Endogenous (In)Formal Institutions.

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Abstract

Despite the huge evidence documenting the relevance of inclusive political institutions and a culture of cooperation, we still lack a framework that identifies their origins and interaction. In a model in which an elite and a citizenry try to cooperate in consumption risk-sharing and investment, we show that a rise in the investment value encourages the elite to introduce more inclusive political institutions to convince the citizenry that a sufficient part of the returns on joint investments will be shared. In addition, accumulation of culture rises with the severity of consumption risk if this is not too large and thus cheating is not too appealing. Finally, the citizenry may over-accumulate culture to credibly commit to cooperate in investment when its value falls and so inclusive political institutions are at risk. These predictions are consistent with the evolution of activity-specific geographic factors, monasticism, and political institutions in a panel of 90 European regions spanning the 1000-1600 period. Evidence from several identification strategies suggests that the relationships we uncover are causal.
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1 Introduction

Overwhelming evidence suggests that "inclusive political institutions," which enable the citizenry to check the executive authority, and a "culture of cooperation," understood as the implicit reward from cooperating in prisoner's dilemma and investment types of activities, are crucial for development and correlated with past inclusive political institutions (Tabellini, 2010; Guiso et al., 2016). Documenting however that these two institutional arrangements reinforce one another and are persistent does not help detect the forces producing each and identify their interaction. This paper lays out a model to tackle this issue and explores its empirical implications exploiting data from the vast institutional revolution that shook Europe between the 11th and 16th centuries. Empowered by the feudal contract indeed, European lords started to offer the peasants high powered farming contracts and to enter into commercial partnerships with a rising class of merchants engaged in the first long-distance trades. Such innovations flourished where they also introduced more inclusive political institutions and persisted where the population sought the support of the Cistercians and Franciscans. These monks dictated a culture of cooperation in exchange for guidance on how to share consumption shocks. As further discussed below, such events have shaped Europe to date.

We envision the simplest and most essential setup necessary to link these deeply related institutional discontinuities to economic incentives and to shed light on similar episodes. Formally, "elite" members and "citizens" either share consumption risk with any other individual or invest with a member of a different group. The inherent differences between these activities discriminate between a more fundamental form of cooperation aimed at hedging against shocks and a more profitable one directed toward surplus formation, e.g., long-distance trades. First of all, each group costly instills into its members a psychological gain from cooperating, for instance, by attracting a monastic order. This implicit reward embodies a culture of cooperation, which thus represents an abstract rule of good conduct applied outside the reference group of friends and relatives and thus a "generalized" instead of a "limited" form of morality (Platteau, 2000). Next, the elite decides whether to introduce democracy or keep autocracy. Democracy allows the citizenry to fix the share of investment value to be spent on the production of a public good and its type, whereas autocracy gives

these prerogatives to the elite. Then, agents are randomly matched, and the elite selects the activity if she meets a citizen. Finally, taxation and public good production possibly follow investment. The activity-specific factors—i.e., the severity of consumption risk and the investment value—are exogenous, e.g., geography. Since inefficiencies in public good production render investment feasible only under democracy, the equilibrium has two key features. First, a rise in the investment value encourages the elite to introduce democracy to convince the citizen that a sufficient part of the returns on joint investments will be shared, and culture rises with the severity of consumption risk if this is not too large and thus cheating is not too appealing. Second, democratization and cultural accumulation by the citizenry can either reinforce or undermine one another. When the investment-specific factor is dominant, culture adds value to investment and democracy. When the risk-sharing-specific factor is dominant, culture hinders democratization since it makes risk-sharing more appealing for the elite. When neither factor is dominant, the elite turns uncooperative to force the citizenry to limit taxation in order to obtain democracy first and the choice of investment then. Yet, to credibly commit to future cooperation in investment despite the fall in the public good production the citizen needs to accumulate a culture possibly higher than the full-cooperative level prevailing without credibility issues. Culture thus becomes an enforcement mechanism for the elite and a commitment device for the citizenry. Crucially, we show that in a dynamic version of this setup over-accumulation of culture by the citizenry also reduces the elite's incentive to reinstate autocracy after a fall of the investment value.

We evaluate the model testable predictions by looking at data from 90 European regions between 1000 and 1600. This sample offers substantial variation on sufficiently simple economies and thus allows us to credibly relate activity-specific factors to institutional evolution. Given that the main economic activities in the sample were farming and long-distance trade, we gauge the severity of consumption risk with the standard deviation of the growing season temperature and the investment value with the availability of a direct access to the coast. Moreover, we proxy the inclusiveness of political institutions with the strength of the constraints on the elite's power and the citizenry's culture with the discounted number of years Cistercian and Franciscan houses were active per square km. We validate these two variables by documenting the strong positive correlation between the former and a mea-

sure of the inclusiveness of present-day regional political institutions and the strong positive relationships between the latter and both an outcome-based measure of past culture and present-day self-reported norms of respect and trust. OLS estimates suggest that more inclusive political institutions were mainly driven by the potential for the Mediterranean and not the Atlantic trades, whereas the diffusion of Western monasticism had an inverted U-shaped relationship with climate volatility. In addition, the opening of the Atlantic routes reinforced the Franciscans' presence in the Mediterranean, where they ran micro-credit activities allowing peasants and merchants to strengthen their partnerships with the nobility in cases of input and liquidity shocks. Consistent with the most innovative prediction of our model, this cultural accumulation helped the citizenry persuade the elite to keep more inclusive political institutions despite the fading investment possibilities and justifies the primacy of Mediterranean over Atlantic trades as institutional driver (see also Greif, [1992]).

While the independence of risk-sharing- and investment-specific geographic factors from human effort excludes that our estimates can be possibly driven by reverse causation, our focus on medieval Europe rules out that they are produced by channels different from that identified by our model and discussed in the extant literature, i.e., the incidence of colonialism (Acemoglu et al., 2001), missionary activities (Nunn, 2010), and slavery (Nunn and Wantchekon, 2011). We cannot however leave out that other unobservable factors are biasing our results. To determine whether the correlations we uncover are causal, we follow a three-step strategy. First, we control not only for time and region fixed effects and the average temperature, but also for other observable factors possibly driving (in)formal institutions, i.e., the terrain ruggedness, the frequency of external wars, and the contemporaneous development level. Including these controls has little effect on the gist of our results. Second, we use insights from Altonji et al. (2005) to calculate how much greater the influence of unobservables would need to be, relative to observables, to completely explain away the relationships between geography and (in)formal institutions. We find that the influence of unobservables would have to be on average almost 31 times greater than that of all observables. Given the very high fit of the regressions, it is then very unlikely that our estimates can be attributed to unobserved heterogeneity. Finally, we perform the following falsification test to examine the relationship between the volatility of the medieval growing season tem-

perature and present-day norms of respect and trust inside and outside the sample. Within the sample, we find a strong positive link between the two variables as expected, given our estimates and the persistence of a culture of cooperation. If medieval climate volatility shaped past culture only through past risk-sharing needs, we should not find a similar relationship where the cost of accumulating past culture was prohibitive because of the opposition to Western monasticism. This is what we find. Looking at 28 NUTS 3 Turkish regions, we estimate an insignificant relationship between medieval climate volatility and present-day norms of respect and trust. This is consistent with the barriers to Western monasticism erected by the Eastern Orthodox Church first and the Ottoman empire then. These robustness checks make difficult to envision that our estimates are driven by unobservables and, in particular, by a mechanism different from the one we model. Accordingly, we take them as causal.

The papers most closely related to ours are Fleck and Hanssen (2006) and Durante (2010). The former claims that democracy expands where it helps the elite convince the citizens that their returns from difficult-to-observe investments will not be expropriated.[1] Durante (2010) instead shows that European regions where the climate was more erratic between 1500 and 1750 present today stronger norms of trust. While however Fleck and Hanssen (2006) do not consider the interaction between inclusive political institutions and culture, Durante (2010) does not identify the mechanism linking past climate volatility to present-day culture.[2] In this perspective, the present paper offers three main contributions. First, we develop a theory of endogenous (in)formal institutions based on risk-sharing needs and inefficiencies in public good production clarifying that, over and above violence (Acemoglu and Robinson, 2000) and political power (Acemoglu et al., 2005), the citizenry can rely on over-accumulation of culture to elicit democratization. Crucially, this mechanism cannot be produced by the extant time-inconsistency-based models of democratization, which overlook the citizenry's need to commit by zeroing his outside option, and it can be fruitfully used to analyze other historical cases in which heterogeneity in endowments across groups with different political

[1] Fleck and Hanssen (2006) document that, at the end of the Dark Ages, the elite in Sparta could easily observe the farmers' investments, whereas that in Athens was prevented by the hillside landscape. Hence, the latter but not the former extended the franchise to encourage investments. This together with our evidence casts doubts on the alleged necessity of a limited resource and income inequality to produce inclusive political institutions put forward by a recent theoretical literature (see Cervellati et al., [2008]).

[2] A related complementary literature studies the impact on initially given cultural norms of the agents' expectations about the economy (Tabellini, 2008) and the actions of leaders (Acemoglu and Jackson, 2015).

power makes inter-group cooperation crucial, e.g., Industrial Revolution (Lizzeri and Persico, 2004). Second, we test our model by using a novel dataset that offers huge variation across time and space. In doing so, we shed light on a key period in history, and we devise a time-dependent measure of past culture, which has been recently shown valid in other contexts (Padró i Miquel et al., 2015).[3] Finally, while characterizing the interactions among activity-specific factors, (in)formal institutions, and the economy, we suggest an instrumental variables approach to separately estimate the role of each institution (see Guerriero, [2015]).

The paper proceeds as follows. we review some stylized facts about medieval Europe in section 2 to motivate the general model of institutional design we analyze in section 3. Next, we state the model predictions in section 4, and we discuss the relative test in section 5. Finally, we conclude in section 6, and we report proofs, figures, and tables in the appendix.

2 (In)Formal Institutions in Medieval Europe

Europe at the end of the 10th century.—The fall of the Western Roman empire deprived Europe of political control, farming technologies, and trades [Stearns 2001, p. 165]. As a result, the defenseless peasants—i.e., *laboratores*—sought the protection of the lords, i.e., *bellatores*. The consequent rise of the feudal contract, institutionalized by the Carolingian kings (877-1037), allowed the nobles to simultaneously exploit their political power as private property and pacify their estates [Stearns 2001, p. 176]. This trend along with the improved climate conditions fueled an institutional revolution that changed Europe forever.

1000-1350: farming, Mediterranean trades, and new institutions.—The prospect of improved land productivity and the opportunity of long-distance trades paved the way to contractual innovations. The lords began to enter into high powered farming agreements with the peasants and commercial partnerships with a rising class of merchants, who obtained protection against piratical incursions and exemption from the duties required to cross the lord's domain [Stearns 2001, p. 191-222].[4] These contractual innovations flourished where the lords introduced more inclusive political institutions to fortify their credibility (Stearns, 2001; Ortu, 2005), and in particular in the *Giudicati* in Sardinia (952-1297), the communes of

[3]Padró i Miquel et al. (2015) gauge culture in Chinese villages with the presence of Buddhist temples and document that this is an important determinant of the effectiveness of inclusive political institutions.

[4]Marriages "often sealed [the] contracts between rural nobility and [...] merchant[s]" [Stearns 2001, p. 216].

Northern Italy and France (1080-1282), the maritime republics of Genoa, Pisa, and Venice (1099-1406), the towns of Aragon and Cataluña (1150-1213), the German imperial cities (1152-1806), and the Swiss Cantons (1291-1515). To illustrate, Peter II of Aragon (Frederick I) granted the communal privileges to the difficult-to-reach Pyrenean (Northern Italian) communities to bolster olives production and the relative tax revenues (in exchange for the sizable payments fixed by the 1183 Peace of Constance) [Orvietani Busch 2001, p. 66-80; Stearns 2001, p. 208], whereas the *communes jurées* of Northern France and the Flanders were chartered by the early Capetian kings interested in gaining from the lucrative exchanges of woolens for Eastern spices [Stearns 2001, p. 199]. These new polities were organized as a sworn association of free men governed by a public assembly selecting the executive [Stearns 2001, p. 216], and they were "aimed at economic prosperity [and protected by the lords'] immediate political and financial considerations" [Stearns 2001, p. 199]. This discontinuity determined the recovery of lost technologies, like the heavy plow (Slocum, 2005), and a shift in public spending composition from war-waging to sanitation and securing commercial routes, which the rural entrepreneurs and the merchants obtained via the local parliaments' veto power on the lords' decisions [Stearns 2001, p. 192-199, 205-221, 239, and 249].

Meanwhile, the Western monasticism was transforming interpersonal relationships. Imported from the East during the 5th century, it spread to Europe with some ascetic and lots of lax examples until 1098, when a group of dissatisfied Cluniac monks abandoned the abbey of Molesme in Burgundy and founded a new monastery in Cîteaux [Logan 2002, p. 126]. This event marked the start of a new and highly influential phase of the medieval Church. The Cistercians indeed revived the original Benedictine emphasis on prayer and manual labor to diffuse the novel and powerful idea, illustrated in their 1119 *Carta Caritatis*, that the relationships among both the houses and the worshipers should be rooted in "mutual love and esteem, combined with a benevolent eye to human frailty [i.e.,] charity rather than the exercise of power" [Tobin 1995, p. 40]. Crucially, these norms of cooperation should have been materialized not through alms but "via moral consideration and practical engagement" [Muzzarelli 2001, p. 115], which the Cistercians themselves supported with the help of lay brothers and sisters known as *conversi* and various classes of secular labourers [Noell 2006, p. 265]. To illustrate, they mainly accepted as grant lands located where the

climate was more unpredictable converting them into fertile compact blocks partly serving the house grange and partly leased to the peasants at rates lower than those offered by the lords [Donkin 1963, p. 184; Tobin 1995, p. 36; Woods 2005, p. 182]. Furthermore, they organized trade fairs [Tobin 1995, p. 128], and they offered insurance against other shocks introducing at the same time several valuable technological innovations.[5] These activities, so attractive in a world where risk-minimization was an imperative, facilitated the diffusion of the charity-based norms of cooperation the Cistercians championed in those communities desperate to keep their guidance and, at the same time, encouraged the neighboring ones to pressure local monasteries to join the order and so deliver the same risk-sharing and cultural accumulation services [Berman 2000, p. 95, 107, and 223]. The principle of "kinship" between houses, which was enforced by the duty of cross-visitation and support, assured indeed the homogeneity of the order's action across regions [Gimpel 1976, p. 3; Tobin 1995, p. 41]. Not surprisingly, in 1153 there were already 435 Cistercian houses scattered around Europe.

1350-1600: Atlantic trades and institutional changes.—The 1348 Black Death destroyed the *conversi* system, and so the Cistercians left the scene to the Franciscans [Tobin 1995, p. 125 and 236]. Differently from the Augustinians, Benedictine, Cluniacs, and Dominicans (Carmelites, Carthusians, Cathars, Premonstratensians, and Waldensians), who specialized in intellectual work (contemplation), the Friars Minor committed to a life of poverty and social engagement and built a network of thousands of houses linked in the Cistercian fashion [Logan 2002, p. 126-135]. Crucially, they organized in Italy, France, and Spain the first European micro-credit institutions—i.e., *Monte di Pietà* (*Frumentario*), which accommodated customers with loans of money (wheat seeds) in exchange for a pledge auctioned if the loan plus an interest payment, much lower than that charged by private bankers—i.e., 3% versus 30%, was not paid [Muzzarelli 2001, p. 60-63]. As in the Cistercians' case, communities from all Europe solicited the Franciscans to first establish a new house and then start a *Monte* [Muzzarelli 2001, p. 21-29]. While running a pawnshop, they examined "the morality and the social behavior of the customers evaluating the loan use" [Muzzarelli 2001, p. 216] to "make the citizenry's cohabitation more cooperative and fair" [Muzzarelli 2001, p. 7].

[5]They provided a shelter (retirement place) for those in need (the elderly), stored up waters, and spread advanced farming and metallurgic techniques, the water wheel, and the greenhouse [Woods 2005, p. 31-39].

This observable cooperative effort also strengthened in different ways the relationships between citizenry and nobility. First, the two groups jointly managed the *Monte* [Montanari 1999, p. 234-238]. Second, the *Monte* was subsidized by special taxes [Montanari 1999, p. 192-194], and it was obliged to support the commune in the time of need—to finance for instance military expenses—and to back up the merchant-nobility partnerships in the case of liquidity shocks [Montanari 1999, p. 48 and 149]. Finally, the loans of wheat seeds avoided that the peasants would stop investing in the farmland and move to the towns in the case of harvest destruction [Montanari 1999, p. 207-209]. Thank to these ties, which locked both peasants and merchants in the agreements took with the lords in spite of the adverse shocks to joint investments, the intensification of the Franciscan penetration in the Mediterranean delayed the return to autocracies after the opening of the Atlantic routes and the consequent fall in the profitability of the Mediterranean trades [Muzzarelli 2001, p. 83]. A case in point is Pisa, where the *Monte* supported the nobility's struggle against Florence becoming "both the symbol and the cause" [Muzzarelli 2001, p. 228] of the 1494-1509 restoration of the Republic. More generally, while the communes of Northern France tumbled under the centralization pressure imposed by the late Capetian kings (1270-1328), the Italian ones turned first into commercial oligarchies and only between the 15th and 16th centuries into autocracies, called *Signoria* and rooted in agreements between the nester nobility and the ennobled merchants [Stearns 2001, p. 202-205 and 255-259]. Over the same period, the growth of Atlantic trade strengthened the merchant groups in England and the Provinces and allowed them to constrain the power of the monarchy (Acemoglu et al., 2005).

3 Theory

Next, we present a model of institutional design in a heterogeneous society rationalizing the stylized facts just presented but applicable to a wider range of historical cases.

3.1 Model Setup

The economy.—Society is composed by a mass one of agents split into $\mu < 1/2$ elite members—i.e., the lords—and $1 - \mu$ citizens, i.e., peasants or merchants. Agents of the same type act identically. The two economic activities are sharing a consumption risk—

e.g., participating in the *Monte*'s business—and investing, e.g., adopting a new farming technology or trading over long distance. The payoff of each of the two activities is shaped by an exogenous activity-specific factor $\lambda_a \in \left[0, \overline{\lambda}\right]$ with $a \in \{R, I\}$, i.e., respectively the severity of consumption risk and the investment value. Agents have quasi-linear utilities and the sub-utility u from public spending g is such that $u' > 0$, $u'' < 0$, $\lim_{g \to 0} u'(g) = \infty$.

Timing of events.—The agents' irreversible choices are ordered as follow (see figure 1).

At time zero, group $i \in \{e, c\}$ decides the psychological gain from cooperating in any economic activity, denoted by $d_i < \overline{d}$,[6] to instill into its members at the cost $d_i^2/2$, e.g., whether to attract Franciscan monks proposing norms of respect and trust and then bear the cost of helping them start up a *Monte*. This assumption incorporates into our model two fundamental insights of evolutionary psychology and Malthusian growth theories: a social group dictates to its members, via natural selection and cross-punishment, cultural norms maximizing its fitness (Barkow et al., 1992; Clark, 2007), and these norms are embraced by the group's members the faster the larger the culturally-driven reproductive advantage is (Andersen et al., 2016). Thus, a group expecting larger returns from cooperation incurs larger cultural accumulation costs and ends up deriving a larger d_i. Crucially, assuming a unique implicit reward rather than two activity-specific ones is not crucial for our argument but is consistent, for instance, with the fact that the *Monte* lent money to both the citizenry in case of famine and the merchant-nobility partnerships in case of liquidity shocks. Similarly, studying the choice of a psychological gain instead of a loss is immaterial to our argument.

At time one, the elite, who holds initially the political power, decides whether to turn autocracy into democracy. The choice of the regime $j \in \{A, D\}$ determines the share s_j of the investment value λ_I to be spent on the production of a public good and its type. There are two types of public good and p_i is group i's favorite one, e.g., war waging for the elite and both sanitation and securing commercial routes for the citizenry (see section 2).

At time two, if democracy has been introduced, the citizenry selects s_D and the type of public good. Under autocracy instead, s_A and the public good type are decided by the elite.

At time three, agents are randomly matched. If two agents of the same group meet, they

[6]The existence of a cap is consistent with psychology studies showing that the human neurological system becomes less sensitive or even numb to repetitions of feelings like the one of virtue (Frederick and Loewenstein, 1999). Kaplow and Shavell (2007) and Rayo and Becker (2007) impose a similar "crowding-out" constraint.

always try to risk-share. Otherwise, the elite chooses the economic activity. Finally, taxation of λ_I and thus public good production possibly follow a successful investment.

Payoffs.—Let $\pi_{a,i,j,m}(d_c, d_e, \lambda_R, \lambda_I)$ be agent i's payoff from activity a under regime j when her/his match is $m \in \{c, e\}$ and $U_{i,j}(d_c, d_e, \lambda_R, \lambda_I)$ agent i's expected utility under regime j. We report the arguments of these functions only when necessary for our analysis.

Risk-sharing resembles a prisoner's dilemma game. Agent i receives d_i from cooperating but also loses λ_R when her/his partner does not. If agent i does not cooperate, she/he receives λ_R if her/his partner cooperates and zero otherwise. The severity of consumption risk λ_R summarizes the exogenous features, different from those captured by λ_I, increasing the gain from cheating and the loss from being cheated in risk-sharing. A volatile climate, which heightens the urgency to make seeds and money available through a *Monte* in times of famine, is a case in point. The possible risk-sharing payoffs $\pi_{R,i,j,m}$ are detailed in table 1.

If the elite chooses to invest, she has to first decide whether to make an up-front payment $f > 0$ to the citizen. Once the elite has provided her input, she immediately receives d_e. Next, the citizen can either shirk and appropriate f or exert an effort that costs f but delivers an immediate gain d_c. The production is zero in the former case and λ_I in the latter. The investment value λ_I synthesizes the exogenous features, different from those gauged by λ_R, raising the value of mutual cooperation in investment and, in particular, the investment profitability and the factors hampering the observability of the citizen's effort (Fleck and Hanssen, 2006). In the case of farming investments (long-distance trades), natural examples are respectively the land suitability for cultivation and the terrain ruggedness (a direct access to the coast and the length and safety of the commercial routes). The inherent differences between the financial risk faced by the nobility and the survival risk the peasants and the merchants bore support the view that investment can be only initiated by the elite, requires the citizen's labor, and entails inputs that cannot be completely expropriated or taxed ex-post. Crucially, we are not artificially imposing any trade-off between the two activities since we link them through cultural accumulation. Following investment, a share $1 - s_j$ of λ_I is pocketed by the elite since she pays in advance f, whereas $s_j \lambda_I$ is spent on public good production. This has a linear technology and is characterized by the following two inefficiencies. First, group i is only able to convert into the other group's favorite good a

share $\gamma \in (0,1)$ of $s_j \lambda_I$ and when in power cannot outsource production to the other group to contract away this technological constraint, because of for instance transaction costs. Second, if agent i consumes the other group's favorite good, her/his sub-utility u is pre-multiplied by $\theta_i < 1$. These frictions can be interpreted as either the heterogeneity in the abilities to produce the public goods and the diversity in the preferences for them discussed in section 2 or as the sources of time-inconsistency analyzed by the extant literature, i.e., γ can be seen as the extent of ex-post expropriation or redistribution of the tax revenues (Acemoglu and Robinson, 2000) and θ_i as the probability of being excluded from public good consumption (Fleck and Hanssen, 2004). As illustrated below however, this second class of inefficiencies cannot produce the aforementioned "commitment dimension" of cultural accumulation if incorporated into our model in the form discussed by the existing literature on democratization. The possible investment payoffs $\pi_{I,i,j,m}$ are reported in tables 2 to 5.[7]

The activity-specific factors are linked to the other exogenous parameters by the following conditions whose mildness is discussed in details in the Internet appendix:

Assumption 1: *a.* $f > \overline{d} > \overline{\lambda} > 1$*; b.* $\theta_c < \left(f - \overline{d}\right) / u\left(\overline{\lambda}\right)$*; c.* $\gamma < u^{-1}\left(f - \overline{d}\right) / \overline{\lambda}$.

Condition 1a guarantees a nontrivial analysis. $f > \overline{d}$ implies that cooperating in investment is never a dominant strategy for the citizen, $\overline{d} > \overline{\lambda}$ ensures that cooperation in risk-sharing is affordable and so its absence is not due to impossibility but to strategic considerations, and $\overline{d} > \overline{\lambda} > 1$ enables over-accumulation of culture, which underlies the most innovative prediction of our model. Conditions 1b and 1c require respectively that the citizen is sufficiently dissatisfied ex-ante with consuming p_e and that the frictions in public good production captured by γ are sufficiently severe. They assure that the citizen does not cooperate in investment under autocracy even when he has built the largest possible culture $\overline{d}$ and the highest possible investment value $\overline{\lambda}$ is pooled into respectively p_e and p_c. With assumption 1 then, we focus on a democratization process made possible only by the desire to gain from cooperative investment despite the inefficiencies in public good production.

In evaluating the generality of the foregoing, several remarks should be heeded. First, the continuity of d_i, s_j, and λ_a is necessary to link scenarios differing in the relative importance

[7] Should the number of agents be discrete, public spending will also depend on the relative size of each group. This change complicates the algebra without delivering additional insights (see Internet appendix).

of the activity-specific factors to institutional evolution. Second, the model message remains intact if both goods can be concurrently produced (see footnote 8) or the elite can transfer funds to the citizenry under autocracy (see footnote 10). Third, our results will survive should also risk-sharing produce a taxable surplus (see footnote 9). Fourth, the timing of events we consider is optimal from the elite's viewpoint and so the most likely to arise in the first place (see footnote 13). Finally, the gist of the model will be similar should the elite be able to restore autocracy in a future period or the agents' type change over time (see section 3.2). All in all, the present one is the simplest and most essential setup necessary to analyze the interactions among activity-specific factors, (in)formal institutions, and the economy.

3.2 Equilibrium (In)Formal Institutions

Since the game is of perfect and complete information, we solve it by backward induction. Furthermore, to ease its illustration, we assume two innocuous tie-breaking rules:

Assumption 2: *If risk-sharing is expected to be the economic activity under any political system, then the elite retains autocracy. Moreover, upon meeting a citizen, the elite chooses investment if she gets the same payoff from both risk-sharing and investment.*

we start with the elite's choice of activity. Under autocracy, risk-sharing always prevails by assumptions 1 and 2. Hence, we identify the conditions under which investment materializes once the elite has introduced democracy and given the sharing rule s_D.

Choosing investment.—Condition 1b also implies that the citizen never cooperates when p_e is produced under democracy and thus he always chooses p_c once in power.[8] After this choice, investment prevails if cooperative and therefore whenever it is the case that

$$(I_e)\quad \pi_{I,e,D,c} \equiv \theta_e u\left(s_D \lambda_I\right) + \left(1 - s_D\right)\lambda_I + d_e - f \geq \pi_{R,e,A,c},\quad (I_c)\quad \pi_{I,c,D,e} \equiv u\left(s_D \lambda_I\right) + d_c \geq f.$$

While the first inequality guarantees that the elite picks investment over risk-sharing, the second one assures that the citizen exerts effort after receiving the up-front payment f.[9]

Choosing s_D.—Three remarks are key at this point. First, the citizen always prefers investing to risk-sharing since the least he can obtain from the former activity—i.e., f—is

[8] Conditions 1b and 1c also entail that our analysis is robust to the possibility that both public goods can be concurrently produced since $u' > 0$ implies that $\theta_c u\left(\eta\overline{\lambda}\right) + u\left(\left(1-\eta\right)\gamma\overline{\lambda}\right) < f - \overline{d}$ for any $\eta \in [0,1]$.

[9] Should cooperative risk-sharing deliver a taxable surplus c, then two activity-specific sharing rules will be set at time two and the elite will pick risk-sharing and autocracy if λ_I and c are similar since in this way she can get her preferred public good and the citizen's cooperation without paying f (see the Internet appendix).

larger than his maximum payoff from the latter, i.e., $\max\{\lambda_R, d_c\}$ (see condition 1a). Second, his payoff from investment strictly rises with s_D since public spending on p_c is the only way to channel to himself some investment value.[10] Third, a violation of either constraint (I_e) or (I_c) triggers autocracy by making investment impossible. Hence, the citizen chooses a sharing rule maximizing his utility given that constraint (I_e) is met. In addition, in a subgame perfect equilibrium, s_D has to respect constraint (I_c). The citizen's problem is

$$\text{maximize}_{s_D \in [0,1]} \quad u(s_D \lambda_I) \quad \text{such that} \tag{1}$$

$$(\nu \geq 0) \qquad \theta_e u(s_D \lambda_I) + (1 - s_D)\lambda_I \geq f - d_e + \pi_{R,e,A,c} \equiv RHS,$$

$$(\psi \geq 0) \qquad (1 - s_D)\lambda_I \geq 0.$$

The corresponding first order condition, which is sufficient since all functions are concave, is $u'(s_D^* \lambda_I) = (\nu + \psi)(1 + \nu\theta_e)^{-1}$, where the superscript * labels equilibrium quantities. The citizen fixes $s_D^* = 1$ except when doing so violates constraint (I_e) and then the unique solution is the highest $s_D < 1$ at which constraint (I_e) binds.[11] Note that s_D^* depends on the levels of culture, d_c and d_e, as well as λ_R and λ_I, and thus $s_D^* = s_D^*(d_c, d_e, \lambda_R, \lambda_I)$. For the sake of clarity, we omit some arguments of this function when this is not confusing.

Because of the paramount role of λ_R and λ_I in influencing the agents' choices, it is useful to establish how these parameters affect the sharing rule. If the investment value λ_I is sufficiently large with respect to the severity of consumption risk λ_R as to satisfy the inequality $\lambda_I > u^{-1}(\max\{f - d_c^*, RHS/\theta_e\})$, investment is very profitable for both groups, and the entire λ_I is spent on p_c. If λ_I however is not as large, then given a pair of d_c and d_e constraint (I_e) can only be satisfied for $s_D^* < 1$. At this sharing rule, the marginal value of λ_I is higher as a transfer than as an input for public good production, i.e., $1 > \theta_e u'(\lambda_I)$. Therefore, when RHS rises, so does the amount of λ_I that needs to be shifted from p_c to transfers $(1 - s_D^*)\lambda_I$, possibly reducing s_D^*. Since RHS equals the risk-sharing payoff under autocracy plus $f - d_e$, it rises as d_c increases because then the elite gets a larger payoff from cheating a citizen, and it falls with d_e. The following lemma formalizes this discussion:

[10] When the citizen can receive transfers under autocracy, the model message stands but democratization is less likely since the elite has another instrument to elicit cooperation (see the Internet appendix).

[11] Hence, the two constraints cannot be slack at the same time. $u'(\lambda_I) \geq (\theta_e)^{-1}$ suffices to ensure $s_D^* = 1$.

Lemma: *Under assumptions 1 and 2,* $s_D^* = 1$ *if and only if* $u^{-1}\left(\max\left\{f - d_c^*, \frac{RHS}{\theta_e}\right\}\right) < \lambda_I$. *Furthermore, any* $s_D^* < 1$ *is nondecreasing with the elite's culture* d_e *and nonincreasing with the citizen's culture* d_c, *i.e., for any* $d_e, d_c \leq \lambda_R$, *then* $s_D^*(d_e, x) = s_D^*(d_e, y) > s_D^*(d_e, w) = s_D^*(d_e, z)$, $\forall x \neq y, z \neq w$ *such that* $y \vee x < \lambda_R \leq z \wedge w$.

s_D^* strategically links culture to the choice of regime when activity-specific factors are not skewed. By fixing a small d_e earlier, the elite raises her outside option and payoff later on.

3.2.1 Cultural Accumulation

Absent credibility issues, each group selects either the uncooperative level of culture 0, the level inducing only within-group cooperation in risk-sharing—i.e., μ $(1-\mu)$ for the elite (citizenry), the level maximizing only the payoff from investment—i.e., $1-\mu$ (μ) for the elite (citizenry), or the full-cooperative level $\tilde{d} \equiv \max\{1, \lambda_R\}$. These choices affect constraint (I_e) by shaping the elite's risk-sharing payoff, which is what she would attain under autocracy, and her implicit reward from cooperating in investment. Moreover, a larger d_c relaxes constraint (I_c) and thus improves the citizen's credibility as an investment partner. In the appendix, we partition $\left[0, \overline{\lambda}\right]$ according to the size of λ_I relative to λ_R to study the links between activity-specific factors and culture, and we obtain three cases: low—i.e., range (A), moderate—i.e., ranges (C), (D), and (E), and high values—i.e., range (B)—of λ_I (see figure 2).

The choices of culture have no bearing on investment and on one another in the polar cases. In range (B), investment and so democracy are certain and both groups are better off with spending λ_I entirely on p_c. Thus, each group builds a culture maximizing at least the investment payoff and possibly also the within-group cooperation in risk-sharing, e.g., $U_{c,D} = \mu\pi_{I,c,D,e} + (1-\mu)\pi_{R,c,D,c} - d_c^2/2$. Then, d_i^* equals $\tilde{d}$ for values of λ_R that are not too high, and $d_e^* = 1-\mu$ and $d_c^* = \mu$ at sufficiently high values of λ_R making cheating too appealing. In range (A) instead, autocracy is inevitable being λ_I too small to make constraint (I_e) hold. Thus, everybody maximizes the risk-sharing payoff—e.g., $U_{c,A} = \mu\pi_{R,c,A,e} + (1-\mu)\pi_{R,c,A,c} - d_c^2/2$, $d_e^* = 1$ and $d_c^* = \tilde{d}$ for λ_R not too large, and $d_e^* = d_c^* = 0$ otherwise.

The choices of culture become strategic in the ranges (C), (D), and (E), where they are strategic substitutes and affect the viability of investment by determining whether constraints (I_e) and (I_c) hold. While indeed for λ_R sufficiently small the equilibrium is as in range (B),

for λ_R large the elite is tempted to curtail d_e^* to raise her stake in risk-sharing and thus extract a larger payoff from investment. Choosing risk-sharing is a credible threat since the citizen always prefers investment and so he cannot reciprocate with a small d_c^*. Formally, as d_e^* goes down, RHS goes up, and thus s_D^* falls. At this point, to satisfy constraint (I_c), the citizen needs to accumulate a culture that is at least as large as the difference between f and his sub-utility from the public good, i.e., $\widehat{d} \equiv f - u\left(s_D^* \lambda_I\right)$. This can well surpass the otherwise optimal full-cooperative $\tilde{d}$ for f sufficiently large and θ_e not too small.[12] If $\widehat{d}$ is not affordable, autocracy prevails. Culture then becomes an enforcement mechanism for the elite and a commitment device for the citizen. As aforementioned, culture loses both properties when the elite can completely exclude the citizenry from public good consumption or if under autocracy (democracy) $f\left(\left(1 - s_D\right)\lambda_I\right)$ can be fully expropriated or redistributed since then the (I_c) $((I_e))$ constraint holds even for $d_c^* \leq \tilde{d}$ (only for $s_D^* \to 1$). The Internet appendix analysis of the order of events we consider further clarifies these points.[13]

To summarize, both groups benefit from building cooperation in risk-sharing as long as λ_R is not too large, otherwise the temptation to cheat is too strong, and only the prospect of democracy can produce some culture. This pattern is consistent with the diffusion of Western monasticism in response to the population's risk-sharing needs (see section 2). The main effect of λ_I on culture instead is to boost d_c^* as it decreases from range (B) to ranges (C), (D), and (E) (see figure 2).[14] Accordingly, as long-distance trades started to shift toward West, the populations of Northern Italy found optimal to insure the merchants-nobility partnerships against liquidity shocks by favoring the spread of the Franciscans and in turn of the *Monte*. This over-accumulation of culture made credible future cooperation and also delayed the rise of the *Signoria* (see section 2).[15] We analyze this dynamics in the

[12] Since $s_D^* < 1$ is implicitly defined by constraint (I_e), then $\widehat{d} > \tilde{d} \leftrightarrow \left(1 - s_D^*\right)\lambda_I + d_e^* > \lambda_R + \theta_e \tilde{d} + \left(1 - \theta_e\right) f$. This inequality is true for $\theta_e \to 1$ and f sufficiently large being $\lambda_I \geq u^{-1}\left(\frac{f - \overline{\lambda}}{\theta_e}\right)$ in ranges (C), (D), and (E).

[13] Other timings do not solve the credibility issues and so make democracy impossible in ranges (C), (D), and (E). Setting culture at the onset and the sharing rule before picking the activity indeed is necessary to permit commitment when needed since these choices define the elite's payoff later on (see the Internet appendix).

[14] In ranges (C), (D), and (E), $d_c^* > 0$ is concave in λ_R—as in figure 2—if $\frac{d^2 d_c^*}{d\lambda_R^2} = -u' \frac{d^2 s_D^*}{d\lambda_R^2}\lambda_I - u''\left(\frac{ds_D^*}{d\lambda_R}\right)^2 \lambda_I^2 \leq 0$, which is the case for λ_I small. Note that $\frac{ds_D^*}{d\lambda_R} < 0$ and $\frac{d^2 s_D^*}{d\lambda_R^2} > 0$ provided that $u''' < 0$.

[15] The commitment dimension of cultural accumulation is also consistent with the negative relationship between the land suitability for agriculture and a culture of cooperation documented by Litina (2016).

Internet appendix where we add to the basic timing a further period in which emerges from the citizenry a group of "ennobled merchants" able to produce without up-front payment a taxable surplus proportional to λ_I and to restore with the elite's help autocracy. Since the merchants prefer to be taxed by the elite because smaller in size, the latter decides whether to seize power. She does so in ranges (A) and (E) since then autocracy assures her a risk-sharing payoff equal to the investment one plus the revenues from taxing the merchants. In the other ranges instead, the elite triggers a coup when levying duties on the merchants is very appealing since they are sufficiently productive, and she tries to elicit the citizenry's cooperation under democracy otherwise. The citizen is now even more cooperative since reverting to autocracy costs him the investment payoff and the taxes on the merchants.

Proposition 1 summarizes the first order relationships involving d_c^* since this is the only level of culture we observe and on which we can focus in the empirical exercise:

Proposition 1: *Under assumptions 1 and 2, the citizen's culture d_c^* rises with the severity of consumption risk λ_R at its moderate values, and then drops, and it may sharply grow as the investment value λ_I falls from high to intermediate—relative to λ_R—values.*

3.2.2 Democratization

All in all, a larger λ_I facilitates democratization by both fostering cultural accumulation—and in turn cooperation—and making mutually beneficial investments more appealing than risk-sharing. As seen in section 2, these mechanisms lie behind the 12th century rise of the communes. On the contrary, λ_R has the second order effect of crippling democratization when λ_I is not sufficiently large. Then indeed, the citizen needs to accumulate a very large and possibly too expensive culture to induce the elite, which turns uncooperative, to pick investment and democracy instead of risk-sharing and autocracy. Both strategic effects threaten democratization. Proposition 2 recaps the first order implication of this section:

Proposition 2: *Under assumptions 1 and 2, higher values of λ_I ease democratization.*

The ability to identify both the separate and joint effects of the activity-specific factors on democratization distinguishes our model from Fleck and Hanssen (2006).

4 Empirical Implications

Propositions 1 and 2 provide us with two insights. First, a rise in the investment value encourages the elite to introduce more inclusive political institutions to convince the citizenry that a sufficient part of the returns on joint investments will be shared, and accumulation of culture rises with the severity of consumption risk if this is not too large and thus cheating is not too appealing. Second, the citizenry may over-accumulate culture to credibly commit to cooperate in investment when its value is or becomes so low to endanger inclusive political institutions (see also section 3.2). These patterns imply the following predictions:

Testable Predictions: *(1) More inclusive political institutions are primarily and positively driven by the investment value; (2) The citizenry's culture is reinforced by the severity of consumption risk if this is not too large and may positively respond to the shocks reducing the investment value to a level threatening more inclusive political institutions.*

5 Evidence

To evaluate these testable predictions, we need proxies for the dependent and independent variables and a suitable empirical strategy. To select them, we build on section 2.

5.1 Measuring Institutions and Geography

For what concerns the cross-sectional dimension, we look at 90 regions in 16 European countries for which we have sufficient geographic and institutional data (see table 6 and footnote 23). As Tabellini (2010), we define each region r building on the Eurostat administrative classification. We consider NUTS 2 or 3 levels merging those neighboring units that, according to Sellier and Sellier (2002), were part of the same political entity for most of the 1000-1600 period.[16] In contrast to a grid approach, this sample design allows us to consider as cross-section identifiers exactly the areas within which the inclusiveness of political institutions and culture were selected (see footnote 20). For what concerns the time dimension t, we consider each half-century between 1000 and 1600 for a total of 13 periods. Although

[16]Since Tabellini (2010) studies instead the 1600-1750 period, we define in a different manner 17 of the 66 regions we have in common. Some regions have also been under the suzerainty of an entity different from the one reported in table 6—i.e., Belgium, Corse, Friuli-Venezia Giulia, and South Switzerland, whereas others have experienced both foreign control and independence, i.e., the Netherlands and Sardegna.

our results are robust to the inclusion of data up to 1850, we concentrate on the first six centuries of the second millennium for three reasons. First, the within-country variation in political institutions almost disappears with the rise of the nation state during the 19th century. Second, the Protestant Reformation deprived Western monasticism of its pivotal role [Tobin 1995, p. 158]. Third, the 17th, 18th, and 19th centuries witnessed technological innovations that made economic activities far more complex than those in the sample.

5.1.1 Measuring Inclusive Political Institutions and a Culture of Cooperation

Following Tabellini (2010), we capture the inclusiveness of political institutions through the "constraints on the executive authority" score as defined in the POLITY IV dataset, i.e., *Democracy* (see table 7 for the summary of all the variables we use). Over the sample then, this variable gauges the institutionalized constraints on the decision making powers of the elite. As Acemoglu et al. (2005), we base our measurement on the events within a 40-year window around each date (see the Internet appendix).[17] We observe over the sample first a trend toward more inclusive political institutions with the mean of *Democracy* rising from 1 in 1000 to 2.28 in 1400 and then a comeback of autocracies with *Democracy* averaging 1.97 in 1600. This pattern is asymmetric across units whereby the Mediterranean regions of Northern Italy, Southern France, and Eastern Spain witnessed the more robust democratization process. The upper-left map of figure 3 illustrates these dissimilarities by displaying the average of *Democracy* across administrative regions over the 1000-1600 period. We build the maps by first dividing the range of each variable into five intervals whose break points are chosen through the goodness of variance fit method and then displaying higher values with darker colors.[18] Differences in *Democracy* have persisted as the distribution of *Democracy-1950-2010* documents (upper-right map of figure 3). *Democracy-1950-2010* is constructed as the average over the 1950-2010 period of the sum of the Polity IV constraints on the executive authority score and an index capturing the political autonomy from the central government of the NUTS 2 regions in the sample (see Guerriero, [2015]).[19] If region r belongs

[17] The correlation between *Democracy* and the constraints on the executive measure devised by Acemoglu et al. (2005) (developed by Tabellini (2010)) is over the common observations 0.49 (0.62).

[18] This fit method minimizes the average deviation of the interval values from the interval mean, while maximizing the average deviation of the interval values from the means of the other intervals.

[19] The latter takes value 1 if the region had exclusive control over some policies, 2 if it was also fiscally decentralized, 3 if it could also elect its parliament and manage all the other regional issues, and 0 otherwise.

to several administrative units, we assign it a figure equal to the average of *Democracy-1950-2010* across the NUTS 2 regions weighted by each unit relative contribution to region r land area. We follow the same procedure for the other variables measured at the regional level.

Our proxy for the citizenry's culture is the discounted number of years Cistercian and Franciscan houses were active in the region per square km, i.e., *Culture*. For each of the 729 (3000) Cistercian (Franciscan) houses, this figure equals in year t the difference between the number of years in which the house had operated and those elapsed from its possible closure per square km if positive and zero otherwise. The discounting emphasizes the importance of the monks' presence but is immaterial to the main findings. The raw data are directly collected from Van Der Meer (1965) and Moorman (1983). As discussed above, both monastic orders assumed a key role in the accumulation of culture by organizing risk-sharing activities together with the population, proposing norms of respect and trust, monitoring their effective spread, and punishing the defectors by withdrawing their support.[20] Given the substantial homogeneity and the uniqueness of the action of the two orders (see section 2),[21] *Culture* gauges the input to the technology that transformed the citizenry's involvement with culture into evolutionary stable norms, and thus higher values of this variable should detect a stronger culture of cooperation in year t. It is worth to note here that, because of the two orders' will to keep a minimum distance between houses—e.g., 24 km in the Cistercian case [Tobin 1995, p. 74]—and their focus on initially underdeveloped and thus underpopulated areas, considering the houses' activity per capita will grossly misrepresent their diffusion.

Focusing on the Cistercians, Andersen et al. (2016) propose a similar mechanism but describe them as aimed at spreading values of hard work and thrift. Albeit consistent with Baumol (1990), this vision is at odds with the more recent and substantial historical literature discussed in section 2. In addition, the *Carta Caritatis* describes the order's members as "unprofitable [servants of] our Lord [who wish] to be of service to [our brothers,] avoid the evil of avarice [and] retain the care of their souls for the sake of charity" warning at the same

[20] Looking at one order at the time produces similar albeit more noisy estimates (see the Internet appendix). The decision to aggregate a new monastery was taken by the most prominent house within an administrative region, i.e., "province." Since this often corresponded to one of the regions r (Van Der Meer, 1965; Moorman, 1983), the empirical design is the most appropriate to match the decision units to the cross-section identifiers.

[21] For instance, Andersen et al. (2016) document that none among Benedictine, Premonstratensians, Cluniacs, and Augustinians had any economic role in forty English counties between 1377 and 1801.

time the novices to abhor social competition and accumulation of capital [Berman 2000, p. 1-23 and 93-97]. Similar provisions guided the Franciscans' activities (Daniel, 1992).

We observe over the sample a trend toward a stronger culture of cooperation whose mean, indeed, climbs from 0 in 1100 to 0.43 in 1600. The two maps at the bottom of figure 3 visualize the close relationship between the average of *Culture* over the 1000-1600 period and its present-day counterpart, i.e., *Culture-2008*. The latter is available for 89 regions and represents the first principal component extracted from the generalized trust and the importance of respect self-reported to the 2008 wave of the European Value Study.[22] Both values as well as *Culture-2008* are higher where Western monasticism was more diffuse (see the Internet appendix and section 5.5). This evidence together with the fact that *Culture* strongly correlates with an outcome-based measure of past norms of cooperation discussed below validates our measurement strategy. Crucially, *Culture* will continue to strongly correlate with *Culture-2008* should the latter also include either the strength of individualism and the importance of obedience or norms of hard-work and thrift (see Guerriero, [2015]).

5.1.2 Measuring Investment- and Risk-sharing-specific Factors

In the basic regressions, we capture the investment value with the profitability of long-distance trades by using time dummies interacted with either a binary for regions with a direct access to the Mediterranean—i.e., *Mediterranean*—or a binary for regions with a direct access to the Atlantic, i.e., *Atlantic*. Building on section 2, we expect *Mediterranean* to pick a profitability of long-distance trades higher (lower) than that captured by *Atlantic* when both binaries are interacted with 1000-1300 (1350-1600) dummies and thus to gauge a fall in λ_I from high to intermediate values when interacted with 1350-1600 dummies. The gist of the empirical exercise will be similar (see the Internet appendix), should we employ instead: 1. *Trade-East*, which is the average of the sea distances between the major region harbor and Istanbul and the major region harbor and Alexandria if the region has a direct access to the Mediterranean and 0 otherwise; 2. *Trade-West*, which is the average of the sea distances between the major region harbor and Havana and the major region harbor and Cape Town

[22] The former (latter) is the share of answers "most people can be trusted" to the question "generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" (mentioning "tolerance and respect for other people" as important qualities children should be encouraged to learn). The average number of respondents in each region is 313 and the median 167.

if the region has a direct access to the Atlantic or 0 otherwise. We consider major harbors those with the highest population according to Bairoch et al. (1988). Since *Trade-East* and *Trade-West* rise with the distance from the major trade hubs (Brady et al., 1994), they measure the difficulty to observe long-distance trades (Fleck and Hanssen, 2006).

Turning to the severity of consumption risk, we follow Durante (2010), and we proxy it with the standard deviation of the spring-summer temperature in the half-century before each observation, i.e., *Temperature-SD*. The raw data are collected from Guiot et al. (2010), are in 5-degree grid format, and cover most of the European surface over the 600-2000 period.[23] Each observation is "reconstructed" from a multiplicity of indirect proxies such as tree-rings, ice cores, pollens, and indexed climate series based on historical documents. To the best of our knowledge, this dataset is the only one estimating the European climate at the within-country level before 1500. To compute *Temperature-SD* for region r at time t, we first calculate the standard deviation of the growing season temperature over the 50 years before t for all the cells—even partially—part of region r. Next, we get the average across the cells weighted by each cell relative contribution to region r land area. We follow the same procedure for the other variables measured at the cell level. *Temperature-SD* was on average significantly higher over the 1000-1600 period than it was between 600 and 950—i.e., 0.45 versus 0.39—and does not show dependence over time according to the canonical serial correlation tests. Thus, we do not correct the estimates for serial correlation in the residuals. Even if substantial however, climate risk within the sample is smaller than outside it (see figure 4). Indeed, not only the maximum value of *Temperature-SD* averaged over the 1000-1600 period—i.e., *Temperature-SD-1000-1600*—in the cells part of the regions we consider is much lower than the maximum value of *Temperature-SD-1000-1600* in all the cells analyzed by Guiot et al. (2010)—i.e., 0.72 versus 1.12, but also the mean value of *Temperature-SD-1000-1600* in the former cells is significantly—at 5%—lower than that in the latter cells, i.e., 0.47 versus 0.52. Hence, λ_R was not too large in the sample, and thus we should

[23] We do not consider Azores, Madeira, and Canarias because not covered by the Guiot et al.'s (2010) dataset. Disregarding also the regions only partially covered produces qualitatively similar results. Finally, we keep out from our empirical exercise the Scandinavian regions and those east of Poland and Slovakia and south-east of Hungary and Slovenia even if examined by Guiot et al. (2010) for two reasons. First, there are insufficient data on the rest of the medieval polities to which they belonged. Second, Western monasticism did not spread in these regions because of the opposition of the Orthodox Church [Tobin 1995, p. 144].

observe mainly the increasing part of the climate risk-culture link. Higher resolution gridded data on temperature and rainfall have been devised for the post-1500 period building on instrumental sources, but they are much less accurate than reconstructed data in describing the pre-1800 variation since the number of climate stations declines exponentially going back to the beginning of the 19th century (Guiot et al., 2010). Incorporating these data into our test makes the estimates of the role of λ_R more noisy (see the Internet appendix).[24]

A glance at figure 3 and the left map of figure 5, which depicts the sizable variation in *Temperature-SD-1000-1600*, reveals that the model testable predictions are confirmed by the data. In the following, we verify this idea by turning to multivariate analysis.

5.2 Estimating Equation and Basic Results

We evaluate the model testable predictions by running panel regressions of the form

$$Y_{r,t} = \alpha_r + \beta_t + \gamma' \mathbf{x}_{r,t} + \delta' \mathbf{z}_{r,t} + \varepsilon_{r,t}, \tag{2}$$

where $Y_{r,t}$ is either *Democracy* or *Culture* in region r at time t. α_r are region fixed effects controlling for time-independent determinants of $Y_{r,t}$ as other geographic traits—e.g., the regional farming sector dependence on irrigation, which has been linked to the elite's ability to monopolize water and in turn power (Bentzen et al., 2015), the land suitability for cultivation, which makes less salient public agricultural infrastructures and in turn might discourage cooperation (Litina, 2016), other farming inputs, and the distance to either the coast, navigable rivers, the nearest technological frontier, or the Cistercians' and Franciscans' mother houses—and pre-determined shocks like the out of Africa exodus of humankind and the consecutive agricultural revolution. While indeed Ashraf and Galor (2013) document that the prehistoric migratory distance from East Africa drove the genetic diversity inherited by parental colonies and so their generalized trust, Olsson and Paik (2015) suggest that societies that made an early transition to agriculture in the Neolithic display stronger patriarchal values and so less inclusive political institutions. β_t are time dummies picking up regional macro-shocks as the Black Death, which modulated the population's incentive to

[24] Over the 16th century, the average volatility of the Luterbacher et al.'s (2004) growing season temperature, which is estimated building on instrumental data, is nine times bigger than that of the Guiot et al.'s (2010) reconstructions, which are specifically tailored to preserve a meaningful comparison over time.

trade and so escape the Malthusian trap (Voigtländer and Voth, 2009). $\mathbf{x}_{r,t}$ gathers *Mediterranean* interacted with β_t, *Atlantic* multiplied by β_t, *Temperature-SD*, and, if $Y_{r,t}$ is *Culture*, *Temperature-SD* squared. This last term reckons with the nonlinear relationship between culture and risk-sharing needs proposed by proposition 1. Finally, $\mathbf{z}_{r,t}$ possibly incorporates the other covariates introduced below and, to exclude that a change in the average climate is biasing our results, always the mean spring-summer temperature over the previous 50 years in Celsius anomalies relative to the 1961-1990 mean (Guiot et al., 2010), i.e., *Temperature-A*.

We do not estimate each pair of equations with dependent variables *Democracy* and *Culture* as a system since we cannot reject, never at a level lower than 0.23, the null hypothesis of the Breusch-Pagan test that the residuals of each pair are uncorrelated. In addition, *Culture* (*Democracy*) is insignificant when included in the specifications with dependent variable *Democracy* (*Culture*) (see the Internet appendix). This confirms the key model insight that formal and informal institutions interact only through activity-specific factors. Finally, to allow for the within-region correlation in $\varepsilon_{r,t}$ possibly driven by the Western monasticism diffusion patterns, we cluster the standard errors at the regional level. In addition, we document that our results will be similar should we deal with the spatial dependence in $\varepsilon_{r,t}$ possibly produced by the relative coarse resolution of climate data by relying on either the Driscoll-Kraay or the Conley (1999) standard errors (see the Internet appendix).

Columns (1) and (2) of table 8 display the estimates relative to the basic specifications controlling for *Temperature-A* only. The estimated coefficients are consistent with the model predictions, and the implied effects are large. In particular, regions having a direct access to the Mediterranean and, in turn, to the Silk Road sustained before 1350 the fastest democratization process, whereas bordering the coast had no statistically significant direct effect on democratization thereafter. To illustrate, *Mediterranean* induced a significant—at 10% or better—rise of roughly one-standard deviation in the inclusiveness of regional political institutions for each half-century between 1100 and 1250, whereas *Atlantic* interacted with time dummies is insignificant in explaining *Democracy* (see column (1)). This evidence implies a primacy of the Mediterranean over the Atlantic trades as institutional driver and is thus at odds with Acemoglu et al. (2005) but consistent with the relevance of the commitment dimension of the citizenry's cultural accumulation identified by our model. With the opening

of the Atlantic routes indeed, the Mediterranean polities were able to preserve political institutions, whose inclusiveness was not too different from that of the political process of the rising Atlantic polities, by gaining a remarkable level of culture and so committing to future cooperation. Having a direct access to the Mediterranean implied indeed a significant—at 5% or better—increase in *Culture* rising from 0.4-standard deviation in 1350 to 2.6-standard deviation in 1600 (see column (2)). Finally, cultural accumulation had an inverted U-shaped relationship with climate volatility, which however did not affect democratization. Consistent with section 5.1.2 analysis, the coefficient on *Temperature-SD* is positive and significant at 5%, whereas that on *Temperature-SD*^{2} is negative but only marginally significant.[25]

5.3 Identifying Causal Relationships

We pursue a three-step strategy to evaluate if the relationships we have uncovered so far are causal. First, we control for relevant confounders. Second, we use selection on these observables to assess the bias from unobservables. Finally, we perform a placebo test of the link between medieval climate volatility and present-day culture in Turkey.

5.3.1 Controlling for Observables

We consider the observable factors that, according to the extant literature, are more likely to affect institutional evolution in the sample and we excluded from the basic specifications. The first one is the terrain ruggedness—i.e., *Ruggedness*—interacted with the time dummies. The raw data are retrieved from the G-Econ dataset, which is in 1-degree grid format and covers the world surface. The right map of figure 5 exhibits the considerable dissimilarities in *Ruggedness* across administrative regions. *Ruggedness* picks up the difficulty to observe the investments in new farming technologies that flourished in Europe from the 11th century on (see section 2). To elaborate, the central driver of the Medieval agriculture revolution was the diffusion of the heavy plow, which required as many as eight oxen to pull it and forced the peasants to combine their ox teams and split their lands into interspersed strips to ensure a more fair plowing (Slocum, 2005). As a result, the elite's returns on such a complex investment were larger the more difficult were its monitoring and the plowing itself. Next, we consider the share of previous century in which each region partook in

[25]The marginal effect of a rise in *Temperature-SD* evaluated at its mean equals 0.238 and is significant at 1%.

external wars (Acemoglu et al., 2005), i.e., *Wars*. According to Besley and Persson (2009), common interest public goods, such as fighting external wars, contribute to institutional development. Finally, we control for the "modernization" effect development can have on (in)formal institutions by including the regional urban potential calculated using the cities in the sample with more than 5,000 inhabitants for at least a t (Bairoch et al., 1988), i.e., *Urbanization*. The urban potential of city c is the average of the population of all the other cities in the sample weighted by each city distance from c (de Vries, 1984), whereas that of region r adds up the urban potential of all the cities in the region. Assigning a weight zero to the cities outside the region to which c belongs or considering the population density, which is available from the HYDE 3.1 dataset, delivers similar results (see the Internet appendix).

Estimating equation (2) when $\mathbf{z}_{r,t}$ includes either one at the time or all together the regressors just introduced delivers the results reported in columns (3) to (10) of table 8. The model predictions continue to be supported by the data. In addition, *Wars* is never significant, the coefficients attached to *Ruggedness* interacted with β_t imply a positive significant impact of the difficulty to observe farming investments on *Democracy*, and *Urbanization* is significant only in columns (8) and (10). This last pattern is consistent with Andersen et al. (2016) and a primacy of culture in promoting development (Guerriero, 2015).

5.3.2 Using Selection on Observables to Assess the Bias from Unobservables

Despite our attempts to control for the key drivers of (in)formal institutions discussed by the extant literature, the estimates presented so far may still be biased by unobservable factors. To evaluate this issue, we calculate the index proposed by Altonji et al. (2005) to measure how much stronger selection on unobservables, relative to selection on observables, must be to explain away the entire estimated effect.[26] To see how the index is calculated, consider a regression with a restricted set of control variables and one with a full set of controls. Next, denote the estimate of the coefficient attached to the variable of interest from the first regression γ^R, where R stands for "restricted," and that from the second regression γ^F, where F stands for "full." Then, the index is the absolute value of $\gamma^F/(\gamma^R - \gamma^F)$. The intuition behind the formula is as follows. The lower the absolute value of $(\gamma^R - \gamma^F)$ is, the less the estimate of the coefficient attached to the variable of interest is affected by selection

[26] We use the version developed by Bellows and Miguel (2009) for possibly endogenous continuous variables.

on observables, and the stronger selection on unobservables needs to be to explain away the entire effect. Moreover, the higher the absolute value of γ^F is, the greater is the effect that needs to be explained away by selection on unobservables, and thus the higher is the index.

In columns (1) and (2) (columns (3) and (4)) of table 9, we consider the specification including in $\mathbf{z}_{r,t}$ only *Temperature-A* as the restricted regression and that including in $\mathbf{z}_{r,t}$ also *Wars* and *Urbanization* (*Wars*, *Urbanization*, and *Ruggedness* interacted with β_t) as the full regression. The indexes calculated from the specifications with dependent variable *Democracy* (*Culture*) are listed in columns (1) and (3) (columns (2) and (4)). We focus on the variables evaluating the model testable predictions, which also display the most significant coefficients in table 8. The median and average indexes in column (3) (column (4)) of table 9 are 3 and 27.3 (11.5 and 35.5). Hence, to attribute the entire estimate to selection effects, selection on unobservables would have to be on average almost 31 times greater than selection on all observables. Given the high fit of the regressions, it is then unlikely that the effects of geography on (in)formal institutions are driven by unobserved heterogeneity.

5.3.3 Falsification Test

Consistent with the persistence of a culture of cooperation documented above, there is a positive and significant relationship between *Temperature-SD-1000-1600* and *Culture-2008* in the sample and, conditional on *Mediterranean*, *Atlantic*, and a constant term, the estimated OLS coefficient equals 0.646 with a t-statistic of 2.36 (see left graph of figure 6). European populations that were more exposed to the risk of harvest destruction accumulated a stronger culture of cooperation, and today their descendants are more cooperative. Our identification strategy rests on the assumption that risk-sharing is the only channel through which medieval climate volatility shaped past culture. If this is true, then a positive link between the volatility of the medieval growing season temperature and present-day norms of respect and trust should not exist where the cost of accumulating culture was prohibitive. This was the case of Turkey, where first the 1058 East-West Schism and then the rise of the Ottoman empire blocked both the Cistercian and the Franciscan penetration.[27] While indeed the Eastern Orthodox church required that monks shied away from any involvement with

[27] Van Der Meer (1965) (Moorman, 1983) reports only one (six) Cistercian (Franciscan) house(s)—i.e., Istanbul (Beyoğlu, Istanbul, Izmir, Samsun, Sinop, and Trabzon)—active over the 1000-1600 period.

the worshipers' life [Tobin 1995, p. 144], Islam considers monasticism an excessive austere practice that should therefore be discouraged (The Qur'an, 57.27).[28] To test whether there is no link between medieval climate volatility and present-day culture of cooperation in Turkey, we build on the sources detailed above and we consider the 28 Turkish NUTS 3 regions for which *Culture-2008* is observable. For this sample, we document a positive but insignificant relationship between *Temperature-SD-1000-1600* and *Culture-2008* (see right graph of figure 6). Conditional on *Mediterranean* and a constant term indeed, the estimated OLS coefficient is 7.707 with a t-statistic of 0.62. This evidence emphasizes the importance of identifying the mechanisms linking activity-specific factors to institutional evolution.

5.4 A Closer Look at the Commitment Dimension

Figure 7 illustrates the mechanism behind the aforementioned relevance of the commitment dimension of the citizenry's cultural accumulation (see section 5.2). In the post 1350-sample, *Culture* rose sharply in the Mediterranean regions despite the stability of their climate volatility (see central and leftmost maps of figure 7). Thank to this over-accumulation of culture, the inclusiveness of political institutions fell less in the Mediterranean than in the inland regions (see rightmost map of figure 7). As seen above, the innovation that most entrenched the citizenry's credibility was the spread of the *Monte* from 1431 onwards.

To deepen our understanding of this historical juncture, we look at the Italian regions between 1400 and 1600 being this the sub-sample with most available information, we constrain the intercepts of the OLS regressions to be common across regions because of the limited degrees of freedom, and we construct a third dependent variable as the number of years *Monti di Pietà* and *Monti Frumentari* were active per square km (Montanari, 1999; Avallone, 2007), i.e., *Monti*. Since a pawnshop survives only when loans are paid back, *Monti* captures the likelihood of successful risk-sharing activities. Hence, it is an outcome-based measure of past culture just as the electoral turnout and the blood donations are of present-day culture (Guiso et al., 2004), and indeed its correlation with *Culture* is 0.8.

Table 10 reveals that more inclusive political institutions were safeguarded in those coastal regions, like Liguria, Toscana, and Veneto, where climate volatility was sufficiently

[28] The Islamic ban on interest-based debt contracts has favored forms of family-grounded risk-sharing, discouraging at the same time alternative providers similar to the monastic orders (Askari and Mirakhor, 2014).

high (see columns (1) and (4)). In these areas, the opening of the Atlantic routes shrank the investment value—i.e., *Mediterranean*—from high to intermediate, relative to the severity of consumption risk *Temperature-SD*, values seriously threatening democratization and so significantly increasing both *Culture* and *Monti* (see columns (2), (3), (5) and (6)). The two measures of culture have again an inverted U-shaped relationship with climate risk.

5.5 Persistent (In)Formal Institutions

The medieval institutional revolution discussed so far has shaped Europe to date as revealed by the cross-regions analysis of the determinants of *Democracy-1950-2010* and *Culture-2008* in table 11. Because of the limited within-country variation due to the removal of the time dimension, we again constrain the intercepts of these regressions to be common across regions. In a nutshell, both past (in)formal institutions and their geographic determinants are powerful predictors of present-day (in)formal institutions, and geography enters the regressions in a separable way, whereby the forces shaping the investment value affect mainly the inclusiveness of political institutions (see column (3)), and the factors modulating the severity of consumption risk determine only culture (see column (4)).

Two remarks are key at this point. First, the persistence of a culture of cooperation holds in the data even after incorporating in the specification those observables that capture the other ways through which Western monasticism has shaped modern economies, i.e., present-day human capital, strength of Catholic beliefs, and financial development, which picks up the expansion of credit markets driven by the spread of the *Monte* (see the Internet appendix). Second, the evidence summarized in table 11 suggests a novel instrumental variables approach to separately estimate the effect of each of the two institutions on development. Embracing this strategy, Guerriero (2015) shows not only that the first stages illustrated in this section remain strong when the cross-section identifiers are 120km $\times$ 120km grids instead of the regions and one controls for country fixed effects but also that only a culture of cooperation has a first order effect on economic development.

6 Concluding Comments

Despite the relevance of inclusive political institutions and a culture of cooperation in

shaping the economy is well known, we still lack a framework that identifies their origins and interaction. In the present paper, we developed and tested a theory of "endogenous (in)formal institutions" based on risk-sharing needs and inefficiencies in public good production.

We close by highlighting avenues for further research. First, an open issue is the identification of the more recent factors, like extractive policies (de Oliveira and Guerriero, 2016) and resource windfalls (Caselli and Tesei, 2016), shaping present-day (in)formal institutions. Since our analysis reveals that the correlations between past and present-day institutions are strong but not perfect, this inquiry can shed light on the present-day institutional variation unexplained by medieval shocks and further clarify that the evidence we unravel is not one of institutional traps. Second, a relevant empirical extension to our analysis is to test the relationships between taxation and culture uncovered by our model. In particular, it suggests that the citizenry selects a tax rate fostering democratization and investment and thus falling with his cultural accumulation and rising with the elite's culture. Finally, the correlation between past formal and informal institutions created by the commitment dimension together with their persistence produces first-stage relationships between past political infrastructures and both present-day democracy and culture (Tabellini, 2010; Guiso et al., 2016). These however are not distinct and cannot be defended as exclusion restrictions given our results. Hence, a key research agenda is to employ medieval geography to unbundle the effects of both present-day inclusive political institutions and culture on today development through a multiple instrumental variables approach (see Guerriero, [2015]). This is particularly relevant in this day and age if one wants to assess whether the negative short-run impact of epochal crises on markets can be offset by their positive long-run effects on institutions.

Appendix

Proof of Lemma

The constrained maximization in equation (1) implies that $s_D^* = \max\{s \in [0,1] \mid \theta_e u(s\lambda_I) + (1-s)\lambda_I \geq RHS\}$. Hence, $s_D^* = 1$ if constraint (I_e) is slack and $s_D^* < 1$ otherwise. In the second case, the citizen maximizes $u(s_D\lambda_I) + \nu[\theta_e u(s_D\lambda_I) + (1-s_D)\lambda_I - RHS]$, with $\nu > 0$. RHS equals $f - d_e$ if $d_e, d_c < \lambda_R$; $f - d_e + \lambda_R$ if $d_e < \lambda_R \leq d_c$; $f - \lambda_R$ if $d_c < \lambda_R \leq d_e$; f if $d_e, d_c \geq \lambda_R$. Thus, the Topkis' (1998) theorem entails that s_D^* is nondecreasing with λ_R and d_e and, if $d_e, d_c \leq \lambda_R$, $s_D^*(d_e, x) = s_D^*(d_e, y) > s_D^*(d_e, w) = s_D^*(d_e, z)$, $\forall x \neq y, z \neq w$ such that $y \vee x < \lambda_R \leq z \wedge w$. □

Proof of Proposition 1

We first partition the range of λ_I according to its relative magnitude with respect to λ_R, building on constraints (I_e) and (I_c), and then we study the choices of d_e^* and d_c^* through this partition. Note that: 1. $RHS \in \left[f - \tilde{d}, f + \tilde{d}\right]$, since d_e is at most λ_R for $\lambda_R \geq 1$ and at most 1 for $\lambda_R < 1$; 2. if $\theta_e u(\lambda_I) \geq f$ then a fortiori $u(\lambda_I) \geq f$, and both constraints hold for $s_D^* = 1$; 3. $s_D^* < 1$ whenever $\theta_e u'(\lambda_I) < 1 - \nu^{-1} u'(\lambda_I) < 1$. As aforementioned, $\widehat{d}$ is the minimum d_c satisfying constraint (I_c).

(A) For $\lambda_I < \tilde{\lambda}_I \equiv \min\left\{\lambda_I \mid \theta_e u(\lambda_I) < f - \overline{\lambda}, \theta_e u'(\lambda_I) \geq 1\right\}$,[29] $\pi_{I,e,D,c}$ rises with s_D and thus the elite would accept $s_D^* = 1$, but investment does not materialize because constraint (I_e) fails even when $d_c < \lambda_R \leq d_e$ and $\lambda_R = \overline{\lambda}$, and thus RHS is the smallest possible. Hence, d_e^* maximizes $U_{e,A} = \mu\pi_{R,e,A,e} + (1-\mu)\pi_{R,e,A,c} - d_e^2/2$ and is either μ, $\tilde{d}$, or 0. The comparison among the possible $U_{e,A}$ values implies that $d_e^* = 1\,(0)$ for $\lambda_R \leq (>) \frac{1}{2(1-\mu)} \in [1/2, 1)$ whether $d_c \geq \lambda_R$ or not and that the elite prefers to always cooperate and be cheated by an uncooperative citizen to cooperating with her own kind only. d_c^* maximizes $U_{c,A} = \mu\pi_{R,c,A,e} + (1-\mu)\pi_{R,c,A,c} - d_c^2/2$ and is either $1-\mu$, $\tilde{d}$, or 0. Then, $d_c^* = \tilde{d}\,(0)$ for $\lambda_R \leq (>) 2(1-\mu)$ whether $d_e \geq \lambda_R$ or not and the citizen prefers to always cooperate and be cheated by an uncooperative elite to cooperating with his own kind only.

(B) For $\lambda_I \geq u^{-1}\left(\frac{f+\lambda_R}{\theta_e}\right) \Leftrightarrow \theta_e u(\lambda_I) > f + \lambda_R$, investment always takes place because it delivers a payoff larger than the largest payoff from risk-sharing. Hence, each group decides between building a culture that maximizes only the investment payoff and one that induces also within-group cooperation in risk-sharing. Accordingly, no one cares about the culture of a different type. The optimal cooperative d_e is $\arg\max_{d_e \geq \lambda_R} U_{e,D} = \mu d_e + (1-\mu)[\theta_e u(\lambda_I) + d_e - f] - \frac{d_e^2}{2} = \tilde{d}\,(1-\mu)$ for $\lambda_R \leq (>) 1 + \sqrt{2\mu - \mu^2}$. Similarly, the optimal uncooperative d_e maximizes $(1-\mu)[\theta_e u(\lambda_I) + d_e - f] - \frac{d_e^2}{2}$ and equals $1 - \mu\,(0)$ for $\lambda_R \leq (>) 1 - \mu$. The citizen faces a completely similar problem, and

[29] For $\theta_e u'(\lambda_I) < 1$, it can be the case that $\theta_e u(s_D^*\lambda_I) + (1 - s_D^*)\lambda_I > f - \overline{\lambda} > \theta_e u(\lambda_I)$ with $s_D^* < 1$.

the cooperative d_c^* is $\tilde{d}(\mu)$ for $\lambda_R \leq (>) 1 + \sqrt{1-\mu^2}$, while the uncooperative one is $\mu(0)$ for $\lambda_R \leq (>) \mu$. Since cooperation is more appealing than cheating, the elite picks $d_e^* = \tilde{d}(1-\mu)$ for $\lambda_R \leq (>) 1 + \sqrt{2\mu - \mu^2}$, and the citizen sets $d_c^* = \tilde{d}(\mu)$ for $\lambda_R \leq (>) 1 + \sqrt{1-\mu^2}$.

In the remaining sub-ranges of λ_I, investment can fail because either constraint (I_e) or (I_c) is violated. This happens since one of the following four circumstances realizes:

(i) $\lambda_I < u^{-1}(f - d_c)$;

(ii) $\theta_e u(\lambda_I) < RHS$, $\exists s \in (0,1)$ such that $\theta_e u(s\lambda_I) + (1-s)\lambda_I = RHS$, but the citizen's expected investment payoff is not worth the cost of building $\widehat{d}$ to assure that constraint (I_c) holds;

(iii) $\theta_e u'(\lambda_I) \geq 1$ and $\theta_e u(\lambda_I) < RHS$;

(iv) $\theta_e u'(\lambda_I) < 1$ and $\theta_e u(\widehat{s}\lambda_I) + (1-\widehat{s})\lambda_I < RHS$, where $\theta_e u'(\widehat{s}\lambda_I) = 1$.

Violations of constraint (I_c) captured by conditions (i) and (ii) realize when there is too little investment value to induce the citizen's cooperation. Condition (iii), on the other hand, entails that although spending the entire λ_I on public good production is the most efficient way of gaining the elite's support, its level is too low to assure that constraint (I_e) is met. Finally, condition (iv) means that the elite cannot be convinced to select investment even if $\nu \to \infty$ and so $s_D^* \to \widehat{s}$, which is her preferred sharing rule. If one among conditions (i)-(iv) holds, d_e^* and d_c^* are as in range (A). Next, we look at the cases in which investment goes through since none of the condition prevails.

(C) For $u^{-1}\left(\frac{f+\lambda_R}{\theta_e}\right) > \lambda_I \geq u^{-1}\left(\frac{f}{\theta_e}\right) \Leftrightarrow f \leq \theta_e u(\lambda_I) < f + \lambda_R$, when the citizen is uncooperative then constraint (I_e) is slack since the elite's payoff from risk-sharing is at most 0. Thus, d_e^* is as in range (B). If instead $d_c \geq \lambda_R$, constraint (I_e) is slack whenever the elite is cooperative and binding otherwise. There are therefore two sub-cases. If $\theta_e u(\lambda_I) < f + \lambda_R - (1-\mu)$, choosing a nonzero uncooperative d_e makes the elite's utility negative, and thus $d_e^* \in \left\{0, \tilde{d}\right\}$. For $\lambda_R > 1$, $U_{e,D}(d_c \geq \lambda_R, d_e = 0) = (1-\mu)\lambda_R$ $(+)$, $U_{e,D}(d_c \geq \lambda_R, d_e = \lambda_R) = \lambda_R + (1-\mu)[\theta_e u(\lambda_I) - f] - \frac{\lambda_R^2}{2}$ $(++)$, and thus $d_e^* = \lambda_R(0)$ $\forall 1 < \lambda_R \leq (>) \mu + \sqrt{\mu^2 + 2(1-\mu)[\theta_e u(\lambda_I) - f]}$. For $\lambda_R \leq 1$, $U_{e,D}(d_c \geq \lambda_R, d_e = 1) = (1-\mu)[\theta_e u(\lambda_I) - f] + \frac{1}{2}$, which compared with $(+)$ implies that $d_e^* = 1(0)$ for $\lambda_R \leq (>) \min\left\{1, \theta_e u(\lambda_I) - f + \frac{1}{2(1-\mu)}\right\}$. If $f + \lambda_R - (1-\mu) \leq \theta_e u(\lambda_I) < f + \lambda_R$, the elite also considers $d_e = 1 - \mu$, which maximizes the investment payoff only. This possibility opens two other scenarios: (a) $d_e^* \in \{0, 1-\mu, \lambda_R\}$ for $1 < \lambda_R$; (b) $d_e^* \in \{0, 1\}$ for $1 \geq \lambda_R$. Under scenario (a), $U_{e,D}(d_c \geq \lambda_R, d_e = 1-\mu) = (1-\mu)[\theta_e u(\lambda_I) - f] + \frac{(1-\mu)^2}{2}$, which compared with $(+)$ and $(++)$ implies that the elite prefers $\lambda_R(1-\mu)$ to $1 - \mu(\lambda_R)$ for $\lambda_R \leq (>) 1 + \sqrt{2\mu - \mu^2}$; $\lambda_R(0)$ to $0(\lambda_R)$ for $\lambda_R \leq (>) \mu + \sqrt{\mu^2 + 2(1-\mu)[\theta_e u(\lambda_I) - f]}$; $1 - \mu(0)$ to $0(1-\mu)$ for $\lambda_R \leq (>) \theta_e u(\lambda_I) - f + \frac{1-\mu}{2}$. For $\mu \to 0$, the first threshold tends to 1, whereas

the second one is greater than 1, and thus $d_e^* = \lambda_R(0)$ for λ_R sufficiently small (large). Under scenario (b), $d_e^* = 1(0)$ for $\lambda_R \leq (>) \min\left\{1, \theta_e u(\lambda_I) - f + \frac{1}{2(1-\mu)}\right\}$. Turning to the citizen, if $d_e \geq \lambda_R$ then $d_c^* = \tilde{d}(\mu)$ for $\lambda_R \leq (>) 1 + \sqrt{1-\mu^2}$. If $d_e^* < \lambda_R \leq d_c^*$, the equilibrium sharing rule s_1 is lower than 1 and defined by $\theta_e u(s_1\lambda_I) + (1-s_1)\lambda_I + d_e^* - f = \lambda_R$. If $\widehat{d}(s_1) \leq \lambda_R$, the citizen gains $\tilde{d} - \frac{\tilde{d}^2}{2} + \mu u(s_1\lambda_I)$ $(\max\left\{\frac{\mu^2}{2}, \mu\widehat{d}(s_1) - \frac{\widehat{d}(s_1)^2}{2}\right\} + \mu u(\lambda_I))$ from selecting $d_c = \tilde{d}$ $(\max\left\{\mu, \widehat{d}(s_1)\right\})$. Thus, $d_c^* = \tilde{d}\left(\max\left\{\mu, \widehat{d}(s_1)\right\}\right)$ if $\tilde{d} \in (1-q_1, 1+q_1)$ (otherwise) with $q_1 \equiv \sqrt{1 - 2\mu\left[u(\lambda_I) - u(s_1\lambda_I)\right] - \max\left\{\mu^2, 2\mu\widehat{d}(s_1) - \widehat{d}(s_1)^2\right\}}$. If $\widehat{d}(s_1) > \lambda_R$, the pertinent utilities are $U_{c,D}\left(\widehat{d}(s_1), d_e < \lambda_R\right) = \mu f + (1-\mu)\widehat{d}(s_1) - \frac{\widehat{d}(s_1)^2}{2}$, where the binding constraint (I_c) is substituted, and $U_{c,D}(\mu, d_e < \lambda_R) = \mu u(\lambda_I) + \frac{\mu^2}{2}$. Thus, $d_c^* = \widehat{d}(s_1)(\mu)$ if $\widehat{d}(s_1) \leq (>) 1 - \mu + \sqrt{(1-\mu)^2 - 2\mu\left[u(\lambda_I) - f\right] - \mu^2}$ or $\lambda_R \leq (>) \tilde{\lambda}_R$ being $\frac{d\widehat{d}}{ds_1} < 0$ and $\frac{ds_1}{d\lambda_R} < 0$. The citizen's cooperation for λ_R large can raise the elite's risk-sharing payoff so much that s_D^* becomes so little to force the former to build a culture surpassing $\tilde{d}$ to make constraint (I_c) hold.

(D) For $u^{-1}\left(\frac{f}{\theta_e}\right) > \lambda_I \geq u^{-1}\left(\frac{f-\lambda_R}{\theta_e}\right) \Leftrightarrow f - \lambda_R \leq \theta_e u(\lambda_I) < f$, when the elite is uncooperative then constraint (I_e) binds. In this case, $d_e^* = 1-\mu$ is not an option, and the equilibrium sharing rule s_2 is lower than 1 and defined by $\theta_e u(s_2\lambda_I) + (1-s_2)\lambda_I - f = \lambda_R$. If $d_c \geq \lambda_R$, $U_{e,D}\left(d_c \geq \lambda_R, \tilde{d}\right) = \tilde{d} + (1-\mu)\left[\theta_e u(\lambda_I) - f\right] - \frac{\left(\tilde{d}\right)^2}{2}$ and $U_{e,D}(d_c \geq \lambda_R, 0) = (1-\mu)\lambda_R$ since constraint (I_e) always binds. Thus, $d_e^* = 1(0)$ for $\lambda_R \leq (>) \min\left\{1, \theta_e u(\lambda_I) - f + \frac{1}{2(1-\mu)}\right\}$, and $d_e^* = \lambda_R(0)$ $\forall 1 < \lambda_R \leq (>) \mu + \sqrt{\mu^2 + 2(1-\mu)\left[\theta_e u(\lambda_I) - f\right]}$. If $d_c < \lambda_R$, $U_{e,D}(d_c < \lambda_R, 0) = 0$ and $U_{e,D}(d_c < \lambda_R, d_e \geq \lambda_R) = \mu\tilde{d} + (1-\mu)\left[\theta_e u(\lambda_I) + \tilde{d} - f\right] - \frac{\tilde{d}^2}{2}$, and thus the elite sets $d_e^* = 1(0)$ for $\lambda_R \leq (>) \min\left\{1, \frac{1}{2(1-\mu)}\right\}$ and $d_e^* = \lambda_R(0)$ $\forall 1 < \lambda_R \leq (>) 1 + \sqrt{1 - 2(1-\mu)\left[f - \theta_e u(\lambda_I)\right]}$. This suggests that the elite is likely uncooperative. For $d_e \geq \lambda_R$, the citizen can maximize his investment payoff by withholding cooperation since constraint (I_e) is slack for $d_e \geq \lambda_R > d_c$. Thus, $d_c^* = \mu(0)$ for $\lambda_R > (\leq) \mu$. In the most likely case of an uncooperative elite, there are two scenarios. If $\widehat{d}(s_2) \geq \lambda_R$ or correspondingly $\lambda_R \geq \tilde{\tilde{\lambda}}_R$, the citizen's choice of culture equals $\widehat{d}(s_2)$ when affordable and maximizes the risk-sharing payoff otherwise. If instead $\widehat{d}(s_2) < \lambda_R$, the citizen can turn uncooperative by selecting $\widehat{d}(s_2)$.

(E) For $\tilde{\lambda}_I \leq \lambda_I < u^{-1}\left(\frac{f-\lambda_R}{\theta_e}\right)$, a feasible investment and risk-sharing bring to the elite the same payoff. Hence, the choices of culture are as in range (D) when the constraint (I_e) binds.

For what finally concerns the relationship between s_D^* and λ_I, the relevant cases are ranges (C), (D), and (E), where $s_D^* \in (0,1)$. In these three scenarios, d_e^* (d_c^*) weakly increases (decreases) with λ_I, and thus RHS weakly falls with λ_I. Therefore, the sharing rule s_D^* weakly rises with λ_I. $\square$

Proof of Proposition 2

Democracy cannot take place in range (A) but arises for sure in range (B) since constraints (I_c) and (I_e) hold being $\lambda_I > u^{-1}\left(\frac{f+\lambda_R}{\theta_e}\right) > u^{-1}(f)$. In the other ranges, it prevails except if one among conditions (i)-(iv) holds. While the first two suggest that a small λ_I discourages democratization, conditions (iii) and (iv) reveal that, if λ_I is not sufficiently large, a large λ_R renders investment impossible being cheating in risk-sharing too lucrative for the elite. Thus, λ_I eases democratization, and λ_R has the second order effect of hindering it for intermediate values of λ_I. □

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Figures and Tables

Figure 1: Timing

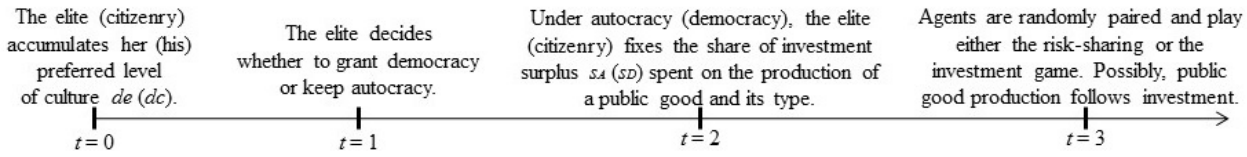


Table 1: The Risk-sharing Game When a Type i Agent Meets a Type $-i$ Agent

Type i Agent \ Type $-i$ Agent	*Cooperate*	*Non Cooperate*
Cooperate	d_i, d_{-i}	$d_i - \lambda_R, \lambda_R$
Non Cooperate	$\lambda_R, d_{-i} - \lambda_R$	$0, 0$

Table 2: The Investment Game Under Autocracy When p_e is Chosen

Citizen \ *Elite*	*Cooperate*	*Non Cooperate*
Cooperate	$\theta_c u(s_A \lambda_I) + d_c, u(s_A \lambda_I) + (1 - s_A)\lambda_I + d_e - f$	$0, 0$
Non Cooperate	$f, d_e - f$	$0, 0$

Table 3: The Investment Game Under Autocracy When p_c is Chosen

		Elite	
		Cooperate	*Non Cooperate*
Citizen	*Cooperate*	$u\left(s_A\gamma\lambda_I\right)+d_c, \theta_e u\left(s_A\gamma\lambda_I\right)+\left(1-s_A\right)\lambda_I+d_e-f$	$0,0$
	Non Cooperate	f, d_e-f	$0,0$

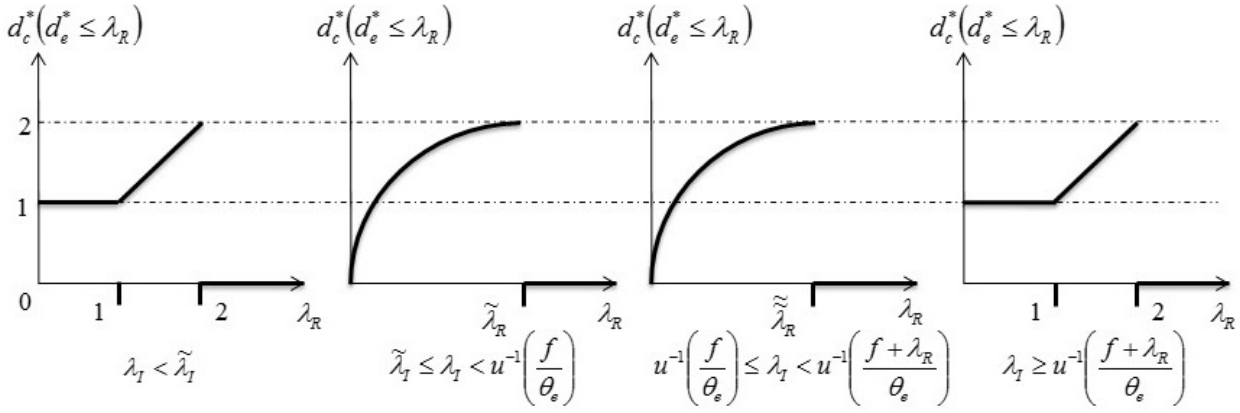
Table 4: The Investment Game Under Democracy When p_c is Chosen

		Elite	
		Cooperate	*Non Cooperate*
Citizen	*Cooperate*	$u\left(s_D\lambda_I\right)+d_c, \theta_e u\left(s_D\lambda_I\right)+\left(1-s_D\right)\lambda_I+d_e-f$	$0,0$
	Non Cooperate	f, d_e-f	$0,0$

Table 5: The Investment Game Under Democracy When p_e is Chosen

		Elite	
		Cooperate	*Non Cooperate*
Citizen	*Cooperate*	$\theta_c u\left(s_D\gamma\lambda_I\right)+d_c, u\left(s_D\gamma\lambda_I\right)+\left(1-s_D\right)\lambda_I+d_e-f$	$0,0$
	Non Cooperate	f, d_e-f	$0,0$

Figure 2: Maximal Citizen's and Average Morality for $\mu \to 0$ and $d_e^* \leq \lambda_R$



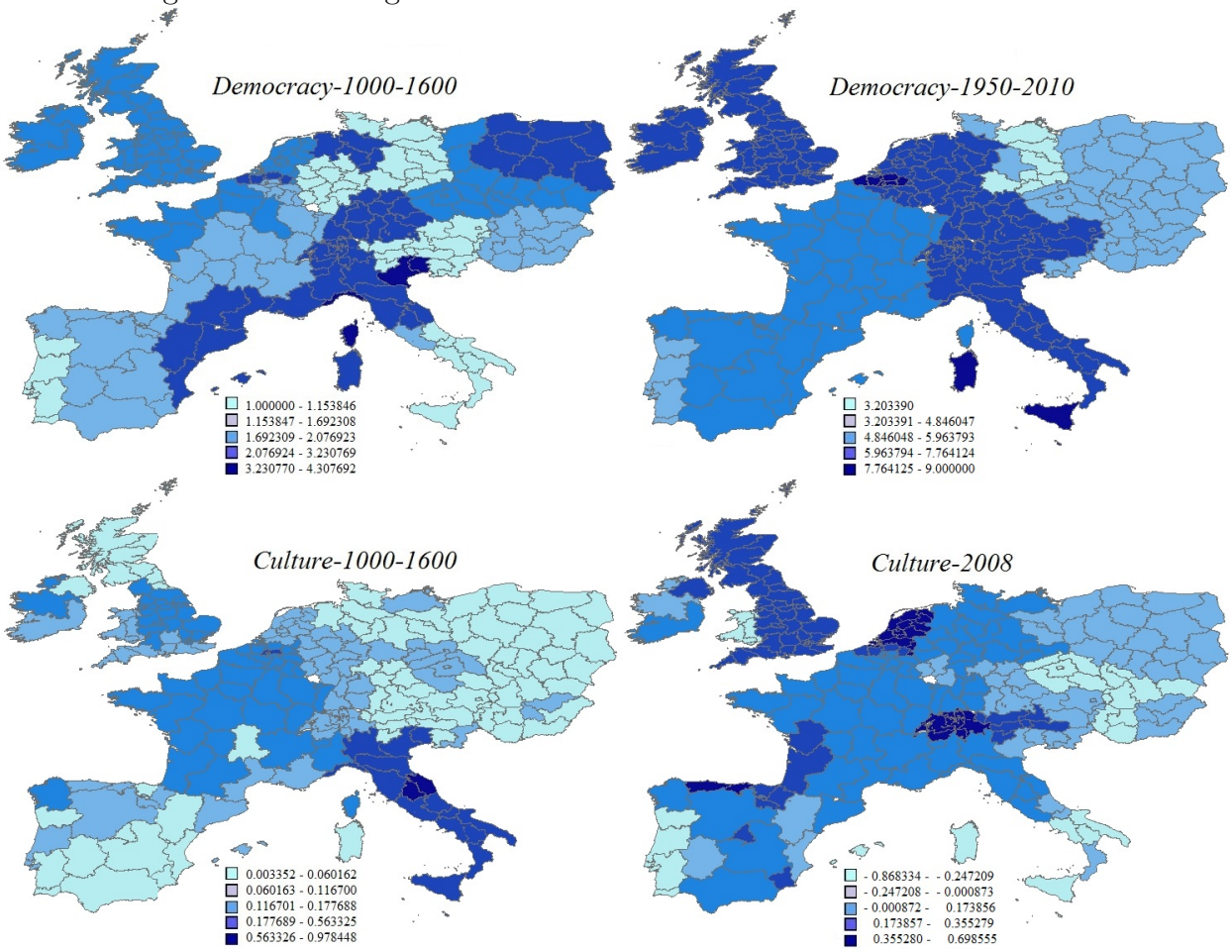
Notes: 1. To draw the graphs, we assume that investment occurs for $\lambda_I \geq \tilde{\lambda}_I$, $\mu \to 0$ and thus $d_c^* \to d^*$, $d_e^* \leq \lambda_R$.
2. $\tilde{\lambda}_I$, $\tilde{\lambda}_R$, and $\tilde{\tilde{\lambda}}_R$ are defined in the appendix.

Table 6: The Sample

GENOA: Italy (*Liguria*); France (*Corse*). HOLY ROMAN EMPIRE: Austria and Italy (*Styria*, *Tyrol - Trentino-Alto Adige*); Belgium (*Région Bruxelles*, *Région Wallone*); Germany (*Baden-Wurttemberg*, *Bayern*, *Brandenburg*, *Bremen - Hamburg - Niedersachsen*, *Hessen*, *Mecklenburg-Vorpommern*, *Nordrhein-Westfalen*, *Rheinland-Pfalz - Saarland*, *Sachsen*, *Schleswig-Holstein*, *Thüringen - Sachsen-Anhalt*); Slovenia (*Carniola*, *Styria*). KINGDOM OF BOHEMIA: Czech Republic (*East Czech Republic*, *West Czech Republic*); Poland (*South Poland*, *West Poland*). KINGDOM OF PORTUGAL: Portugal (*Alentejo*, *Algarve*, *Centro*, *Lisboa - Vale do Tejo*, *Norte*). KINGDOM OF SICILY: Italy (*Abruzzo - Molise*, *Basilicata - Campania*, *Calabria*, *Puglia*, *Sicilia*). KINGDOM OF TUSCANY: Italy (*Toscana*). PAPAL STATE: Italy (*Emilia-Romagna*, *Lazio*, *Marche - Umbria*). PROVINCES: Netherlands (*Noord Nederland - Groningen*, *Oost-Nederland*, *West-Nederland*, *Zuid-Nederland*). REIGN OF ENGLAND: Ireland (*East Ireland*, *West Ireland*); UK (*East Anglia - London*, *East Midlands*, *North-East UK*, *North-West UK*, *Northern Ireland*, *Scotland*, *South-East UK*, *South-West UK*, *Wales*, *West Midlands*, *Yorkshire - Humberside*). REIGN OF FRANCE: Belgium (*Vlaams Gewest*); France (*East France*, *Île de France*, *Mediterranean France*, *North France*, *Paris Basin*, *South-East France*, *South-West France*, *West France*). REIGN OF HUNGARY: Hungary (*Central Hungary*, *Styria-Hungary*, *West Hungary*); Slovakia (*East Slovakia*, *West Slovakia*). REIGN OF POLAND: Poland (*East Poland*, *North Poland*). REIGN OF SPAIN: Spain (*Andalucia*, *Aragon*, *Asturias - Cantabria*, *Baleares*, *Castilla-La Mancha*, *Castilla y León*, *Cataluña*, *Comunidad Valencian*, *Extremadura*, *Galicia*, *Madrid*, *Murcia*, *Navarra - Rioja*, *Pais Vasco*). SARDINIAN GIUDICATI: Italy (*Sardegna*). SAVOY: Italy (*Piemonte - Valle D'Aosta*). STATE OF MILAN: Italy (*Lombardia*). SWISS CANTONS: Switzerland (*North Switzerland*, *South Switzerland*). VENICE: Italy (*Friuli-Venezia Giulia - Veneto*).

Note: 1. The names of the historical polities are in capital letters, those of the regions that constitute the cross-section identifiers are in Italic lowercase letters, and those of the present-day countries to which the regions belong are in regular lowercase letters.

Figure 3: The Long-run Evolution of Formal and Informal Institutions



Note: 1. The range of each variable is divided into five intervals using the goodness of variance fit method.

Figure 4: Climate Volatility in the Sample and in all Guiot et al. (2010) Cells

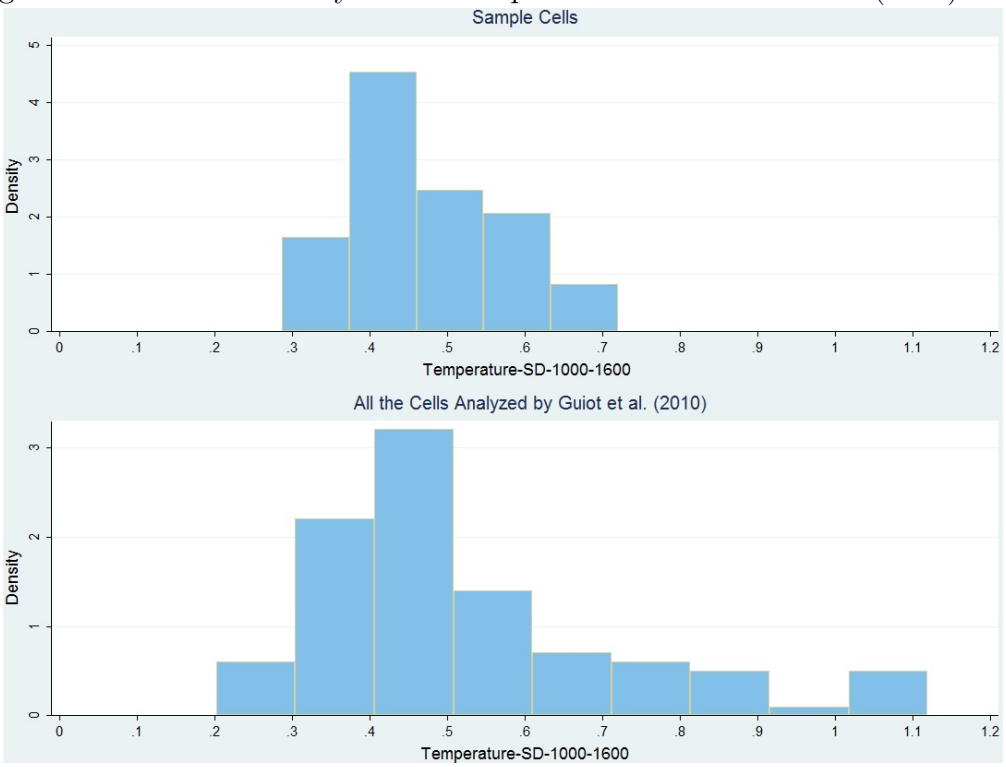
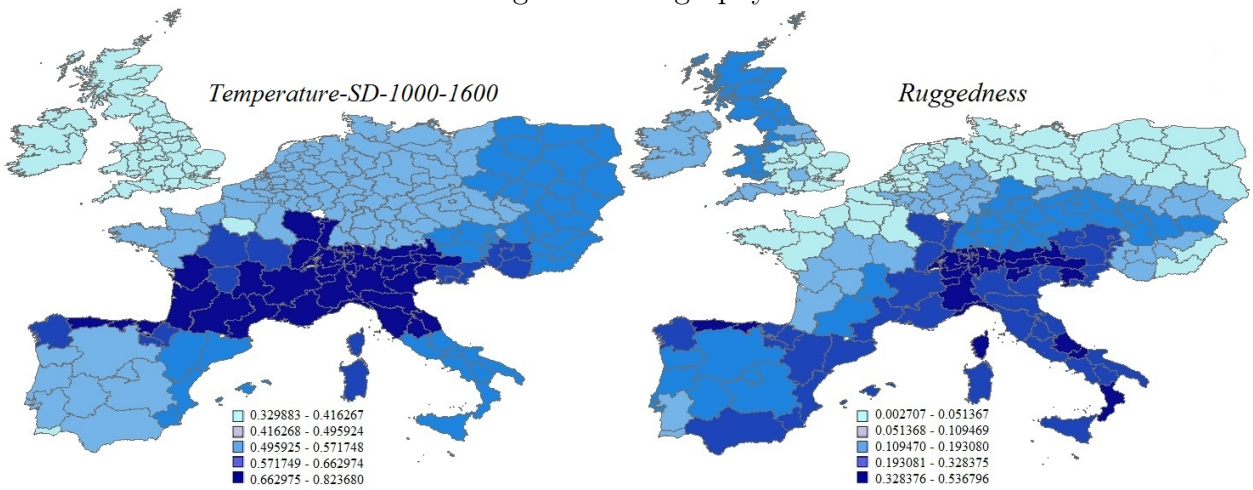


Figure 5: Geography



Note: 1. The range of each variable is divided into five intervals using the goodness of variance fit method.

Table 7: Summary of Variables

	Variable	Definition and Sources	Statistics
(In)formal institutions:	*Democracy*:	See text. Source: Authors' codification.	1.833 (1.130)
	Democracy-1000-1600:	*Democracy* averaged over the 1000-1600 period. Source: Authors' codification.	1.833 (0.720)
	Democracy-1950-2010:	See Guerriero (2015). Source: Guerriero (2015).	6.023 (1.384)
	Culture:	See text. Sources: Van Der Meer (1965); Moorman (1983).	0.123 (0.254)
	Culture-1000-1600:	*Culture* averaged over the 1000-1600 period. Sources: Van Der Meer (1965); Moorman (1983).	0.123 (0.133)
	Monti:	See text. Sources: Montanari (1999); Avallone (2007).	0.026 (0.065)
	Culture-2008:	See text. Source: 2008 European Value Study, GESIS (2008).	0.039 (0.284)
Geography:	*Mediterranean*:	Dummy equal to 1 if the region has a direct access to the Mediterranean sea, 0 otherwise.	0.222 (0.416)
	Atlantic:	Dummy equal to 1 if the region has a direct access to the Atlantic ocean, 0 otherwise.	0.367 (0.482)
	Temperature-SD:	Standard deviation of the growing season temperature in the previous 50 years in Celsius averaged over the cells in the region. Source: Guiot et al. (2010).	0.455 (0.128)
	Temperature-SD-1000-1600:	*Temperature-SD* averaged over the 1000-1600 period. Source: Guiot et al. (2010).	0.528 (0.122)
	Temperature-A:	Mean growing season temperature over the previous 50 years in Celsius anomalies relative to the 1961-1990 mean averaged over the cells in the region. Source: Guiot et al. (2010).	0.015 (0.269)
	Ruggedness:	Terrain ruggedness averaged over the cells in the region. Source: G-Econ (2010).	0.169 (0.130)
Other controls:	*Wars*:	Share of previous century in which the region partook in external wars. Source: Acemoglu et al. (2005).	0.411 (0.400)
	Urbanization:	Urban potential in the region. Source: Bairoch et al. (1988).	192.156 (280.242)

Note: 1. The last column reports the mean value and, in parentheses, the standard deviation of each variable. Both are computed building on the sample used in table 8 except for the case of *Monti*, when they are calculated using the sample employed to obtain table 10, and for the cases of *Democracy-1950-2010*, *Culture-2008*, *Democracy-1000-1600*, *Culture-1000-1600*, and *Temperature-SD-1000-1600*, when they are computed employing the sample used to get the estimates reported in table 11.

Table 8: The Geographic Origins of Formal and Informal Institutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	The dependent variable is:									
	Democracy	*Culture*	*Democracy*	*Culture*	*Democracy*	*Culture*	*Democracy*	*Culture*	*Democracy*	*Culture*
Mediterranean × 1050	- 0.108	0.012	- 0.016	0.008	- 0.109	0.012	- 0.104	0.009	- 0.015	0.007
	(0.046)**	(0.005)**	(0.023)	(0.003)**	(0.046)**	(0.005)**	(0.045)**	(0.005)*	(0.022)	(0.003)**
Mediterranean × 1100	1.086	0.019	0.765	0.019	1.092	0.022	1.090	0.016	0.776	0.020
	(0.503)**	(0.006)***	(0.609)	(0.006)***	(0.502)**	(0.007)***	(0.504)**	(0.006)***	(0.608)	(0.007)***
Mediterranean × 1150	0.894	0.019	0.680	0.007	0.900	0.023	0.902	0.014	0.692	0.008
	(0.515)*	(0.009)**	(0.610)	(0.006)	(0.513)*	(0.010)**	(0.516)*	(0.009)	(0.609)	(0.006)
Mediterranean × 1200	1.214	0.009	0.828	0.008	1.218	0.011	1.195	0.021	0.815	0.021
	(0.487)**	(0.006)	(0.590)	(0.006)	(0.487)**	(0.007)	(0.490)**	(0.012)*	(0.599)	(0.013)
Mediterranean × 1250	1.134	0.001	1.161	0.005	1.138	0.003	1.108	0.019	1.142	0.022
	(0.412)***	(0.008)	(0.428)***	(0.008)	(0.413)***	(0.008)	(0.414)***	(0.009)**	(0.435)***	(0.010)**
Mediterranean × 1300	0.347	0.036	0.121	0.039	0.358	0.041	0.342	0.040	0.136	0.042
	(0.317)	(0.019)*	(0.361)	(0.021)*	(0.318)	(0.020)**	(0.320)	(0.017)**	(0.365)	(0.020)**
Mediterranean × 1350	0.065	0.094	- 0.139	0.110	0.076	0.099	0.059	0.098	- 0.123	0.112
	(0.349)	(0.035)***	(0.381)	(0.038)***	(0.348)	(0.036)***	(0.352)	(0.034)***	(0.384)	(0.039)***
Mediterranean × 1400	- 0.174	0.144	- 0.307	0.163	- 0.158	0.152	- 0.200	0.161	- 0.300	0.179
	(0.345)	(0.062)**	(0.368)	(0.070)**	(0.343)	(0.064)**	(0.345)	(0.057)***	(0.366)	(0.067)***
Mediterranean × 1450	- 0.141	0.227	- 0.226	0.243	- 0.125	0.235	- 0.167	0.244	- 0.222	0.261
	(0.343)	(0.088)**	(0.366)	(0.099)**	(0.341)	(0.090)***	(0.343)	(0.083)***	(0.363)	(0.095)***
Mediterranean × 1500	- 0.249	0.360	- 0.261	0.370	- 0.251	0.359	- 0.263	0.369	- 0.258	0.366
	(0.353)	(0.118)***	(0.394)	(0.133)***	(0.353)	(0.119)***	(0.353)	(0.114)***	(0.399)	(0.131)***
Mediterranean × 1550	0.196	0.512	- 0.070	0.522	0.194	0.511	0.183	0.520	- 0.063	0.515
	(0.402)	(0.151)***	(0.410)	(0.170)***	(0.403)	(0.151)***	(0.403)	(0.148)***	(0.414)	(0.169)***
Mediterranean × 1600	0.084	0.652	- 0.064	0.642	0.092	0.656	0.125	0.625	0.006	0.600
	(0.407)	(0.188)***	(0.427)	(0.213)***	(0.406)	(0.188)***	(0.409)	(0.190)***	(0.435)	(0.217)***
Atlantic × 1050	0.103	- 0.008	0.057	- 0.007	0.103	- 0.008	0.099	- 0.005	0.052	- 0.004
	(0.059)*	(0.005)	(0.053)	(0.004)	(0.059)*	(0.005)	(0.058)*	(0.005)	(0.053)	(0.004)
Atlantic × 1100	- 0.221	- 0.004	- 0.065	- 0.002	- 0.221	- 0.005	- 0.226	- 0.001	- 0.071	0.002
	(0.199)	(0.006)	(0.167)	(0.006)	(0.199)	(0.006)	(0.199)	(0.006)	(0.166)	(0.007)
Atlantic × 1150	- 0.168	- 0.016	- 0.063	- 0.011	- 0.168	- 0.016	- 0.175	- 0.011	- 0.070	- 0.006
	(0.211)	(0.009)*	(0.193)	(0.008)	(0.211)	(0.009)*	(0.210)	(0.008)	(0.192)	(0.007)
Atlantic × 1200	- 0.326	- 0.001	- 0.136	- 0.001	- 0.319	0.002	- 0.343	0.010	- 0.146	0.016
	(0.227)	(0.006)	(0.185)	(0.006)	(0.228)	(0.007)	(0.232)	(0.010)	(0.191)	(0.012)
Atlantic × 1250	0.272	0.019	0.259	0.019	0.279	0.022	0.262	0.025	0.257	0.030
	(0.227)	(0.008)**	(0.229)	(0.008)**	(0.229)	(0.009)**	(0.230)	(0.008)***	(0.235)	(0.011)***
Atlantic × 1300	0.032	0.018	0.147	0.018	0.033	0.018	0.023	0.024	0.137	0.026
	(0.205)	(0.013)	(0.210)	(0.015)	(0.206)	(0.014)	(0.208)	(0.012)**	(0.213)	(0.013)**
Atlantic × 1350	- 0.016	0.027	0.089	0.024	- 0.015	0.027	- 0.020	0.029	0.084	0.028
	(0.209)	(0.019)	(0.221)	(0.020)	(0.210)	(0.020)	(0.211)	(0.017)*	(0.223)	(0.018)
Atlantic × 1400	0.235	0.012	0.304	0.002	0.242	0.016	0.228	0.017	0.300	0.015
	(0.173)	(0.025)	(0.179)*	(0.026)	(0.173)	(0.026)	(0.177)	(0.020)	(0.184)	(0.022)
Atlantic × 1450	0.117	0.007	0.161	0.000	0.124	0.010	0.108	0.013	0.156	0.013
	(0.191)	(0.030)	(0.199)	(0.032)	(0.194)	(0.031)	(0.196)	(0.025)	(0.206)	(0.028)
Atlantic × 1500	- 0.317	- 0.003	- 0.308	- 0.006	- 0.316	- 0.003	- 0.324	0.001	- 0.319	0.003
	(0.205)	(0.039)	(0.210)	(0.041)	(0.205)	(0.039)	(0.211)	(0.035)	(0.214)	(0.038)
Atlantic × 1550	- 0.140	- 0.005	- 0.005	- 0.003	- 0.138	- 0.004	- 0.141	- 0.004	- 0.011	0.003
	(0.232)	(0.048)	(0.238)	(0.050)	(0.232)	(0.048)	(0.236)	(0.045)	(0.242)	(0.047)
Atlantic × 1600	0.446	- 0.047	0.525	- 0.040	0.452	- 0.044	0.445	- 0.046	0.527	- 0.030
	(0.297)	(0.062)	(0.308)*	(0.063)	(0.294)	(0.061)	(0.297)	(0.060)	(0.304)*	(0.061)
Temperature-SD	0.091	0.507	0.070	0.604	0.081	0.486	0.097	0.474	0.066	0.584
	(0.465)	(0.204)**	(0.460)	(0.249)**	(0.461)	(0.203)**	(0.463)	(0.209)**	(0.454)	(0.250)**
Temperature-SD^2		- 0.295		- 0.331		- 0.281		- 0.269		- 0.320
		(0.160)*		(0.200)*		(0.161)*		(0.160)*		(0.206)
p-value for *Ruggedness* × *1050-1600 dummies*			[0.00]	[0.02]					[0.00]	[0.04]
Wars					- 0.032	- 0.015			- 0.038	- 0.018
					(0.059)	(0.012)			(0.061)	(0.012)
Urbanization							- 0.0003	0.0002	- 0.0003	0.0002
							(0.0003)	(0.0001)***	(0.0003)	(0.0001)***
Estimation	Fixed region and time effects OLS.									
Within R^2	0.34	0.59	0.35	0.60	0.34	0.60	0.34	0.60	0.35	0.61
Number of observations	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170

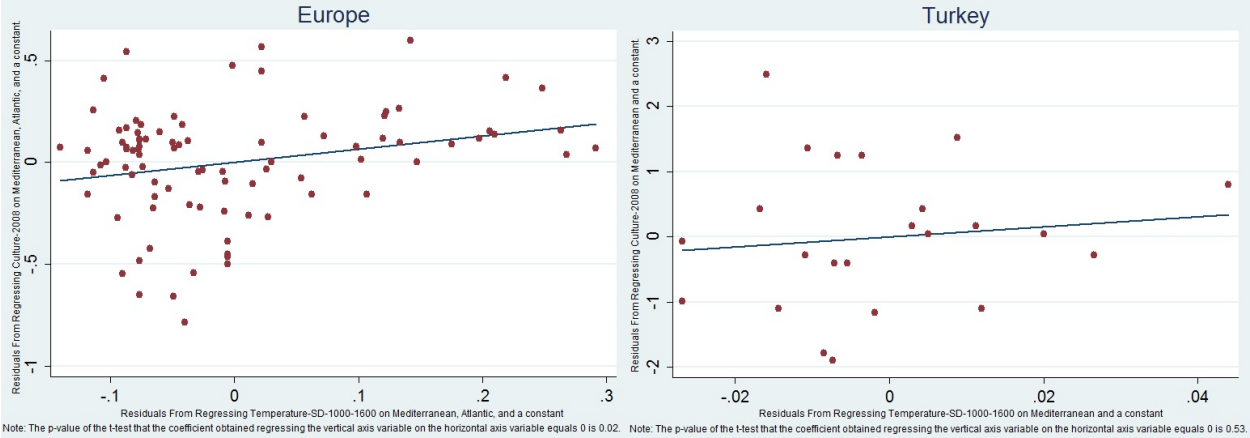
Notes: 1. Standard errors clustered at the regional level in parentheses. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
2. The specifications always include *Temperature-A*.

Table 9: Using Selection on Observables to Assess the Bias from Unobservables

	(1)	(2)	(3)	(4)
	The dependent variable is:			
	Democracy	*Culture*	*Democracy*	*Culture*
The index is calculated for the variable:				
Mediterranean × *1050*	35		0.16	
Mediterranean × *1100*	109.60		2.50	
Mediterranean × *1150*	64.86		3.43	
Mediterranean × *1200*	79.93		2.04	
Mediterranean × *1250*	50.55		142.75	
Mediterranean × *1300*	58.83		0.64	
Mediterranean × *1350*		11.44		6.22
Mediterranean × *1400*		6.54		5.11
Mediterranean × *1450*		9.73		7.68
Mediterranean × *1500*		46		61
Mediterranean × *1550*		74.14		171.67
Mediterranean × *1600*		27.35		11.54
Atlantic × *1350*	5		0.84	
Atlantic × *1400*	293.25		4.64	
Atlantic × *1450*	57.50		4	
Atlantic × *1500*	53.83		159.50	
Atlantic × *1550*	466.67		0.09	
Atlantic × *1600*	112.50		6.51	
Temperature-SD		8.05		7.58
Temperature-SD^2		6.20		12.80
The extra controls in the full set are:				
Wars, *Urbanization*,	YES	YES	YES	YES
and *Ruggedness* × *1050-1600 dummies*	NO	NO	YES	YES

Note: 1. Each cell reports an index constructed as explained in section 5.3.2 and based on the coefficients attached to the relevant variable and obtained from two regressions. In one, the covariates are those incorporated in the specifications in columns (1) and (2) of table 8. In the other, the "full set" of covariates includes also *Wars* and *Urbanization* (*Wars*, *Urbanization*, and *Ruggedness* × *1050-1600 dummies*) in the case of columns (1) and (2) (columns (3) and (4)). The sample size of these regressions is always 1170.

Figure 6: Medieval Risk-sharing Needs and Present-day Culture — Placebo Test



Note: 1. The residuals plot and the predictions line are obtained from a regression run on the sample used in column (4) of table 11 in the case of the left graph and from a regression run on a sample of 28 NUTS 3 Turkish regions in the case of the right graph.

Figure 7: The Commitment Dimension

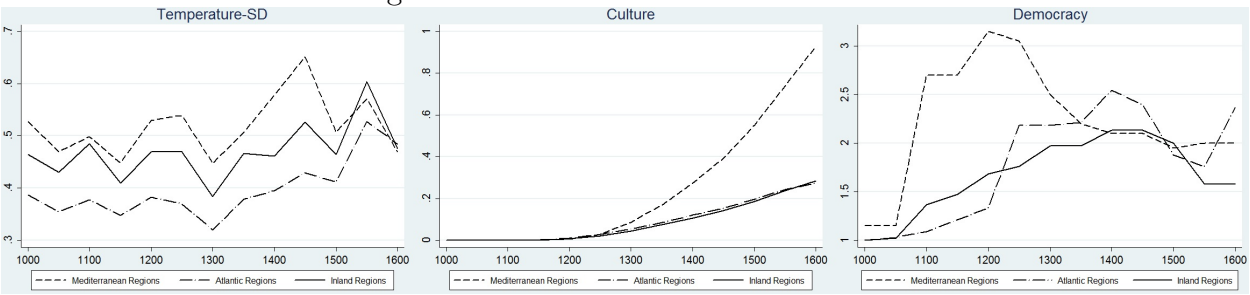


Table 10: A Closer Look at the Commitment Dimension — the Italian Case

	(1)	(2)	(3)	(4)	(5)	(6)
	The dependent variable is:					
	Democracy	*Culture*	*Monti*	*Democracy*	*Culture*	*Monti*
Mediterranean × *1450*	1.051	0.317	- 0.010	1.290	0.290	- 0.006
	(0.418)**	(0.191)*	(0.010)	(0.498)**	(0.183)	(0.013)
Mediterranean × *1500*	0.115	0.491	0.033	0.124	0.391	0.023
	(0.330)	(0.184)***	(0.011)***	(0.468)	(0.180)**	(0.012)*
Mediterranean × *1550*	1.805	- 0.050	- 0.018	2.180	- 0.206	- 0.035
	(0.787)**	(0.270)	(0.033)	(0.842)**	(0.386)	(0.043)
Mediterranean × *1600*	0.634	0.960	0.096	0.790	0.827	0.051
	(0.462)	(0.398)**	(0.063)	(0.644)	(0.347)**	(0.034)
Temperature-SD	9.813	26.759	3.401	10.241	24.335	2.806
	(1.465)***	(11.731)**	(1.358)**	(1.490)***	(12.995)*	(1.223)**
Temperature-SD^2		- 19.715	- 2.535		- 17.951	- 2.087
		(8.880)**	(1.019)**		(9.889)*	(0.924)**
p-value for *Ruggedness* × *1450-1600 dummies*				[0.50]	[0.71]	[0.48]
Urbanization				- 0.0001	- 0.0001	- 0.00002
				(0.0001)	(0.0002)	(0.00001)
Estimation	OLS.					
R^2	0.49	0.44	0.43	0.52	0.45	0.48
Number of observations	70	70	70	70	70	70

Notes: 1. Robust standard errors in parentheses. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
2. The specifications always include a constant term and *Temperature-A. Wars* is omitted from the specifications reported in columns (4) to (6) due to multicollinearity.

Table 11: Persistent Endogenous Formal and Informal Institutions

	(1)	(2)	(3)	(4)
	The dependent variable is:			
	Democracy-1950-2010	*Culture-2008*	*Democracy-1950-2010*	*Culture-2008*
Democracy-1000-1600	0.722			
	(0.211)***			
Culture-1000-1600		0.495		
		(0.236)**		
Mediterranean		- 0.180	1.011	- 0.137
		(0.100)*	(0.351)***	(0.071)*
Atlantic		0.114	0.385	0.180
		(0.064)*	(0.356)	(0.070)**
Temperature-SD-1000-1600	- 1.170		- 0.503	0.646
	(0.794)		(1.131)	(0.201)***
Estimation	OLS.			
R^2	0.13	0.12	0.08	0.13
Number of observations	90	89	90	89

Notes: 1. Robust standard errors in parentheses. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
2. The specifications always include a constant term.