Earthquakes, Religion, and Transition to Self-Government in Italian Cities[*]

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Abstract

For a panel of about 60 Episcopal see cities (governed by a bishop) over 300 years in the medieval northern-central Italy, we document that the occurrence of an earthquake retarded transition from feudal regime to commune. To provide an interpretation of our findings, we offer a simple conceptual framework highlighting the basic trade-offs involved in the process of institutional change when the incumbent political leader is also the religious authority and derive a number of testable predictions. First, shocks heightening people's religiosity, such as seismic events in the Middle Ages, strengthen the *status quo* regime and, as a consequence, retard institutional change. Second, this effect is the larger the stronger is the shock. Third, the effect lasts only in the short-run. Our interpretation is corroborated by ample historical evidence and by a number of additional empirical findings. In particular, the negative effect of the earthquake is observed for both destructive earthquakes and earthquakes that did not result in any physical damage to people or buildings but were still felt by the population, the former producing a larger impact. And, the effect of an earthquake on the transition probability lasts no more than 10 years. Consistent with the idea that an earthquake, in our historical context, represents a shock to people's religiosity, we also find that: the number of churches in each city is positively correlated with the seismicity of such city; and the negative impact of earthquakes on institutional transitions is not observed in the group of non-Episcopal see cities, where the communal movement was also under way in the period considered.

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1. Introduction

Political institutions controlled by religiously connected leaders have historically proved to be stable. For instance, Ancient Egypt under the rule of the pharaohs, China under the Han dynasty, the Roman Empire, the State of the Church in central Italy up to the late 19th century, the Meiji empire in Japan and the ayatollah's supreme leadership in Iran are all long lasting regimes in which political leaders and religious leaders are one and the same person. Some scholars have maintained that such a remarkable stability is a consequence of the close connection between religious and political leaders. For instance, Niccolo Machiavelli ("The Prince",1532; ch. 11) maintained that religiosity might support political stability and ensure social order. Discussing how the sovereign can ensure his power, the author makes a distinction between the ecclesiastical and the other principates: in the former, he states, power is relatively easier to maintain, since the prince can count on popular support based on religious feelings.[1]

This paper studies how religiosity can affect institutional change and provides political leaders the means to conserve the *status quo*. Disentangling the relationship between religion and stability of the political power is of course challenging. In the ideal experiment, we would observe political regimes characterized by a correspondence between political and religious authorities in a period of potential institutional change, in which the incumbent leaders are threatened and possibly overturned by the secular elites. We would also observe exogenous shocks affecting people's religiosity and assess whether or not these shocks, in turn, strengthen the *status quo* political regime so to retard institutional change.

The ideal setting just outlined is to be seen in northern and central Italy between the 11th and the 13th centuries. In this period, Italian cities witnessed a process of profound change in political and institutional configurations, known as the communal movement, in which the power of the incumbent feudal leaders was challenged and, often replaced, by the bourgeois elite. In the *status quo* feudal regime, the political leader was either the bishop, in the Episcopal see cities, or the feudal lord, in the non-Episcopal see cities. In the former, that will be the focus of our study, the bishops were at the same time political leaders, monopolists in the provision of religious services, and the supreme religious authorities. In the *status quo* regime they ruled, *de facto* and

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[1] "It only remains now to speak of ecclesiastical principalities […]. These princes alone have states and do not defend them, they have subjects and do not rule them; and the states, although unguarded, are not taken from them, and the subjects, although not ruled, do not care, and they have neither the desire nor the ability to alienate themselves. Such principalities only are secure and happy." Machiavelli, *The Prince*, Ch. 11.

de jure, free of checks and balances. Hence, the transition from the feudal regime to the commune represented a radical change in political institutions. As we explain in greater detail in subsection 3.2, the commune represented the evolution of private associations of citizens extended over the whole city. In the communal system, the political power was exercised by the representatives of all the citizens and checked by constitutional limitations and representative assemblies.

As we illustrate in the conceptual framework, the Episcopal regime and the commune can be seen as two alternative institutional configurations to ensure social order, e.g. minimize the risk of expropriation by other private citizens. The former ruled by exploiting the strong religious feelings prevailing in Italy in the 11^{th} century and the obedience of the citizens to the political-religious leader. The latter, by contrast, relied on the higher level of civic capital, political participation, and juridical knowledge that developed during the three hundred years of interest and acted by means of enforceable agreements between individuals, such as written contracts, guilds, private associations, and so on. Consistently, the transition from the Episcopal regime to the commune is triggered by factors that make the civic associations (eventually the commune), relative to the Episcopal regime, more efficient in ensuring social order. By contrast, a shock to people's religiosity, momentarily retards this process by increasing the ability of the Episcopal regime to guarantee social order and property rights protection.

The exogenous shock to the people's religiosity, in our experiment, is offered by the occurrence of an earthquake. During the Middle Ages in Western Europe, earthquakes represented mysterious and unforeseeable events men could only account for as manifestation of God's wrath. This conviction was widespread and was maintained at least until the Enlightenment (Guidoboni, 2000; Guidoboni and Poirier, 2004; Nur and Borgess, 2008; Schenk, 2010). As amply documented in subsection 3.3, after an earthquake, peoples' common reaction was panic, consternation, and an immediate urge for reconciliation with God. This resulted in a sudden increase in participation in (and thus an increase in the demand for) religious services, such as collective prayers, processions, and fasts. Consistent with the idea that earthquakes represent a shock to religiosity, we document (subsection 6.4) that in the Italian cities the number of existing churches today (including all the churches built in the past up to nowadays) positively correlates with the number of earthquakes that occurred in the medieval period, controlling for the number of earthquakes that occurred in different periods, population, and regional fixed effects.

Our analysis is conducted on a unique large panel dataset, specially constructed for the purpose. Starting from the sample of the largest cities in northern-central Italy for which reliable historical documents on the communal experience are available, we collected (various sources) information on the cities that were seat of a bishop (Episcopal see cities) before 1000, their political regime (either feudal or communal), the year when the change to communal institutions (if any) occurred and other observable city characteristics. The transition to a commune is dated to the publication of the *statutum* and/or when the presence of the *consules* is testified by the historical sources (as explained in greater detail in subection 5.1). These data are matched with information on the earthquakes (epicenter, time, intensity at the epicenter and at the locality in Mercalli-Cancani-Sieberg scale) that occurred in Italian cities in the period under analysis. The latter is provided by the DBMI04 dataset (Database Macro Sismico Italiano, 2004) and collected by researchers at the Italian National Institute for Geophysics and Volcanology (Stucchi et al., 2007). In particular, we work with 141 seismic events registered between 1000 and 1300, and are able to distinguish between earthquakes for which physical damage to people, natural objects, buildings, and other man-made objects and the Earth's surface were reported, and earthquakes that did not result in material damage but were still felt by the population (this distinction is crucial, as will be evident shortly). In order to address potential concerns about possible unreported earthquakes due to missing or inaccurate historical sources, in the robustness checks we augment the dataset by assigning an earthquake to all the cities in the neighborhood of a city for which historical records were available documenting that an earthquake took place (subsection 5.3).

Exploiting the panel structure of the data, we document a strong negative empirical relationship between the occurrence of an earthquake and transition to commune in the group of Episcopal see cities. An earthquake brings the probability of transition down to zero in the 10 years following the event. A first potential concern to consider in the interpretation of our findings is that our results might be driven by the fact that an earthquake may be associated not only with a religiosity shock but also with an income shock. This possibility is ruled out by the fact that earthquakes that did not result into physical damage to people or buildings, but were nevertheless felt by the population, also delayed institutional transition to the communal system.

This suggests that such an effect does not depend on the material damage, increase in poverty, deaths or the (possibly) differential material impact it has on the social classes involved in the political transition.

Although our findings tend to rule out the possibility that the effects of the earthquakes are driven by material factors, it is still possible that our findings are related to other non-religious factors such as fear or need to maintain the *status quo* in periods of potential catastrophe for reasons not related to religion. To exclude this possibility, we collect the same information included in the main dataset for the sample of the largest northern and central Italian cities that were not seats of bishops. In the medieval period, non-Episcopal see cities were normally governed by secular leaders (counts and marquises) and thus, in these cities, there was no correspondence between political and religious authorities. Our results show that an earthquake does not retard transitions to communal institutions when non-Episcopal see cities are considered. The effect is not statistically significant and very close to zero in magnitude.

The paper proceeds as follows. Section 2 offers brief reference to the relevant literature. In section 3 we provide the historical background documenting, in particular, the widespread belief in the Middle Ages that God was considered the ultimate cause of earthquakes and other natural disasters and the central role of the bishop as the religious authority to protect the 'flock' against such events. In section 4 we introduce a conceptual framework and suggest a number of theoretical predictions. While section 5 provides data description, section 6 reports the empirical strategy, the results, and a number of robustness checks. In section 7 we discuss alternative explanations involving other factors possibly driving our results and find no compelling and consistent evidence (either historical or empirical) to support them. Section 8 concludes the paper. We also provide an appendix explaining the sample restriction and the data sources in greater detail.

2. Related Literature

Our study relates to three distinct literatures: economic history, economics of religion, and political economy of institutional change.

Regarding the first, the crucial role of communal institutions in the development of Italian cities is supported by substantial historical research and a number of economic studies (Coleman, 1999; Tabacco, 1989; Menant, 2005; DeLong and Shleifer, 1993). In particular, it is amply documented that cities adopting communal institutions reached higher levels of urbanization and rates of growth than the cities governed by despotic political leaders. Recent work also suggests that communal institutions had a long-term impact on trust and social capital (Guiso, Sapienza and Zingales, 2008).

Second, the interest among economists in the role of religion[2] in affecting economic outcomes and political institutions is also sustained by a large literature. Barro and McCleary (2003) and McCleary and Barro (2006) investigate the effects of country differences in religious beliefs and religion adherence on economic growth, while Becker and Woessman (2009) focus on the positive effects of Protestantism on economic prosperity, working through higher education. Barro (1999) studies the relation between the primary religious affiliation of a country and its electoral rights indicator, interpreted as a degree of democracy; whereas Barro and McCleary (2005) adopt a political economy approach to study the determinants of the differences across nations in the probability of having state religion. Murphy and Shleifer (2004) point out the role of core issues (such as religious beliefs) in building social networks (such as political parties or religious coalitions) and, indirectly passing through the social network, in creating popular support for political leaders. We contribute to this literature by exploring how religion and correspondence between religious and political leaders account for the probability of institutional change and the stability of political regimes in the medieval period.

Finally, our work relates to the literature on the effects of economic shocks on institutional change. Brückner and Ciccone (2011) find that negative rainfall shocks are followed by a significant improvement in democratic institutions in contemporary Sub-Saharan African countries.[3] Chaney (2013) investigates the effects of economic and other shocks on the political power of religious leaders. Using historical data, the author finds that the probability of change in Egypt's most powerful religious authority decreased during deviant Nile floods. Based on historical records and empirical evidence on the construction of religious buildings (taken as a proxy of religious leaders' preferred policies), he argues that his main findings are consistent with the view that deviant Nile floods altered the balance of power in favor of the religious authority, whose political influence was rooted in their control of popular support. Unlike Chaney (2013), we are able to measure the impact of the shock to the actual institutional change.

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[2] On the economics of religion see, among others, Iannaccone (1991) and Ekelund, and Tollison (2011).

[3] This result is challenged by Barron, Miguel, and Satyanath (2013).

The historical experiment in this paper provides, to the best of our knowledge, the first suggestive example of how religion may interfere with political and institutional change

3. Historical Background

3.1 The Status Quo Feudal Regime

The process leading to the emergence of the commune started at the beginning of the 11th century in northern-central Italian cities that were formally part of the Holy Roman-German Empire. Cities in the empire were governed by feudal lords or bishops. While until the 10th century feudal lords were officials appointed by and dependent on the emperors, between 1000 and 1300 they became increasingly autonomous thanks to the decline in the political influence of the German emperors' central authority on the fringes of the empire. As a consequence, the feudal lords' power over their territory came to encompass the social, political, judicial, and economic spheres (Bloch, 1961; Ascheri, 2009) and obtained the establishment of a system of hereditary rules over the land allocated.[4] Bishops in Episcopal see cities filled the same political role as feudal lords in non-Episcopal cities.

The institution of Episcopal sees is dated back to the Council of Sardica in the IVth century A.D. where it was established that Episcopal seats could only be set in the roman *urbes*, which were the administrative and religious centers of the Ancient Roman Empire.[5] In these cities, the bishop held religious power, managed – and benefitted for life from – the property of the Cathedral (the church that was formally his see), and could also benefit from the exercise of the local fiscal power and the rents on lands and other resources (Ascheri, 2009; Tabacco, 1987). Formally, the city bishops were chosen by the local churches, but the elections were actually influenced by the emperors. Once elected, they were then appointed to local political and judicial offices. Unlike the feudal lords (counts or marquises), the bishops did not have the right to transfer their temporal power to their heirs. In many circumstances bishops acted as officials of the Empire in northern-central Italy and the emperor granted them rights and power previously wielded by secular rulers. As a consequence, the bishop came to serve as an advisor, judge,

[4] With the *Quierzy Capitulary* in 877, the emperor Charles II assigned to the most important feudal lords the right to transfer their feuds to their heirs. In 1037 this right was extended to all feudal lords.

[5] "*Non licere autem simpliciter Episcopum constituere in aliquo pago vel parva urbe, cui vel unus Presbyter sufficit*" in Synodorum Generalium ac Provincialium Decreta et Canones, scholiis, notis ac historicâ actorum dissertatione illustrati; studio et labore Christiani Lupi (1673).

warlord, and messenger of the emperor and was, thus, at the same time the head of the local church and the supreme political authority. This fact merits particular emphasis since (in northern-central Italy as in the rest of western Europe) the Catholic Church was, in turn, the monopolist in religion. There was no actual competition with other religious organizations and, in Episcopal see cities, the bishop was the head of the hierarchy and controlled the provision of all religious services. In cities without an Episcopal see, political power, and religious services were more clearly separated, the former being held by feudal lords, the latter provided by several local representatives of the Catholic Church (e.g. parish priests or monks).

3.2 The Emergence of the Commune

Starting from the 10th century, the northern and central Italian cities saw an increase in urbanization rates and in their economic importance. From this background an urban elite of merchants, entrepreneurs, and lawyers emerged and became economically prominent in the cities. Soon, some members of this elite started to form groups of individuals who agreed in a *patto giurato* (sworn pact) to provide mutual help and cooperate on issues of common interest. Gradually, more stable institutions emerged and the citizens signing the pact began to be involved in the city government, from which they were previously excluded. Hence, the commune was the evolution of private agreements extended to the whole city. In this period, citizens learnt to regulate their economic and social relations and to settle their disputes in a decentralized way weakening, as a consequence, the need for a central authority and support to the authoritarian leaders.

The shift from the rule of the bishops or feudal lords to the commune implied a dramatic improvement in terms of citizen participation in the political sphere and the emergence of constitutional checks and balances. The representatives of the commune exercised their power in the name of all the citizens. In particular, the city government was based on a general council of citizens and on elected *consules,* who held the executive power. The general council's decisions were valid only if taken in the presence of at least a given minimum number of citizens, and resolutions were always recorded (Senatore, 2008). The *consules* exercised executive power within the limits of a constitution: the *statutum*. With the commune, personal freedoms were accorded legal protection against abuses by government officials, whose actions were subject to the control of *ad-hoc* institutions, including courts of law to which citizens could appeal (Galizia, 1951).[6] Rules, laws, and formal decisions were always made in the name of the citizens (males of majority age owning a house had political rights; women, servants, Jews and Muslims were excluded). Overall, the commune proved to have some degree of separation of powers and contained some checks and balances as in contemporary democracies.

The transition from Episcopal or feudal regime to the commune followed different patterns. In some cities the transition entailed an explicit conflict, as in Mantua, where the emerging communal institutions fought the powerful Marquises of Canossa, or in Cremona, where the conflict broke out between the commune and the bishop from the very outset (Ascheri, 2009; Tabacco, 1987). In some other cases the transition was peaceful. For example, in Milan at the very beginning of the communal period the bishop and the *consules* ruled the city together (Ascheri, 2009). Yet, even where there was apparent cooperation between the incumbent feudal leaders and the emerging urban elite calling for establishment of the commune, the institutional change triggered a potential conflict. The very fact of sharing the management of justice and the government of the city with the *consules* and the existence of a set of rules registered in the *statutum* implied severe limitation of the former leaders' authority. The loss of executive and judicial power was not limited to the public sphere, but also involved the private domain: with the establishment and consolidation of the communes, the new city's institutions came to administering justice also over the former lands of the bishop (Pellegrini, 2009; Nobili, 2011). The conflict over the administration of justice often resulted into a formal juridical debate; in several cases the conflict was violent (Pellegrini, 2009), as is amply documented by historical cases (Albini, 2005).

3.3 Natural Disasters and Religiosity in the Middle Ages

In the Middle Ages, the belief that God was the ultimate cause of natural events (Le Goff, 1982) was rooted in biblical references, suggesting that earthquakes and other calamities were the result of God's pleasure or displeasure with men. This view was supported by popular thinkers among the early fathers of the Church. For example, Philastrius, bishop of Brescia in the 4th century, wrote: "*It is a heresy to believe that an earthquake results, not from the will and outrage of God,*

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[6] The *statuta* of the *consules* of the commune of Pistoia (1117) are the oldest documents of this kind that have reached modern times in their original form (whereas only copies of other similar documents have been handed down to the modern period), and offer an idea of the content of these constitutional documents. http://www.societapistoiesestoriapatria.it/P_ListaPagine.aspx?IDLibro=d6d732c6-095b-4e2d-9e7e-150d6a561901

but from the nature of the elements themselves, thus denying the Holy Scriptures”.[7] Isidore of Seville, in his work “*De rerum natura*” maintained that earthquakes were originated by the spirit of God (*spirito oris Dei*) judging sinners (*iudicium peccatores*).[8] Thomas Aquinas, who represented the summation of medieval Christian philosophy, recognized God as the ultimate cause of earthquakes and, in line with Aristotle’s thought, the wind driving into the earth as the physical means causing them.[9]

Saba Malaspina, a priest writing in the *Curia* of Pope Martin IV in the year 1280, described earthquakes as a sign of God’s wrath (Schenk, 2010). Even in the *corpus iuris civilis*, the collection of legal rules written under the emperor Justinian, earthquakes are described as consequences of sins against God, such as blasphemy.[10]

The view that earthquakes were caused by God was confirmed in the Catholic liturgy. For instance, during the rogation days, the three days before Ascension Day, people used to take part in processions and fasts and sang litanies praying God to protect them from plagues, natural disasters, and earthquakes. Rogation days were introduced in 463 AD by Mamertus (bishop of Vienne) in France right after an earthquake and were extended to all the Catholic Church by the council of Orleans in 511 AD (Geary, 2010).

The belief that earthquakes were caused by God to punish evil behavior was not limited to Italy, but was widespread in Europe. For example, a chronicle describing the life of Otto, bishop of Bamberg in Germany, reports that in 1117 an earthquake occurred because of people’s sins and that the Earth was fighting for God against the ‘unwise’.[11] This view persisted in Europe at least until the Enlightenment. A breaking point came with the earthquake that almost totally destroyed Lisbon in 1755. This event was still seen by some as a manifestation of divine judgment,[12] but most thinkers started to reject such an idea.[13]

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[7] Authors’ translation from: *Philastrius, De haeresibus liber*, in Banterle, G. (1991) *Delle varie eresie/San Filastrio Di Brescia. Trattati/San Gaudenzio di Brescia*, Citta Nuova, Roma.

[8] Isidore de Séville (1969), *Traité de la Nature*, in J. Fontaine, Bordeaux, Bibliothèque de l’École des Hautes Études Hispaniques, 28.

[9] See Guidoboni and Poirier (2004).

[10] Rudolf Schoell (1895) ed., *Corpus iuris civilis* vol. III, in *Novellae*, Berolini, Weidmann.

[11] Ebbo, P.J. (1869) *Ebonis Vita Ottonis Episcopi Bambergensis*, Berolini: Apud Weidmannos.

[12] “*Will you say, in seeing this mass of victims: "God is revenged, their death is the price for their crimes?" What crime, what error did these children, Crushed and bloody on their mothers' breasts, commit? Did Lisbon, which is*

3.4 Peoples' Reaction After an Earthquake

The peoples' common reaction after an earthquake was panic and consternation. Significantly, earthquakes that did not cause physical damage also frightened people. For example, the chronicles report that in 1279 an earthquake with epicenter in the Umbria-Marche region was felt to some extent in Rome. When the earthquake shook the Earth, the Pope was at dinner and his table and the whole palace moved "miraculously", and all the people believed that this heralded God's judgment.[14]

After the immediate panic there was an urge for reconciliation and an increase in the demand for religious services and, in particular, processions. Many medieval chronicles refer to processions as the very first public act in a city after a seismic event.[15] They had the aim of purifying the city land and were conceived as a first step in the restoration of public order. Both religious and political leaders took part in the procession; the structure of this ritual, in which all the citizens participated, was conceived to show that the authority of the leaders was still strong, despite the damage to palaces and cathedrals occasionally caused by earthquakes (Guidoboni and Poirier, 2004). For example, in the period covered in our dataset, on the 25th of December 1222, a violent earthquake hit the city of Modena (in our dataset registered with 7 degrees MCS in magnitude). The historical records report that the day after the earthquake the bishop led all the clergy and all the citizens of Modena in a procession to purify the city.[16] The same happened in Pistoia in 1293, where the chronicles report that after the earthquake (8 degrees MCS) that repeatedly hit the city for eight days, all the citizens (including the children) participated in a number of processions.[17]

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no more, have more vices Than London and Paris immersed in their pleasures? Lisbon is destroyed, and they dance in Paris!" Voltaire: Poem on the Lisbon Disaster, 1755, in *Candide, and Related Texts*, trans. David Wootton (Indianapolis: Hackett, 2000).

[13] See for instance Rousseau's response to Voltaire: *The Dialogue between Voltaire and Rousseau on the Lisbon Earthquake: The Emergence of a Social Science View*. Russell Rowe Dynes (University of Delaware: Disaster Research Center, 1999).

[14] *Chronica S. Petri Erfordensis moderna (1072-1335)* cited in *Earthquake of 30 April 1279 Umbria and Marche Apennines*, *Annali di Geofisica* 43(4), August, 2000: Appendix A.

[15] Processions took place even when earthquakes did not cause physical damage (see Riera Melis, 2010).

[16] The episode is recorded in *Codice Capitolare Duomo di Modena* (0 III, n.13) and reported in A. Dondi (1895), *Notizie Storiche ed Artistiche del Duomo di Modena, Coll'Elenco dei Codici Capitolari*, Modena.

[17] *Storie Pistoresi* [MCCC-MCCCXLVIII], in S. Adrasto Barbi (1907-1927) ed., Città di Castello Tipi della Casa Editrice S. Lapi (RIS2, XI/V): p. 3.

The role of the bishops was crucial, not only because they were the monopolists in the provision of religious services in the Episcopal see cities, but also because there was a widespread belief that, given their role as intermediary between God and his ‘flock’, the bishops held an apotropaic power and could actually influence natural events. An example is offered by Savino, bishop of Piacenza, who ordered (through his official, a notary) the river Po to stop flooding before it invaded the bishop’s lands (Benvenuti, 2010).[18]

4. Conceptual framework

In this section, we provide a simple conceptual framework useful to: *a*) offer a stylized representation of the historical context where communes emerged and *b*) understand how shocks heightening people’s religiosity may strengthen the power of the incumbent religious-political leader and derive corresponding predictions. Our conceptual framework grounds on Djankov et al. (2003) and Glaeser and Shleifer (2002). Different institutional configurations can be seen as alternative solutions to maximize social order, that is to minimize the welfare losses from expropriation of the private property by the citizens through, for instance, banditry, robberies, encroachments. Possible institutional configurations range from autocratic regimes (in our case the Episcopal regime), where the political leader takes decisions autonomously, to more inclusive forms of government (in our case the commune), in which citizens collectively participate into public decisions.

In our framework, social order can be achieved by alternative combinations of two types of protection. We call religious protection, denoted by P_r, the protection exerted by the religious leader (intermediary between God and the people), whereas we call civic protection, denoted by P_c, the form of protection ensured by the civic associations (eventually the commune).

Citizens are endowed with one unit of time that they can allocate to religious practices or to civic and political participation. We denote by T_r and T_c the fractions of time devoted, respectively, to the two activities (where $T_r + T_c = 1$). Religious practices consist of participation in rituals and adoption of norms of conduct and obedience to the religious leader (in our case the bishop); but T_r can also include any resources transferred to the religious authority, such as

[18] As reported in Benvenuti (2010), the bishop’s order was “*Pado, precipio tibi in nomine Ihesu Christi Domini ut de alveo tuo in locis istis ulterius non exeas, nec terras aeccesiae ledere praesumas*” (“*Pado, I order you in the name of Jesus Christ not to abandon your flood towards these lands, so that the lands protected by the Church be not destroyed*”).

votive offerings (for instance, to build churches), *corvees*, excessive taxation, and so on. The more resources T_r are devoted to religious practices, the larger is the power of and, hence, the protection exerted by the religious leader, P_r.[19] We assume that $P_r = \theta_r T_r^a$, where a<1 and θ_r is a technological parameter that reflects the ability of the religious leader in ensuring protection to the citizens (transforming the resources into social order). This protection is supported by the factual power of the religious leader and is reinforced by religious principles (e.g. "do to the others as you would have them do to you").[20] For instance, an increase in religious feeling represents a positive shock to θ_r.

The time allocated to civic and political activities, T_c, consists of participation to private agreements (e.g. *patti giurati*), public assemblies, and discussions, and writing and enforcing private agreements, laws, and legal rules. The greater the time allocated to civic and political activities the larger the power of and, thus, the protection by the civic associations[21] (eventually the commune), P_c. We assume that $P_c = \theta_c T_c^a$, where a<1 and θ_c is a technological parameter that reflects the ability of the civic associations in transforming private resources into social protection. For example, the diffusion of the *lex mercatoria* (the law of the merchants) or the *patti giurati* represents a positive shock to θ_c.

The total amount of social order prevailing in a medieval society of an Episcopal see city depends on the level of protection guaranteed by the bishop (P_r) and that assured by the civic associations (P_c). We assume that private citizens are indifferent between the technologies of protection *per se*, that is they are only interested in the total level of social order, regardless of whether it is achieved by religious or civic protection. Hence, they maximize $P_r + P_c$.

To clarify the basic trade-off involved in this framework, we adopt Figures 1. On the two axes, we measure our outputs, P_r and P_c. The rays emanating from the origin represent alternative institutional configurations. The Episcopal regime can be set along the *OE* ray, whereas the communal institutions can be associated with positions along the *OC* ray. As one

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[19] This assumption is consistent with evidence showing a positive correlation between church membership and property rights enforcement increases (e.g. Lipford, McCormick, and Tollison, 1993, and Hull and Bold, 1995).

[20] This was a basic intuition in Machiavelli's *Prince* where the author stated that the government of religious leaders did not need strong external enforcement since obedience would follow from religious beliefs (Machiavelli, *The Prince*, Ch. 11).

[21] For instance this is the case of the Lex merchatoria and the guilds (see Greif, Milgrom and Weingast, 1994)

can see, the ratio between P_r and P_c is, of course, lower under the commune. The *OPF* depicts the order possibility frontier representing the set of the various combinations of P_r and P_c that can be obtained efficiently using the two inputs, T_r and T_c (it gives the maximum amount of religious protection achievable for any given amount of civic protection and *viceversa*). The position and the slope of the *OPF* reflect the particular conditions characterizing a society in the historical context under examination. They relate, for instance, to the level of education, human capital, civic knowledge, and religious beliefs. All these factors are captured by the technological parameters θ_r and θ_c. A given institutional configuration, in a certain historical moment, is identified by the intersection between the ray from the origin and the relevant *OPF* for the considered society.

The slope of the *OPF* indicates the marginal rate of transformation between civic and religious protection. Intuitively, for a given unit of time, it reflects the amount of P_c a society must forgo in order to obtain one additional unit of P_r. Hence, the marginal rate of transformation is given by $\theta_r T_r^{a-1} / \theta_c T_c^{a-1}$.

FIGURES 1 ABOUT HERE

The decreasing straight lines in Figures 1 represent the iso-order curves. These lines are drawn 45° sloped under the aforementioned assumption that individuals value equally P_c and P_r. The problem of the society therefore is to maximize $P_c + P_r$, subject to the constraints $T_c + T_r = 1$, $P_r = \theta_r T_r^a$, and $P_c = \theta_c T_c^a$. An efficient institutional choice is a tangent point between the relevant *OPF* and the 45° line: it identifies the point where the total level of protection is maximized, given the historical constraints. At the efficient institutional choice we have $\theta_c / \theta_r = (T_c / T_r)^{1-a}$.

The feudal society of the collapsing Carolingean Empire was characterized by poor civic capital and substantial coordination problems in social and economic interactions. We can imagine the relevant order possibility frontier to be *OPF* in Figure 1.a. In this context, the efficient institutional choice is represented by a position like point *E*: in the absence of civic knowledge and technologies capable to self-regulating social and economic interactions, the institutional regime that maximizes social order is characterized by a large amount of protection provided by the bishop relatively to the protection ensured by the private associations. In other words, where private associations are inefficient (or even inexistent), social order is increased by strengthening the power of the bishop.

The development process that took place starting from the beginning of the 11th century can be seen as an up-left shift of the *OPF* (as illustrated in the figure), which moves to *OPF'*. The revival of commerce, the flourishing of the economic activity, and the consequent increase in per-capita income created the incentives for citizens to participate in the management of the public affairs, to regulate economic interactions, and to secure property rights (Epstein, 1993; Greif et al., 1994). In terms of the present framework, this entails an increase in the ratio θ_c/θ_r so that the *OPF* becomes steeper (θ_c increases relatively to θ_r). Point *C* in the figure represents the new equilibrium point, which is reached at the end of this development process: the commune substitutes the Episcopal regime in the city considered.[22]

By contrast, an increase in religious beliefs implies a decrease in θ_c/θ_r (the religious authority becomes more effective over individual behaviors, hence θ_r increases relatively to θ_c). An example of this effect, in the Middle Ages, is provided by the occurrence of a seismic event. An earthquake implies, in general, a decrease in social order spreading panic and consternation among the private citizens. Yet, as documented in the previous sections, under the belief that the natural event was a manifestation of God's wrath, it has the contemporaneous effect of increasing the participation in religious practices[23] and the obedience to the bishop. Hence, the *OPF* tends to move downward also implying a decrease in the slope: the new curve is *OPF''*, as depicted in Figure 1.b, and a new equilibrium point is *E'*. This event retards momentarily the institutional evolution process and makes a transition to the commune less likely.

This simple framework allows us to formulate the following predictions, for an Episcopal see city:[24]

1. The occurrence of a seismic event is followed by an increase in people's religiosity. As a consequence θ_r/θ_c and T_r/T_c increase and the *OPF* becomes flatter with a consequent move of the equilibrium point downright. This retards the transition from feudal to communal institutions.

2. The effect of a seismic event on the transition probability is limited in time: in the long-

[22] This process could be seen as modernization (Lipset, 1959).

[23] This effect is consistent with the literature showing that the returns from participation in religious services are higher in high risk environments (see Ager and Ciccone, 2012).

[24] It is worth noting that all the following effects are observationally equivalent to an increase in the value that citizens attach to P_r relative to P_c.

run, along the cities' development process, the ratio θ_c/θ_r tends eventually to increase as well as the fraction T_c/T_r.[25]

3. Such an effect is not confined to catastrophic earthquakes. Indeed, earthquakes that did not produce any physical damage, but still were felt by the population, are also dreadful events and are thus likely to have an impact on religious feelings. Under the assumption that the stronger the earthquake, the greater the shock to religious feelings (and, hence, to θ_r/θ_c), the effect on the probability of transition of a just felt earthquake should be lower relative to that of a destructive one.

These predictions hold under the assumption, consistent with the history described in section 3, that the occurrence of a seismic event has a positive impact on religious feeling implying an increase in the power of the religious leader. Two facts would support such an assumption:

4. The number of earthquakes occurred in a city increases the observable manifestations of human reverence for God, for instance the number of churches, and

5. In non-Episcopal see cities, seismic events have no observable effects on the transition probability because the political leader is here distinct from the religious authority.

In the next sections we will support the above predictions with empirical evidence.

5. Data Description

5.1 Sample and Transition to Commune

The main results of our empirical analysis are obtained on a sample of Episcopal see cities in northern-central Italy, that is cities that were governed by a bishop and that already existed at the beginning of the sample period (beginning of the 11th century). The latter requirement is guaranteed by the fact (already mentioned in subsection 3.1) that, according to the Council of Sardica (IVth century A.D.), Episcopal seats could only be set in the roman *urbes*. For each city in the sample, we collected information on whether or not the city became a commune during the three centuries under analysis and (if so) the year in which the institutional transition occurred, the year in which it experienced an earthquake (if any), the earthquake's intensity and other related information. The size of the sample is constrained by data availability. In particular, we

[25] This prediction does not follow directly from the framework, but it is ultimately an empirical question. Yet, there is no evidence in the literature that earthquakes caused permanent reductions in income (Cavallo and Noy, 2009; Cavallo et al., 2010). In our empirical analysis, by temporary effect we mean an effect lasting one decade at most.

only include in the analysis the 61 cities for which we have consistent historical sources documenting whether or not the cities became communes and when. Cities for which historical sources provide uncertain dates are dropped as we explain below in greater detail.

Following the historiography (Ascheri, 2006), we identified as date of transition to commune the first year for which the historical sources offer evidence of the presence of the *consules* or the *statutum* was registered. Since these dates are not systematically available from uniform data sources, we adopted the following criterion. We first tracked down academic medieval history books, encyclopedic references (i.e. the Enciclopedia Treccani, which is the main Italian encyclopedic reference), and the documents conserved in the local national archives mentioning the first date that *consules* were present in the city or the *statutum* was registered. When no date for the birth of the commune could be established on the evidence of these initial sources, we combed through a number of books on the histories of each city and Wikipedia.[26] Whenever we found discordance between two sources, we tracked down a third source and opted for a date recorded in at least two out of the three sources. When this criterion was not satisfied, we left the date of the birth of the commune as missing data point. This procedure left us with 61 cities; city names are listed in Table 1 where we also report, for the cities that became communes in the sample period, the year of transition. Note that most of the Episcopal see cities eventually became communes in the sample period.

TABLE 1 ABOUT HERE

In the empirical analysis (section 6.5), we also employ a panel dataset over the same sample period only including non-Episcopal see cities existing at the beginning of the 11th century. To guarantee the existence of these cities in our period of interest, we only consider the northern-central Italian cities included in Malanima's sample (Malanima, 2005).[27] Likewise, for this group of cities we collected information on the year of transition to commune (if any), as above described, and on earthquakes experienced in the span of time considered, as explained in the

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[26] The whole series of sources is available upon request.

[27] We made this choice since we must ensure our sample to consist of cities that were founded before 1000 and that at the beginning of the 11th century were large enough to ever experience the communal movement. Unfortunately, as a selection criterion, we cannot employ the city's population because the first available data on the number of inhabitants in Italian cities dates back at the earliest to the 14th century (Malanima, 2005), whereas other data (Bairoch, Batou, and Chevre, 1988) covering the 11th century are limited to 8 cities only.

next subsection. This sample, which we then employed in the placebo test, consists of 47 cities (names are reported in the appendix for reasons of space).

5.2 Earthquakes

The data on earthquakes were drawn from the DBMI04 dataset[28] (Database Macrosismico Italiano 2004), assembled by researchers at the Italian National Institute for Geophysics and Volcanology (Stucchi et al., 2007), which contains information on earthquakes occurring in Italian cities between 217 BC and 2002. The catalogue, an extraordinarily rich source of information, is fruit of a branch of seismology called historical seismology (Vogt, 1989). Historical seismology is a multidisciplinary project, which uses historical sources to identify the occurrence and effects of seismic events, even in the remote past (Guidoboni, 2002; Stucchi, 1993), and processes historical information into macroseismic parameters, such as time, epicentral location, and intensity (Gasperini and Ferrari, 2000). The sources of information range from historical records, including archives of public administrations and institutions, diaries, chronicles, letters, monastic, ecclesiastic and capitular archives, *notulae*, and the archives of notaries, to actual archaeological traces (e.g. damage to churches and buildings and subsequent restorations) which the seismic events left behind (Guidoboni and Ebel, 2009). In the past three decades, the meticulous approach followed by the historical seismologists has led to a dramatic improvement in the quality of the investigation and enabled acquisition of information on the effects of earthquakes, often with a surprising amount of detail (Stucchi, 1993). The material available through these sources is particularly rich for Italy (Boschi et. Al., 2000; Guidoboni, 2002; Guidoboni and Ferrari, 1989). The historical records for the period studied here refer to universal chronicles, monastic annals, ecclesiastical and liturgical sources, ancient literary sources and coeval historiography (Guidoboni, 2000, 2002). For instance, critical historical investigation making use of accounts by monks, notaries, and the Pope's chancellery has revealed with greater precision the effects of the earthquake that hit Brescia and the surrounding territory on the 25th of December 1222, which was long transmitted as a legendary event (Guidoboni, 1986, and Guidoboni and Comaschi, 2005; see also Stucchi et al., 2008, and references therein). The archaeoseismological information and critical and comparative analysis of a significant number (about 94) of different sources have revealed with fair approximation the

[28] The data are in the public domain and can be accessed at: http://emidius.mi.ingv.it/DBMI04/

location and the considerable amount of damage provoked by the earthquake that hit the Verona area on the 3rd of January 1117 (for an assessment see Guidoboni et al. 2005; see also Stucchi et al., 2008, and references therein).

For each Italian locality the DBMI04 gives the identification number of the earthquake that struck the locality, the time (day, month, year, exact time), the site that registered the most serious damage, its epicenter, the greatest macroseismic intensity on the Mercalli-Cancani-Sieberg (MCS hereafter) scale, the intensity registered at the epicenter and that registered at the locality, and finally the latitude and longitude of the epicenter, of the site that registered the maximum intensity and of the locality. The main source for the geographical references is the ENEL-ISTAT catalogue of Italian localities (ENEL, 1978) and updates. In most cases the locality coincides with a city, but sometimes it refers to a broader geographical area (such as a region). In our analysis we only considered earthquakes for which it was possible to track down clear correspondence between a locality in the DBMI04 and a city in our sample. Figure 4 shows the number of earthquakes that occurred in the northern-central Italy by city between 1000-1300.

FIGURE 2 ABOUT HERE

The intensity (*I*, hereafter) of the earthquake is registered on the MCS scale, which measures the effects brought about by the seismic event on people, natural objects, buildings and other man-made objects, and the Earth's surface. The scale goes from 1 to 12: when *I* stands at 1 it means that people did not feel the earthquake; *I* at 2 means that the earthquake was felt by very few persons; *I* from 3 to 5 means that the earthquake was felt but did not cause damage; *I* from 6 to 7 indicates that physical damage was reported; *I* from 8 to 10 that human victims were also registered; *I* equal to 11 indicates catastrophic destruction; and *I* equal to 12 total (apocalyptic) destruction. In our main analysis we only considered earthquakes for which the effects could be registered in terms of macroseismic intensity and use seismic events for which the intensity is unreported in the robustness checks.

In the period (1000-1300) and geographical area (northern-central Italy) considered in this paper, 141 earthquakes occurred. Of these, 67 caused damage to buildings or people ($I>5$; hereafter denoted by D), 37 were felt by people but did not cause any physical damage ($I\leq5$; hereafter denoted by F), and 37 were registered with unreported intensity. Table 2 lists the names of the cities that were struck by an earthquake in the sample period. In the table, we also indicate the year in which the earthquake occurred and its intensity (in MCS scale). Note that this table shows all the earthquakes (141) registered by the DBMI04 for all the cities in our sample, both Episcopal (102) and non-Episcopal (39) in the period under study.

TABLE 2 ABOUT HERE

As can be seen, the strongest (*I* above 8) earthquakes were registered in Verona in 1117 (intensity 9) and in Camerino in 1279 (intensity 8-9). Intensities above 9 do not occur in our sample: earthquakes with I=10 were observed only in the south of Italy during the time period here considered; the first earthquake with I=11 was registered in 1456; finally, earthquakes with intensity 12 have never occurred in Italy.

5.3 An Augmented Dataset of Earthquakes

A possible concern with these data is that not all the earthquakes that occurred have been recorded, due to missing or inaccurate historical sources. Adopting the mild hypothesis that this form of measurement error is constant over time within a city, this might not be a concern since the panel structure of the dataset allows for this type of error to be absorbed by the fixed effects in our regressions. However, taking this concern more seriously, we also use in our regressions a dataset augmented in the following way. Let us assume that city i at time t was struck by an earthquake but that the historical sources were not handed down to the most recent periods so that the earthquake was not registered in the baseline dataset. It still remains possible that the earthquake that hit city i but turns out unreported in the dataset for that city was instead recorded in some neighboring cities. Hence, we impute an earthquake as occurring in city i at time t if the neighboring (within some threshold distance) city j recorded an earthquake in that given year. As threshold distances we consider 20, 25 or 30 km from city i. In this way, we increase the number of earthquakes from 141 to 288 (of which 197 are just felt), 408 (157), and 512 (200) when the threshold distance is 20, 25, and 30 km respectively. Note that, central-northern Italy being a territory with a high density of cities, a threshold of 30 km is pretty large. To perform this exercise, we exploit all the available information on the reported earthquakes that occurred in the period considered, even when reference is to cities not included in our sample.

6. Empirical Strategy and Results

6.1 Regression Analysis

Our baseline regression equation is as follows:

$$transition_{it} = \alpha_{it} + \beta_{it} + \gamma \times earthquake_{it} + \varepsilon_{it}, \tag{1}$$

where i is the city and t is a 10-year interval. The dependent variable, *transition*, captures the institutional transition to a commune, and is equal to 1 if city i became a commune at time t (i.e. if the year of independence is 1005, *transition* is equal to 1 in 1010, meaning in the time interval between 1001 and 1010) and 0 otherwise. The independent variable involved, *earthquake* is a dummy that is equal to 1 if an earthquake occurred in city i and at time t (in the time interval as explained above) and 0 otherwise. Finally, α_i and β_t are respectively the city and the time fixed effects. Given our design, a number of issues are worth pointing out.

First, in our dataset the time dimension is defined every 10 years. The reason for this choice is that the number of years needed for the effects of an earthquake (if any) to materialize may vary from one city to another and may take more than one year. Imposing that the potential effects of an earthquake on the process of institutional change must occur within one year (and so adopting a one-year time dimensional framework) would be very restrictive and would probably rule out *a priori* a number of potential cases. By adopting the 10-year interval framework we opt for a more conservative scenario in which, potentially, the effects of an earthquake on transition can materialize up to 10 years after its occurrence. Of course, we are using an approximation, since we are not discriminating between situations in which a transition has occurred, say, two years after an earthquake and situations in which the former event follows the latter by nine years. Let us emphasize, however, that in the sample period transition to commune never occurs within the 10 years after the earthquake struck the city.[29]

Second, since we are interested in studying the effects of an earthquake on the transition to a commune, if the transition occurred at time t in city i, no time after t is defined for that city.[30]

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[29] As a robustness check we have also repeated our regressions using five-year intervals. Conclusions are not substantially changed.

[30] Notice that the shift from communal institutions back to feudal regime is not an option for historical reasons. After the communal experience, some cities became *Signorie*, an authoritarian government ruled by the *Signore* (the Lord). Yet, this transition process was very heterogeneous across cities. The emergence of *Signorie* is connected to two phenomena: a fast growth of the wealth of a class of individuals enabling them, sometimes, to take over the

Third, in some cases it may happen that in decade *t* both an earthquake and transition to commune took place, but the former event followed the latter, so that no causal relation can, of course, be inferred between them. In order to prevent such cases from affecting our inferences, we set the earthquake dummy to 0 in the decade in which the institutional shift occurred. Since the time is not defined for that city afterwards (see above), the occurrence of these earthquakes plays no role in our analysis.

Finally, in our dataset the year associated with the transition of the city to a commune is the one in which the transition was finalized. Clearly, the transition process may be slow and start well before the year in which the transition is recorded in the data. Since we cannot observe the exact moment in time when the transition process begins, the outcome to consider cannot but be the year in which the commune was formally established (date of publication of the *statutum* and/or that on which the presence of the *consules* is testified by the historical sources, as explained in subsection 5.1). It follows that, in our estimation regression, for a given city *i* hit by an earthquake at time *t*, we measure the difference between the probability of the occurrence of the actual outcome (e.g. a commune was established and an earthquake had occurred) and the probability of the potential outcome had the city not experienced the earthquake (a commune was established and no earthquake had occurred).

6.2 Main Results

We start our analysis presenting our findings on the effects earthquakes had on transition to commune for Episcopal see cities. Our regression model (1) and variations of it are estimated with a linear probability model. Standard errors are consistently clustered at the city level. Table 3 reports the basic results. In column 1, we include as a regressor a dummy variable (*earthquake*) equal to 1 if an earthquake of any intensity (including both earthquakes resulting in material damage and deaths and earthquakes only felt by people) occurred. Consistently with prediction 1 of our conceptual framework (section 4), we obtain that the effect is negative and statistically significant at the one percent level.

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control of communal institutions (e.g. the Medicis in Florence); territorial expansion of the communes that conquered the neighboring cities and established regional states. Thus the number of *Signorie* is much smaller than the number of communes since many cities ended up to be governed by the same lord (the *Signore*; e.g. the cities of Bergamo and Cremona were conquered by Milan under the *Signoria* of the Visconti family).

In column 3, the regression is run including in the dataset all the earthquakes, those for which an intensity is registered in MCS scale and those with uncertain effects. Conclusions are unchanged. In the other columns, we include results obtained by employing also the earthquakes from the augmented dataset, namely by imputing earthquakes to cities which had a nearby city hit by an earthquake. We do so applying thresholds of 20, 25, and 30 km. The results are essentially the same, but the effects are on a larger scale. The mean of the dependent variable in our sample is 0.039. Therefore, the point estimate on the earthquake brings the probability of transition down to zero.

TABLE 3 ABOUT HERE

In column 2 we also include the lagged dummy on the earthquake and it turns out that the effect is still negative although not statistically significant. The latter result is consistent with our prediction 3 that the effect of an earthquake is limited in time, that is lasts no more than one decade. To further study the dynamics of this effect, in Figures 3 we plot the coefficients of a regression obtained exploiting the dataset using five-year time interval and including up to seven lags (meaning 40 years). As one can observe from the figures, the negative effect of a seismic event on the transition probability is concentrated in the first decade, with the coefficients being, if anything, positive (but not statistically significant) in the second and the third decade following an earthquake.

FIGURES 3 ABOUT HERE

The results just described, together with the history discussed in section 3, are consistent with our predictions 1 and 2 of the conceptual framework. First (prediction 1), earthquakes delayed transition to commune. Second (prediction 2), the effect is concentrated in the short-run.

6.3 Results: The Intensity of the Earthquakes

One major concern with the interpretation of the previous results is that earthquakes may delay transition to commune for reasons other than a shock to religiosity. In fact, earthquakes are also associated with physical destruction, deaths, and income shocks. All these factors could potentially also play a role in delaying transition. To explore whether this conjecture finds support from the data, we exploit detailed information on the intensity of each earthquake. The results are given in Table 4. First (in columns 1 and 2), we use distinguish between earthquakes that were felt by the population but caused no damage (intensity below or equal to 5), and earthquakes associated with physical damage (intensity above 5). The results are consistent with those reported in the previous tables: earthquakes delay institutional transitions. Yet the effect is stronger for destructive earthquakes. In the last two columns of Table 4, we only include earthquakes causing physical damage (greater than 5) and distinguish between weak earthquakes (intensity greater than 6 and smaller than 8) and strong earthquakes (intensity between 8 and 9, extremes included).

Alternative specifications with the augmented dataset go in the same direction: both destructive and just felt earthquakes retard the transition probability to commune, stronger earthquakes having stronger effects. These findings are consistent with prediction 3 in our conceptual framework.

TABLE 4 ABOUT HERE

6.4 Churches and Natural Disasters

Our interpretation of the previous results holds under the assumption that an earthquake represents a shock to people's religiosity. Providing empirical support to this hypothesis is no simple exercise given the absence of systematic data in the medieval period. A possibility is offered by observing that the number of churches in a given city is likely to capture the demand for religious services and may represent a measure of the degree of religiosity characterizing the population of residents. Indeed, according to the Catholic religion, churches are not only the houses of God where people celebrate rituals but also among the main manifestations of faith in God.[31]

Hence, exploiting data from the National Office for Ecclesiastical Cultural Assets and Information Services of the Association of Italian Catholic bishops (Conferenza Episcopale Italiana) we have collected data on the number of churches in each city.[32] Although in some case it is possible to obtain the first year in which the church was registered in the archive, this information is missing in most cases and the degree of inaccuracy is largely inconsistent across

[31] See "Catechismo della Chiesa Cattolica", (2004) Section 2 Ch. 2., Libreria Editrice Vaticana.

[32] The data are in the public domain and available at http://www.chieseitaliane.chiesacattolica.it/chieseitaliane/.

centuries. From this it follows that we could not exploit the panel dimension of the dataset and decided to regress, in a cross section, the current number of churches on the number of earthquakes that occurred in each Episcopal see city in the sample between 1000 and 1300. Of course, for each city the stock also includes the churches built in our period (11th-13th centuries), as well as in the previous and subsequent periods. For this reason, we also control for the number of earthquakes occurred after the 13th century. We also include regional fixed effects in order to control for variation in seismicity across regions, which is constant over time, the logarithm of the current population (ISTAT, 2009) and other observable city characteristics: whether or not it was on the sea (ISTAT, 2009) and whether or not it was an Etruscan city (Guiso, Sapienza, and Zingales, 2008). Results are reported in Table 5.[33]

TABLE 5 ABOUT HERE

As can be seen, consistently with our point 4 in the conceptual framework, there is a positive and statistically significant correlation between the number of churches in each city and the number of earthquakes that struck the city between 1000 and 1300, even after controlling for regional fixed effects, number of earthquakes in different periods, and other city characteristics. This is true, again, for both destructive earthquakes and earthquake that did not cause any damage to people or objects, corroborating our previous findings.

6.5 Non-Episcopal See Cities

Although the previous results tend to rule out the hypothesis that the effects of the earthquakes are driven by material factors, it is still possible that the previous findings be driven by other non-religious factors, such as dread, and by the need to maintain the *status quo* political regime in periods when some natural catastrophe (regardless of its possible relation with God's will) upsets everyday life. The historical context we consider in this paper offers the possibility to take this aspect into account. Indeed, if our hypothesis is correct, the negative effect of the earthquake should not be found in non-Episcopal see cities that were governed by secular leaders (counts and marquises). This is our ancillary prediction 5.

Hence, as a placebo test for our previous findings, we estimate regression (1) and its

[33] The sample is here composed of 81 cities because we do not exclude Episcopal see cities with uncertain date of transition (results do not change if the sample restriction is applied).

variation using the sample of cities that were not seats of bishops. Since the number of earthquakes documented for these cities is scanty, we employ the augmented datasets (20, 25 and 30 km respectively). The results are shown in Table 6. Columns 1-3 replicate the regressions shown in Table 3 but for non-Episcopal see cities, while columns 3-6 replicate the regression shown in Table 4 column 2, respectively using the 20, 25 and 30 km augmented datasets. The point estimates on the earthquakes are much smaller in absolute value and never statistically significant. In some cases they are even positive.

TABLE 6 ABOUT HERE

6.6 Robustness Checks

To challenge the robustness of our results, we implement a placebo test (in the spirit of DellaVigna and La Ferrara, 2010). We randomly impute to our 61 cities the number of earthquakes that truly hit cities in our sample according to the main dataset and so create a 'fake' earthquake dummy variable. We then run our regression including, as independent variable, the 'fake' earthquake dummy variable in place of the true one. We repeat this procedure 1,000 times (employing alternative numbers of replications does not affect our results in any significant way) and save the estimated coefficients. In Figures 4.a we show the cumulative density function of the 1,000 'fake' point-estimates and with a vertical line indicate our 'true' point-estimates (-0.0832, reported in column (1) of Table 3). We also conduct this exercise by randomly stratifying the number of earthquakes by century, and depict the relative results in Figure 4.b. The idea of this test is to check how many times these randomly generated 'fake' point-estimates happen to be smaller or too close to our 'true' point-estimate. If our previous findings were just a matter of chance, we should observe 'fake' coefficients very close to our 'true' estimates. As can be seen from Figures 4.a and 4.b, the point-estimates generated in the placebo test are almost always on the right of (meaning larger in value than) the 'true' estimated coefficients (this does not obtain in only one and three cases out of 1,000, respectively in the two figures). On the whole, this exercise offers considerable evidence suggesting that our results are not an artifact of a small number of cities 'treated' in the dataset. We repeat the test also using the *unreported intensity earthquakes dataset*. Results are offered in Figures 4.c and 4.d, respectively for the exercises without and with century stratification.

FIGURES 4 ABOUT HERE

In column 7 of table 6 we set out the results drawn from the entire sample of cities (both Episcopal and non-Episcopal see cities) and look at the interaction term between the dummy for the earthquake (adopting the augmented dataset – 30 km) and a dummy for the Episcopal see city. As expected, this interaction term is negative and statistically significant. Finally, for robustness, we also include other interaction terms between earthquakes and fixed characteristics of the city: whether or not it was on the sea and whether or not it was an Etruscan city. The results, given in columns 8-9, show that the interaction terms between the dummy for the earthquake and that for the Episcopal see city remain negative suggesting that the presence of a bishop in the city reduces the probability of transition following an earthquake even after controlling for other time constant characteristics of the cities related to their (possibly strategic) location or their proximity to the sea.

In another test we restrict the sample to those cities for which data on the population in the medieval era have been collected. These data are from Malanima (2005) and apply to cities with at least 1,000 inhabitants in 1300 (earlier data are not available). The aim of this exercise is to show that our findings hold even if we only consider cities that were more likely to be densely populated and for which more accurate historical records are likely to be available. The results (not reported here) are essentially identical to the main results.

Finally, to increase the ratio between the number of earthquakes and the number of observations, we check if the results remain unchanged when we organize the data taking as temporal unit a time interval of 20 instead of 10 years. Again, not surprisingly, by rescaling the coefficients for the alternative time intervals, the results (not reported here) remain essentially unchanged.

7. Discussion

Our empirical analysis documents two facts: *a*) there exist a negative relationship between the occurrence of an earthquake and the institutional transition holds for Episcopal see cities only, and *b*) the earthquakes that do not cause physical damage also have negative impact on the emergence of communes. These facts are consistent with the main predictions of our conceptual framework, under the assumption that an earthquake represents a positive shock to people's religiosity.

An alternative interpretation relates to the possibility that, after a natural catastrophe, people may prefer to have a more centralized and authoritarian government (by bishops or feudal lords) expecting such a government to be more effective in reconstruction. However, this hypothesis is not consistent with the evidence given in the previous sections showing that also earthquakes not resulting in material damage have an impact on the probability of emergence of a commune. In order to be consistent with our results, an explanation based on the greater effectiveness of the feudal leaders in the reconstruction process with respect to the communal institutions would require that: *a*) bishops, compared to secular lords, were more effective in the reconstruction and thus received more support from the citizens, and *b*) the people's support for the existing authoritarian leaders increased also after an earthquake that caused no damage and so required no reconstruction. In this case support for the authoritarian political leaders would be an insurance device and such support would be greater for bishops than for feudal lords. Although we cannot directly test this explanation, historical research (Guidoboni and Poirier, 2004; Guidoboni and Ebel, 2009) indicates that there was no difference between Episcopal see cities and other cities as far as financing reconstruction in the period considered is concerned. In all the cases, there were no direct transfers from the political authorities to the citizens, and in general the main financial support for reconstruction lay in tax breaks. Transfers from the government to the citizens are documented only much later, starting with the Medicis family, which, in the Grand-Duchy of Tuscany in the 16th century, accorded small credits at low interest rates for reconstruction to damaged households (Favier, 2002).

8. Conclusions

Understanding the determinants of institutional change is one of the thorniest issues in the political economy literature. In particular, empirical investigation of the channels leading to transitions toward broader-based institutions, both in the contemporary world and in the past, has recently proved of much interest to economists. One of the main challenges in this literature has been finding a way to single out the possible mechanisms working in such a complicated process and to identify the causality. Our effort goes in this direction and focuses on a particular historical episode of institutional change: the birth of communal institutions in the northern and central Italian cities in the Middle Ages.

Our contribution in the present paper focuses on a narrow and precise empirical relation, but with possibly broader implications and stimulus for future work. We study the effects of the occurrence of a natural catastrophe, an earthquake, in a city, and the transition probability for that city to become a commune in the subsequent periods. Our empirical findings show two things. First, the occurrence of an earthquake reduces to a substantial and statistically significant degree such a probability in the decade following the event. Second, this effect is independent of the earthquake's intensity and occurred even if the earthquake was only felt by people without causing any physical damage to buildings or deaths. The negative effect of earthquakes on the institutional transition is present and strong only in Episcopal see cities, while being absent in cities governed by secular feudal leaders. Thus the negative effect of an earthquake on the probability of transition did not necessarily work through material destruction, aggravated poverty, deaths or differential material impact on the social classes involved in the political transition but rather through the consternation caused by an uncontrollable natural event, dread of God's wrath falling upon the people, and urge for reconciliation, being amplified by the material causes. Since the bishop was the mediator between men and God and the monopolist in religious services, on the one hand, and the political leader in Episcopal see cities, on the other, the earthquake may be seen as resulting in a barrier to institutional change. With the available data we are not able to test this interpretation directly; however, both the historical records and our empirical evidence seem to be consistent with it and, as we argue in the text, alternative interpretations of our findings do not seem particularly compelling.

While our contribution focuses on a particular historical episode, and given that the political economy interpretation proposed in the paper is supported with historical records relevant to that specific period, the mechanisms uncovered may prove important in other historical contexts as well, and their implications call for further investigation in broader circumstances. For instance, the central role of religion is not an exclusive peculiarity of the medieval period. Religious leaders have historically influenced political decisions up to the present day. In the very recent history of Italy, the Church has played a crucial role in preventing the extension to *de facto* couples of certain basic civil rights that are currently acquired by people only after marriage. Similarly, the opposition of the Church to extension of the local property tax to commercial activities run by religious institutes, exempted up to 2012, has always been able to rely on the ample support of people and policy-makers. Interestingly, the fiscal exemption was finally removed by a technical government (presided over by Mario Monti) that did not need political support for elections.[34]

Religion is still important in many other contexts, in democratic and nondemocratic countries as well, though to different degrees. Strikingly, the belief that the governance of natural events is in the hands of God is not that far from the culture of contemporary society in Italy[35] and in some countries, where the threat of God's punishment is still used to control people.[36] There is a widespread tendency to look to God, his mediators, or charismatic political leaders for protection in periods of uncertainty and instability, which has been seen as playing an important role in a number of historical episodes conducive to the re-emergence of despotic institutions after substantial progress towards democracy. Of course, our contribution cannot bring fully to light such vast phenomena, nor does it have any ambition to do so. Nonetheless the findings presented in this paper point to the existence of possible mechanisms that, to the best of our knowledge, are still largely unexplored in the economic literature and are suggestive of implications that seem worth further exploration.

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[34] http://www.corriere.it/economia/12_febbraio_16/calabro-la-svolta-ici-sulla-chiesa_4c1a85ee-5867-11e1-9269-1668ca0418d4.shtml

[35] Corriere della Sera (one of the current biggest selling Italian daily newspapers) on March 12th 2012 published an article with the following title: "Another period of drought after March. [Florence's] Cardinal says: pray God for the rain". http://www.corriere.it/cronache/12_marzo_30/caprara-pioggia-caldo-preghiera_08fa616e-7a2a-11e1-aa2f-fa6a0a9a2b72.shtml

[36] Iran's Shiite clerics recently threatened earthquakes if people do not repent from their sins: http://www.washingtonpost.com/wp-dyn/content/article/2010/04/21/AR2010042102998.html (Washington Post, April 21st 2010).

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TABLES AND FIGURES

Table 1. Episcopal see cities and transitions to commune

City	Year	City	Year
acqui terme	1135	narni	-
alba	1169	novara	1116
anagni	-	orvieto	1157
arezzo	1098	padova	1138
ascoli piceno	1183	parma	1149
asti	1095	pavia	1106
bergamo	1098	perugia	1139
bologna	1116	pesaro	-
brescia	1127	piacenza	1126
camerino	-	pisa	1081
cesena	1176	pistoia	1105
comacchio	-	ravenna	-
como	1109	reggio nell'emili	1136
cremona	1098	rieti	-
faenza	1141	savona	1191
fano	1114	senigallia	-
feltre	-	siena	1147
fermo	1199	sora	-
ferrara	1105	spoleto	1173
fiesole	-	terni	-
firenze	1125	tortona	1122
foligno	-	trento	-
fondi	-	treviso	1150
forlì	1182	trieste	1295
fossombrone	-	ventimiglia	1149
imola	1084	vercelli	1141
ivrea	1171	veroli	-
lodi	1142	verona	1136
mantova	1115	vicenza	1147
milano	1097	volterra	1170
modena	1135		

Note: Sample period (1000-1300). Year is the year when the commune was formally established (date of the publication of the statutum and/or that in which the presence of consules is testified by the historical sources, as explained in the text). '-' denotes the city never becomes a commune within the sample period.

Table 2. Earthquakes

City	Year	Intensity	City	Year	Intensity	City	Year	Intensity
arezzo	1005	7-8	genova	1182	6	bologna	1249	NR
cassino	1005	7-8	cesena	1194	6-7	modena	1249	7-8
pistoia	1005	5	pistoia	1196	6	parma	1249	NR
bologna	1065	NR	bologna	1197	NR	reggio nell'emilia	1249	5
brescia	1065	8	brescia	1197	6-7	feltre	1268	F
genova	1065	NR	genova	1197	NR	padova	1268	5
milano	1065	F	lodi	1197	NR	treviso	1268	8
venezia	1065	NR	milano	1197	NR	aNRona	1269	8
verona	1065	NR	parma	1197	NR	sansepolcro	1270	7-8
belluno	1117	F	piacenza	1197	NR	casalmaggiore	1276	F
bergamo	1117	NR	verona	1197	NR	castelleone	1276	F
bologna	1117	NR	genova	1217	5-6	genova	1276	5
brescia	1117	NR	alessandria	1222	F	lodi	1276	F
carpi	1117	D	bergamo	1222	5-6	milano	1276	NR
casale monferrato	1117	NR	bologna	1222	6-7	monza	1276	F
ceccano	1117	NR	brescia	1222	8	piacenza	1276	F
cerea	1117	D	casalmaggior	1222	NR	san damiano d'asti	1276	5-6
como	1117	NR	castelleone	1222	6-7	sermide	1276	F
cremona	1117	D	cesena	1222	F	verona	1276	NR
faenza	1117	NR	cividale del f	1222	NR	spoleto	1277	8
feltre	1117	F	como	1222	NR	arcevia	1279	7-8
ferrara	1117	5-6	cremona	1222	7	cagli	1279	F
gonzaga	1117	F	ferrara	1222	6-7	camerino	1279	8-9
legnago	1117	D	forlì	1222	NR	cingoli	1279	7-8
lodi	1117	NR	genova	1222	5-6	cividale del friuli	1279	8
lucca	1117	NR	lodi	1222	6	fabriano	1279	8
mantova	1117	NR	mantova	1222	5	faenza	1279	6-7
milano	1117	7	milano	1222	6	foligno	1279	7-8
mirandola	1117	F	modena	1222	7	forlì	1279	6-7
modena	1117	F	padova	1222	6	matelica	1279	7-8
padova	1117	D	parma	1222	5-6	ravenna	1279	5
parma	1117	D	piacenza	1222	F	san severino marche	1279	7-8
pavia	1117	D	reggio nell'er	1222	5-6	venezia	1279	5-6
piacenza	1117	D	san remo	1222	NR	parma	1284	F
piove di sacco	1117	D	tortona	1222	5	venezia	1284	7
pisa	1117	4	treviso	1222	6-7	ferrara	1285	7
sansepolcro	1117	NR	varese	1222	F	padova	1285	NR
trento	1117	F	venezia	1222	6	pistoia	1293	8
treviso	1117	7	ventimiglia	1222	NR	bergamo	1295	6-7
venezia	1117	F	verona	1222	6	como	1295	F
verona	1117	9	vicenza	1222	NR	milano	1295	F
viadana	1117	NR	bologna	1234	NR	monza	1295	F
vicenza	1117	D	ferrara	1234	7	verona	1295	F
cassino	1120	5	mantova	1234	NR	forlì	1298	F
firenze	1148	7	padova	1234	NR	rieti	1298	8
pisa	1168	5-6	venezia	1234	NR	sansepolcro	1298	6-7
ceccano	1170	8	spoleto	1246	7-8	spoleto	1298	8

Note: Sample period (1000-1300). Year is the year when the earthquake was registered. Intensity is in MCS scale (when intensity was not specified in the original sources, D denotes I=(5,9] and F denotes I=(2,5]).

Table 3. Main results

	(1) Main dataset	(2) Lags - Main dataset	(3) Lags - With unreported	(4) Augmented (20 km)	(5) Augmented (25 km)	(6) Augmented (30 km)
Earthquake	-0.0832***	-0.0866***	-0.0973***	-0.0907***	-0.0893***	-0.0848***
	(0.0278)	(0.0320)	(0.0312)	(0.0283)	(0.0271)	(0.0253)
Lag erthquake		-0.0309	0.0009	-0.0000	-0.0048	-0.0130
		(0.0622)	(0.0615)	(0.0523)	(0.0501)	(0.0455)
Observations	1,138	1,077	1,077	1,077	1,077	1,077
R-squared	0.151	0.155	0.156	0.156	0.156	0.157
Number of cities	61	61	61	61	61	61

Note: Estimation by OLS; standard errors (in parentheses) are clustered at the city level. The dependent variable is a dummy=1 if city *i* became a commune at time *t*, and 0 otherwise. *Earthquake* is a dummy =1 if an earthquake occurred in city *i* at time *t,* and 0 otherwise. *** significant at 1%; ** significant at 5%; * significant at 10%.

Table 4. Intensity

	(1) Damage and felt	(2) Damage and felt (lags)	(3) Weak and strong	(4) Weak and strong (lags)
Earthquake (damage/strong)	-0.0996***	-0.1033***	-0.1195***	-0.1331***
	(0.0315)	(0.0349)	(0.0411)	(0.0414)
Earthquake (felt/weak)	-0.0579*	-0.0603	-0.0584**	-0.0552*
	(0.0291)	(0.0367)	(0.0245)	(0.0304)
Lag earthquake (damage/strong)		-0.0059		-0.1482***
		(0.1028)		(0.0448)
Lag earthquake (felt/weak)		-0.0652**		-0.0684**
		(0.0316)		(0.0315)
Observations	1,138	1,077	1,138	1,077
R-squared	0.151	0.153	0.149	0.153
Number of cities	61	61	61	61

NOTE: Estimation by ordinary least squares; standard errors (in parentheses) are clustered at the city level. The dependent variable, *transition*, is equal to 1 if city *i* became a commune at time *t* and 0 otherwise. *Earthquake* is equal to 1 if an earthquake occurred in city *i* and at time *t* and 0 otherwise. Intensity classes are refined as follows: *Weak earthquake*: *I*=(5,7]; *Strong earthquake*: *I* =[8,10); *Earthquake damage*: *I*=(5,10); *Earthquake felt*: *I*=[2,5]. City and time fixed effects are always included. *** significant at 1%; ** significant at 5%; * significant at 10%.

Table 5. Churches and earthquakes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Any earthquake				Damage and felt			
Quakes XI-XIV	20.39***	24.73***	14.51***	11.56***				
	(3.57)	(4.34)	(4.46)	(3.75)				
Quakes XV-			0.85***	-0.05				
			(0.19)	(0.22)				
Quakes (damage) XI-XIV					22.74***	25.50***	14.16***	11.30**
					(4.76)	(5.05)	(5.15)	(4.29)
Quakes (felt) XI-XIV					15.33**	22.63***	12.73	13.11*
					(7.64)	(8.21)	(7.89)	(6.60)
Quakes (damage) XV-							-0.47	0.70
							(1.42)	(1.20)
Quakes (felt) XV-							1.39	-0.74
							(1.40)	(1.22)
Sea				-17.78*				-17.88*
				(10.13)				(10.07)
Etruscan				-0.00				-0.72
				(11.87)				(12.18)
Population 1991				30.91***				31.40***
				(5.14)				(5.31)
Observations	81	81	81	81	81	81	81	81
R-squared	0.293	0.483	0.602	0.749	0.298	0.483	0.605	0.747
Fixed effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes

NOTE: Estimation by ordinary least squares; standard errors in parentheses. The dependent variable is the current number of churches in each city. *Quakes XI-XIV* is the number of earthquakes that stroke the city between 1000 and 1300, *quakes XIV-* is the number of earthquakes registered after 1300 in the city. *Felt* and *damage* refer respectively to earthquakes with I=[2,5] and I=(5,10). *** significant at 1%; ** significant at 5%; * significant at 10%.

Table 6 – Robustness checks

	Non-Episcopal see cities						Whole sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Augmented (20 km)	Augmented (25 km)	Augmented (30 km)	Augmented (20 km)	Augmented (25 km)	Augmented (30 km)	Main - Bishop	Main - Etruscan	Main - Sea
Earthquake	-0.0096	-0.0081	-0.0059				-0.0205*	-0.0180	-0.0219*
	(0.0353)	(0.0110)	(0.0099)				(0.0121)	(0.0122)	(0.0126)
Lag earthquake	-0.0026	-0.0048	-0.0031				-0.0125	-0.0188	-0.0115
	(0.0353)	(0.0120)	(0.0106)				(0.0111)	(0.0175)	(0.0112)
Earthquake (damage)				-0.0234	-0.0166	-0.0120			
				(0.0451)	(0.0152)	(0.0127)			
Earthquake (felt)				0.0021	-0.0038	-0.0031			
				(0.0516)	(0.0108)	(0.0101)			
Quake*bishop							-0.0408***	-0.0396***	-0.0415***
							(0.0132)	(0.0129)	(0.0132)
Lag quake*bishop							0.0214	0.0161	0.0215
							(0.0488)	(0.0449)	(0.0490)
Quake*etruscan								-0.0210	
								(0.0174)	
Lag quake*etruscan								0.0467	
								(0.0915)	
Quake*sea									0.0202
									(0.0205)
Lag quake*sea									-0.0163
									(0.0294)
Observations	1,145	1,145	1,145	1,192	1,192	1,192	2,222	2,222	2,222
R-squared	0.090	0.090	0.090	0.087	0.087	0.087	0.109	0.110	0.109
Number of cities	47	47	47	47	47	47	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOTE: Estimation by least squares; standard errors (in parentheses) are clustered at the city level. The dependent variable, *transition*, is equal to 1 if city *i* became a commune at time *t* and 0 otherwise. *Earthquake* is equal to 1 if an earthquake occurred in city *i* and at time *t* and 0 otherwise. *Earthquake n km* is equal to 1 if an earthquake occurred in a neighboring (within *n* km) city *i* and at time *t* and 0 otherwise. *Interaction* is the interaction term between *earthquake* and one of the following: *Etruscan* is equal to 1 if the city was Etruscan and 0 otherwise; *Sea* is equal to 1 if the city was on the coast and 0 otherwise; *Bishop* is equal to 1 if the city was seat of a bishop before 1000 and 0 otherwise. In columns 7, 8, and 9 we use the augmented dataset – 30 km. City and time fixed effects are always included. *** significant at 1%; ** significant at 5%; * significant at 10%.

Figure 1.a – Conceptual framework: institutional change

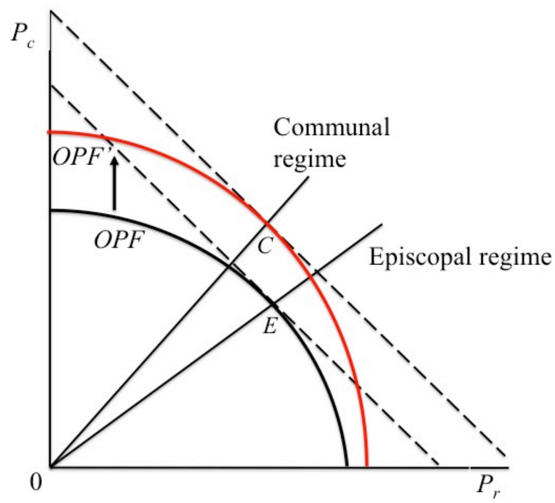


Figure 1.b – Conceptual framework: earthquakes

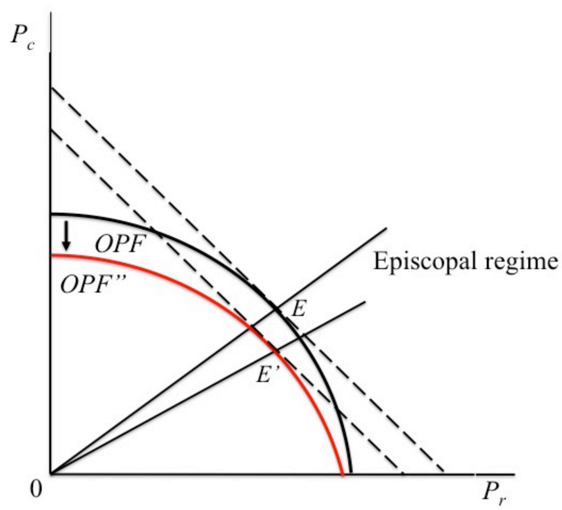
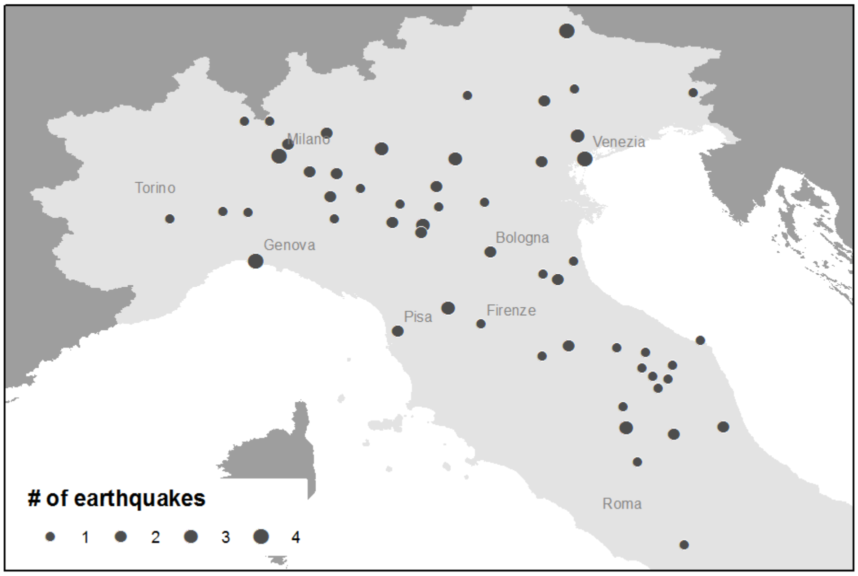


Figure 2 – Earthquakes in northern-central Italy between 1000 and 1300



NOTE: Data from the DBMI04 (Database Macro Sismico Italiano, 2004).

Figures 3 – Parameter estimates of lagged earthquakes (5-year intervals)

Figure 3.a: 3 lags (20-year horizon)

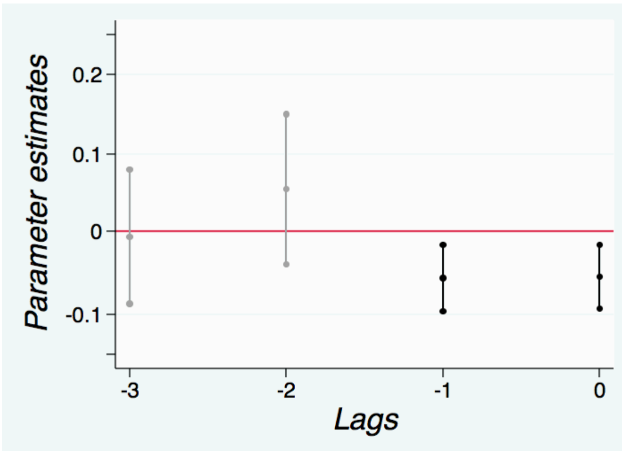


Figure 3.b: 5 lags (30-year horizon)

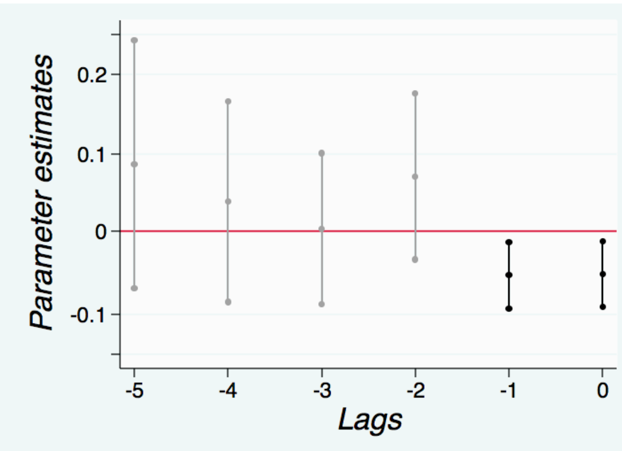
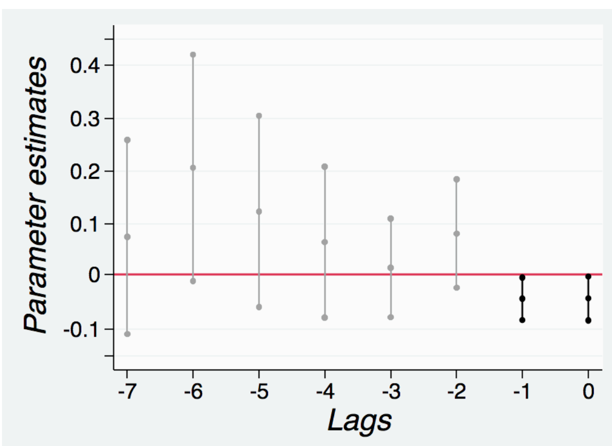


Figure 3.c: 7 lags (40-year horizon)



NOTE: Plotted coefficients are obtained by estimating regression (1) including up to seven lags of the independent variable (*earthquake*) and by adopting the five-year dataset. Coefficients in black are statistically significant (10%), whereas those in light gray are not statistically significant.

Figure 4: Placebo test

Figure 4.a: Main dataset

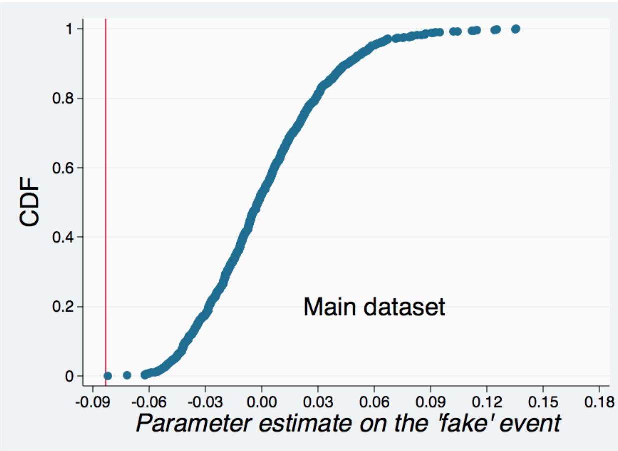


Figure 4.b: Main dataset

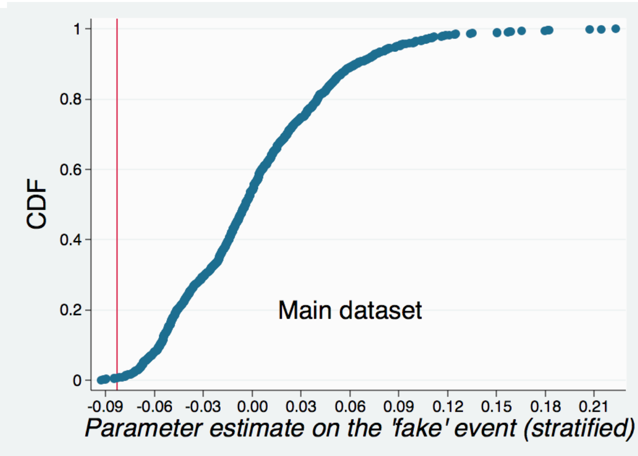


Figure 4.c: Earthquakes with unrep intensity

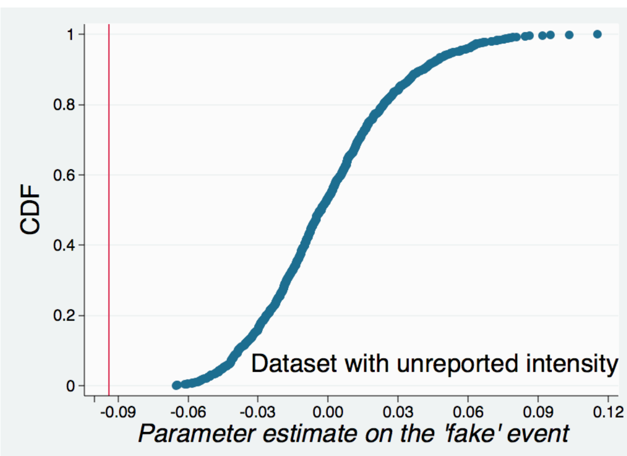
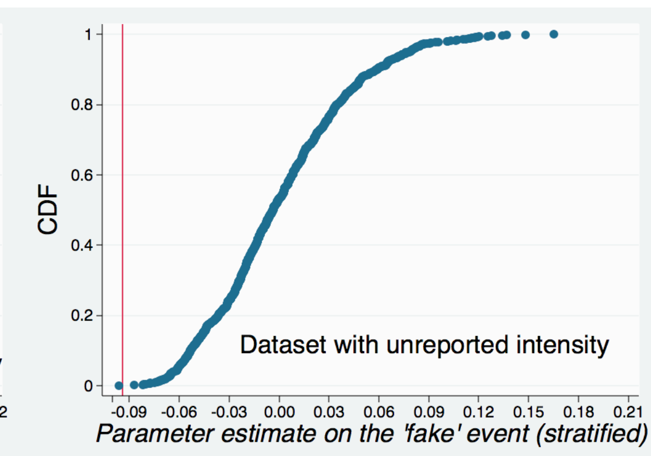


Figure 4.d: Earthquakes with unrep intensity



NOTE: Plotted coefficients are obtained by estimating regression (1) including the 'fake' earthquake dummy as independent variable, as explained in the text, and iterating for 1,000 times. Vertical lines indicate our 'true' point-estimates (-0.0832) reported in column (1) of Table 3.