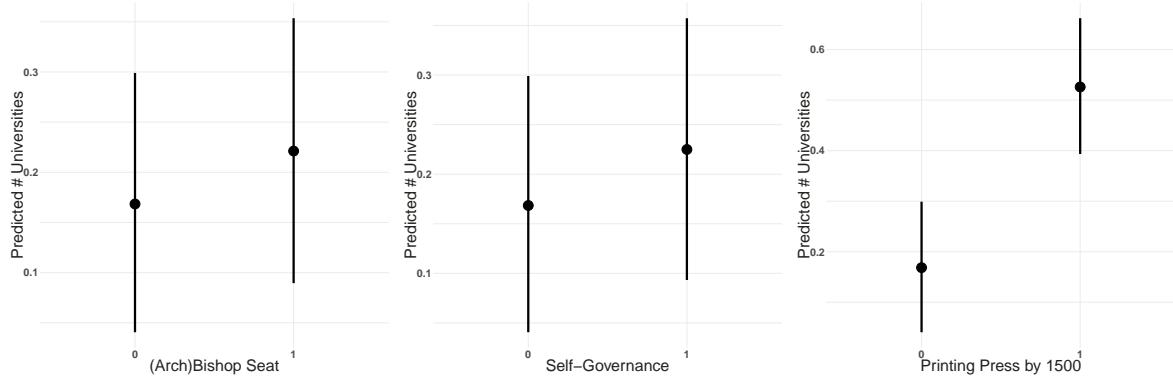


Figure 5: This plot shows the marginal effect of a city being a bishop or archbishop seat (left), a city having some form of self-governance (middle), and having a printing press in 1500 (right), holding all other variables constant. While both self-governance and bishop seats are associated with higher number of universities, the printing press clearly has the largest estimated effect. Cities which had printing presses in 1500 are predicted to have 0.52 universities compared to 0.18 in those cities without printing presses by 1500.

war making were more likely to establish universities. On the other hand, there is some evidence that capital cities are associated with a higher number of universities.

The evidence in favor of Enlightenment (*H4*) is probably the strongest, with a large estimated effect. All else equal, cities with a printing press in 1500 had almost 0.4 universities more than those without. The right plot in Figure 5 shows the marginal effect of having a printing press in 1500 holding all other variables constant. Cities which had a printing press in 1500 are predicted to have 0.52 universities, compared to 0.18 for cities without printing presses. We recover very similar results when we estimate this model as a multilevel logit with our binary dependent variable (Results presented in Table A.3).

Given the long time period studied and the possibility for differential effects across time periods, we investigate whether the relationship between universities and our main independent variables changes over time. We therefore estimate the same model as above but add random slopes by century for the following covariates: conflict, self-governance, parliament, city size (categorical), and bishop.

Figure 6 again displays the median estimates of the population level effects and their 90% and 95% highest-posterior density intervals. We again find a positive association

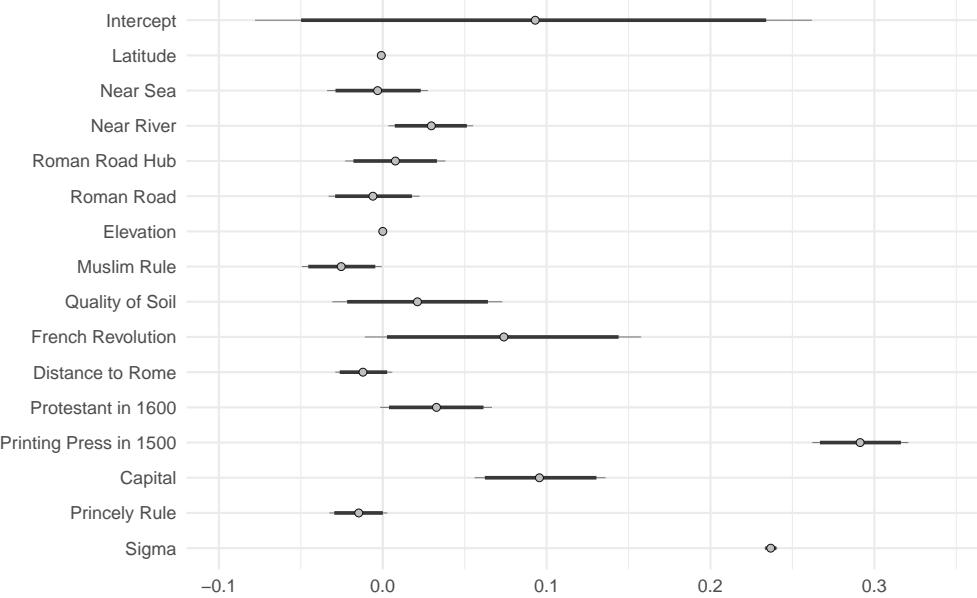


Figure 6: This figure shows the median estimates of the population level effects and their 90% and 95% highest posterior density intervals. The most important population level effect is again that of the printing press, which doubles the predicted number of universities. Similarly, capital cities are again positively associated with the number of universities. The coefficient estimate for the French Revolution is now positive, which may be due to the negative year specific effect of conflict in 1800.

between capital city and the number of universities, which is in line with arguments about state capacity being produced in the capital and could lend some support to a bellicistic interpretation. The strongest effect is again estimated to be that of the printing press, where the estimated coefficient is almost the same as in the model with only random intercepts. The cities with a printing press in 1500 are predicted to have 0.44 universities compared to 0.15 in cities without a printing press, all else equal.

The most significant difference to the previous model is the estimated effect of the French Revolution which is now positive, though the 95% credible interval covers zero. It is possible that the previously estimated negative effect of the French Revolution variable is now attributed to the effect of conflict in 1800. Whereas conflict is estimated close to a null effect with large credible intervals, in 1800 the effect is estimated to be negative and the 95% credible interval does not cover zero. Figure A.1 in the Appendix shows the random slopes for conflict by year.

With respect to the other three hypotheses, the year specific slopes reveal interesting

results. First, we again find evidence that population size may matter for very large cities – but the positive effect is also restricted to later centuries. The effect of the categorical city size variable is positive only for the largest category after 1200, all other estimates are essentially zero. Similarly, the credible intervals for all years aside from 1300, 1400, and possibly 1800 do cover zero. Median estimates and 95% credible intervals are shown in Figure A.2 in the Appendix. When we estimate the same model with the continuous population variable, the year specific effects are estimated to be zero early on but positive after 1300 and largest for 1800. The categorical representation of the variable suggest, however, that these results are driven by the largest cities in the sample.

Based on the multilevel model with random slopes, we also find more evidence for H_2 about the relationship between the church and universities. Figure 7 shows the year specific effects of the bishop variable, i.e. marking those cities which were hosts to Archbishop or Bishop seats. Whereas the previous model revealed a generally positive effect of bishop seats, we now recover more nuanced results. Specifically, as Figure 7 shows, the year specific effects are estimated to be essentially zero from 900 – 1300. Starting with the 13th century, however, the effect of having a bishop seat is positive and the 90% and 95% credible intervals do not cover zero (except for the 95% interval in 1500). The estimated relationship between bishop seats and universities is largest for 1700. These differential effects, especially pre- and post-1400, are in line with the idea that the papal schism from 1378 to 1417 led to important changes in the organization of the church and the relationship between secular and religious authorities.

Lastly, with respect to H_4 and secular state building efforts, we find that cities that were more engaged in early democratic practices and self-governance were in fact more likely to open universities. Again, however, the relationship is not constant over time. Figure 8 shows the year specific effects for cities that engaged in self-governance, while Figure A.3 in the Appendix shows the year specific effects of cities participating in parliaments. For both variables, the estimated effect is close to zero for early centuries with both 90% and 95% credible intervals covering a null effect. The positive impact of self-governance institutions on universities starts in 1400 but is only reliably estimated to be positive in 1600 – 1800. For cities participating in parliaments, the estimated relationship

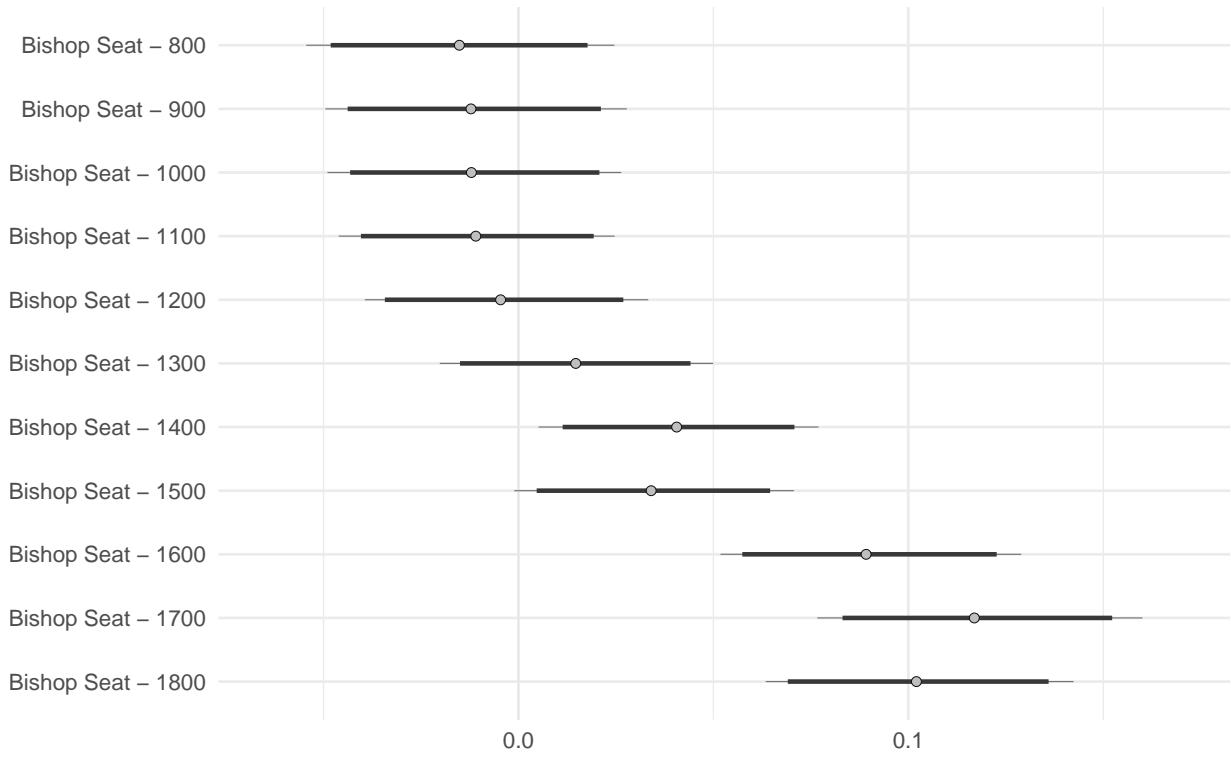


Figure 7: This figure shows the estimated random slopes by year for the (Arch)Bishop variable. As the plot shows, the relationship is estimated to be essentially zero until 1400 when it becomes positive. This coincides with the papal schism from 1378 until 1417. The effect is estimated to be largest in 1700.

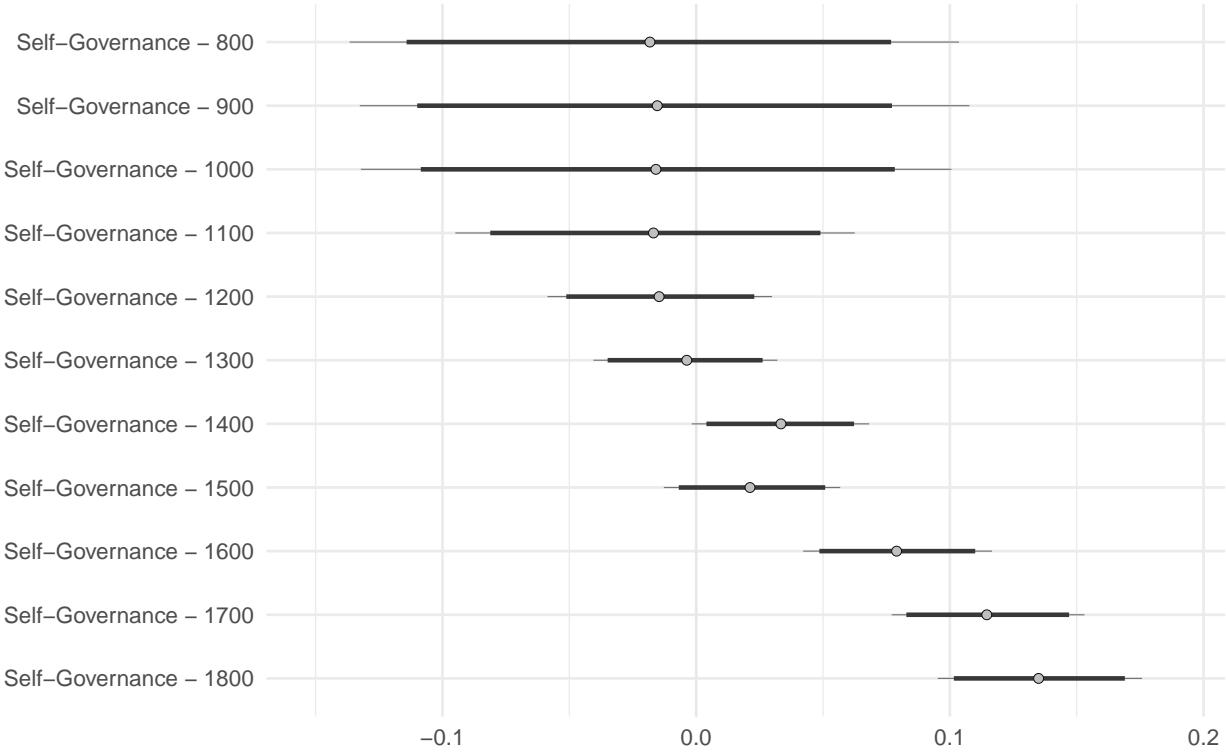


Figure 8: This figure shows the year specific effects of cities with self-governance institutions. The effect is essentially zero for long periods of time but is estimated to be positive starting in 1400. The relationship is strongest for 1800 but the 95% credible intervals for 1600, 1700, and 1800 do not include zero.

is much smaller (about half of that of self-governance institutions) and only for 1700 and 1800 does the 90% credible interval not include zero.

The more flexible model with random slopes by year for our main variables of interest confirms the general results presented in the model above, but reveals more nuanced insights. For many of the variables, the estimated effects are only important in later centuries. This is not surprising, however, given that Figure 1 shows that the majority of universities were founded after the turn to the 15th century. Furthermore, the number of observations in early years is quite small for some variables, meaning that there is not enough information to change the slope estimates from the overall mean. This is exemplified by the non-identification of some of the interactions with year fixed effects in the OLS models presented below.

4.1.1 Additional Robustness Checks

We also estimate the above presented models as multilevel logit models with a binary dependent variable that is one for cities with at least one university. The results are very similar to the ones presented here. Tables A.3 and A.6 in the Appendix give the estimates for the population level effects of the binary models. In addition, we estimate an additional multilevel model where we added year specific slopes for the capital and princely rule variables. The main results do not change substantially and based on model comparisons we decided to present the slightly simpler model.

4.2 Fixed Effects Models & Results

For our main results we have so far presented multilevel models with random intercepts for cities and years as well as random slopes for a number of variables. We believe those models to be most appropriate, however, some reader may be concerned about remaining unobserved covariates at the city level. We therefore also present OLS fixed effects models which may be seen as more appropriate for those concerned about other potential time-invariant confounders, such as city location or natural resource endowments. On the other hand these models only estimate coefficients based on within city variances and some unobserved confounders could potentially be post-treatment.

For our OLS fixed effects model, we take the number of universities (or the binary variable) in each city i , in political unit k in century t as a function of predictor variables \mathbf{x}_{it} , containing controls and our substantive variables of interest, and fixed effects for city-level (η_i) and century (γ_t). Additionally, we here also add fixed effects for the political unit (α_k). This results in the following model specification:

$$y_{ikt} = \eta_i + \alpha_k + \gamma_t + \mathbf{f}' \mathbf{x}_{it} + \epsilon_{ikt}$$

The inclusion of century fixed effects accounts for any secular, Europe-wide trends in the creation of universities (e.g., via the diffusion of this institutional model). Fixed effects for political units account for unobservable characteristics of specific states, and city-fixed effects control for unobservable characteristics of city locations. Additionally,

as with the random slopes above, we also estimate a model with interactions between the year fixed effects and our main variables of interest.

Table 1 below shows the coefficient estimates and standard errors from six different fixed effects model specifications. Column 1 presents the results when regressing the university count on our covariates and only including year and historical state fixed effects. Column 2 shows the results for the same model when we use the binary dependent variable, in column 3 we use the alternative university dummy from [Bosker, Buringh and van Zanden \(2012\)](#). For the models shown in columns 4,5, and 6 we add fixed effects for each city.

By and large, the results from the fixed effects models confirm the inferences made above. First, results are very similar no matter the dependent variable, i.e., the results are robust when estimating the models on a binary DV as well as when we use the university count from [Bosker, Buringh and van Zanden \(2012\)](#).

Compared to the Bayesian multilevel model, there are few pronounced differences. We again find that rivers are associated with more universities. Regarding population size, the fixed effects models recover a slight negative effect for smaller cities, this is in contrast to the results presented above. The main finding, however, that very large cities are positively associated with the number of universities (or the probability of any university) is confirmed.

Similar to the results presented above, the largest effect is again that of the printing press, in line with our *enlightenment* hypothesis. While slightly smaller, the estimated coefficient again implies approximately 0.32 universities more in cities that had a printing press in 1500 (Model 4 in Table 1).

With respect to *bellicist* theories, we find no evidence of a relationship between conflict and the number of universities (again similar to the multilevel models) but do find a small positive effect of the capital variable. This result goes away, however, once city and country fixed effects are included. Similarly, self-governance is positively associated with our own university count (and binary DV), but not with the university measure by [Bosker, Buringh and van Zanden \(2012\)](#). The estimated association with self-governance is also not recovered in the model with the binary outcome once city and country fixed

Table 1: University Creation

	University Count (1)	University (2)	University Alt (3)	University Count (4)	University (5)	University Alt (6)
Latitude	-0.004 (0.003)	-0.004* (0.002)	-0.004 (0.003)	(0.00)	(0.00)	(0.00)
Sea	-0.01 (0.02)	0.001 (0.02)	-0.001 (0.02)	-0.32 (0.40)	-0.15 (0.25)	0.03 (0.13)
River	0.04** (0.02)	0.03** (0.02)	0.04** (0.02)	(0.00)	(0.00)	(0.00)
Roman Hub	-0.02 (0.03)	-0.02 (0.02)	0.02 (0.02)	(0.00)	(0.00)	(0.00)
Roman Road	-0.03 (0.02)	-0.01 (0.02)	-0.01 (0.02)	(0.00)	(0.00)	(0.00)
Elevation	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	(0.00)	(0.00)	(0.00)
Soil Quality	0.05 (0.04)	0.04 (0.03)	0.02 (0.03)	(0.00)	(0.00)	(0.00)
Muslim	0.01 (0.03)	-0.01 (0.02)	-0.02 (0.02)	0.01 (0.07)	-0.01 (0.07)	-0.12** (0.06)
Distance Rome	0.02 (0.03)	0.02 (0.01)	0.01 (0.02)	(0.00)	(0.00)	(0.00)
Early Protestant	0.03 (0.07)	0.03 (0.04)	0.05 (0.04)	0.04 (0.07)	0.03 (0.04)	0.05 (0.04)
French Revolution	-0.01 (0.14)	-0.10* (0.06)	-0.01 (0.05)	-0.06 (0.15)	-0.14** (0.07)	-0.04 (0.05)
City Population 70th	-0.05** (0.02)	-0.03* (0.02)	-0.005 (0.02)	-0.05** (0.02)	-0.04** (0.02)	0.01 (0.01)
City Population 80th	-0.04** (0.02)	-0.03* (0.02)	-0.02 (0.02)	-0.04** (0.02)	-0.03** (0.02)	-0.01 (0.01)
City Population 90th	0.03 (0.03)	0.04* (0.02)	0.03 (0.02)	0.01 (0.03)	0.03 (0.02)	0.03 (0.02)
City Population 100th	0.10*** (0.04)	0.09*** (0.03)	0.09*** (0.03)	0.08* (0.04)	0.07** (0.03)	0.10*** (0.03)
Bishop	0.06*** (0.02)	0.05*** (0.02)	0.03* (0.02)	0.10** (0.04)	0.08** (0.03)	0.03 (0.03)
Conflict	0.0001 (0.001)	-0.001 (0.001)	0.001 (0.001)	0.0001 (0.001)	-0.0005 (0.001)	0.001 (0.001)
Capital	0.19** (0.08)	0.12** (0.05)	0.09* (0.06)	0.01 (0.08)	0.02 (0.06)	0.05 (0.06)
Prince	-0.02 (0.02)	-0.002 (0.02)	-0.01 (0.02)	-0.02 (0.03)	-0.01 (0.02)	-0.005 (0.02)
Self-Governance	0.07*** (0.03)	0.05** (0.02)	0.03 (0.02)	0.04* (0.02)	0.03 (0.02)	0.01 (0.02)
Parliament	0.06 (0.04)	0.02 (0.03)	0.03 (0.03)	0.03 (0.03)	0.01 (0.03)	0.01 (0.02)
Early Printing Press	0.31*** (0.05)	0.25*** (0.04)	0.21*** (0.04)	0.32*** (0.05)	0.25*** (0.04)	0.21*** (0.04)
Historical State FE	Yes	Yes	Yes	Yes	Yes	Yes
City FE	No	No	No	Yes	Yes	Yes
Century FE	Yes	Yes	Yes	Yes	Yes	Yes
N	4,851	4,851	4,851	4,851	4,851	4,851
R ²	0.29	0.33	0.31	0.50	0.54	0.60
Adjusted R ²	0.25	0.30	0.27	0.41	0.47	0.53
Residual Std. Error	0.32 (df = 4595)	0.24 (df = 4595)	0.23 (df = 4595)	0.29 (df = 4162)	0.21 (df = 4162)	0.19 (df = 4162)

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

effects are included. As above, we do again find strong evidence that cities with bishop or archbishop seats were more likely to establish universities, these results actually become stronger once city fixed effects are included.

Next we estimate the same models but now include interactions between our variables of interest and the year fixed effects. All plots of interaction effects are displayed in the Appendix in section A.2. The result largely confirm the results from the random effects models above.

First, with respect to $H1$, we find somewhat similar evidence compared to the Bayesian model. Figure A.4 shows the interaction effect between year fixed effects and the four city size categories. We again find that for smaller cities there is no effect of population. In contrast to the multilevel model, the fixed effects model suggests a positive effect for the third category ($80^{th} - 90^{th}$ percentile) in later centuries. Figure A.5 shows the year specific effects of the bishop variable as estimated in the fixed effects model. Again, ecclesiastical rule seems to have mattered in later centuries. As in the multilevel models, the effect is close to zero early on, but positive and significant in later centuries (starting in 1600). Regarding the bellicist theories ($H3a$), the fixed effects model suggests slight differences. As Figure A.6 shows, capital cities are associated fewer universities in early parts of our sample, while the interaction between year fixed effects and conflict is positive and significant for 1500 – 1700 (Figure A.7). Though the interpretation of the capital city coefficient in models with fixed effects for city and political units is somewhat unusual, as the variation is due to cities who gain/lose capital status.

We do find evidence similar to that presented above for $H3b$ about the effects of secular rule. We find a slight negative effect of princely rule for the last two centuries in our sample, though the interactive effects are not significantly different from zero (Figure A.8). As can be seen in Figure A.10 and A.9, we find that parliament mostly has no effect, but the interaction is significant and positive for 1800 and that self-governance has a positive and significant effect in the 18th and 19th centuries. Lastly, with respect to the enlightenment argument, the printing press variable again has a comparatively large coefficient (0.22) and is significant at the 1% level.

In sum, the traditional fixed effects models largely replicate our initial findings from

the Bayesian model. The data suggest a pattern of university creation that is driven mostly by the demands of ecclesiastical rule, particular modes of secular governance, and the early adoption of the printing press. Mere city size or the macro-level demands of warfare at the state-level, if at all, only weakly associated with the emergence of universities.

5 Conclusion

Universities emerged in Western Europe around 1200 and soon became to dominate the tertiary education sector as well as the production of basic research. Before the university appeared in its modern (and global) form, it played a more narrow, albeit just as important role for the development of European states. From 1200 to 1800 universities were the primary supplier of an administrative workforce that could be used to staff increasingly differentiated state bureaucracies. Universities also helped advance governance structures by articulating and developing formal legal codes of governance and commerce and differentiating secular notions of legitimacy.

In this paper, we empirically investigate the origin and spread of European universities from 800–1800. We identify four mechanisms that could explain the emergence of universities across Europe: economic-structural drivers, the demands of ecclesiastical rule, the needs of secular rule, and the influence of early Enlightenment thought. We provide original data on the number of universities across Europe and pair them with detailed information on cities that can serve as possible locations for university foundings, to create a panel dataset of nearly 700 cities, nested in historical states. We use Bayesian multi-level mixed and fixed effects OLS models to ascertain the association between the four mechanisms and the number of universities in each city. While our empirical exercise is mainly descriptive, it nonetheless reveals some noteworthy patterns. We find little evidence that economic development or the demands of war-making are direct drivers of university creations. Instead, the demands of ecclesiastical rule, specific forms of local secular rule, and the early presence of a printing press are robustly associated with the spread of universities.

These patterns add to the existing literature in several ways. First, by focusing on

the creation of universities, we broaden the literature on state-building that often centers on the means of coercion and tax capacity, instead of other aspects of governance. Second, our empirical findings suggest that mechanisms that are prominent in the literature on generic state capacity, have little purchase in the domain of 1) the supply of skilled state administrators and 2) the production of governance knowledge. It seems that violent contest between territorial governance units is not the only way by which competition spurs state-building. Instead, the rivalry between religious and secular authorities along functional dimensions generated a fruitful theoretical and ideational arms race that found its institutional engine in the university. Our findings concerning the influences of the early Enlightenment can be seen in the same spirit. While innovations in military technology (e.g., the famous longbow or the effective military use of gunpowder) spurred coercive state-building, ideational innovations in the form of the Enlightenment, spurred the creation of universities and contributed to the build-up of state capacity concerning differentiated governance theories and technologies.

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A Appendix

A.1 Bayesian Multilevel Model Results

Table A.1: Model Results: Simple Bayesian Multilevel Model

	Mean	Std Error	lower 90% HDI	upper 90% HDI	lower 90% HDI	upper 90% HDI	Rhat
Intercept	0.02	0.09	-0.12	0.16	-0.15	0.19	1
Latitude	0.00	0.00	0.00	0.00	0.00	0.00	1
Near Sea	0.00	0.02	-0.03	0.02	-0.03	0.03	1
Near River	0.02	0.01	0.00	0.05	0.00	0.05	1
Roman Road Hub	-0.01	0.02	-0.04	0.01	-0.04	0.02	1
Roman Road	-0.01	0.01	-0.04	0.01	-0.04	0.02	1
Elevation	0.00	0.00	0.00	0.00	0.00	0.00	1
Muslim Rule	-0.01	0.01	-0.03	0.01	-0.03	0.02	1
Quality of Soil	0.02	0.03	-0.02	0.07	-0.04	0.07	1
French Revolution	-0.06	0.04	-0.12	0.00	-0.13	0.01	1
Distance to Rome	-0.01	0.01	-0.02	0.01	-0.02	0.01	1
Bishop Seat	0.05	0.01	0.04	0.07	0.03	0.07	1
Protestant in 1600	0.05	0.02	0.03	0.08	0.02	0.09	1
Printing Press in 1500	0.36	0.01	0.34	0.38	0.33	0.38	1
up to 70 %tile Pop	-0.03	0.01	-0.05	0.00	-0.05	0.00	1
70-80 %ile Pop	-0.01	0.01	-0.03	0.01	-0.03	0.01	1
80-90 %ile Pop	0.03	0.01	0.01	0.05	0.00	0.05	1
greater 90 %ile Pop	0.09	0.01	0.06	0.11	0.06	0.12	1
Conflicts	0.00	0.00	0.00	0.00	0.00	0.00	1
Capital	0.08	0.02	0.04	0.11	0.04	0.12	1
Self-Governance	0.06	0.01	0.04	0.07	0.04	0.08	1
Princely Rule	-0.04	0.01	-0.05	-0.03	-0.06	-0.02	1
Active Parliament	0.04	0.01	0.02	0.06	0.02	0.06	1
Sigma	0.24	0.00	0.24	0.25	0.24	0.25	1

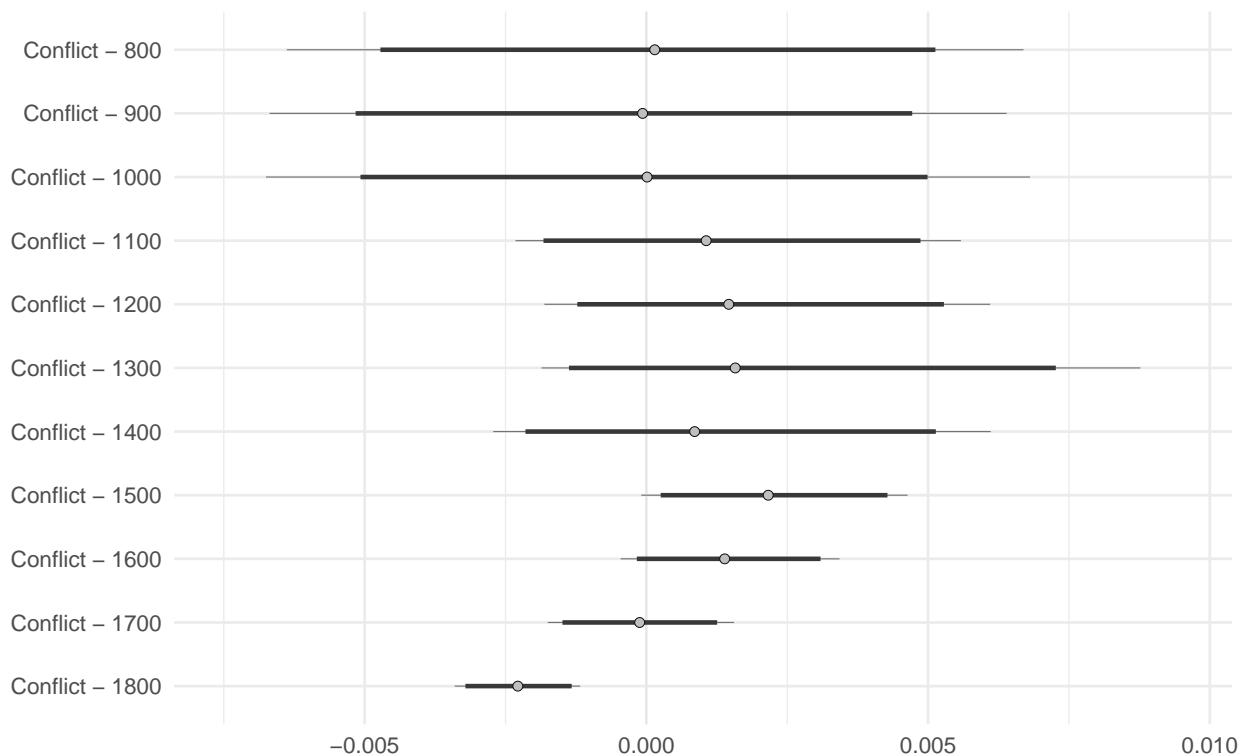


Figure A.1: This figure shows the estimated random slopes by year for the conflict variable. The estimates are close to zero for all centuries but negative for 1800.

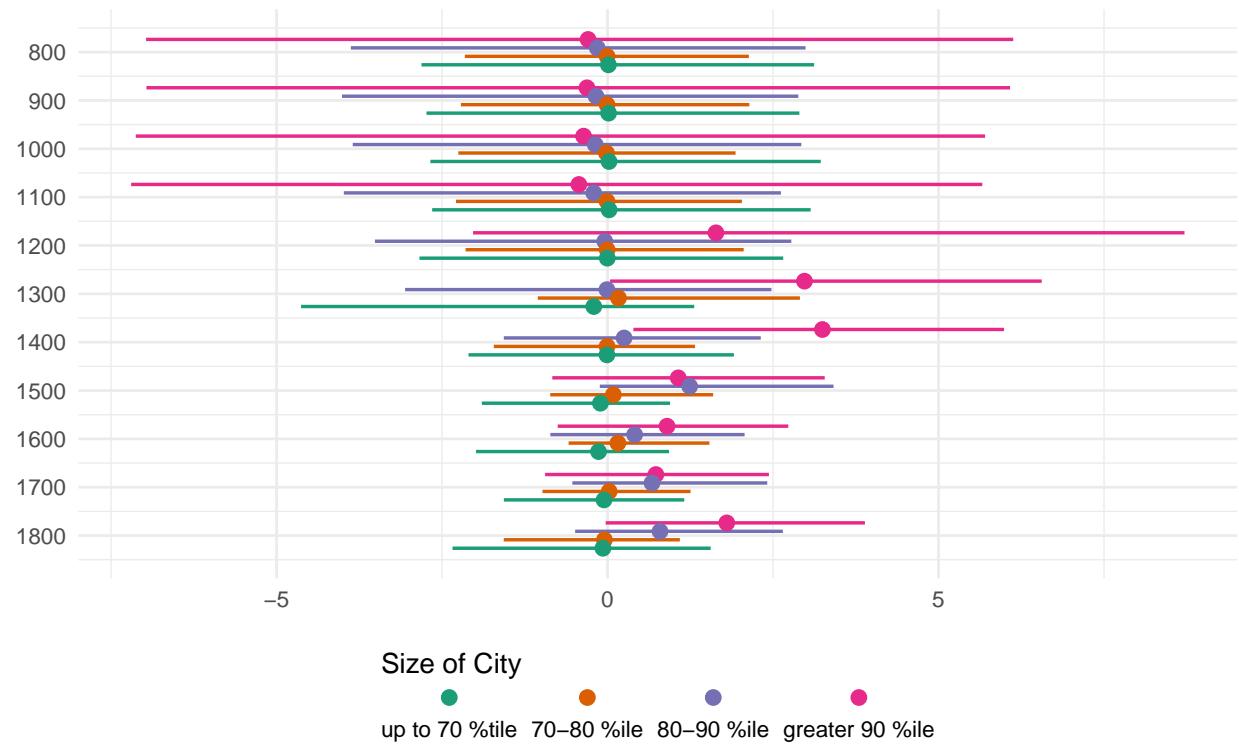


Figure A.2: This figure shows the estimated random slopes by year for the four city size categories. The estimates are close to zero for all centuries and categories but positive for the largest category for 1300, 1400, and 1800.

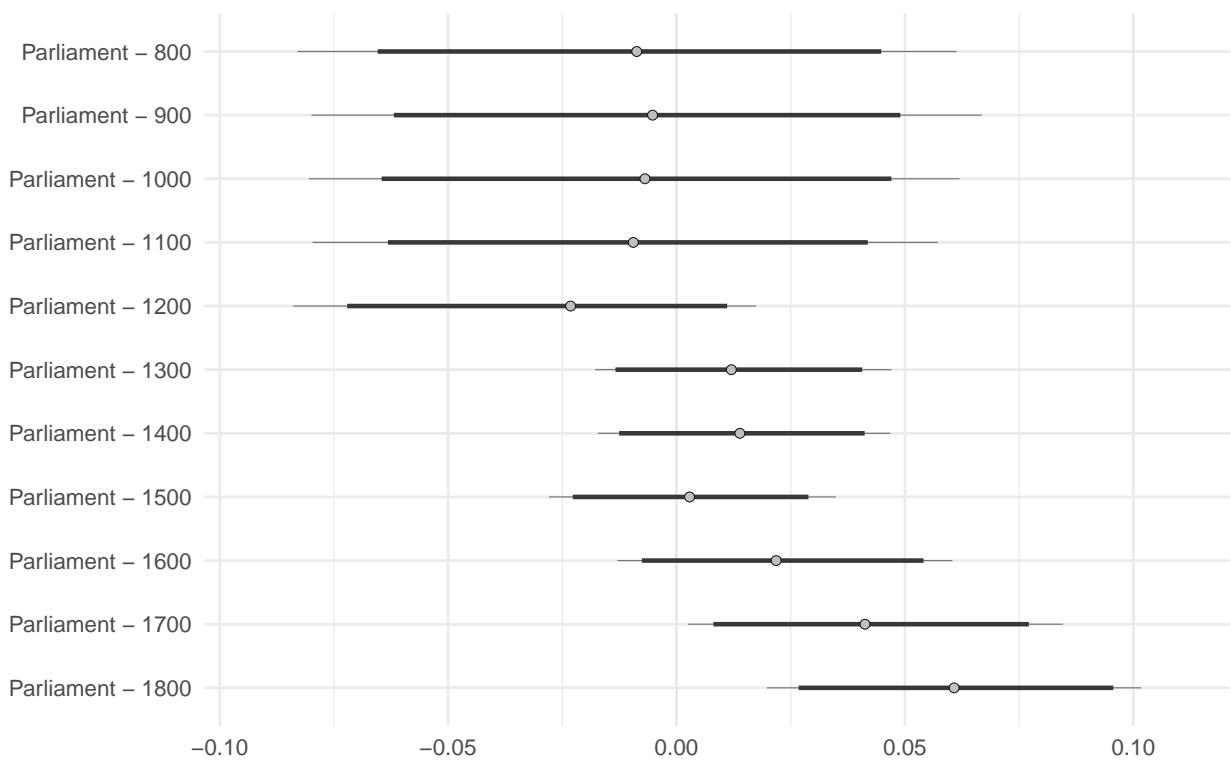


Figure A.3: This figure shows the estimated random slopes by year for the parliament variable. As the plot suggests, participation in a parliament seems to have had a positive impact on the number of universities in 1700, 1800, and possibly 1600.

Table A.2: Model Results: Simple Bayesian Multilevel Model – Continuous Population

	Mean	Std Error	lower 90% HDI	upper 90% HDI	lower 90% HDI	upper 90% HDI	Rhat
Intercept	0.00	0.09	-0.13	0.15	-0.16	0.17	1
Latitude	0.00	0.00	0.00	0.00	0.00	0.00	1
Near Sea	-0.01	0.02	-0.04	0.02	-0.04	0.02	1
Near River	0.02	0.01	0.00	0.05	0.00	0.05	1
Roman Road Hub	-0.02	0.02	-0.04	0.01	-0.05	0.01	1
Roman Road	-0.01	0.01	-0.03	0.01	-0.04	0.02	1
Elevation	0.00	0.00	0.00	0.00	0.00	0.00	1
Muslim Rule	-0.01	0.01	-0.03	0.01	-0.03	0.02	1
Quality of Soil	0.02	0.03	-0.03	0.06	-0.03	0.07	1
French Revolution	-0.07	0.04	-0.12	-0.01	-0.14	0.00	1
Distance to Rome	-0.01	0.01	-0.02	0.01	-0.02	0.01	1
Bishop Seat	0.05	0.01	0.04	0.07	0.03	0.07	1
Protestant in 1600	0.04	0.02	0.02	0.07	0.01	0.08	1
Printing Press in 1500	0.33	0.01	0.31	0.36	0.31	0.36	1
Population	0.00	0.00	0.00	0.00	0.00	0.00	1
Conflicts	0.00	0.00	0.00	0.00	0.00	0.00	1
Capital	0.01	0.02	-0.02	0.05	-0.03	0.05	1
Self-Governance	0.05	0.01	0.04	0.07	0.03	0.07	1
Princely Rule	-0.04	0.01	-0.06	-0.03	-0.06	-0.03	1
Active Parliament	0.04	0.01	0.02	0.05	0.02	0.06	1
Sigma	0.24	0.00	0.23	0.24	0.23	0.24	1

Table A.3: Model Results: Simple Bayesian Multilevel Model – Binary DV

	Mean	Std Error	lower 90% HDI	upper 90% HDI	lower 90% HDI	upper 90% HDI	Rhat
Intercept	-18.13	6.72	-29.23	-7.21	-31.72	-5.48	1.00
Latitude	0.01	0.09	-0.15	0.16	-0.18	0.19	1.00
Near Sea	0.07	0.92	-1.42	1.53	-1.71	1.84	1.00
Near River	2.61	0.87	1.25	4.09	0.86	4.30	1.00
Roman Road Hub	1.13	0.90	-0.25	2.68	-0.62	2.91	1.00
Roman Road	0.81	0.90	-0.70	2.26	-0.91	2.59	1.01
Elevation	0.00	0.00	0.00	0.01	0.00	0.01	1.00
Muslim Rule	-2.23	1.31	-4.38	-0.08	-4.75	0.38	1.00
Quality of Soil	1.17	1.32	-1.11	3.26	-1.35	3.84	1.00
French Revolution	-3.03	1.03	-4.67	-1.26	-5.09	-1.02	1.00
Distance to Rome	-0.80	0.54	-1.73	0.06	-1.91	0.25	1.00
Bishop Seat	2.88	0.72	1.70	4.14	1.53	4.40	1.00
Protestant in 1600	1.19	0.75	-0.04	2.44	-0.31	2.62	1.00
Printing Press in 1500	2.76	0.62	1.66	3.70	1.56	4.00	1.00
up to 70%tile Pop	-0.19	0.58	-1.11	0.78	-1.37	0.90	1.00
70-80 %ile Pop	0.55	0.45	-0.18	1.28	-0.37	1.38	1.00
80-90 %ile Pop	1.38	0.50	0.58	2.19	0.44	2.35	1.00
greater 90 %ile Pop	2.06	0.59	1.10	3.03	0.91	3.22	1.00
Conflicts	-0.04	0.01	-0.06	-0.02	-0.07	-0.01	1.00
Capital	1.66	0.77	0.42	2.94	0.24	3.24	1.00
Self-Governance	2.17	0.64	1.12	3.21	0.96	3.46	1.00
Princely Rule	0.22	0.42	-0.44	0.93	-0.56	1.10	1.00
Active Parliament	1.22	0.47	0.41	1.97	0.27	2.13	1.00

Table A.4: Bayesian Multilevel Model w. limited Random Slopes

	Mean	Std Error	lower 90% HDI	upper 90% HDI	lower 90% HDI	upper 90% HDI	Rhat
Intercept	0.09	0.09	-0.05	0.23	-0.07	0.27	1
Latitude	0.00	0.00	0.00	0.00	0.00	0.00	1
Near Sea	0.00	0.02	-0.03	0.02	-0.03	0.03	1
Near River	0.03	0.01	0.01	0.05	0.00	0.06	1
Roman Road Hub	0.01	0.02	-0.02	0.03	-0.02	0.04	1
Roman Road	-0.01	0.01	-0.03	0.02	-0.03	0.02	1
Elevation	0.00	0.00	0.00	0.00	0.00	0.00	1
Muslim Rule	-0.03	0.01	-0.04	0.00	-0.05	0.00	1
Quality of Soil	0.02	0.03	-0.02	0.06	-0.03	0.07	1
French Revolution	0.07	0.04	0.01	0.15	-0.01	0.15	1
Distance to Rome	-0.01	0.01	-0.03	0.00	-0.03	0.01	1
Protestant in 1600	0.03	0.02	0.01	0.06	0.00	0.07	1
Printing Press in 1500	0.29	0.01	0.27	0.31	0.26	0.32	1
Capital	0.10	0.02	0.06	0.13	0.06	0.14	1
Princely Rule	-0.01	0.01	-0.03	0.00	-0.03	0.00	1
Sigma	0.24	0.00	0.23	0.24	0.23	0.24	1

Table A.5: Bayesian Multilevel Model w. limited Random Slopes – Continuous Population

	Mean	Std Error	lower 90% HDI	upper 90% HDI	lower 90% HDI	upper 90% HDI	Rhat
Intercept	0.09	0.09	-0.05	0.23	-0.08	0.26	1
Latitude	0.00	0.00	0.00	0.00	0.00	0.00	1
Near Sea	-0.01	0.02	-0.03	0.02	-0.04	0.02	1
Near River	0.03	0.01	0.01	0.05	0.00	0.05	1
Roman Road Hub	0.00	0.02	-0.02	0.03	-0.03	0.03	1
Roman Road	0.00	0.01	-0.03	0.02	-0.03	0.02	1
Elevation	0.00	0.00	0.00	0.00	0.00	0.00	1
Muslim Rule	-0.02	0.01	-0.04	0.00	-0.04	0.00	1
Quality of Soil	0.02	0.03	-0.02	0.06	-0.03	0.07	1
French Revolution	0.06	0.04	-0.01	0.13	-0.02	0.14	1
Distance to Rome	-0.01	0.01	-0.03	0.00	-0.03	0.01	1
Protestant in 1600	0.02	0.02	0.00	0.05	-0.01	0.06	1
Printing Press in 1500	0.28	0.01	0.25	0.30	0.25	0.31	1
Capital	0.06	0.02	0.03	0.10	0.02	0.10	1
Princely Rule	-0.02	0.01	-0.03	0.00	-0.03	0.00	1
Sigma	0.23	0.00	0.23	0.24	0.23	0.24	1

Table A.6: Bayesian Multilevel Model w. limited Random Slopes – Binary DV

	Mean	Std Error	lower 90% HDI	upper 90% HDI	lower 90% HDI	upper 90% HDI	Rhat
Intercept	-19.25	7.51	-32.46	-7.25	-34.09	-3.64	1
Latitude	0.01	0.11	-0.17	0.19	-0.22	0.22	1
Near Sea	0.05	1.03	-1.68	1.73	-1.98	2.13	1
Near River	3.01	0.99	1.39	4.61	1.12	4.99	1
Roman Road Hub	1.36	1.05	-0.44	3.02	-0.64	3.48	1
Roman Road	0.87	1.03	-0.80	2.61	-1.14	2.97	1
Elevation	0.00	0.00	0.00	0.01	0.00	0.01	1
Muslim Rule	-2.36	1.43	-4.74	-0.13	-5.22	0.24	1
Quality of Soil	1.18	1.47	-1.18	3.65	-1.68	4.03	1
French Revolution	-0.42	1.26	-2.51	1.60	-3.01	1.92	1
Distance to Rome	-1.09	0.64	-2.14	-0.04	-2.33	0.17	1
Protestant in 1600	2.00	0.85	0.54	3.40	0.31	3.72	1
Printing Press in 1500	3.55	0.78	2.31	4.88	2.05	5.15	1
Capital	1.81	0.93	0.30	3.34	0.02	3.63	1
Princely Rule	0.05	0.53	-0.85	0.93	-1.02	1.13	1

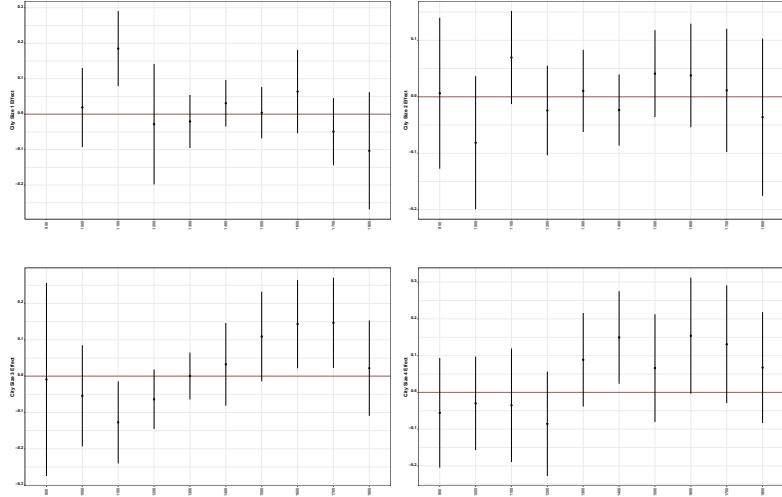


Figure A.4: This plot shows the interactive effects of the different city size categories with year fixed effects. The upper left plot shows the interaction for the smallest category (up to 70th percentile). The estimates show a null effect, except for 1100 which is positive. The upper right plot shows the interactive effect for cities in the 70th to 80th percentile. Here we recover no significant interactive effects. In the bottom left plot we show the interaction with cities in the 80th to 90th percentile. Most notably, for these larger cities a positive effect is estimated for 1600 and 1700. Lastly, for the large category (bottom right), we find slightly positive coefficients for the latter half of our sample, but these effects are not significant at the 5% level. Overall, these results are similar but not quite the same as those in the Bayesian multilevel model.

A.2 Fixed Effects Model Results

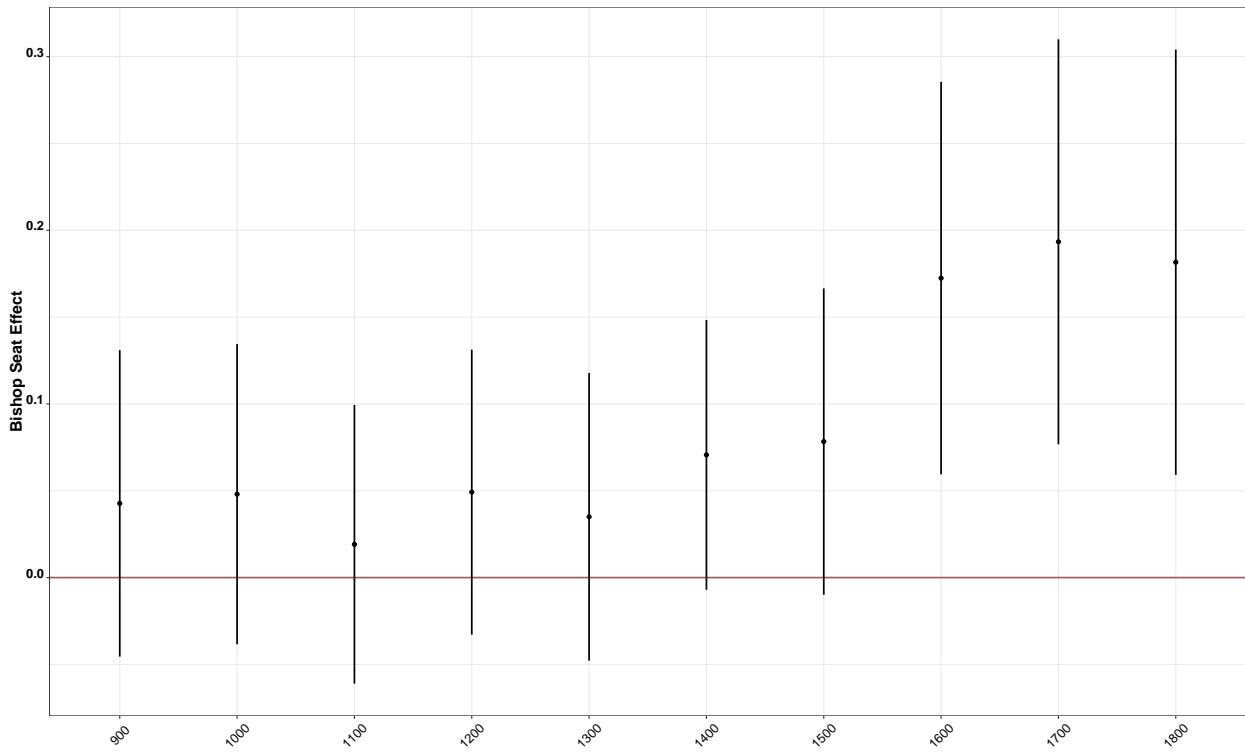


Figure A.5: The plot shows the interactive effect of year fixed effects and being host to a Bishop or Archbishop seat. Similar to the multilevel model presented above, we find essentially a null effect for early years and a positive effect starting in 1400. Though the estimated relationship is only significant for 1600 – 1800.

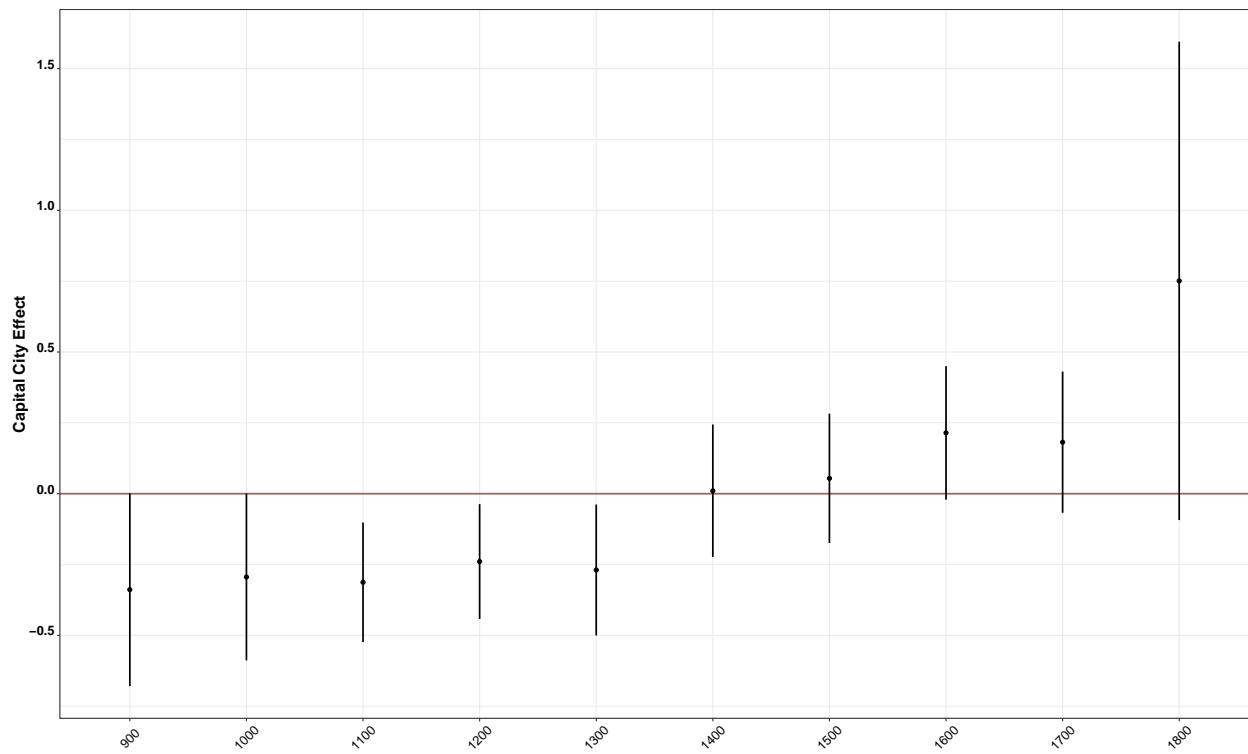


Figure A.6: The plot shows the interactive effect of year fixed effects and being a capital city. Here we find a negative effect until 1300 and then a slight, but insignificant, negative effect for later centuries.

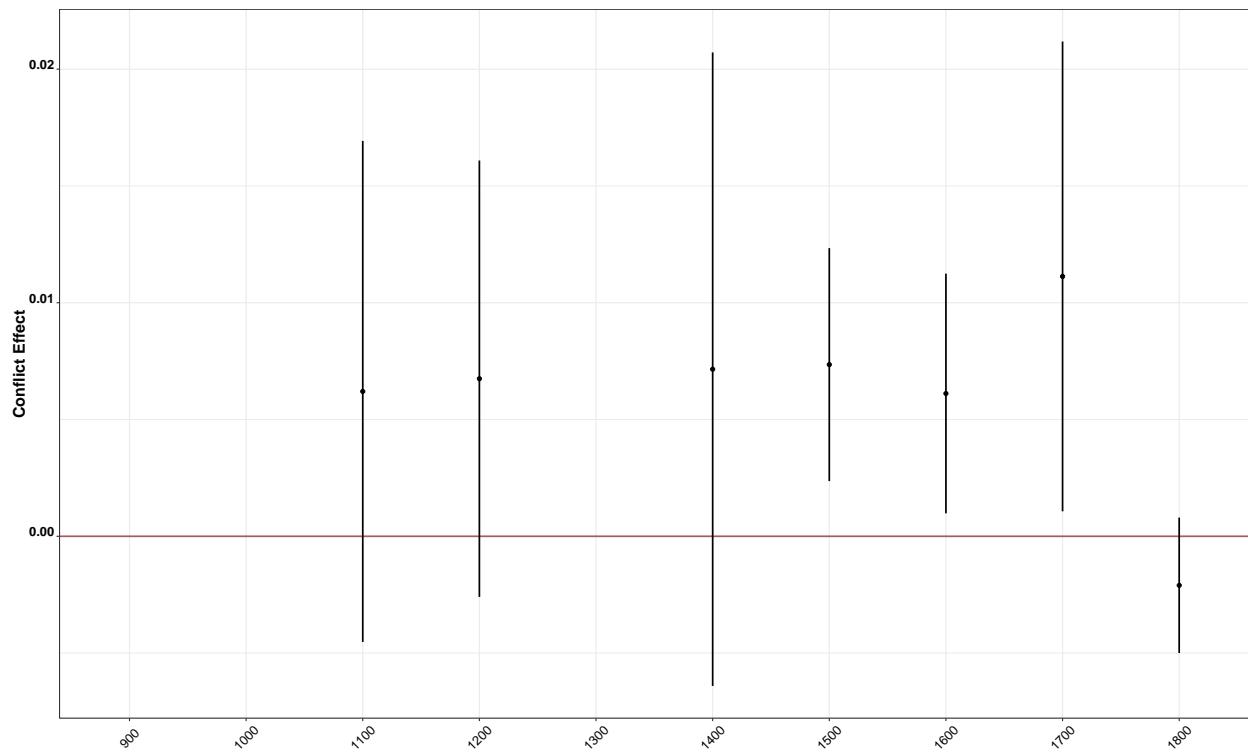


Figure A.7: This figure shows the estimated interaction between year fixed effects and conflict. For 900, 1000, and 1300 the coefficient is not identifiable. The FE model reveals a slight negative effect in 1800, but a positive and significant effect for 1500-1700.

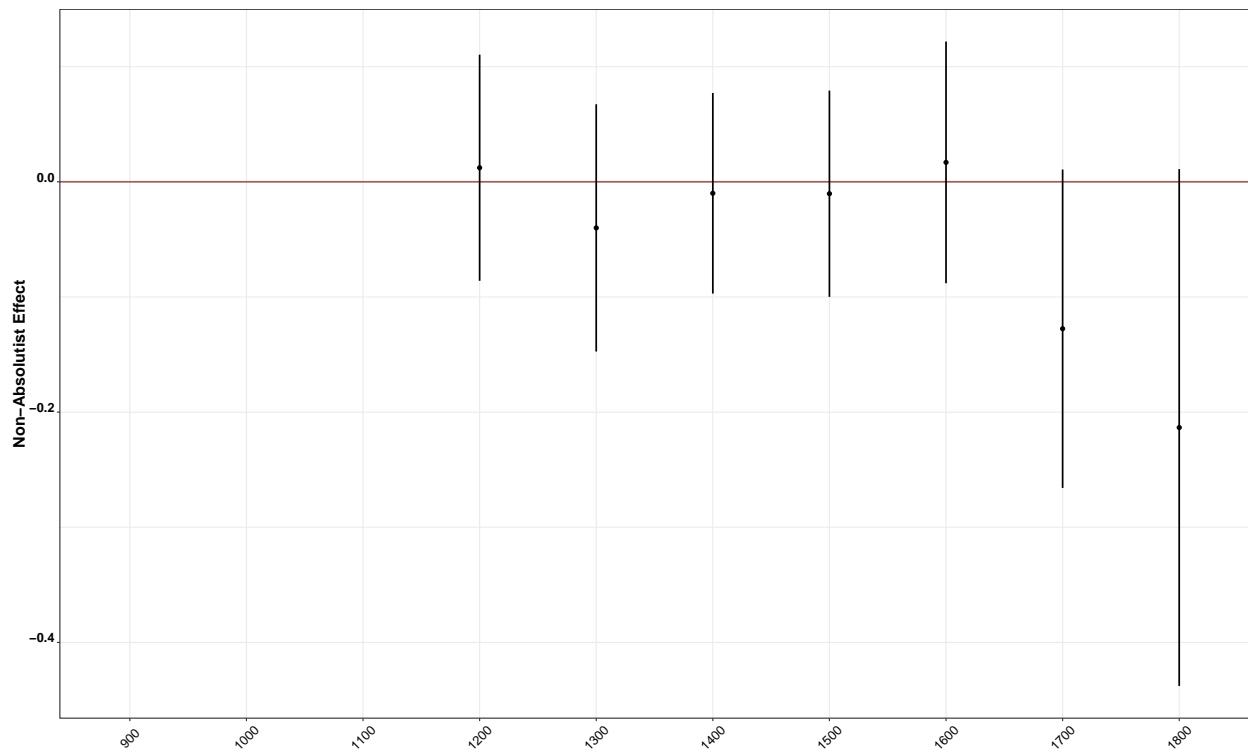


Figure A.8: The plot shows the interactive effect of year fixed effects and residing under princely rule. The effect is essentially zero for all years, but negative in 1700 and 1800 (though insignificant at conventional levels).

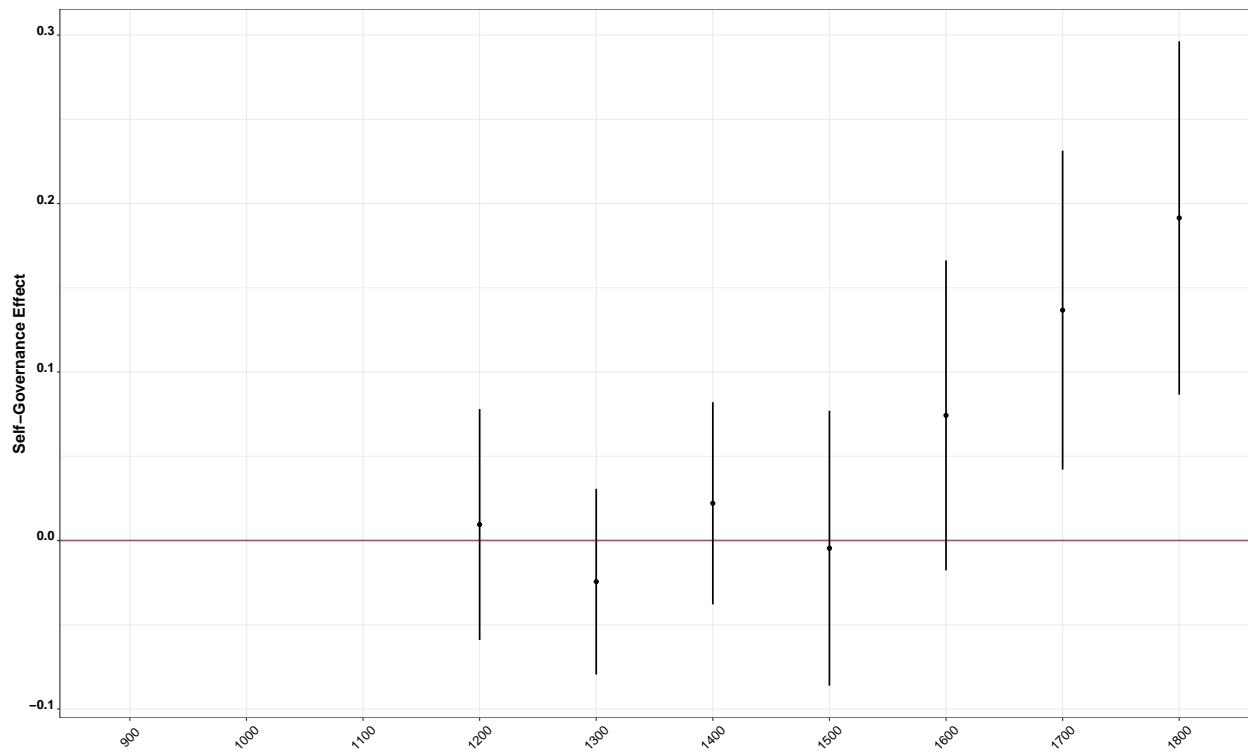


Figure A.9: This figure shows the estimated interaction between year fixed effects and the self-governance dummy. The effect is not identified for 900, 1000, and 1100. Similar to the random effects models presented above, we find a positive and significant effect for later centuries, specifically 1700 and 1800.

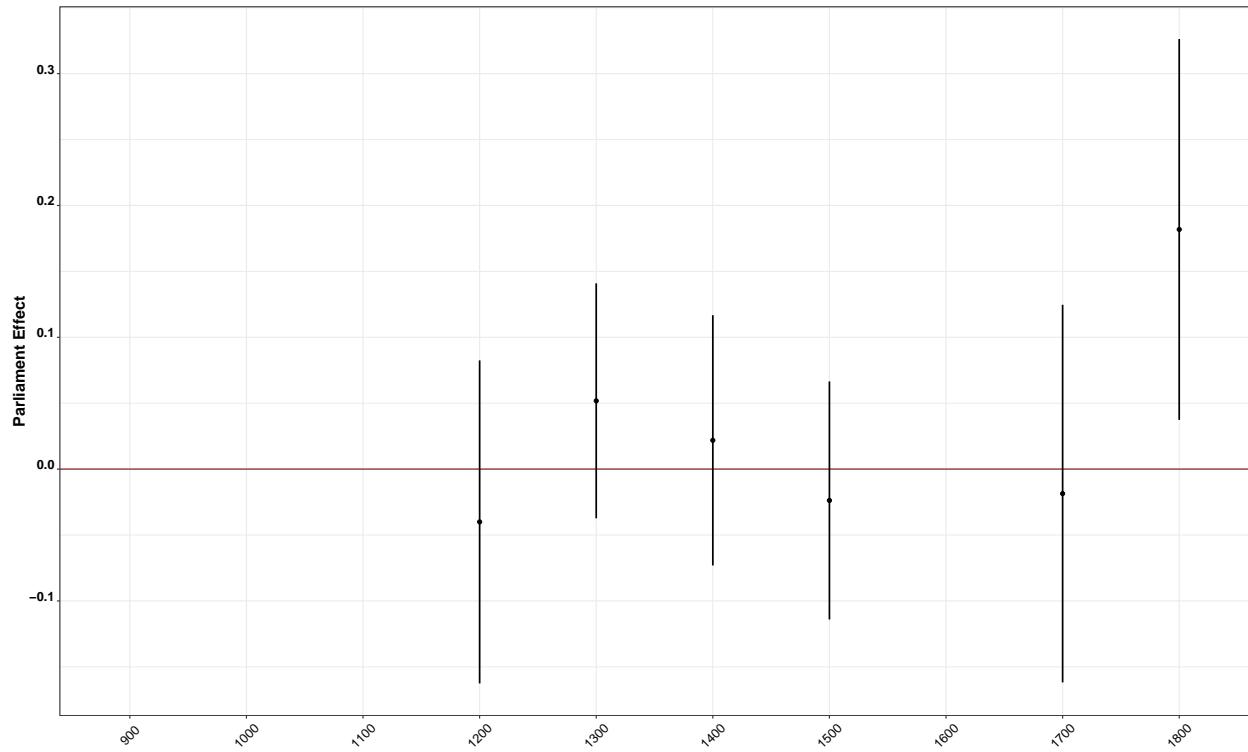


Figure A.10: The plot shows the interactive effect of year fixed effects and participation in a parliament. Again, several years are not identifiable (900 – 1100 & 1600), the remaining results are similar to those in the random effects models. We find little evidence for a robust relationship with universities prior to, but a positive and significant effect for the 19th century.