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Law, human capital, and the emergence of free city-states in medieval Italy

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Abstract
This paper considers how the foundation of the first universities in Italy affected the emergence of free city-states (the communes) in the period 1000–1300 CE. Exploiting a panel dataset of 121 cities, we show that the time variant distance of the sample cities to their closest university is inversely correlated with the probability of their transition to communal institutions. Our evidence is consistent with the hypothesis that the medieval universities provided the useful juridical knowledge and skills for building legal capacity and developing communal institutions.

Keywords Institutional change · Education · Human capital accumulation · Communal movement

JEL Classification I20 · I23 · K01 · N33

1 Introduction

In this paper, we document the relation between the development of higher educational institutions and the emergence of new political entities. We investigate how the birth of the first universities in Italy and the consequent diffusion of new juridical

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knowledge are associated with the profound institutional evolution of north-central Italian cities in the late Middle Ages that is known as the communal movement.

The emergence of the communes as free city-states between the eleventh and fourteenth centuries was a fundamental episode in the history of Western Europe: a dramatic change in the institutional setting of cities with respect to the feudal regime. Whereas under feudalism the city was governed by rulers (lord or bishop), deriving their authority from a superior political entity (the Emperor), under the communal institutions citizens started to take part in public affairs. Personal freedoms were defended by constitutional limits on abuses, and the city was governed by citizens' representatives, whose actions were checked by collective assemblies. This particular institutional setting, unprecedented in Europe with some notable exceptions such as the ancient Greek democracies, constituted the first form of state with the capacity for public provision of public goods since the fall of the Roman Empire (Berman, 1983).[1]

The early eleventh century also witnessed another important event: the birth of the core of the first university in the world, the University of Bologna, in 1088, with the foundation of the "*studium*". This was a small center of study and education established following the request of Matilda of Canossa, a feudatory ruler in central Italy, for the philological systematization of the books of ancient Roman law coded by Justinian. According to the historical tradition, this task was assigned to Irnerius, a philologist and legal scholar who taught law by innovative rhetorical methods and interpreted the ancient Roman law in accordance with twelfth-century societal norms, and to a small group of scholars related to him (Berman, 1983; Roversi Monaco, 2007). The approach to the study of law developed in Bologna proved to be extremely successful, attracting hundreds of students from the whole Italy and other regions of Europe. In Italy, the establishment of the university of Bologna was followed by a string of others: Modena (1182), Reggio nell'Emilia (1188), Vicenza (1204), Arezzo (1215), Padua (1222), Naples (1224), Vercelli (1228), Siena (1246), Piacenza (1248), and Macerata (1290). In these universities the ancient Code of Justinian (the *Corpus iuris civilis,* the body of Civil Law) was taught. From then on, law and jurisprudence were considered as a distinct subject of study, a specific discipline organized as a structured set of general principles for application to general and unprecedented situations (Berman, 1983).

This paper explores how these two events, the transition to communal institutions and the development of the first Italian universities, both crucial for the transformation of northern-central Italy in the Middle Ages, evolved together. Our central argument is that universities trained officials contributing to institutional building in the transition process from feudalism to independent free-city states. This hypothesis is consistent with the historical narrative (Ascheri, 1996; Grossi, 2008) that we support with an empirical analysis. To this purpose, we use

[1] Historical and economic research (Coleman, 1999; Tabacco, 1979; DeLong and Shleifer, 1993) has demonstrated that the cities with communal institutions attained higher levels of urbanization and faster growth than those under autocratic leaders. Guiso, Sapienza, and Zingales (2016) and Putnam, Leonardi, and Nanetti (1993) show that the communal experience has had a historically enduring impact on trust and social capital: the cities that adopted communal institutions in the Middle Ages have more social capital than other cities even today.

a unique, original, dataset of historical information on 121 northern and central Italian cities over a period of 300 years, from the early eleventh to the late thirteenth century: the communal experience of each city in the sample, their historical characteristics (time-invariant characteristics such as location and episcopal status, time-variant variables such as size or the construction and ornamentation of religious buildings), and a proxy for the level of 'juridical' human capital (information on the places of birth and the careers of prominent jurists during our period of interest). Exploiting the panel structure of the dataset, we show that the establishment of the first universities and the diffusion of legal scholarship and education are associated with the diffusion of the communes. In particular, the data indicate that, after the foundation of the first university (that of Bologna in 1088), the time varying distance between each city in our sample and its closest university city—a proxy for the cost of university attendance for their inhabitants—is negatively correlated with the probability of adopting communal institutions. And, while caution is certainly required in taking this as a causal link working from the development of universities to the emergence of communes, we show that our results are robust to an array of alternative specifications and are likely not an artifact of a reverse causation.

The intuition underlying the interpretation of our results is that, starting at the end of the eleventh century, legal scholars trained in the newly founded universities provided Italian municipal institutions with the skills and the knowledge that were instrumental to writing and interpreting the legal rules. In this paper, we use the expression "human capital" to refer to this set of tools and knowledge that, in the context object of investigation, was necessary, as we argue, to institutional building. Such an interpretation is consistent with the historical analysis according to which the first universities in Europe served the need for written and enforceable law and facilitated the settlement of disputes. The university graduates endowed the system with a method for the administration of public affairs and, in particular, for establishing coherent and effective constitutional agreements (the statutes), which formed the backbone of the communes' legal system [see, in particular, Ascheri (1996) and Grossi (2008)]. Thus, jurists trained in the universities can be seen as providing a catalyzer to communal transitions.

The historical narrative is also consistent with the predictions by the literature on state capacity (Besley & Persson, 2009), which claims that the communal institutions relied on complementarities between legal and fiscal capacity: legal capacity stimulated the development of fiscal capacity and enabled the public provision of defense, which was essential to the consolidation of the free city-states. This view is consistent with historical studies documenting the importance of the diffusion of university-generated knowledge to the emergence of the medieval communes (Bellomo, 1999; Cobban, 1975; Menzinger, 2005; Padoa-Schioppa, 2005).

To dig more deeply in such an interpretation, we collected additional data on the city of origin of the jurists that graduated in Bologna and on the cities where they moved during their careers: we find that both the presence of at least one jurist and the number of jurists in a city are positively correlated with the development of communal institutions. This evidence is consistent with the idea that higher levels of

human capital, in the sense previously explained, facilitated the emergence and diffusion of the communes in the late medieval period.

Our work contributes to the literature that holds education to be a fundamental driver of desirable institutional change (among others, Barro, 1999; Glaeser et al., 2007; Lipset, 1959). Although to the best of our knowledge we are the first to conduct an empirical study of the impact of the first law schools on the emergence of political institutions, the effects of the spread of universities in Europe have already been explored. In particular, Cantoni and Yuchman (2014) suggest that the establishment of universities in Germany was a significant factor in the expansion of economic activity and the development of markets, while Huff (2003) maintains that universities were an essential spur to technical change and the generation of scientific knowledge. Belloc et al. (2016) offer a companion inquiry into the process that led to the emergence of communal institutions.

The paper is structured as follows. Section 2 presents the historical background. Section 3 describes the dataset and some preliminary evidence. Section 4 explains the empirical strategy, discusses the main identification issues, and illustrates the results. Section 5 provides additional evidence supporting our interpretation and Sect. 6 concludes.

2 Historical background

2.1 The communes

Our study focuses on the emergence of communal institutions in northern and central Italy, which during the Middle Ages was part of the German Holy Roman Empire. Although formally the territory was under the authority of the Emperor, the Empire (unlike the Norman Kingdom in the south of Italy) was never a unified state with a centralized administration. This fragmentation was the end-result of a process that had gotten under way in the ninth century, after the fall of the Carolingian Empire. During the Carolingian period, the feudal lords, as local representatives of the Emperor, administered civil and penal justice, levied taxes, and exercised the executive power. In the absence of a centralized bureaucracy, the feudal lords' power became so great that the Emperor eventually accorded them the right to transfer their domains to their heirs (Tabacco, 1979). Hence, under the feudal regime the cities of the empire were governed by rulers who derived their authority from a distant superior political power (the Emperor) (Ascheri, 2009; Bloch, 1961). Rulers were either the bishops (in the episcopal sees) or feudal lords (in the non-episcopal cities); these were the supreme political authorities, governing in the Emperor's name (Pellegrini, 2009). In administering justice, they generally followed local customs and applied customary laws (e.g. the Salic law of the Frankish Empire). These laws set rights and duties at the community level, demanded clan loyalty, and neglected concepts such as individual responsibility. Basic public goods, such as defense, were provided privately by the cities' rulers as a form of protection of their own property. Legal rules and judicial procedures were transmitted, for the most part, orally and applied without

the support of official, written documents (Berman, 1983; Storti, 2012; Wieacker, 1995). Such a system of unwritten law embodied in customs obviously left a great deal of scope for arbitrary decision on the part of the feudal leaders.

At the turn of the millennium, north-central Italy embarked upon a period of significant economic growth, sustained by the revival of middle- and long-distance trade, and consequent demographic growth, which fostered flourishing city life and spurred urbanization (Epstein, 1993, 2000; Verhulst, 1999). A dynamic elite of merchants, craftsmen, and bankers arose to play the leading role on the economic, social, and political scene [Pirenne, 1925 (2014)]. To regulate the new economic relations in the cities, citizens began to form private associations and to agree on common rules for mutual assistance and cooperation in the common interest (Tabacco, 1979). At first, however, these agreements and associations operated only privately: despite their social and economic importance, until the formation of the communes, citizens were still excluded from the government of public affairs and the administration of the law (Ascheri, 2009; Pellegrini, 2009).

Beginning in the eleventh century, citizens managed to extend these private agreements in the form of sworn pacts of mutual defense allegiance that applied to the whole city (Ascheri, 2009; Galizia, 1951); these pacts and agreements then gradually evolved into communal institutions. The commune was governed by a general council of elected officials (the *consules*). Political and juridical structures differed considerably from city to city, but they had at least two common features: a legislative body embracing all adult male citizens owning a house (excluding servants, Jews, and Muslims), which passed resolutions that were systematically recorded (Senatore, 2008); and the exercise of the executive power by the *consules* under the limitations of a constitution, or statute (the *statutum*). The *statutum*, at the very beginning, was a document whereby the *consules* swore obedience to the communal rules and observance of certain norms of conduct, and which extended their rights and duties. Later the *statutum* became a much more complete document, encompassing the laws that presided over every aspect of the city's life (private, family, commercial, penal law, etc.). Under the communal institutions, personal freedoms were defined and guaranteed by the law, and special courts were established to determine when citizens' rights were violated (Galizia, 1951). Citizens could also appeal against officials' abuses of power. Finally, with the emergence of the commune, fiscal authority was transferred from the feudal rulers to the communal institutions. This transfer of fiscal authority is crucial. Under the feudal regime, taxation was generally an arbitrary expropriation, in the form of income or property tax, custom tax (*salaria*), and tolls. For instance, the feudal ruler would impose a tribute (*taglia*) on all savings or properties within his territory, and there was practically no redistribution to the populace (Cavazzuti & Di Pietro, 1994). Another example of such expropriation of private resources by the feudal leaders was *corvées*, i.e. compulsory labor, usually a number of days of unpaid agricultural work on the land of the feudatory. Under the communes, by contrast, taxes were levied for purposes of common interest, such as the construction or the maintenance of city walls (Menzinger, 2005). What emerged was a complex public legal and political order applying locally to all citizens and taking the place of the old, arbitrary system in the interpretation of customary law.

2.2 The foundation of the first universities

The establishment and functioning of the complex political and legal framework described above required the development and the diffusion among citizens of juridical knowledge adequate to the design, drafting, and interpretation of the rules (Ascheri, 2009). This need was served by the creation of the first universities in the Western world. Legal historians have described the University of Bologna as the cradle of the medieval legal revolution (Berman, 1983).

Some remarks can help understand the process we are studying. Unlike today's universities, *studia* in the Middle Ages were conceived as study centers hinging on a few masters and consequently on their disciples. The *studium* of Bologna had this kind of organization, and its success depended initially on the innovative work of a handful of scholars. Its foundation in 1088 is traditionally placed at the moment when two scholars, Pepo and Irnerius, started to teach to a small group of disciples (Roversi Monaco, 2007). While Pepo left few traces of his scholarly work, Irnerius made important contributions and left a considerable opus (Pennington, 2020). He was a philologist and expert jurist mandated by the Great Countess Matilda of Canossa, the most powerful feudatory in central Italy, who ruled over part of Tuscany and Emilia, to define the philology and produce a systematic presentation of the texts of Roman law present in the city of Bologna (Roversi Monaco, 2007). These texts were very few in number and had probably come to Bologna accidentally from Ravenna (Cortese, 2004; Radding & Ciaralli, 2008). Thus, his initial task was to reassemble the texts of Justinian's codification [see Radding and Ciaralli (2008), for a reconstruction of the circulation of Roman manuscripts at the time]. However, Irnerius and his followers did not merely perform a philological reconstruction of Justinian's body of law, but also drafted a series of explanatory notes—glosses—to make the content of the law comprehensible. In doing this, he worked a methodological revolution by applying scholastic methods of analysis and synthesis to interpret Roman law consistently with twelfth-century societal norms (Berman, 1983; Pennington, 2020).

Overall, the foundation of the studium in Bologna contributed to transform Roman law from an abstract ideal into a body of legal principles and methods that could be used in practice. It was this new approach to study that made the University of Bologna central to the diffusion of juristic knowledge in this period. The jurists of Bologna won such great prestige that the Emperors decided to help foster the consolidation of the universities in general. They saw the rediscovery of the ancient Roman law as a means of legitimating the unceasing struggle against the Papacy that marked the history of the eleventh and twelfth centuries. The birth of the *studium* and the activity of the first juridical scholars, however, did not follow from a specific political project and did not originate from particular political objectives (Chiodi, 2012).

2.3 The impact of Roman law

University scholars rediscovered and codified the ancient Roman law, the *Corpus iuris civilis*, a codification executed in the early sixth century by order of the Emperor Justinian (Berman, 1983). This code provided medieval jurists with a

structured model for contracts, civil procedures, and property, family, and public law. University graduates in law acquired a method of analysis and synthesis that could apply well beyond the bounds of local jurisprudence and in fact was soon transplanted to other disciplines. Consequently, they developed the skills for coping with unprecedented, complex situations and offered their expertise to the public administration and private corporations. Legal historians (Berman, 1983) maintain that the emergence of the free cities have been facilitated by the diffusion of legal scholarship. The jurists had the methodological skills and knowledge to reconcile the rediscovered Roman law, which served as a universal law (*jus commune*), with local customs and rules (*jura propria*) (Ascheri, 1996; Bellomo, 1999; Berman, 1983; Storti, 2012). The communes systematically resorted to the assistance of jurists to settle disputes, to interpret apparently conflicting laws, and even to obtain political advice. Menzinger (2007), for instance, recalls the case of Siena where the commune resorted in a systematic way to the advice of *sapientis iuris* (legal experts). Moreover, and most importantly, as remarked by Ascheri (1996), the jurists' skills and knowledge were instrumental in drafting written rules and, in particular, the statues that constituted the basis of the communal legislation. According to Ascheri (1996), in an organization where the political authority was shared by the citizens, the communes had a very concrete motivation for drafting 'rules', by whom the city administrators and judges should abide. In addition, juridical knowledge favored the emergence of the law of merchants, which in turn increased the economic power and importance of the urban merchant elite (Greif et al., 1994; Milgrom et al., 1990).

Juridical skills were also fundamental in settling disputes and defining the rules that regulated social and economic interactions within a large community of citizens: not only a set of rules agreed on and universally enforced but also a conceptual framework and a set of interpretative tools to apply to new situations. These developments reduced uncertainty in transactions and so helped sustain economic activity. The crucial difference between actions under Roman and under customary law was the focus, in the former, on the key legal issues, in order to bring them out immediately in a dispute. Traditional medieval litigation consisted in a whole series of charges that were often marginal to the fundamental legal point at issue, which judges or arbiters then had to sort out in arriving at a judgment. Roman-style actions, instead, stated the principal legal issue explicitly and at the outset, greatly improving efficiency in handling disputes (Wickham, 2003).

The complex body of knowledge developed in Bologna started to spill over to the writing and application of law in other cities, thanks to the work of jurists who graduated from the *studium*. As remarked by Ascheri (1996), the university doctors had a notable function in this respect: their students would come out of the classrooms with the skills necessary to elaborate and apply the statutes. The Justinian body of laws thus formed the model of communal legislation. The commune acquired a specific identity because, in addition to its own magistrates, it also had its own written body of laws (Ascheri, 1996).

One instance of such knowledge spillover is Pisa, where scholars trained in Bologna contributed to the adaptation of local law to Roman legal principles and took active roles in the city's government. For instance, the "constitution" (*statutum*) of Pisa adopted Roman law as the city's official law (Wickham, 2003). This

constitution was elaborated by legal scholars, including Burgundio, who translated the Greek sections of Justinian's digest (one of the parts of the *Corpus iuris civilis*) into Latin (Wickham, 2015). Bulgarus, another university-trained jurist, was born and worked in Pisa: he played an important role in the functioning of the city's communal institutions in the twelfth century (Pennington, 2020). Many members of the Pisan house of Familiati, a family of jurists that included Bandino (a prominent scholar in Bologna), served as communal judges and consuls. Nor was Pisa an isolated case: in other cities as well, we find examples of Bologna trained jurists holding political office or playing important roles in the elaboration of local constitutions. For instance, Iacopo Baldovini, who taught at the university of Bologna, was instrumental in adapting the *statuta* of the city of Genoa to the principles of Roman law (Piergiovanni, 1988). Baldovini is a typical example of a top lawyer trained in Bologna that made his expertise available to the communal institutions. In Genova he served in the government, as *podesta* (governor) and contributed to the writing of the statutes (Abbondanza, 1963). In Milan, Rolando di Guamignano, a scholar who left important commentaries on the digest of Justinian, held several public offices (Wickham, 2015). Also in Milan, Anselmo dall'Orto, after his studies in Bologna, served as consul of justice, producing a host of regulations, taking part in trials, and signing the act of surrender to Frederick I Barbarossa in 1167 (Cortese, 2013). Interestingly, when Anselmo was still studying in Bologna, his father Oberto dall'Orto, at the time consul of Milan, asked his advice so as to make administrative decisions consistent with both customary and Roman law (Birocchi et al., 2013). In Piacenza, Ugo Speroni, after studying law in Bologna, was consul several times between 1164 and 1171 (Birocchi et al., 2013).

3 Data

3.1 Data sources and data description

Our empirical investigation focuses on cities in central and northern Italy between 1000 and 1300. Our sample consists of all the cities for which the historical documents available permit verification of three pieces of information: the cities' existence at the beginning of the eleventh century, the date when, if ever, they acquired communal institutions, and whether they were seats of a bishopric during the sample period or not. The resulting sample consists of 121 cities.[2]

First, we need to know whether each of our sample cities ever acquired communal institutions and, if so, in what year. Based on the historical records, we date the institutional transition at the first year in which the sources provide reliable evidence of the presence of the *consules*, the *statutum*, an official document signed by representatives of the commune, or any other fact attesting that the communal experience had begun. For details, see Belloc et al. (2016), who also specify each city's episcopal or non-episcopal status in 1000.

[2] Appendix A.1 lists the cities and the year of their transition (if ever) to communal institutions.

Second, we consider the years of foundation of universities during the sample period.[3] The university of Bologna, according to several consistent sources, was established in 1088, followed by the universities of Modena in 1182, Reggio nell'Emilia in 1188, Vicenza in 1204, Arezzo in 1215, Padua in 1222, Naples in 1224, Vercelli in 1228, Siena in 1246, Piacenza in 1248, and Macerata in 1290. Figure 1 shows the university cities located in the map of Italy.

Third, we measure the distance of every sample city from the university cities. Following the literature (Cantoni & Yuchman, 2014), we take this distance as a proxy of the cost of university attendance for a city's administrative elite. In computing it, we have tried to duplicate the actual route someone travelling in the Middle Ages would have taken and to gauge the time required, depending on the relative ruggedness of the path and not just the linear distance between the two geographical points. To this end, we considered two items: the network of Roman roads existing in the Middle Ages (information is taken from DARMC, 2016), depicted in Fig. 1, and orography [data from SRTM (2016)].

Consider, for instance, Sarsina, which was not on a Roman road, and Bologna, which was on the Roman road called Via *Aemilia*. To calculate the distance between Sarsina and Bologna, we first measured the distance between Sarsina and the closest point on the Via *Aemilia* and then added the distance along the Via *Aemilia* from that point to Bologna. Similarly, take Fano, which is on the Roman road called Via *Flaminia*. To compute the distance from Fano to Bologna, we added the length of the path on the Via *Flaminia* connecting Fano and Rimini (on the way to Bologna) and that on the Via *Aemilia* from Rimini to Bologna. Finally, we adjusted the resulting distance to take account of orography, applying a coefficient of between zero and one to routes with a downward slope, a coefficient equal to one to flat routes (zero slope), and a coefficient greater than one to routes with an upward slope, the penalty coefficient being the larger, the steeper the slope. Of course, this distance proxy is not the same if we go, say, from Sarsina to Bologna or the other way round. Our preferred measure is the distance (in hundreds of kilometers) from whatever sample city to the nearest university city; but the results reported below would not change if we considered the inverse distance. We employ these data to build the variable *Distance to closest university city*, that is the distance between each city in the sample and the closest university city in each year of the period considered. Hence, for a given city, this variable is equal to zero between 1000 and 1087 (the value taken in this time interval does not matter as we will see later), to the distance to Bologna between 1088 and 1181 (the university of Modena was founded in 1182), to the distance to Modena (if Modena was closer than Bologna) or to the distance to Bologna (otherwise) between 1182 and 1187 (the university of Reggio nell'Emilia was founded in 1188), and so on. Our main empirical specification is based on the latter variable, which exploits a margin of variation in the access to universities that varies over time.

To gauge cities' economic and institutional characteristics and their dynamics (in particular, in the years prior to the foundation of the university of Bologna), we

[3] Notice that we have included in our sample only the universities whose foundation is dated by the historical sources with a reasonable degree of accuracy. These sources are listed in Appendix B.

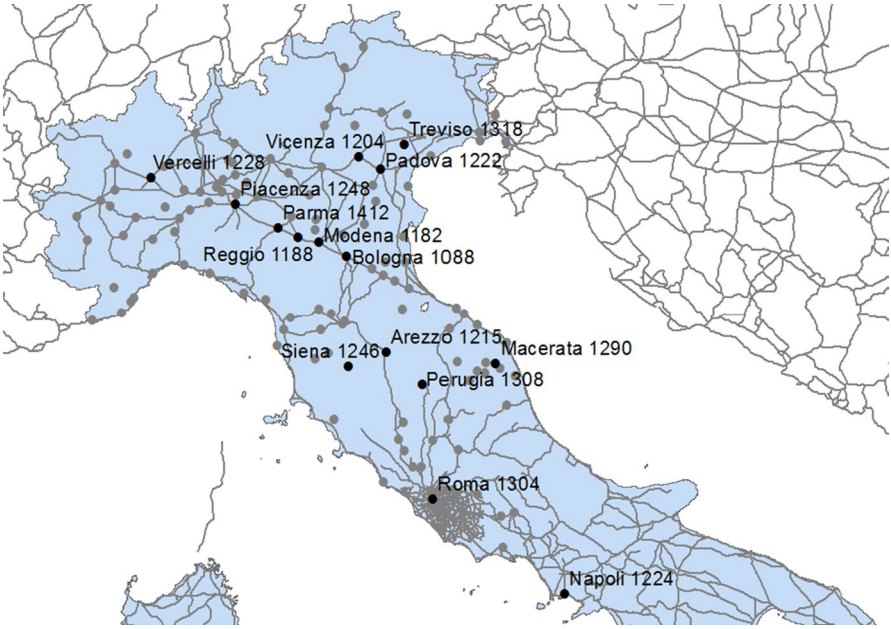

Fig. 1 Map of northern and central Italy. *Note*: Northern and central Italy. Black bullets indicate university cities, with the date of university foundation; gray bullets indicate other cities in the sample. The map also shows the network of Roman roads

assemble a set of additional variables as follows. From DARMC (2016), we extract *Distance to Roman road* as the distance between each city and the closest Roman road in hundreds of kilometers and *Coastal city*, a dummy equal to one if the city was on the coast and zero otherwise. From Istat (2009), we obtain *Elevation*, the city's elevation in meters. From Hubert (2004), we take the cities' size in square kilometers in the tenth and twelfth centuries and consider their difference ($\Delta Size$), which is unfortunately only available for nine of the sample cities (see Appendix A.1 for the list of cities).[4] To proxy level of urbanization and development, we use data on the construction and ornamentation of religious buildings in our sample period and, in particular, build two variables: for each city, the number of churches and monasteries erected until 1087 (*Churches and monasteries*) and the difference of the levels of this variable, respectively, in 1087 and in 1000 (Δ*Churches and monasteries*). To do so, we augment the data collected by Belloc et al. (2016) on churches' construction and ornamentation between 1000 and 1300 [data from the National Office for Ecclesiastical Cultural Assets and Information Services of the Italian Episcopal Conference and other sources; see Belloc et al., (2016) for details] with

[4] These cities are: Arezzo, Bologna, Firenze, Genova, Milano, Pavia, Piacenza, Pisa, and Pistoia. Note that, since we need to gauge the cities' development before the foundation of the university of Bologna, we cannot use data from Malanima (2005), who gives population for a large sample of Italian cities, but only as far back as 1300.

additional information on monasteries constructed in the sample period (see Appendix C for details on the sources). Moreover, to control for institutional spillovers we count, for each city in the sample, the yearly number of cities that had adopted communal institutions that were located within a threshold distance of 100 km.

Finally, we assemble data on the places of birth and the careers of prominent jurists graduated at the University of Bologna, who studied and worked in the period under consideration. The data are drawn from two sources: Alidosi (1620) and Birocchi et al. (2013). The first book reports, when available, biographical information about the graduates of the University of Bologna starting from its year of foundation (1088). The second book contains the biographies of hundreds of Italian notable legal scholars and lawyers, who also studied at the University of Bologna, from the eleventh to the twentieth century. Based on this information, we construct four variables: the first two are a dummy equal to one if at least one graduate legal scholar was born in the city and zero otherwise (*At least one jurist born in the city*) and their number (*Number of jurists born in the city*). Moreover, we collect information on the cities where jurists worked and lived after graduation in Bologna and build two analogous variables regarding the cities of destination (*At least one jurist who lived in the city* and *Number of jurists who lived in the city*).[5]

3.2 Summary statistics and balancing test

In Table 1, we report descriptive statistics of all the variables employed in our analysis and balancing tests. In particular, we split our sample into two groups: cities whose distance to the closest university city (over the whole sample period before their transition to communal institutions, if any) is equal to or less than the median (of the distribution of city distances to their closest university city), which is equal to 155 km, and cities for which this distance is more than the median. The two groups are composed, respectively, of 61 and 60 cities. When we consider the city size (last row of the table), the median is computed with respect to the sample of cities for which the land area is available and is equal to 158 km (and the two groups are made of 5 and 4 cities, respectively). Finally, when we run this exercise with respect to the variables that capture the presence of jurists graduated at the university of Bologna, the distance is that between each city and Bologna. The median distance, in this case, is 247 km.

The table shows that the difference between the two groups of cities in the time-invariant city's characteristics is not statistically significant, with the single exception of *Elevation*, whose mean differs in a statistically significant way between the group of cities closer to a university city and those farther from it (higher elevation).[6]

[5] The employed list of jurists operating before the 1300 includes 503 observations. Within this sample, the jurists who worked outside Bologna (those for which we could identified a city of destination and work different from Bologna) are 85. Among these, 30 jurists worked in communal administrations (as consuls, judges, ambassadors, or podestas).

[6] The difference in elevation between the two groups is not relevant for the identification of the effects of interest in the following analysis, where we always control for the fixed effects.

Similarly, the three time-varying variables that measure urbanization in the period before the foundation of the first university,

Churches and monasteries in 1087, Δ*Churches and monasteries 1000–1087*, and Δ*City size*, are balanced between the two groups of cities (although admittedly Δ*City size* is relatively uninformative, given the very small number of cities for which it is available). While this is not a proper test on pre-trends (for a more specific one see below), this exercise shows that there is no compelling reason to think that the cities which were closer to a university were in a more favorable position, for *ex ante* geographical or historical reasons, to become communes.[7] Finally, by contrast and as expected, both the probability to have at least one and the number of graduate jurists are higher in cities (both as cities of origin and as cities of destination) closer to Bologna and the difference between the two groups is statistically significant at every confidence level. These results corroborate the idea that the distance to a university is a proxy of the cost of university attendance for a city's administrative elite and that, indeed, cities closer to Bologna had access to a greater stock of human capital. Given the historical importance of Bologna, in the appendix we replicate Table 1 by considering the median distance to Bologna as a threshold (see Appendix A.2).

4 Empirical strategy and results

4.1 The empirical model

In this section, we discuss our empirical design. In the analysis that follows, we exploit the panel structure of the data. On the one hand, our sample cities transited to communal institutions at different points in time, producing a time variation in the dependent variable. On the other hand, as for our main explanatory variable, the emergence of universities in different moments of our period of interest leads to a variation of the cost of university attendance over time. A panel analysis allows us to exploit the margin of variation in proximity to a university over time and at the same to control for city time invariant characteristics and common shocks to all cities in the sample. Hence, we do not exploit cross-city variation in the event of a transition (whether a given city ever transited to communal institution or not), but rather the timing of the transitions as a function of the (time varying) distance between each city and to its closest university in each period.

To assess how the foundation of a university affects the probability of institutional change, we estimate the following model:

$$Transition_{it} = \alpha_i + \beta_t + \gamma \times Log(distance\ to\ closest\ univ.\ city)_{it} \times Post1088_t + \varepsilon_{it}, \quad (1)$$

where i and t denote respectively the city and the year, and ε_{it} is the error term. The dependent variable, $Transition_{it}$, is a dummy equal to one if city i established

[7] The probability to eventually adopt the communal institution is not correlated with elevation.

Table 1 Descriptive statistics and balancing tests

Variable	Min	Max	Mean (SE)		Mean of the difference (SE)
			Group close	Group far	
Episcopal see city (dummy)	0.00	1.00	0.5167	0.6393	− 0.1227
			(0.0651)	(0.0620)	(0.0898)
Elevation (meters)	0.00	1001.00	126.1500	186.9180	− 60.7680
			(21.1552)	(24.2162)	(32.1936)
Distance to closest passes (100 s of km)	0.71	8.04	4.2031	3.8668	0.3363
			(0.2120)	(0.2738)	(0.3470)
Distance to Roman road (100 s of km)	0.00	0.37	0.0532	0.0502	0.0031
			(0.0098)	(0.0120)	(0.0156)
Caostal city (dummy)	0.00	1.00	0.2131	0.2000	0.0131
			(0.0529)	(0.0521)	(0.0742)
Churches and monasteries in 1087	0.00	44.00	4.8333	6.2951	− 1.4617
			(1.0110)	(1.1292)	(1.5171)
ΔChurches and monasteries (1000–1087)	0.00	18.00	1.0500	1.0820	− 0.3200
			(0.3537)	(0.2329)	(0.4221)
Number of jurists born in the city	0.00	12.00	0.6393	0.0833	0.5560
			(0.2290)	(0.0360)	(0.2337)
At least one jurist born in the city (dummy)	0.00	1.00	0.2623	0.0833	0.1790
			(0.0568)	(0.0360)	(0.0675)
Number of jurists who lived in the city	0.00	41.00	1.6230	0.2833	1.3397
			(0.6872)	(0.1011)	(0.7001
At least one jurist who lived in the city (dummy)	0.00	1.00	0.3607	0.1500	0.2107
			(0.0620)	(0.0465)	(0.0777)
Number of observations	121		61	60	
ΔCity size (square kms)	22	155	50.5000	71.0000	− 20.5000
			(16.4139)	(23.7845)	(30.5805)
Number of observations	9		5	4	

"Group close" ("group far") is the group of cities that have a distance to their closest university over the sample period (before city transition) shorter (longer) than the median. For the variables *At least one jurist* and *Number of jurists* (born or that lived in the city) the distance is computed with respect to Bologna

communal institutions in year t and zero otherwise. Since what we are interested in the effect of the proximity to a university on the likelihood of institutional transition, if the transition occurred in city i at time t, we define no time for that city after t.[8] $Log(distance\ to\ closest\ univ.\ city)_{it}$ is the shortest log distance at time t between city i and any university city and is interacted with the $Post1088_t$ that is a dummy

[8] The inverse transition, from communal institutions to feudal regime, is not found historically in any of our sample cities. Hence, the dependent variable is an absorbing state and after the transition, if any, a city drops from the sample (see Belloc, Drago, and Galbiati, 2016, for details).

equal to zero when t is prior to 1088 (the year of foundation of the first university in Bologna) and one from then on. Hence, after 1088, $Log(distance\ to\ closest\ univ.\ city)_{it} \times Post1088_t$ is equal to the log distance between city i and Bologna between 1088 and 1182, to the distance between city i and Modena between 1182 and 1188 if the distance to Modena is shorter than that to Bologna (otherwise it remains equal to the distance to Bologna), to the log distance between city i and Reggio nell'Emilia between 1188 and 1204 if the distance to Reggio nell'Emilia is shorter than that to Modena (otherwise it remains equal to the distance from Modena), and so on. α_i and β_t are, respectively, city fixed effects and year dummies, which control respectively for city time invariant characteristics and common shocks to all cities. The log distance from the closest university before the foundation of the first university (we might take the log distance from Bologna, for instance) is a city fixed effect that is absorbed by α_i. The estimated coefficient γ is expected to be negative, indicating that the positive effect of the establishment of the university is decreasing in the distance from the closest university city. Note that, since we exploit the within-city variation from the closest university interacted with $Post1088_t$ dummy, the four cities (Genova, Imola, Pisa, and Lucca, see Appendix A.1) that experienced a transition before the foundation of the first university in Bologna in 1088 do not contribute to the identification of the coefficient γ.

The key identifying assumption for model (1) is that the underlying probability of transition for cities located at various distances to the closest university city would not have changed after the foundation year had the university not been established. Conditions implying violation of this assumption include the endogeneity of the university foundation itself: if, prior to the institutional transition, the establishment of a university in a certain city (and not elsewhere) was caused by factors relating to the communal process (for instance, the increase in commerce), the coefficients of interest in model (1) would reflect reverse causality. The estimated coefficients could also reflect unobservable trends affecting both the university foundation and the institutional transition, such as the increasing exposure to trade that took place at the beginning of the eleventh century. We address these concerns with a pre-trends exercise (Sect. 4.3) and by augmenting model (1) with interactions between a linear trend and a number of time invariant geographical and institutional variables, such the closest (log) distance to a pass or to a Roman road, the coastal city dummy, the (log) city elevation, and the Episcopal see city dummy (Table 3).

Since we exploit within-city variation, identification in our analysis comes from cities that eventually adopt a communal institution. Nonetheless, there is no reason to exclude cities that never experienced a transition, which also contribute to estimation.[9]

[9] In fact, for these cities, there is no variation in the dependent variable (so that estimation of γ in model (1) could not be accomplished if the sample were only composed of such cities), but there is variation in the distance to university cities. Hence, these cities, together with those adopting communal institutions, do contribute to the estimation the parameter γ in our model.

4.2 Pre-trends

To provide evidence that the birth of communes (the dependent variable in our main analysis) did not lead to the establishment of universities in the surrounding area, in this section we report a simple pre-trend exercise. Specifically, we estimate the following model:

$$University\,foundation_{it,x} = \alpha_i + \beta_t + \delta \times Transition_{it+z} + \zeta_{it}, \quad (2)$$

where $University\ foundation_{it,x}$ is equal to one if a university is founded in year t within $x = (25, 50, 75, 100)$ kilometers away from city i and to zero otherwise, while $Transition_{it+z}$ is equal to one if city i established communal institutions in year t, remains equal to one in the z (=5, 10, 15, 20) years after t, and is equal to zero otherwise. ζ_{it} is the error term. For model estimation, we compute both standard errors clustered at the city level and, in addition, Conley's standard errors adjusted for potential spatial dependence between observations with threshold distance of, alternatively, 100 km or 150 km (Conley, 1999) and temporal correlation with threshold lag of 100 years and linear decay in time (Newey & West, 1987).[10]

Results, for all combinations of x (=25, 50, 75, 100 km) and z (=5, 10, 15, 20 years), are reported in Table 2 (clustered standard errors in round brackets and Conley's standard errors in square brackets) and show that there is no consistent pattern indicating that the transition to communal institutions led to the foundation of a new university. Hence, we find no compelling evidence that causality goes from establishment of communes to birth of universities.

4.3 Main results

Model (1) is estimated by OLS to accommodate a large set of year and city fixed effects [see also Belloc et al., (2016), for a discussion]. Table 3 shows the estimated coefficient γ from model (1), again reporting standard errors clustered at city level in round brackets and Conley's standard errors corrected for spatial and time dependence in square brackets. The distance from the closest university is in logarithmic terms (we consider the log of the distance in kilometers plus one meter to keep university cities in the sample with a distance equal to zero). Column (1) reports the results for the full sample. The estimated coefficient is negative and statistically different from zero despite the fact the presence of a large set of fixed effects absorbs a sizable fraction of the variation. This result suggests that, for a given city, doubling the distance away from its closest university decreases, each year, the probability of transition by 0.0017, namely by 63% with respect to the baseline probability of transition in the sample (that is equal to 0.0027).

Considering that the first transition to communal institutions occurred in 1080 (Genova), for robustness, in column (2) we report results obtained after excluding from the sample period the first and the last 80 years. The estimated coefficient is

[10] Results would not change, should we adopt a different threshold distance or threshold lag.

Table 2 Pre-trends

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$z=5$ years	$z=5$ years	$z=5$ years	$z=5$ years	$z=10$ years	$z=10$ years	$z=10$ years	$z=10$ years
	$x=25$ km	$x=50$ km	$x=75$ km	$x=100$ km	$x=25$ km	$x=50$ km	$x=75$ km	$x=100$ km
Transition	− 0.0009	0.0007	0.0072	0.0058	− 0.0008	− 0.0006	0.0034	0.0033
	(0.0007)	(0.0031)	(0.0059)	(0.0057)	(0.0006)	(0.0017)	(0.0040)	(0.0042)
	[0.0006]	[0.0028]	[0.0053]	[0.0049]	[0.0005]	[0.0015]	[0.0035]	[0.0039]
Observations	26,067	26,067	26,067	26,067	26,413	26,413	26,413	26,413
R-squared	0.0639	0.1282	0.2345	0.2742	0.0635	0.1273	0.2319	0.2710
Cities	121	121	121	121	121	121	121	121
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	$z=15$ years	$z=15$ years	$z=15$ years	$z=15$ years	$z=20$ years	$z=20$ years	$z=20$ years	$z=20$ years
	$x=25$ km	$x=50$ km	$x=75$ km	$x=100$ km	$x=25$ km	$x=50$ km	$x=75$ km	$x=100$ km
Transition	− 0.0009	− 0.0012	0.0008	0.0011	− 0.0009	− 0.0007	0.0004	0.0011
	(0.0006)	(0.0013)	(0.0029)	(0.0034)	(0.0006)	(0.0014)	(0.0023)	(0.0028)
	[0.0004]	[0.0011]	[0.0024]	[0.0032]	[0.0004]	[0.0010]	[0.0018]	[0.0024]
Observations	26,758	26,758	26,758	26,758	27,103	27,103	27,103	27,103
R-squared	0.0632	0.1262	0.2293	0.2676	0.0628	0.1285	0.2310	0.2687
Cities	0.0632	0.126	0.229	0.268	121	121	121	121

OLS estimation of model (2). The dependent variable is a dummy = 1 if a university was established within x (= 25, 50, 75, 100) km away from city i at time t and for z (= 5, 10, 15, 20) years after t, and = 0 otherwise. City fixed effects and time dummies always included. Standard errors clustered at the city level are in round brackets; Conley's standard errors corrected for spatial and time dependence are reported in square brackets. ***Significant at 1%; **Significant at 5%; *Significant at 10%. Statistical significance is indicated employing clustered standard errors

Table 3 Main results

	(1) Main	(2) Drop first 80 and last 80 years	(3) Control for distance to closest pass × trend	(4) Control for distance to roman road × trend	(5) Control for costal city dummy × trend	(6) Control for elevation × trend	(7) Control for episcopal city dummy × trend	(8) Control for institutional spillovers
Log(distance)	− 0.0017***	− 0.0016*	− 0.0016**	− 0.0018***	− 0.0017**	− 0.0018***	− 0.0020***	− 0.0015**
↔Post1088	(0.0006)	(0.0009)	(0.0007)	(0.0006)	(0.0007)	(0.0006)	(0.0005)	(0.0007)
	[0.0007]	[0.0010]	[0.0008]	[0.0007]	[0.0008]	[0.0007]	[0.0007]	[0.0008]
	[0.0007]	[0.0011]	[0.0008]	[0.0007]	(0.0007)	[0.0007]	[0.0007]	[0.0008]
Observations	25,787	11,878	25,787	25,787	25,787	25,486	25,787	25,787
R-squared	0.0264	0.0700	0.0266	0.0266	0.0264	0.0266	0.0270	0.0265
Cities	121	121	121	121	121	120	121	121

OLS estimation of model (1). The dependent variable is a dummy = 1 if city *i* became a commune at time *t* and = 0 otherwise. City fixed effects and time dummies always included. Standard errors clustered at the city level are in round brackets; Conley's standard errors corrected for spatial and time dependence are reported in square brackets. Spatial threshold distance is alternatively 100 km (first line) or 150 km (second line); time dependence lag is 100 years. ***Significant at 1%; **Significant at 5%; *Significant at 10%. Statistical significance is indicated employing clustered standard errors

still negative and statistically significant, suggesting that the results reported in column (1) are not an artifact of the panel structure of the data and to the concentration of the transition events in the twelfth century.

In columns (3)–(7), we augment the model by including an interaction between a linear trend and the log distance from the closest pass, a linear trend and the log distance to the closest Roman road, a linear trend and the coastal city dummy, a linear trend and the log city elevation, and the linear trend and the Episcopal see city dummy. As we can see, the coefficients remain stable hinting at the fact that our results are not entirely driven by unobservable trends such as the increasing trade exposure over the sample period or other dynamics correlated with cities' geographical or cultural characteristics.

Finally, results reported in column (8) are from a specification that also includes a control for institutional spillover effects, which measures for each city and year in the sample, the number of cities that had adopted communal institutions within a threshold distance of 100 km. As one can verify, our coefficient of interest is marginally affected in size and remains negative and statistically significant at the 5% level.

5 Additional evidence

So far, we have presented evidence consistent with the story that the establishment of institutions of higher education fostered the transition from the feudal regime to communes. We maintain that the main driver of this effect is the human capital building in universities, which provided a set of fundamental skills favoring the emergence and diffusion of communal institutions. In particular, the jurists provided the skills necessary to write statutes that were a coherent body of rules by whom cities administrators and citizens had to abide. In the absence of a superior authority (the Emperor) to justifying the political power of local rulers (bishops and feudal rulers), these written rules were a fundamental element of the local order. Unfortunately, given our empirical design—and despite the robustness checks—it is difficult to entirely exclude alternative explanations of the reduced-form results. In this section, we report pieces of evidence consistent with our interpretation.

We know from Table 1 that there is a negative correlation between the presence of graduate legal scholars in a given city (at least one and their number) and its distance to Bologna. We interpreted this pattern as supportive evidence that in fact a longer distance implies a higher cost of university attendance. Then, to corroborate the idea that the presence of legal scholars facilitated the establishment and diffusion of communal institutions, we study the association between the presence and the number of jurists in each city and the time elapsed between 1088 and the year of the city's transition to communal institutions.

Accordingly, we estimate the following model:

$$Time\ to\ transition_i = \alpha_i + \gamma \times Jurists_i + Controls_i + \phi_i, \tag{3}$$

Table 4 Communal institutions and human capital

	Jurists born in the city		Jurists who lived in the city	
	(1)	(2)	(3)	(4)
At least one jurist	− 63.8339***		− 85.4399***	
	(18.8969)		(16.9506)	
Number of jurists		− 10.0892**		− 3.4709**
		(4.9642)		(1.6203)
Episcopal see	− 52.2828***	− 59.5207***	− 29.9817*	− 58.1460***
	(14.7476)	(14.9582)	(15.1266)	(15.0056)
Log(elevation)	− 3.6280	− 3.5778	− 6.8739*	− 3.7764
	(4.2529)	(4.4010)	(4.0998)	(4.3996)
Log(distance to closest pass)	30.1182***	33.9507***	25.7730**	34.5947***
	(11.2414)	(11.5211)	(10.7052)	(11.4913)
Log(distance to Roman road)	− 2.2377	− 1.6262	− 0.1211	− 1.1827
	(3.2153)	(3.3113)	(3.0254)	(3.2899)
Costal city	11.6600	11.1964	− 3.9592	9.3022
	(20.6423)	(21.3956)	(19.8923)	(21.4520)
ΔChurches and monasteries	− 41.7296	− 45.5036	− 51.9243	− 53.4706
	(34.5299)	(35.6795)	(32.4917)	(35.3662)
Churches and monasteries in 1088	36.2333	37.0288	47.5628	44.2512
	(34.4554)	(35.6589)	(32.5194)	(35.3929)
Constant	99.9421	77.2096	137.3660**	74.2663
	(66.3053)	(67.8709)	(63.5980)	(67.6387)
R-squared	0.3992	0.3602	0.4623	0.3628
Cities	117	117	117	117

OLS estimation. The dependent variable (*Time to transition*) is the number of years that elapsed between 1088 and the transition of city *i* to communal institutions (cities that transited before 1088 are excluded). ***Significant at 1%; **Significant at 5%; *Significant at 10%

where *i* denotes the city, $Time\ to\ transition_i$ is defined as the difference between 1300 and the year of transition for city *i*, if any, $Jurists_i$ is, alternatively, the number of jurists born in city *i* or the number of jurists who lived in city *i*. $Controls_i$ is a vector of variables which controls for city *i*'s time invariant characteristics: *Episcopal see city dummy*, *Log*(*elevation*), *Log*(*distance to closest pass*), *Log*(*distance to Roman road*), *Coastal city dummy*, *Churches and monasteries in 1088,* and Δ*Churches and monasteries (between 1088 and 1000)*. ϕ_i is the error term.

The regression results are given in Table 4. The point estimates document that the presence of jurists reduces the time to accomplish a transition. The estimate in column (2), for example, suggests that an additional jurist in a city reduces the time to a transition by about 10 years. This cross-sectional evidence supports the hypothesis that more human capital is conducive to institutional change towards communes.

6 Concluding remarks

We have inquired into the relationship between the diffusion of higher education and the process of institutional change. To this end, we have exploited an empirical setting given by two historic developments in the Middle Ages in north-central Italy: the foundation of the first universities and the establishment of communal institutions. Accordingly, we have presented historical and empirical evidence consistent with the thesis that a positive shock to human capital accumulation helped stimulate the adoption of more democratic institutional forms. Our findings are consistent with the idea that university trained jurist served the purpose of writing and interpreting laws and statutes: they acquired the skills that were necessary to this task and this task was fundamental for the establishment and consolidation of communal institutions. The availability of written rules, indeed, facilitated the application of law to all the citizens, including administrators, in a context of diffuse power where the political authorities (contrary to the preceding regime) did not derive their power from a superior political entity (the Emperor).

While these conclusions need to be taken with caution in view of the difficulty of disentangling causal relationships in the complex context under examination, our results suggest that the diffusion of juridical knowledge played an important role in fostering the emergence of more inclusive institutions in medieval Italy.

Appendix A.1: Transition dates

City	Year	Episcopal	City	Year	Episcopal	City	Year	Episcopal
Acqui Terme	1135	Yes	Fondi	–	Yes	Pistoia	1105	Yes
Alassio	–	No	Forlì	1182	Yes	Prato	1107	No
Alba	1169	Yes	Fossombrone	–	Yes	Ravenna	1109	Yes
Albenga	1098	Yes	Galliate	–	No	Reggio Nell'Emilia	1136	Yes
Aquileia	–	Yes	Garlasco	–	No	Rieti	1171	Yes
Arezzo	1098	Yes	Genova	1080	Yes	Rovereto	–	No
Ascoli Piceno	1183	Yes	Gorizia	–	No	Rovigo	–	No
Asiago	–	No	Grado	–	Yes	Saluzzo	–	No
Asti	1095	Yes	Grosseto	1204	No	San Colombano Al Lambro	–	No
Bergamo	1098	Yes	Iesolo	–	Yes	San Gimignano	1199	No

City	Year	Episcopal	City	Year	Episcopal	City	Year	Episcopal
Biella	1245	No	Imola	1084	Yes	San Severino Marche	1170	No
Bologna	1116	Yes	Imperia	–	No	Sant'Angelo Lodigiano	–	No
Bolzano	–	No	Ivrea	1171	Yes	Sarsina	–	Yes
Brescia	1127	Yes	La Spezia	–	No	Savona	1191	Yes
Bressanone	–	Yes	Livorno	–	No	Senigallia	–	Yes
Camerino	–	Yes	Lodi	1142	Yes	Siena	1147	Yes
Caravaggio	1182	No	Lucca	1081	Yes	Sora	–	Yes
Carpi	–	No	Lugo	–	No	Soresina	–	No
Castiglione Delle Stiviere	–	No	Macerata	1138	No	Stradella	–	No
Cento	–	No	Mantova	1115	Yes	Subiaco	1193	No
Cesena	1176	Yes	Massa	–	No	Sutri	–	Yes
Chiavari	1243	No	Milano	1097	Yes	Tolentino	1166	No
Chieri	1150	No	Modena	1135	Yes	Tortona	1122	Yes
Chioggia	–	No	Monselice	–	No	Treia	1157	No
Chivasso	–	No	Montefiascone	–	No	Trento	–	Yes
Civitavecchia	–	Yes	Narni	–	Yes	Treviglio	–	No
Codogno	1232	No	Nepi	1131	Yes	Treviso	1150	Yes
Comacchio	–	Yes	Novara	1116	Yes	Trieste	1295	Yes
Como	1109	Yes	Novi Di Modena	–	No	Valenza	1204	No
Corridonia	–	No	Novi Ligure	1135	No	Ventimiglia	1149	Yes
Crema	1185	No	Numana	–	Yes	Vercelli	1141	Yes
Cremona	1098	Yes	Ormea	–	No	Veroli	–	Yes
Empoli	–	No	Orvieto	1157	Yes	Verona	1136	Yes
Fabriano	1234	No	Padova	1138	Yes	Viadana	–	No
Faenza	1141	Yes	Parma	1149	Yes	Vicenza	1147	Yes
Fano	1114	Yes	Pavia	1106	Yes	Viterbo	1099	No
Feltre	–	Yes	Perugia	1139	Yes	Vittorio Veneto	–	Yes
Fermo	1199	Yes	Pesaro	1182	Yes	Voghera	1136	No
Ferrara	1105	Yes	Piacenza	1126	Yes	Volterra	1170	Yes
Fiesole	–	Yes	Pinerolo	1220	No			
Firenze	1125	Yes	Pisa	1081	Yes			

Sample period (1000–1300). "Year" is the year when the first evidence of the commune can be found in historical sources; "-" indicates that the city never becomes a commune within the sample period. Episcopal 'Yes' denotes the seat of a bishop (70 cities); Episcopal 'No' that the city was not an episcopal see (51 cities). Sources are reported in Belloc et al. (2016)

Appendix A.2: Descriptive statistics and balancing tests with respect to the median distance to Bologna

Variable	Min	Max	Mean (SE)		Mean of the difference (SE)
			Group close	Group far	
Episcopal see city (dummy)	0.00	1.00	0.5902	0.5667	0.0235
			(0.0635)	(0.0645)	(0.0905)
Elevation (meters)	0.00	1001.00	234.2833	80.5574	153.7260
			(26.7057)	(12.8335)	(29.4766)
Distance to closest passes (100 s of km)	0.71	8.04	3.7404	4.3316	− 0.5911
			(0.1486)	(0.3124)	(0.3441)
Distance to Roman road (100 s of km)	0.00	0.37	0.0478	0.0556	− 0.0078
			(0.0103)	(0.0117)	(0.0156)
Caostal city (dummy)	0.00	1.00	0.1967	0.2167	− 0.0199
			(0.0513)	(0.0536)	(0.0742)
Churches and monasteries in 1087	0.00	44.00	1.1967	1.0000	0.1967
			(0.3551)	(0.22676)	(0.4229)
ΔChurches and monasteries (1000–1087)	0.00	18.00	1.1475	0.9833	0.1642
			(0.3552)	(0.2249)	(0.4219)
Number of jurists born in the city	0.00	12.00	0.6393	0.0833	0.5560
			(0.2290)	(0.0360)	(0.2337)
At least one jurist born in the city (dummy)	0.00	1.00	0.2623	0.0833	0.1790
			(0.0568)	(0.0360)	(0.0675)
Number of jurists who lived in the city	0.00	41.00	1.6230	0.2833	1.3397
			(0.6872)	(0.1011)	(0.7001
At least one jurist who lived in the city (dummy)	0.00	1.00	0.3607	0.1500	0.2107
			(0.0620)	(0.0465)	(0.0777)
Number of observations	121		61	60	
ΔCity size (square kms)	22	155	50.5000	71.0000	20.5000
			(16.4134)	(23.7845)	(30.5804)
Number of observations	9		5	4	

Appendix B: Sources for dates of university foundations

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Appendix C: Sources for dates of construction and ornamentation of monasteries

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