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EMERGENCE OF ENDOGENOUS LEGAL
INSTITUTIONS:
PROPERTY RIGHTS AND COMMUNITY
GOVERNANCE IN THE ITALIAN ALPS

by

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Abstract:

This paper studies the legal institutions set up by communities in the Italian Alps in the 13th-19th century to manage their common pastures and forests. Over time, private-order institutions in the form of charters replaced informal arrangements sustained by the long-run interaction among villagers. Although costly to run, the charters accomplished several tasks that increased resource use efficiency. We present an empirical analysis of institutional choice of about two hundred communities and show that relative efficiency was an important factor in the selection of a governance regime.

JEL: Q23, Q24, D23, K4

Keywords: property rights, transaction costs, community enforcement, sanctions, natural resources, common property.

1 Introduction

Although institutional change is considered a key factor in economic growth, there is an imperfect understanding of the driving forces behind it and the exact mechanisms that make it possible (North, 2005). We present a case study of reallocation of property rights on natural resources. Following Demsetz's (1967) intuition about efficiency-driven institutional change, we carry out a property rights analysis of alternative management systems of common pastures and forests in medieval and modern Italy. We broaden Demsetz's intuition in two ways. First, we articulate its implications for resource appropriation when there is a long-term interaction among resource users. Second, we examine a transition mechanism that may bring institutional change.

We analyze data about the emergence of legal institutions, called *Carte di Regola* or "charters," for the management of common property resources in about two hundred villages in the Trentino region of the Italian Alps. Forests and pastures were managed in common for at least six centuries until this system was forcefully abolished by Napoleon in 1805. The environment seems to have been ideal for informal and mutually beneficial cooperation; the communities were small and isolated in a mountainous area, the villagers frequently interacted with one another and families' local roots extended back for several generations. Despite this, villagers built specific legal institutions at the community level to specify property rights and enforcement mechanisms as early as the 13th century (Figure 1).[1] About two thirds of the Trentino villages eventually adopted a charter.

Why would the villagers choose to build costly legal institutions when informal cooperation through repeated interaction was available? The answer focuses on the role of legal institutions

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[1] Allen (1998) defines property rights as "one's ability, without penalty, to exercise a choice over a good, a service, or person" and transaction costs as "the costs of establishing and maintaining property rights." See also Barzel (1997).

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in enhancing the performance of informal cooperation and in providing alternative punishment technologies. The benefits of the charter differed widely depending on the location and size of each community. The mechanism that made the transition from an informal cooperation arrangement to a legal institution such as a charter possible was the initial long-term interaction of community members. This interaction provided the incentive for the emergence of a more formal governance regime.

The structure of the paper is the following. Section 2 gives an overview of governance regimes on the common land while Section 3 presents institutional evidence from the Trentino communities. Section 4 discusses the transitioning from one management regime to another. The empirical analysis is presented in Section 5. The discussion and conclusions are in Section 6.

2 Governance Regimes

This section highlights five property rights arrangements, or governance regimes, that are relevant for the analysis of the Trentino case. On one extreme there is open access (a) and on the opposite extreme there is private property (b). "In-between" governance regimes – listed below as (c), (d), and (e) – can avoid the worst effects of the tragedy of the commons and in same cases may deliver optimal outcomes (Ostrom et al., 2002; Gibson et al., 2000; Stevenson, 1991).

(a) *Open access*

When a natural resource like a forest or a pasture is available for everybody to use (*open access*), there is complete dissipation of any rent for the users (Gordon, 1954). This result of heavy resource overexploitation is known as the tragedy of the commons.

(b) *Private property*

Unlike an underground oil reserve or a fishery, the common land could technically be divided into individual plots. A single owner would have the correct incentive to harvest the resource optimally when all others were excluded from using it. To achieve this outcome, what matters is not the legal entitlement to the resource but the effective exclusion of others (Barzel, 2003).

(c) *Communal property with state enforcement*

This regime is the textbook example of the commons (Clark, 1990) where there are multiple owners (insiders) who use the resource and can exclude all others (outsiders). The enforcement against outsiders is done through the state. The insiders do not have any internal structure of governance; they compete with one another for resource appropriation, which results in an overuse of the resource.

(d) *Communal property with informal enforcement*

Multiple owners share the resource and enforce property rights informally and without the state. As in (c), insiders do not have any internal structure of governance. When insiders are engaged in a long-term interaction and are sufficiently patient, they may be able to harvest the resource optimally. Cooperation may be sustained because an individual deviation from a target level of resource use could be punished by the others in future interactions. Even if there is a short-run incentive to deviate, repetition can make it in the best interest of each user to follow the target harvesting level. The necessary conditions for this result are formally listed in the so called "folk theorem," which applies to a variety of situations, including common resource appropriation under the condition that participants interact repeatedly and do so indefinitely into the future (Rubistein, 1979).[2]

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[2] "In the 1950s, several game theorists had conjectured that rational players should be able to cooperate – for example in the [...] prisoners' dilemma – if the game would only continue long enough [...]. Its folklore flavor is

There are three potential problems with this regime. First, with informal enforcement, many levels of cooperation may be sustainable, not just one. The folk theorem clearly states that anything from no cooperation to full cooperation on the optimal harvesting policy could be possible equilibria. To avoid the tragedy of the commons, the resource users must coordinate on a specific target and on a specific punishment strategy. Miscoordination on either one may easily lead to the unraveling of cooperation (Kandori, 1992b).

The second problem is that the efficiency of informal enforcement is related to how perfectly insiders are able to monitor the harvesting actions of other users.[3] As noted, the folk theorem predicts a range of sustainable outcomes. We will call the most efficient of these outcomes in the range the *"informal cooperation solution."* The more uncertainty there is on the harvesting done by other users, the less efficient is the informal cooperation solution. The reason is that the less a user is able to monitor others, the less likely she is to accurately detect a deviation from the target strategy. As a result, punishment is sometimes inflicted when everyone is actually cooperating.[4] Although standard in cartel studies, these considerations have rarely been applied to common property resource use.[5]

The third problem is that trespassing from outsiders increases the uncertainty about the harvesting level of insiders. In a completely isolated community, everybody knows that any harvesting going on was carried out by insiders even when there is uncertainty as to which person actually did it. Such inference is more difficult when trespassing is possible (Baland and

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the reason why the result came to be referred to as the 'Folk Theorem.' " (Royal Swedish Academy of Sciences, 2005).

[3] The formal derivations can be found in Abreu, Pearce, and Stacchetti (1990), Fudenberg, Levin, and Maskin (1994).

[4] For instance, setting up the lysine cartel among five corporations during 1993-95 involved 25 multiparty price-fixing meetings at the top level; dozens of supplementary bilateral meetings by regional sales managers and hundreds of telephone calls. The FTC secretly videotaped some of these meetings (Connor, 2002).

[5] For an application to fisheries, see Laukkanen (2003). Greif (1993) presents an application of this strategy to long-distance trade in the Mediterranean in the middle-age.

Platteau, 1996). After observing overexploitation of the resource, a user may engage in the punishment of insiders when the deviation from the target was actually due to an outsider. In conclusion, the possibility of trespassing reduces the efficiency of the informal cooperation solution.

(e) *Communal property with private-order governance*

Insiders internally negotiate a set of rules to manage the common resource and have them approved or at least tolerated by the higher political authority. These rules concern levels and modality of harvest as well as enforcement procedures. Bromley (1992) presents several case-studies of fisheries, pastures, and water resources managed under this regime. Ostrom (1990) summarizes the features shared by private-order institutions that were long-enduring. On one hand, private-order governance entails costs both for setting-up and for administering it. On the other hand, it may bring three types of improvements over plain informal enforcement (c).

First, private-order governance can lead to superior information about resource appropriation. One obvious way to achieve this is to gather additional information by actively monitoring users. This activity is costly, but could enable insiders to achieve higher levels of efficiency. Without an explicit organization for providing this public good, however, it may be difficult to put enough effort into monitoring. Another solution is to make existing private information public. Collecting pieces of information from insiders and sharing them with all can greatly improve the ability of insiders to coordinate on a more efficient equilibrium. Milgrom et al. (1990) provide an analysis of a Middle Age merchant registry, accessible to any merchant in the Guild, that recorded the identity of merchants who did not honor their contract obligations.

Second, a private-order institution can introduce more efficient punishment technologies toward *insiders*. When information is less than perfect, informal enforcement entails some

degree of punishment in equilibrium.[6] Informal punishment may involve a general, although temporary, suspension of cooperation among all insiders and, as such, it is always a deadweight loss for society. Consider firms in a Cournot oligopoly that are in a collusion agreement but where the production of competing firms is known with uncertainty. Abreu, Pearce, and Stacchetti (1990) prove the optimality for firms to engage periodically in "price wars." Cutting prices generates an unrecoverable loss of profits for the colluding firms. Private-order governance can introduce legal-type punishment for the villagers in the form of monetary sanctions, which do not destroy wealth but simply transfer it.[7]

Third, private order governance may create a more effective enforcement toward *outsiders*. Informal punishment of outsiders is more problematic than the punishment of insiders. Trespassing outsiders may be either neighbors or strangers. When dealing with a stranger, a legal-type punishment has a clear advantage because informal punishment is ineffective. With neighbors, the interaction is repeated although the monitoring problems may be so severe that state enforcement is preferable to an informal cooperation solution. For instance the victimized community may observe a person trespassing, while the trespasser's community may be unaware of it. A retaliatory harvesting raid in the trespasser's community territory will be interpreted as a first action of trespassing, which, in turn, deserves punishment. If such instances are frequent, this will induce continuous "wars" among neighboring communities. For external enforcement, a community may profit from replacing an informal mechanism with a legal type mechanism.

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[6] When information is perfect, nobody in equilibrium ever defects from the cooperative agreement and hence there is no punishment. In that case, as long as the punishment threat is credible, the specific punishment technology adopted is irrelevant.

[7] As Haddock (2003) illustrates, property rights can also be protected with private violence but such enforcement could generate heavy deadweight costs for a society.

3 Institutional Evidence

3.1 Governance Regimes

Trentino is a mountainous area of about 2,400 square miles situated to the northwest of the Republic of Venice. It is on the Italian side of the Alps, and includes parts of the Dolomite Mountains. In the 19th century, forests covered about half of the area while grazing land and meadows covered about one-third, and an overwhelming portion of both were owned in common.[8] There is abundant anecdotal evidence in the charters about the communal property of forests and grazing land. Quantitative evidence can be found in the 1780 Land Registers. Although a systematic analysis of this source has not been yet carried out, micro-level data from two very different villages show a clear pattern (Figure 2). First, almost all forest and a large portion of meadows and pastures were communal property (100%, 95% and 60%, 66%, respectively). Second, only a small portion of arable land was communal property (27%, 8%) while the remaining was private property.

One can conclude that villagers knew alternative property rights regimes and adopted them selectively according to the type of asset. Private property on land with a low specific value may have been too expensive to enforce. On the other hand, the high labor input prior to the harvest season necessary for crops on arable land gave private property a clear advantage.[9] Given that communal property was for some reason the preferred mode of ownership, this paper studies the emergence of alternative governance regimes that could solve the social dilemma generated by the communal property.

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[8] Consiglio Provinciale d'Agricoltura (1903). A 1897 survey for the whole Trentino reveals that more than 76% of the forest in the region was municipal or state owned. Scotoni (1974) estimates a forest coverage of Trentino of about 60% for the 9th century. As in many parts of Italy, the mountain landscape made it difficult to farm large portions of the surface (Epstein, 1998).

[9] Vineyards, cereals, and fruits were the main uses of arable land. Arable land accounted for only 8% of the regional surface in 1897. Netting (1981) and Casari (1998) consider possible reasons for the persistence of communal property on forests and pastures. See also Anderson and Hill (1975) for a classic article on the rational for communal property.

As a rule, only *pater familias* that were members of a community (*vicini*) could use the communal property, and this right was inherited from father to son. Outsiders (*forestieri*) were excluded from the use of communal resources, even when they lived in the village.[10] Hence, forests and pastures in Trentino were common property and not open access resources.

This study will focus on communal property management, in particular, on informal enforcement (d) and private-order governance (e). As mentioned, the villagers held the resources neither as open access (a) nor as private property (b). Moreover, state enforcement of property rights (c) was problematic. The Principality of Trento had a court system to protect property rights. When the issue involved high stakes, such as the delimitation of property borderlines between communities, there is evidence of state justice involvement. The archives contain several documents about border disputes, mostly regarding communal property issues between neighboring villages.[11] The use of state courts for many other controversies was often impractical because of their high costs relative to any smaller matters, such as a stolen tree. Persuading the state to absorb the costs to micro-enforce property rights for the peasants was not a feasible option; hence, villagers were mostly left to fend for themselves to enforce property rights on the common land and could either adopt informal mechanisms or private-order institutions.

3.2 Stable Communities

Villagers stayed in the same community for generations. A comparison over time of last

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[10] Examples of *forestieri* were the residents of neighboring villages, seasonal workers living in the village, occasional travelers. Similar systems were adopted in other regions of Europe (Popkin, 1979).

[11] Since 1027, the main political authority of the region was the Prince-Bishop of Trento, who was jointly appointed by the Emperor of the Holy Roman Empire and by the Pope for a lifetime term. This political structure lasted until the 1796 French invasion of Napoleon and the charter system was definitely removed in 1805. The main archives are *Archivio di Stato di Trento*, *Ferdinandeum Museum* of Innsbruck, and the *Archivio di Castel Bragher* (data sources in Appendix.)

names of *pater familias* within the same villages shows a remarkable stability.[12] Moreover, villages were generally very small. In 1810, the median population of a village was 410 people. The common land was shared among people of the same community, which was mostly limited to one village. According to the folk theorem, when a stable group of people is engaged in an indefinitely repeated interaction, informal cooperation could emerge in the use of the communal resources.

Admission into and departures from the community were limited by the peculiar structure of property rights on the land. A person became an insider either by inheritance from his father or by the approval of the insiders' assembly. Interestingly, a person could not become an insider by buying a fraction of the communal property from an existing insider because such trading with outsiders was not allowed. Selling communal land was always a collective right that belonged to the community as a whole. Moreover, an alienation decision required the consent of a supra-majority of the community.[13] An outsider could petition the villagers to become an insider. The villagers generally tried to screen out candidates who they did not believe were trustworthy and would sometimes ask prospective residents for convincing proof of decency and of an honest life.[14] Also, to admit a new user, a supra-majority consensus was

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[12] There was limited mobility of males across communities as it is evident from the list of participants to the general community meetings. A comparison of last names at intervals of one or two centuries could be used as a proxy for mobility. The reason is that, first, most last names are village-specific; second, both membership rights and last names were transmitted through male lineage. Last name lists reveal little change within each community. This proxy is not perfect because a family name can also disappear from natural death, especially in the long run, and new last names can emerge as modifications of old last names.

[13] A qualified majority of at least 2/3 was required to sell the common land in Cles 1641, c.5 and in Cis 1587, c.80. Some authors interpret the absolute prohibition to sell the common land as a pivotal aspect of the traditional land management of the Trentino communities (Andreatta and Pace, 1981). In this paper, I argue that this statement is not empirically correct and that it is not a requirement from a theoretical point of view to ensure a long-term relationship among users. Absolute inalienability and indivisibility of the commons were not cornerstones of the historical form of common ownership in Trentino, although selling the commons was sometimes subjected to the authorization of the feudal authorities (Cagnò, 1587, c. 3, modification of 1693).

[14] Cles, 1641 (modification 1719, c.2), *"attestati autentici della sua buona vita et costumi."* In addition to requiring the prospective member to give good references about his reputation, Nago and Torbole required some form of real warranty in case of mis-behavior. For instance, see Nago and Torbole, 1647 (modified in 1670, c. 72): outsiders

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required.[15] Upon admission, the newcomer had to pay an annual fee. Such fees were usually assessed on a case-by-case basis and were in proportion to the expected use of the forest and pasture, depending on the size of the family or on the number of animals owned.[16] Admitting additional users to the common resource meant giving away a share of the claims on the resource profits.[17] Interestingly enough, in 1671 the assembly of the village of Cis stated - in the very same article of their charter - that admitting a new member had to be deliberated with the same majority as the one adopted for selling the common land.[18]

Exiting the community was possible but costly because it involved losing the social support of the community and losing the right to use the common land. An insider could sell his individually owned house and fields but not his share in the community land. According to current property laws in civil law countries, if three people own a piece of land in common and one of them wants to get out of the estate for no reason, he or she has the right either to sell his part to anybody or to be refunded by the other two. The arrangement in the north Italian villages was rather different.[19] While away from the village, the insider could no longer use the common resources. The right to return was also restricted. Regulations differ locally, but

cannot stay in the village for more than 3 days unless they own a piece of land or a house (*stabili*) worth at least 200 fiorini. No outlaw could be accepted (*banditi* or *ricercati*).

[15] Not all charters described the admission procedure. Three examples are Cis, 1587 (all but 3 dissenters), Cles,1641, Tres, 1551 (unanimity required in 1599)

[16] For example Cles, 1641,c.57: "*Che li forestieri habitanti nella comunità di Cles siino colettati dalla regola per l'honesto in loro arbitrio, considerando la loro qualità et animali che tengono sopra li comuni, et in più concorrino ad ogni cosa ordinaria et straordinaria come li vicini,...*". See also Tres, 1551 and following modifications.

[17] The existing users wanted not only to have a say about the admission decision but also to be compensated for the reduction in their share of resources. In corporate law, this right is analogous to the right of shareholders to deliberate about the issuance of new preferred shares and decide about their price. Formally, when all users appropriate the resource at the same rate, the addition of a new user to a group is equivalent – for the original N agents – to alienate at least a $1/(N+1)^{th}$ of the value of the resource. When the group is informally cooperating, the *same* group surplus is divided into N+1 parts instead of N. When the outcome is the Nash equilibrium solution, a *lower* group surplus is divided in N+1 parts.

[18] See the modification to Cis, 1587, chaper 80: "*... alienare beni comunali o ricevere alcuno forestiero per vicino se meno di 3 vicini son contrari*" (any group of three or more insiders could veto the decision).

[19] No charter ever mentions the right of an insider to be refunded the value of his share of common land in case he leaves the community, let alone the procedures to satisfy that right, but they prohibit the trading of rights to membership.

generally involve the temporary or permanent suspension of benefits upon return and other punishments.[20] All these regulations on community membership and trading restrictions on the common land had the purpose of locking-in insiders in a long-term relationship.

3.3 Monitoring and Coordinating

Once insiders face a continuing relationship, informal cooperation can be sustained provided that each insider can monitor the cooperation level of the others (governance regime (d)). The available evidence suggests that monitoring was imperfect. This is puzzling at first considering the small size of villages. In 1810, about 80% of the villages had less than 1000 inhabitants. Moreover, considerable information about insiders' actions was freely acquired as a byproduct of daily activities. Still, there was under-provision of information in relation to the socially optimal level.

Consider first the ability to monitor individual actions. Thefts from the private fields were widespread. There were frequent complaints of robberies of fruits and vegetables. In order to reduce this risk, the peasants adopted inefficient agricultural practices, such as tiny vegetable gardens located near houses and small areas devoted to orchards.[21] It was not uncommon to prohibit overnight stays in the high mountain meadows and forests or outings during religious holidays. The 1586 charter of Sanzeno explains that the aim of the rule was to avoid free riding on the common resource or thefts in individual plots. Otherwise, given that everyone

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[20] From Statuti et Ordini della Spet. Communità di Nago e Torbole (1683): Nago and Torbole, 1647: *"Cittadini, che non habitaranno non possino goder beni communi"* (c.73: They cannot bring timber outside the village borders; they can use the common land only if they still have individually owned land in the village). *"Cittadini, che partono dal commune, et ritornano, che non possino goder beni communi, se non passato un anno"* (c.74). Similar rules can be found in the charters of other villages, for instance Tres, 1551 (the 1599 modifications regulates the insider status) and Casez, 1632, c.45

[21] For references from community charters, see for instance Malosco 1593, c.25, 26 and Tres 1551, c.53, 54, and 55. Monteleone (1964), pages 34-37, provides clear evidence for the years 1810s when the community charters were abolished. Not only were grapes stolen, but the wooden supports from the vineyards as well.

else in the village was observing the no-work custom, the free rider would have been difficult to catch.[22]

Consider now the ability to observe the overall cooperation level of the community. In alternative to monitoring individual actions, a villager could have inferred what others had harvested, and thus whether they were cooperating, by simply observing the physical stock of the common forest or pasture. This information, however, was just an imprecise proxy of the community cooperation level. A farmer could observe the milk production of his cow after a day of grazing the common pasture and from it draw some inference on the status of the common pasture. A walk into the forest may give a villager a good sense of the level of exploitation of the forest. However, the villagers did not know exactly how many trees were in the forest or the exact quantity of grass that was on the ground in comparison with the level to be found if the harvesting was optimal. Moreover, the resource stock estimate could have been private information instead of being publicly known. A case of private information would be if villagers sampled different areas of the common land and did not share their information with everybody else. If different villagers had different information (private estimates), the informal cooperation solution could have been even less efficient.[23] Given imperfect monitoring, the informal cooperation solution could have been sub-optimal.

An additional challenge for a community engaged in informal cooperation was to agree on a specific level of cooperation. This coordination problem is particularly difficult when monitoring is not perfect because after having agreed on a cooperation level there may be

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[22] Pieve di Sanzeno, 1586, ch.23: *"Item per tor via molti abusi et cative usanze et cativi costumi che per alcuni che per il passato si ha fatto, si statuisce che niuno della pieve non debba, né anco forestiero ardisca, di stare di notte, né dì di festa, eccetto che il gazaro, uno over più, in la montagna predetta ed massime nel tempo della segagion ed mentre è ancor il fieno nelli pradi: sotto penna de lire cinque per cadauna persona; ed se fosse rubato fieno ad alcuno over legnami over anco taiato legnami (...) che si imputi tal furto ed contrafacion a quello over quelli che si trovarono esser stati la note over il giorno di festa sul monte"*, see Cagnò, 1587, c.43 for a more generic rule against working during holidays.

[23] For a theoretical analysis see Kandori and Matsushima (1998), Compte (1998), Mailath and Morris (2002).

disagreement on how to implement it. In particular, coordinating on an informal cooperation solution is likely more difficult for larger communities (Implication 1). One obvious reason is simply the number of heads. Another reason is that individual estimates about others' cooperation level are more likely to be different in a larger community.

Implication 1 (Population)

The larger the group, the higher the cost of coordination on informal punishment. Hence, communities with a large population are more likely to increase their efficiency by adopting a charter than small communities.

Additional issues on monitoring and enforcing cooperation are raised by outsiders trespassing on the common property. The villages of Romeno, Don, and Amblar could count on topography. The villagers owned in common a side valley mainly covered by forest. The valley was delimited on three sides by steep mountains and on the only side where access was feasible, the entrance was so narrow that villagers built a gate on it and provided the gate with a lock. As the 1459 charter states, the only key was kept in the church of the village of Romeno. The community governor could have easily controlled everybody who went into the valley to log trees and lock the door at the end of the season.[24]

Natural barriers such as mountain ranges or rugged creeks were sometimes phenomenal obstacles for trespassers but they were not always available to a community. As explained in Section 2, there is a synergy between monitoring insiders and outsiders. When monitoring insiders is difficult, the informal cooperation solution is less efficient for those communities

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[24] The reference is to the villages of Romeno, Don, and Amblar. Regulation of the gate is mentioned in the 1459 community charter (article 24: *Item che la chiave della porta di Vallavena sia tenutta et conservatta nella sacrestia della chiesa di santa Maria di Romeno*).

more subject to outsider trespassing. We conjecture that more remote communities were endowed with more natural barriers and had a lower density of potential trespassers.

Implication 2 (Remoteness)

The more remote the community, in the sense of being far away from towns and communication routes, the more efficient the informal cooperation solution.

3.4 The Private Order Solution

The community charters emerged in the 13th century as a legal innovation to reduce the transaction costs involved in enforcing property rights on the land.[25] Villagers negotiated a set of rules among themselves in a general meeting, would call a notary to write them in a contract, and petition the Prince of Trento for approval. This process was always initiated by the communities. The approval of a charter operated a partial delegation of judicial powers in economic affairs from the Prince courts to a local community, which generally included the powers to appoint guards and inflict monetary sanctions on trespassers. From the community standpoint, this decentralization lowered enforcement costs. In exchange for this more effective enforcement technology, the government asked for a payment. This transfer generally took the form of a share of the collected fines, either one-third or one-half.[26]

The charters set up a system of paid guards that would monitor and report violations of the agreed harvesting rules. Some guards were hired to patrol the high mountain pastures and forests while others were in charge of patrolling the meadows near the village. The regulations restricted individual resource use, in the form of individual quotas, time, and place

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[25] The oldest known of such charters dates back to 1202 and was drawn by the small village of Civezzano, near the administrative center of Trento.
[26] In a sample of 23 charters in the years 1580-1650, such payment was required from 35% of the communities.

restrictions.[27] The guards could generally retain a third of the fine paid by convicted persons, which provided an important incentive to engage in costly monitoring activities. The remaining share of the fine went either to the state government elites or to the community treasure.

Any insider could actually report violations and, if the person was convicted, one third of the fine would go to him instead of going to the guard.[28] Punishments were in the form of monetary fines. The Prince did not allow any physical punishment, as those were under state jurisdiction and not to be delegated to simple villagers. Moreover, there was a mandated maximum cap on the monetary fine that could be inflicted on violators.

A charter could boost efficiency not only by organizing the gathering additional information but through fact-checking and information-sharing institutions. The simple village court proceedings were an effective way to distinguish baseless rumors from corroborated findings, hence resolving ambiguities that could have otherwise damaged the ability to sustain cooperation. The verdict was the "official truth" of the community that could have served as a coordination clue. Moreover, all charters indicate the need of regular meetings among the insiders to discuss common business. The meetings were often mandatory for everybody and unjustified absence was penalized with a fine. A public announcement in the meeting made any information common knowledge.[29] This informational advantage alone may have justified the introduction of the charters.[30]

Another definite advantage was in effectively deterring trespassing. There is evidence from the record of fines that a high fraction of them were incurred by outsiders. The 1677-78

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[27] Some regulations imposed a re-organization of production to make actions more readily observable.

[28] For an experimental study of the Carte di Regola monitoring and sanctioning system see Casari and Plott (2003)

[29] For instance, in some Bolivian communities that rely on informal sanctioning institutions, the leader of the village publicly announces when somebody has violated a norm about the use of the common resource. The announcement works as a coordination device to trigger the informal punishment by all the villagers. Oral communication by Marco Boscolo, June 2000.

[30] Moreover, there was an economy of scope in monitoring insiders and outsiders, as the same guards could be employed to report both trespassing by outsiders

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administration booklet of the community of Coredo lists at least ten fines extolled from outsiders, oftentimes for cutting trees in the village forest.[31] The 1589 administration booklet from the community of Mezzolombardo provides additional evidence that fines were actually inflicted.[32] If a trespasser was caught, he had to refund the market value of whatever he harvested and in addition pay a penalty. Detecting a trespasser, bringing him to court, and collecting the fine was considerably easier when performed at the village level than by the state courts and allowed for a stricter enforcement of property rights.

A charter brought advantages in terms of information, a legal punishment technology for insiders, and effective enforcement toward outsiders. Still, it involved sunk costs for creating and maintaining it. Writing an official document such as a community charter involved non-recoverable costs, as did spending time in the community meetings or serving as a community officer. If the potential surplus generated by the common property resources is small in absolute terms, the fixed costs to set up and run a private-order institution would not have been recovered.[33]

Implication 3 (Minimum size of the commons)

Under the assumption of a fixed cost to set up and run a community charter, all other things being equal, the higher the value of the common resources, the higher is the potential gain of

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[31] From the *Libri de Conti della Honoranda Comunità di Coredo:* "*ricevuto per condane fatte alli sottoscritti come forestieri*" (1677-78). There are other reports of fines where it is not specified if the payment came from insiders or outsiders: "*per due larici taliati nel ingazato, e venduti a Sfruz*" (1672-73), "*per haver tagliato un pez dent in sas nella sorte*" (1673-74), "*per il valor di legni menati dal monte con buoi forestieri senza licenza*" (1677-78).

[32] On July 18, 1589, the governor of the village recorded that a gentleman named Michel had been caught while illegally collecting firewood on common land. As a result, he had to pay a fine for an amount of *troni* (4) and *carantani* (10) in accordance with the community charter. Libretto di Amministrazione (1589): "*per una codanaza fatta per aver menado entro legna da le giare del nos,*" which literally means "for a penalty inflicted for having removed firewood from the bank of the river *Nos.*" The community charters of Mezzolombardo is reported in Devigili (1979). Most of these booklets went destroyed. We were able to find them for just two communities and for selected years.

[33] A sufficient condition for implication 3 to hold is that charter creation and administration costs are less than proportional than the value of the common property benefits.

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adopting a charter. In particular, with an endowment of common property below a given threshold, it would be more efficient to rely on a repeated game solution than on a charter.

4 Governance Regime Transition

Suppose there exist communities where a private-order governance regime (e) is a more efficient arrangement than informal cooperation (d). One can simply assume the *potential* gains of a management regime are enough to drive its adoption. Eggertsson (1990) calls this position the naïve theory of property rights. In alternative, or in addition, one can identify and test empirically the role of possible obstacles toward an efficiency-improving transition.

Setting up a charter may involve solving a collective action problem. Everybody would be better off with the charter but, as the individual effort is costly, nobody has an incentive to contribute to it. The actual process of establishing the charter resembled a social contract situation and hence voting could have overcome the dilemma that an unstructured group generally faces. A community charter had to pass two tests of consensus. First, the village assembly needed to agree on a set of rules through a supra-majority voting procedure. Second, the local political authority, which in this case was the Prince of Trento, had the right to accept or reject the charter.[34]

Yet, it is well known from social choice theory that voting procedures often generate cycles and instability in the outcome or could have no core. How was this problem overcome in the case of the northern Italian communities? If we assume that there was homogeneity of interest among the villagers of a community, in the sense that either preferences were identical or highly correlated, then efficiency enhancing policies should have had majority or supra-majority

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[34] There are instances where a charter was approved under the condition that some specific provisions had to be changed. As it is for private contracts today, there was also a general framework of rules that no charter could contradict.

support. For the above reasons, the larger the group, the more difficult would be the provision of a charter.

Implication 4 (Population; *Alternative to Implication 2*)

Communities with a large population are less likely to transition to a charter than small communities.

The communities that adopted a charter did so at different points in time, in some cases centuries apart (Figure 1). The patterns of geographical diffusion may be revealing about the underlying motive of adoption. We discuss two possible reasons, innovation by imitation and deterrence (Implication 5). A community of mostly illiterate peasants would find it hard to create a relatively sophisticated legal institution like a charter from scratch, at least not without a pre-existing model. Imitation of other communities seems more plausible than invention. Imitation would be easier if the community was aware of the existence of this legal institution and, more importantly, there was social proximity with a working example of it.

An alternative reason for adopting a charter is as a defensive measure toward neighboring communities having adopted it first. A charter may have worked as a signaling device toward trespassers; when a community adopted it, it diverted violators from its resources to the resources of neighboring communities. Once the process of charter adoption got started, the other communities, especially the physical neighbors, felt an increasing pressure to adopt it as well.[35]

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[35] In this sense, the role of the charters may resemble to the role that home security systems play in neighborhoods where warning stickers at entry points deter thieves, but encourage them to make a break somewhere else without security devices.

Implication 5 (Contagion)

A community is more likely to adopt a charter when nearby communities have already adopted it.

The two explanations point to quite different welfare effects of charter adoption and we will try to disentangle them empirically. In the former case, the regime transition is purely efficiency-enhancing. The delay in the transition is a deadweight loss caused by difficulties in information transmission. In the latter case, the increased surplus in the charter-establishing communities is, at least partially, offset by declines in surplus from increased outsider infringement in non-charter communities. In the latter case, it may also be that the aggregate costs of private-order institutions are higher than the aggregate benefits. Once locked up into an all-charter situation, no community would have an incentive to switch back to informal cooperation.

5 Empirical Analysis

5.1 Static Model

This section includes two empirical models of charter adoption, one static and one dynamic. The static model presents factors that influenced the decision of a community to adopt a charter at any point in time before 1805 (Table 1). A total of 231 communities are included in the regressions (Table 2).[36] The first charter was adopted in 1202 and the last one in 1795. By the

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[36] The dataset was built using both published and unpublished sources as detailed in the Appendix. The year of eventual adoption of a charter was recorded after accessing the original document, a transcription of it, or reliable news of the existence of the document. In 26 instances, the community charter regulated two or more villages. In that case the villages are consolidated into a single community. Moreover, 7 communities were excluded because the charter date was unreliable. Trento was excluded as well because it was the major city in the region and had a unique peculiar statute.

end of the period, about 61% of the 231 communities coded in the dataset had a charter, which corresponds to 76% of the land.

Proxies for community remoteness are built using linear and altitude distances from major towns. Distances are measured in reference to seventeen major towns that were headquarters of the decentralized government administration in the year 1810. In a mountain landscape, the length, as well as the steepness of a path could be related to how isolated a community is, although altitude and linear distances are correlated (ρ=0.54). Community-level population data are from the 1810 census (Andreatta and Pace, 1981).[37] A third dimension considered for remoteness is being on the border of the region analyzed.

Using the 1897 land survey data, land is classified according to four productivity levels. The most valuable land is used for vineyards, fruit gardens, and plow land (L1). At lower levels of productivity there are meadows (L2), then forests, alps, and grazing land (L3), and finally wasteland, lakes, and ponds (L4). Only L1 and L3 are included in the regressions because of the high correlation between L3 and L2 (0.84). We take L3 as a proxy for the land owned in common. As mentioned before, a quantitative analysis of the 1790 land registers of two communities suggests that L3 land was almost entirely common property (Goio, 1978; Varesco, 1981). To capture the possible non-linear effect of L3, a dummy is created which is equal to 1 for communities with an endowment of L3 above the sample median. To control for fixed effects, thirteen binary dummies were created for different areas of the region.

The logit regression presented in Table 1 estimates the likelihood that a community has already adopted a charter at any time before 1805. Such likelihood significantly decreases with the remoteness of the community, measured as distance from the local town. This finding is in

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[37] When break-downs at the village level were not available, we use the proportions from 1897 data (Consiglio provinciale d'agricoltura pel Tirolo, 1903).

line with Implication 1. The other dimensions of remoteness, altitude difference from the administrative center and being at the regional border are not significant. Table 1 includes two specifications of the static model, (A) and (B), which yield similar results. Specification (B) drops some insignificant variables in order to reduce multi-collinearity problems.

An important result is that the larger the community in terms of population, the more likely it is to adopt a charter. Implications 2 and 4 had opposite predictions regarding the impact of population. Implication 2 relied on the higher efficiency of the legal institution solution for larger communities and that is supported by the data. Implication 4 stressed the increasing difficulty to transition to a more efficient management regime as population size increases, but that does not seem to be the case. Finally, large amounts of commonly owned resources are positively correlated with the likelihood of adopting a charter. This finding is in line with Implication 3.

5.2 Dynamic Model

The second model aims at explaining both whether and when a community adopted a charter. The timing of charter adoption is shown in Figure 1. The estimation presented in Table 3 is done through an event history model and it confirms all findings coming from the static model. We use a discrete time version of the event history model. In particular, the time unit is 5-years, hence we have 120 time intervals t between 1200 and 1800. The relevant observations for the analysis are those communities who have not yet adopted a charter at each point in time (risk set). A community that adopted a charter in a year that falls in time interval t contributes to the dataset with t observations. Those observations up to the time interval (t-1) have a dependent variable set to 0; and the observation at the time interval t of adoption has a dependent variable set to 1. For time intervals subsequent to t, no observations are included in the data set for that

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community. If a community never adopts a charter, it has 120 observations, one for each time interval. Otherwise, it has less.[38] The actual dependent variable in the event history model is the hazard rate, P(t); given that a particular community has not yet adopted a charter (hence it is in the risk set), we model the probability that a charter will be adopted in the following time interval. This estimation is carried out with the following logit regression model:

$$(7) \quad \log \frac{P(t)}{1-P(t)} = a(t) + b_1 x_1 + b_2 x_2(t) + \varepsilon(t), \qquad \varepsilon(t) \text{ is } N(0, \sigma^2) \text{ i.i.d.,}$$

where P(t) is the number of charters adopted in time interval t divided by the number of communities in the risk set in the same time interval t. There are three classes of explanatory variables:

1) Time trend, a(t): century fixed effects

2) Time-invariant variables, x_1: remoteness proxies, private property size, common property size, area fixed effects

3) Time-varying variables, x_2: community population, contagion variables, specific historic event dummies.

In addition to the time-invariant variables x_1 of the static model, the explanatory variables a(t) and x_2 were added to the dynamic model. Population data at the community level are not available from primary sources for each 5-year interval. The 1810 data were taken as the main reference and have been scaled proportionally over time using the Italian population data from Bellettini (1987). In some ways, it is unsatisfactory because it ignores internal migrations,

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[38] This methodology can handle two issues present in the data set, censoring and time-varying explanatory variables (Allison, 1984). Censoring occurs because the period considered is finite and the event of a charter adoption does not occur for all the units. Time-varying explanatory variables such as if a neighboring community has already adopted a charter could be relevant before the community itself adopts the charter but not after that event.

differential growth within the region, and differences in population trends between Italy and Trentino.

To control for fixed effects, both area and century dummies were employed. As in the static model, thirteen binary dummies were included for different areas of the region. In addition, five century dummies were created to control for variations in the trend of the baseline hazard function over time (no dummy for 1700-1800). In addition, dummies for important historical events that might have influenced the adoption of a charter are also included: the Black Death (from 1350 to 1400), the Peasant War (1525-1535), the Council of Trento (1545-1565), and the Italian crisis of the first half of the XVII century (1600-1650). As it turns out, none of these latter historical dummies show a significant impact.

Another class of regressors concern contagion effect, i.e. the impact of the previous charter adoption by another set of communities.[39] Three different reference sets of communities are considered: (1) the whole region, (2) administrative neighbors, or (3) geographical neighbors. Contagion proxy (1) records the number of charters already adopted up to the previous time interval. Contagion proxy (2) is built in two steps. First, the region was divided into 89 non-overlapping and exhaustive clusters of communities. This partition is taken from the 1800 administrative districting of Trentino. The regressor is a dummy variable indicating whether there is at least one community in the cluster that has adopted a charter at or before time interval (t-1). Contagion proxy (3) considers the set of communities that shares borderlines with the community itself. Once the set of neighbors is identified, we build a dummy variable indicating whether at least one neighbor has adopted a charter in the previous time interval. This last

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[39] Consider a model of contagion, where the dynamic is governed by a logistic function: $Dx(t)/dt = rx(t)((1-x(t))/K)$, where r, K>0 and x(t) is the number of communities who have already adopted a charter. The cumulative number of charters, x(t), is an S-shaped function of time. The regressor is the number of communities with a charter in the previous time interval as the variable to be explained is $P(t) = (dx/dt)/(1-x) = rx/K$.

variable captures the impact of a charter as a signaling device. The three proxies are highly correlated.[40]

Table 3 presents four different specifications of the event history model. The first column is the most general, while the other three are limited to significant regressors and just one contagion proxy to avoid multi-collinearity problems. All the results from the dynamic model confirm the findings of the static model with regard to remoteness, population, and common property size.

Although all the signs are correct for all contagion proxies, the only significant impact comes from the regional proxy (1). Even when (2) or (3) is the only contagion proxy in the model, it is not significant at a 10% level. In other words the existence of other communities with a charter significantly raised the likelihood of a community to adopt a charter itself. The influence was not local but there was a general adoption trend in the region. Neither the adoption by physical neighbors (proxy 3) nor by the immediate administrative group around the community had a significant impact (proxy 2). These results have important consequence for evaluating the motivation behind a charter adoption. Setting up a new charter was not a reaction to off-set the better protection strategy of immediate neighbors; the interpretation of charter adoption as a zero-sum game is not corroborated by the data. The significance of the general proxy (3) is ambiguous. The variable could capture general factors missing from the model such as commodity prices that influenced charter adoption by all communities. Still, it is compatible with an interpretation of the charters as legal innovation that spreads the more rapidly the lower the costs of information about its content and procedure of adoption.

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[40] $\rho = 0.47$ for (1) with (2); $\rho = 0.63$ for (1) with (2); $\rho = 0.45$ for (3) with (2).

6 Discussion and Conclusion

Demsetz (1967) suggested that societies reallocate property rights in response to changes in the costs and benefits of an existing regime. His account fails to specify any mechanism by which the transition can actually occur, and the existence of such a mechanism is not obvious, because the transition is likely to be costly (Banner, 2002). This paper studies about two hundredcommunities in the Italian Alps during the 13th-19th century and examines their transition from informal to formal property rights arrangements in the management of the common forest and grazing land (the charter system).

The key to interpreting the choice of governance regime over the natural resources held in common is the long term interaction among the stake-holders. A close-knit group living in the same village for generations was eventually able to establish and enforce a new system of property rights, in the form of a "charter". Given the long-term interaction within the group, the *emergence* of a charter could be an equilibrium.

At the same time, one may argue that, thanks to the long-term interaction, informal cooperation in using the common resource could spontaneously arise without the need of a charter or any other formal enforcement institution. The tragedy of the commons literature generally assumes a one-shot interaction among the resource users. Empirically, that is clearly not the case in many situations and specifically in these alpine communities. Henceforth, the conditions that may explain the transition to a charter governance regime are the very ones that may foster informal community cooperation, thus making a regime transition not needed.

We show that this contradiction is only apparent because the informal cooperation regime was plagued by several weaknesses in the management of the common resources and the costly charter regime included several provisions that complemented and boosted informal

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cooperation. Through the lenses of the theory of indefinitely repeated games (folk theorems), we identified five such institutional functions. These functions set critical incentives in any organization where members repeatedly engage in a collective action task or in team production:

- *Protection from outsiders' appropriations.* Through the charter, the state allows the local community legal jurisdiction to prosecute outside poaching. Although it is an important pre-condition for cooperation among insiders, long-term interaction by itself was either ineffective or wasteful in protecting from outsiders' appropriation.

- *Community building institutions* that restrict mobility in and out of the group. Settling into a new community, or cheating and immediately leaving the community carried implicit and explicit penalties. The charter had provisions to raise those penalties in order to make the group even more stable over time.

- *Information-enhancing institutions* that gather new information, consolidate and validate existing information. To sustain informal cooperation, everyone must be able to monitor others' resource appropriations. Using guards and public meetings, charters actively organized the public dissemination of novel and of private information, hence making it possible to sustain higher levels of cooperation.

- *Coordination institutions* to select one of the multiple equilibria available to the group and to select a strategy to implement such equilibrium. Charters employed written rules on limits to resource appropriation and associated penalties, court verdicts, and legal procedures for collective deliberations, which solved the coordination problem.

- *Punishment institutions* that provide adequate incentives to group members to comply with the rules while minimizing the social loss of punishment. While there are plenty of

informal ways available to punish others, the charters employed monetary fines, which present two advantages, they avoid physical injuries (the state would prosecute the punisher as a criminal) and they are not wasteful because they simply transfer resources.

A charter may be more beneficial to some communities than to others. As a matter of fact, about one-third of the communities in the sample never adopted a charter. This paper presents an empirical analysis on more than two hundredcommunities to seek factors that explain charter adoption. We expect that the benefits of protection from outsider appropriations be smaller for more remote and isolated communities (Implication 1) and empirically that this is a significant factor in charter adoption. Larger communities may value the coordination function of formal institutions more highly (Implication 2). Community population is a strong predictor of charter adoption. A formal institution like a charter entailed fixed costs to be built and run. We expect communities with a small endowment of common property to be less likely to adopt a charter (Implication 3) and found that it is the case.

We found no evidence that the transition from informal cooperation to a charter was problematic. For instance, while a larger population size in a community could be an obstacle to building a costly public good like a charter (Implication 4), the empirical results do not support this view. The reason probably lies in the long-term interaction within the community. Finally, we tested for three models of diffusion of the charters from other communities within the region. There is an inverse-U time trend in charter adoption (Figure 1) that seem unrelated to the decisions of the immediate neighbors. A charter was adopted based on efficiency consideration of the individual community and not as a reaction to the competition with others.

Data Appendix

COMMUNITY CHARTERS (*Carte di Regola*)
Unpublished sources: The original manuscripts are kept at several archives: Biblioteca Comunale di Trento, Archivio di Stato di Trento, Archivio della Curia Arcivescovile di Trento, Biblioteca Civica di Rovereto, Ferdinandeum Museum of Innsbruck, Archivio di Castel Bragher (Coredo, Trento), and in village archives. Casetti (1961) provides a basic guide to the Trentino archives. A list of unpublished manuscripts currently available in the archives has been kindly supplied by Marco Stenico of the Department of Sociology of the University of Trento.
Published sources: About 190 of these charters where published in Giacomoni (1991). Many other publications have published just one charter. An exhaustive list of such articles and books for the years before 1988 is given in Nequirito (1988) while for the years after 1988 a list can be provided upon request.
Dataset: We have collected information for 356 charters from both published and unpublished sources. Of them, the text was found for 265 charters while only the news of their existence is available for 91 charters. They refer to 224 different geographical units, although there are instances of a charter referring to a group of villages and villages within the group having a distinct charter. The present study focuses only on the first adoption of a charter by a village. Some charters are newer versions of a first draft.

LAND REGISTER DATA (*Dati catastali*)
Year 1780, Unpublished: A collection of manuscripted books recording property rights on land can be found in the Archivio di Stato di Trento under *Serie Catasti Teresiani*. It comprises one or more books for each village (*comune catastale*) and describes in a systematic manner all parcels of land in the region and records the owner.
A detailed data analysis of the books for the village of Levico was done in Goio (1978). An analogous analysis for the village of Predazzo was done in Varesco (1981).
Year 1897, Published: Consiglio provinciale d'agricoltura pel Tirolo (1903). The original sources of the data are land registers. Land registers are not the *Catasti Teresiani*. A new survey was carried out in the mid nineteenth century with new criteria and in addition to the books, maps were drawn up (*Mappe Napoleoniche*). The 1897 land register partition of the region is taken as reference for the community charter analysis. The region is divided into 392 geographical units which with a handful of exceptions is always a finer partition than the community areas of the charters. The regional statistics brought from this source consider an area of 6,356.33 square km; that is, 2.4% greater than the current area of the province of Trento.
Dataset: For each of the 395 geographical units (comune catastale), the data set reports village surface devoted in 1897 to plowland, meadow, fruit garden, vineyard, grazing land, alp, forest, lake or pond, wasteland, houses, and total surface in hectares (10,000 squared meters).

POPULATION DATA
The 1810 village level data used in the regression are based on the data reported in Andreatta and Pace (1981). In the instances where a finer partition was necessary, the 1810 figure was divided proportionally to the 1897 figures, which are published in Consiglio provinciale d'agricoltura pel Tirolo (1903).

NEIGHBORING COMMUNITIES
Partitioning of the region: based on the 1810 administrative division of Trentino described in Andreatta and Pace (1981).
Physical bordering: reconstructed using land register data and GIS maps kindly provided by dr. Filippo Militello, Director of the Ufficio Catastale di Fondo (Trento).

COMMUNITY INTERNAL ADMINISTRATION
Unpublished:
Libretti d'Amministrazione [della Comunità di Mezzolombardo], *series of booklets of the years 1589, 1652-1699, 1718-1797, manuscripts, Archivio Comunale di Mezzolombardo, province of Trento, Italy*
Libro de' Conti dei Regolani della Honoranda Comunità di Coredo, *series of booklets from 1635-36 to 1698-1699, manuscript, Archivio Comunale di Coredo, province of Trento, Italy*
Published: Delugan and Visani (1988), Valenti(1911), Papaleoni (1891, 1893), and Dossi (1913, 1927) describe aspects of the property rights structure on the land.

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Monteleone (1964), Capuzzo (1985), Grossi (1992).

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Table 1: Charter adoption analysis for the year 1800 (static model)

Dependent variable: A charter was adopted by a community in or
before 1800

Independent variables:	(A)	(B)
Remoteness – Linear distance from local town	-0.08665**	-0.08522***
	(0.03667)	(0.03089)
Remoteness – Altitude difference from local town (meters)	0.00032	
	(0.00106)	
Remoteness - At regional border (dummy)	-0.39089	
	(0.46218)	
L1 (vineyard, plowland, fruit garden) - hectares	0.00045	
	(0.00164)	
L3 (forest, alp, grazing land)	-0.00004	
	(0.00012)	
Community Size – 1810 community population	0.00104*	0.00101***
	(0.00054)	(0.00034)
High endowment of common resources – (dummy for L3 above	0.82307**	0.80075**
median)	(0.39545)	(0.36970)
Constant	1.29218*	1.18574*
	(0.69498)	(0.62582)
Pseudo-R²	0.2205	0.2173
log likelihood	-120.3832	-120.8746
Number of observations:	231	231

Notes: Logit regression. To control for fixed effects, 13 area dummies are included among regressors; they are not
reported in the table. Standard deviations in parentheses. Significant at * = 10%; ** 5%; *** = 1%.

Table 2: Summary statistics for the static dataset (1800)

	Mean	Std. Dev.	Min	Max
Have adopted a charter (dependent variable)	0.610	0.489	0	1
Remoteness - Linear distance from local town (kilometers)	7.359	5.993	0	25
Remoteness – Altitude difference from local town (meters)	210.931	207.408	0	962
Remoteness - At regional border (dummy)	0.212	0.410	0	1
L1 (vineyard, plowland, fruit garden) - hectares	208.697	291.710	4	2143.6
L2 (meadows)	181.540	417.082	0	4292.2
L3 (forest, alp, grazing land)	1867.031	3526.125	8	36980
L4 (wasteland, pond, lakes)	343.413	794.759	2.5	5204.5
Total surface	2600.681	4621.16	68.5	44994..8
High endowment of common resources – (dummy for L3 above median)	0.550	0.499	0	1
Community population in 1810	897.779	1345.625	46	9478
Number of observations	231			

Table 3: Event history model of charter adoption (dynamic model)

Specifications:	(General)	(1)	(2)	(3)
Dependent variable: First adoption of a charter by a community in a specific time interval				
Independent variables:				
Remoteness – Linear distance from local town	-0.03106 (0.02115)	-0.03911** (0.01756)	-0.03889** (0.01751)	-0.03704** (0.01754)
Remoteness – Altitude difference from local town	-0.00059 (0.00063)			
Remoteness – At regional border	-0.23464 (0.24597)			
L1 (vineyard, plowland, fruit garden)	-0.00012 (0.00055)			
L3 (forest, alp, grazing land)	0.00007 (0.00005)			
High endowment of common resources – (dummy for L3 above median)	0.47930** (0.20810)	0.57688*** (0.19191)	0.57213*** (0.19187)	0.54562*** (0.19330)
Community size – Population	0.00063** (0.00027)	0.00075*** (0.00012)	0.00075*** (0.00012)	0.00073*** (0.00012)
Contagion – (1) Number of charters adopted in the region (lagged)	0.01729* (0.00959)	0.01827** (0.00926)		
Contagion – (2) There is at least a community with a charter in the administrative district (lagged)	0.20640 (0.21107)		0.24548 (0.20685)	
Contagion – (3) There is at least a physical neighbors with a charter (lagged)	0.11462 (0.27948)			0.25107 (0.26929)
Black death	-0.24611 (0.55434)			
Peasant war	-1.63731 (1.02016)			
Council of Trento	-0.09703 (0.36221)			
Crisis of first half of XVII century	0.41544 (0.47950)			
Constant	-6.15912*** (1.27686)	-6.15738*** (1.24369)	-4.00266*** (0.37034)	-4.04029*** (0.41706)
Log likelihook	*-754.0698*	*-759.5016*	*-760.6324*	*-760.9890*
Number of observations:	*20861*	*20861*	*20861*	*20861*

Notes: Event history model, logit regression. To control for fixed effects, 5 century dummies (no dummy for 1700-1800) and 13 area dummies are included among regressors; they are not reported in the table. Standard deviations in parentheses. No pair of regressors in the same column has a correlation 0.50 or higher with the exception for specification (B) of linear distance and altitude difference from local town (0.54). Significant at * = 10%; ** 5%; *** = 1%.

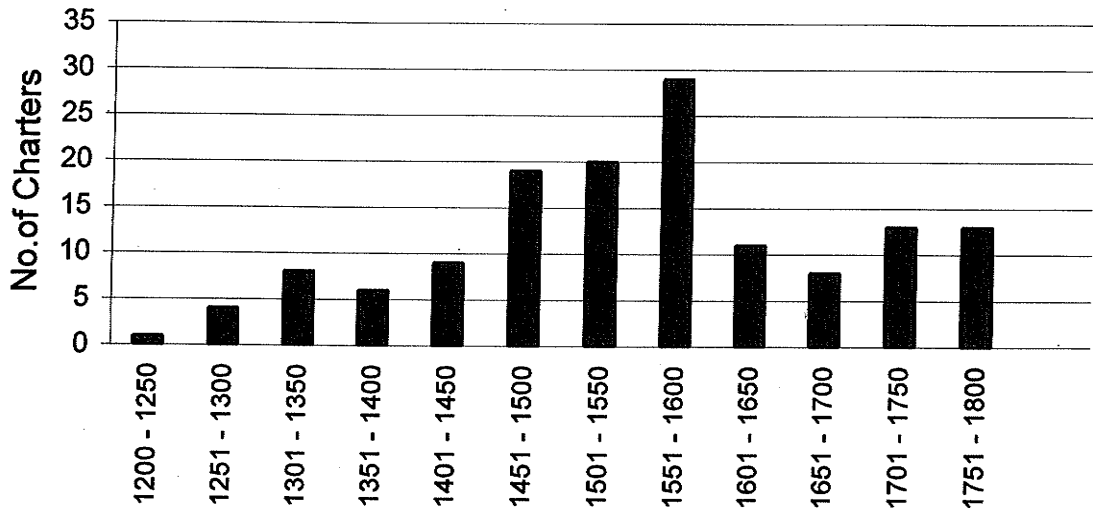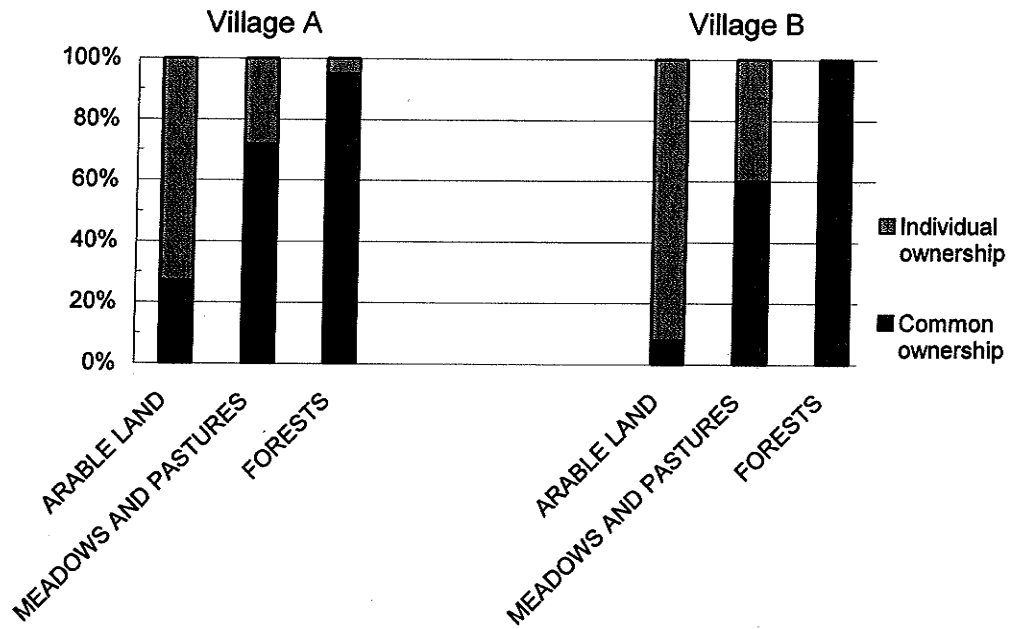*Figure 1:* Time profile of first-time charter adoption

Figure 2: Property right structure on the land

Notes: A= Levico (larger-than-average village, in the bottom of a valley, Goio, 1978), B=Predazzo (medium-size village, in a high mountain valley, Varesco, 1981). Individual ownership includes estates owned by clergy, parishes, and feudal landlords. Original source: Catasti Teresiani of 1780-90, Archivio di Stato di Trento.