

# Vermin Trials

Peter T. Leeson *George Mason University*

## Abstract

For 250 years insects and rodents accused of committing property crimes were tried as legal persons in French, Italian, and Swiss ecclesiastic courts under the same laws and according to the same procedures used to try actual persons. I argue that the Catholic Church used vermin trials to increase tithe revenues where tithe evasion threatened to erode them. Vermin trials achieved this by bolstering citizens' belief in the validity of Church punishments for tithe evasion: estrangement from God through sin, excommunication, and anathema. Vermin trials permitted ecclesiastics to evidence their supernatural sanctions' legitimacy by producing outcomes that supported those sanctions' validity. These outcomes strengthened citizens' belief that the Church's imprecations were real, which allowed ecclesiastics to reclaim jeopardized tithe revenue.

May every soul be subdued to higher powers, because whoever resists the powerful, resists God's rules, and whoever does this, is eternally condemned. (Alonso de Vega 1598, p. 1030)<sup>1</sup>

## 1. Introduction

Everyone has heard of a kangaroo court. But how about a court for kangaroos? What about a court for caterpillars? Impossible though it seems, for 250 years French, Italian, and Swiss legal systems had just that. Their ecclesiastic courts tried insects and rodents for property crimes as legal persons under the same laws and according to the same procedures used to try actual persons. These courts summonsed snails to answer charges of trespass, appointed legal counselors to locusts, and considered defenses for grasshoppers on the grounds that they were God's creatures. They convicted cockchafers of cozening crops, ful-

<sup>1</sup> Translation in Tausiet (2003, p. 437).

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minated against field mice for filching from farmers, and exiled weevils under pain of excommunication and anathema.

Vermin trials were not the province of Dark Age ignorance or impoverished primitivism. They were of a much later, more enlightened vintage—a Renaissance one. Further, they occurred in the wealthiest countries in the world.

One interpretation of vermin trials is that the judicial officials who conducted them were mad. In examining these trials' records, it is tempting to conclude as much. In the records, we find distinguished judges ordering crickets to follow legal instructions, dignified jurists negotiating a settlement between farmers and beetles, and a decorous court granting a horde of rat defendants a continuance on the grounds that some cats prevented them from attending their trial.

One gets the sense from these records that history is playing a bizarre joke on us or that perhaps Alice's Wonderland was a real place after all. But history is not playing a joke. And while the talking, pipe-puffing caterpillar in Alice's Wonderland is fictitious, legal systems that treated caterpillars as if they could talk and might occasionally enjoy a good pipe are very real.

Vermin trials pose a peculiar puzzle. As one scholar describes that puzzle, "[N]obody knows what they were for, and nobody has ever known" (Ewald 1995, p. 1925). Whatever vermin trials were for, uncovering their *raison d'être* would seem to defy penetration by rational choice.

In this paper, I solve the peculiar puzzle posed by vermin trials. To do so, I use the theory of rational choice. My analysis brings sense to the seeming senselessness of trying vermin for behaviors over which neither they nor legal systems had control. It uncovers why judges used excommunication and anathema to punish creatures that were never communicated in the first place. It sheds light on vermin trials' unusual geographic distribution, which focused on eastern France and the bordering regions of northern Italy and western Switzerland. And it illuminates the surprisingly late burst of these trials' use in Europe.

I argue that the Catholic Church used vermin trials to increase tithe revenues where tithe evasion threatened to erode them. Vermin trials achieved this by bolstering citizens' belief in the validity of punishments by the Church for tithe evasion: estrangement from God through sin, excommunication, and anathema.

Vermin trials permitted ecclesiastics to evidence their supernatural sanctions' legitimacy by producing outcomes that supported those sanctions' validity. Insects and rodents are itinerant. Moreover, they may be driven away or killed by predators or flee or die naturally for other unobserved reasons. Vermin that departed under courts' imprecations evidenced ecclesiastics' power to use the same imprecations to punish tithe evaders. Such trial outcomes strengthened citizens' belief that the Church's supernatural sanctions were real, thereby allowing ecclesiastics to reclaim jeopardized tithe revenue.

My theory of vermin trials applies Kamenica and Gentzkow's (2011) theory of Bayesian persuasion. Kamenica and Gentzkow demonstrate how, by choosing how much information to reveal about the state of the world, one person can persuade another to take an action he would prefer over the action that the

target of his persuasion originally planned to take. This is true even though both persons are rational Bayesians and even though the target of persuasion knows that the persuader makes his choice of how much information to reveal with the goal of manipulating the target's behavior for his own benefit.

In the context I consider, ecclesiastic courts aim to persuade citizens that the Church can supernaturally punish tithe evaders. By choosing vermin trials' durations, courts choose how much information to convey to citizens about the legitimacy of ecclesiastics' supernatural sanctions. The probability that pests will flee or die naturally increases as time passes. So shorter trials reveal more information about the validity of ecclesiastics' supernatural sanctions, and longer trials reveal less. A shorter trial therefore increases citizens' belief more if it produces the outcome that ecclesiastics want: vermins' departure. But precisely because it is shorter, such a trial is more likely to produce the outcome that ecclesiastics do not want: vermins' persistence. Courts' optimal trial duration negotiates this trade-off to induce a distribution of beliefs that leads citizens who would otherwise evade their tithes to pay them instead.

Economists have said nothing about vermin trials.<sup>2</sup> However, they have discussed the law and economics of superstition. This paper contributes to that literature. The law and economics of superstition explores the role that objectively false beliefs play in the legal systems of rational people. For example, Posner (1980) considers superstition's role in primitive societies' legal systems. Leeson (2012) studies superstition's role in medieval judicial ordeals of fire and water. Leeson also considers superstition's role in protecting property rights among medieval monks (Leeson, forthcoming) and facilitating law enforcement among Gypsies (Leeson 2013).

My study of vermin trials contributes to this literature by explaining how early modern legal systems leveraged and fostered citizens' superstition to increase their operators' revenues. Rather than consider the origin of citizens' belief that clerics might be able to supernaturally sanction people and pests, I investigate how clerics manipulated citizens' existing belief in that possibility to improve tithe compliance through vermin trials.

This paper is also closely connected to Ekelund, Hébert, and Tollison's (1989, 2002, 2006) and Ekelund et al.'s (1996) work. These authors study the medieval Catholic Church as a firm. They discuss how ecclesiastics used supernatural sanctions to protect the Church's monopoly on spiritual services against heretical competition.

My study also treats Church officials as profit maximizers. It complements Ekelund, Hébert, and Tollison (2002, 2006) by explaining how profit-maximizing ecclesiastics used vermin trials to manufacture additional belief in their supernatural sanctions where heretics undermined that belief and, thus, tithe revenue.

<sup>2</sup> Several noneconomists have discussed vermin trials, including Westermarck (1906), Carson (1917), McNamara (1927–28), Weiss (1937), Beach (1950), Beirnes (1994), Humphrey (2002), and Girgen (2003). Many of these authors essentially recount the discussion by Evans (1906).

## 2. Damned Vermin

The golden age of vermin trials was the fifteenth through seventeenth centuries.<sup>3</sup> During this era, citizens who confronted pest control problems used class action lawsuits to sue vermin in ecclesiastic courts. These courts conducted vermin trials under bishops' authority and jurisdiction. A community of distressed citizens was the plaintiff. A species of insect or rodent was the defendant.

Vermin trials were based on an early modern superstition. According to that superstition, if ecclesiastics invoked the appropriate conjurations against vermin that were pestering people without God's permission, God would thwart the pests supernaturally.

Early modern citizens' knowledge of pests and how to control them was poor. A perusal of pest control manuals used by professional farmers reveals just how poor. State-of-the-art Renaissance pesticides included sprinkling weasel ashes or water in which a cat had been bathed over fields to drive away mice; capturing a rodent, castrating it, and releasing it among other rodents to deter them; putting castor oil plants in afflicted fields to drive away moles; and hanging garlic around flock leaders' necks to protect sheep from wolves.<sup>4</sup>

These pest control remedies were handed down from classical authorities. As one historian of agriculture put it, "Apparently the man of the Renaissance was all too ready to accept without question and to recommend to others the remedies he found in the classical authors. . . . There is little mention of experimentation" (Dannenfeldt 1982, p. 558). Because of this, early modern farmers' knowledge of pests was barely better than the ancients'.

Thus, it is unsurprising that, together with the other impressive remedies noted above, early modern farmers considered the ecclesiastical trial of vermin as a possible pesticide. Indeed, early modern pest control manuals explicitly advised farmers to use divine pesticide when confronted with difficult-to-resolve infestations. As one manual put it, "When all of these remedies are unsuccessful, one must turn to the ban of the Church" (Dannenfeldt 1982, p. 555).

Early modern citizens' divine-pesticide superstition is still less surprising when one considers the superstitions held by Europe's intellectual elite during the same period. These individuals held, for example, that the continent was infested by witches who had intercourse with demons and stole men's genitals while the men slept. When compared with this belief, simple farmers' belief that God might be able to exterminate pests is unremarkable.

Citizens prosecuted vermin for violating their property rights. They sued in-

<sup>3</sup> This paper considers ecclesiastic trials of vermin only. It does not consider the prosecution of domestic animals, such as dogs and pigs, in secular courts. For information on trials of domestic animals, which is often mixed with discussions of vermin trials, see Evans (1906) and Finkelstein (1981). For information on trials of inanimate objects, which is also occasionally mixed with discussions of animal trials, see Hyde (1916, 1917a, 1917b) and Pietz (1997). For information on animal trials conducted under Roman law, see Jackson (1978).

<sup>4</sup> Early modern manuals contain a few pest control methods that are more sensible, for example, poison. But even these display incredible ignorance. One suggests using butter to poison rats.

sects and rodents for eating their crops, burrowing holes in their farmland, and trespassing on their property. For example, in the sixteenth century, the inhabitants of Autun, France, charged some rats with “having feloniously eaten up and wantonly destroyed the barley-crop of that province” (Evans 1906, p. 18). Similarly, in 1478 the inhabitants of Berne, Switzerland, sued some “ingers”—a species of beetle—for “creeping secretly in the earth devastat[ing] the fields, meadows and all other kinds of grain” (Evans 1906, p. 117).<sup>5</sup>

Plaintiffs initiated legal action against vermin by addressing their concerns to their bishop, the bishop’s local representative, or local officials charged with legally representing the community in its dealings with other local governments and the Crown. Plaintiffs’ complaints ultimately came to the attention of the local officials. These officials, called procurators, were comparable to modern district attorneys.

Following plaintiffs’ appeal, the procurator produced a formal statement of their complaint. He delivered this statement before the ecclesiastic court exercising the bishop’s jurisdiction over the community he represented. The procurator’s statement identified the property crime his clients’ alleged, the species of insect or rodent accused of committing the crime, and asked the court to order the offending vermin to immediately cease violating his clients’ rights, compelling them to if they refused.

Consider the prosecuting attorney’s statement to the court in a case the presiding justice aptly dubbed “The People versus Locusts.” The citizens of Lombardy, Italy, launched this lawsuit against the locusts in 1541 (Evans 1906, pp. 96–97):

Gentlemen, these poor people on their knees and with tearful eyes, appeal to your sense of justice. . . . In the power of excommunication you have a weapon more effective than any wielded by that emperor [Augustus Caesar] to save these poor supplicants from impending famine produced by the ravages of little beasts, which spare neither the corn nor the vines. . . . It remains, therefore, after complying with the usual forms, only to adjudicate upon the case in accordance with the facts stated in the Petition of the Plaintiffs, which is right and reasonable, and, to this effect, to enjoin these animals from continuing their devastations, ordering them to quit the aforesaid fields and to withdraw to the place assigned them, pronouncing the necessary anathemas and execrations proscribed by our Holy Mother, the Church, for which your petitioners do ever pray.

If the court saw merit in the plaintiffs’ petition, it might exhort the plaintiffs to pray publicly for the vermin to depart, hold processions for this purpose, and direct the plaintiffs to display extrareligiosity and repent of their sins. If the pests remained, the court might try them to determine their guilt. Alternatively, the court dispensed with the pious prelude and tried the vermin immediately.

Ecclesiastic courts appointed defense attorneys to represent accused insects

<sup>5</sup> Multiple communities beset by the same pests sometimes sued vermin collectively. For instance, in 1659 the Italian communes of Chiavenna, Mese, Gordona, Prada, and Samolico banded together to prosecute caterpillars they charged with trespassing on and damaging their fields.

and rodents. Thus, when in 1519 the inhabitants of Glurns, Italy, sued some field mice for property damage, the court appointed legal counsel for the mice “to the end that they may have nothing to complain of in these proceedings” (Evans 1906, p. 112). Similarly, later that century, when the inhabitants of Saint-Jean-de-Maurienne, France, sued some weevils, the court appointed the creatures two legal representatives, a procurator and an advocate, “lest the animals against whom the action lies should remain defenseless” (Cohen 1993, p. 120).

Ecclesiastic judges showed impressive fairness toward vermin in such trials. Consider a fourteenth-century lawsuit brought against some flies by the inhabitants of Mainz, Germany. To the court’s consternation, the flies refused to appear before the bench after being summonsed. The court concluded that “in consideration of their small size and the fact that they had not yet reached their majority,” it would overlook the flies’ failure to appear and would appoint them adequate defense counsel to prevent it from happening again (Evans 1906, pp. 110–11).

Some court-appointed defense counselors for vermin were more than adequate. One attorney for vermin, Bartholomé Chassenée, was a leading jurist of his era. In 1540, Chassenée became president of the Parlement de Provence, having earned an enviable reputation by defending a horde of rats.

The lawyers representing vermin argued strenuously for their clients at trial. A common defense was that the defendants were God’s creations. Thus, they had as much right to enjoy the fruit of His earth as the plaintiffs. Another common defense was that the case was invalid. Thus, the plaintiffs should be nonsuited.

One argument that vermin defense attorneys made toward this end was that their clients were vermin (Evans 1906, pp. 98–99). This would have been a sensible argument against treating pests as legal persons—presumably the most sensible one—were it not offered by way of elaborate judicial proceedings that presumed the legitimacy of treating grasshoppers and moles as legal persons *ipso facto*.<sup>6</sup>

Procurators on both sides “took their job very seriously, devoting a great deal of time, knowledge, and legal expertise to the defense of their clients” (Cohen 1993, p. 120). Vermin trials involved much legal wrangling. And judges at least pretended to be at great pains to decide cases justly.

Having taken such pains, the court made its judgment. Usually this was to convict the vermin.<sup>7</sup> On occasion, however, the vermin were exonerated, or at least were not convicted, which amounted to the same (Evans 1906, pp. 38–39).

<sup>6</sup> According to Chassenée (1531), another legal maneuver attorneys for vermin resorted to was to argue that their clients were clerics, which entitled the vermin to the benefit of clergy. This would have permitted insects and rodents to have an ecclesiastic judge decide their case when the bishop granted jurisdiction to a secular magistrate (Evans 1906, pp. 32–33). No vermin counselor ever used this argument. Still, the possibility that caterpillars or field mice might be men of the cloth was an argument the courts were willing to entertain.

<sup>7</sup> Vermin often lost their case by default. Judges summonsed vermin to appear in court to answer the charges against them three times. “The summonses were . . . served in the usual way by an officer of the court, reading them at the places most frequented by the animals” (Jamieson 1988, p. 51). If the vermin failed to respond to the third and final summons, the court could convict them.

To ensure that all members of the convicted species were aware of their sentence, the court announced its verdict publicly and nailed broadsheets declaring its judgment to trees in the affected area. Alternatively, the court might bring some specimens before the bench to inform them of its decision, remitting the creatures to the afflicted area to share the decision with their colleagues (Dinzelbacher 2002, p. 410).

The court also notified the convicted pests of the penalty they would suffer should they prove contumacious: excommunication from the Holy Church and anathema. Consider the court's decision in "The People versus Locusts" (Evans 1906, p. 107):

In the name and by virtue of God, the omnipotent, Father, Son and Holy Spirit, and of Mary, the most blessed Mother of our Lord Jesus Christ, and by the authority of the holy apostles Peter and Paul, as well as by that which has made us functionary in this case, we admonish by these presents the aforesaid locusts and grasshoppers and other animals by whatsoever name they may be called, under pain of malediction and anathema to depart from the vineyards and fields of this district within six days from the publication of this sentence and to do no further damage there or elsewhere.

Vermin trials ended ironically. Pests that were damned figuratively by beleaguered plaintiffs were damned literally by courts of law.

### 3. *La Dîme Ecclesiastique* and Divine Punishment

#### 3.1. *Tithe Evasion*

*La dîme ecclesiastique*—the ecclesiastic tithe—was the Church's tax on citizens. In principle, citizens owed tithes on all agricultural output, livestock, and the proceeds of fishing, hunting, and trade. In practice, churchmen demanded tithes on crops and livestock. These tithes were a central source of Church revenue in the early modern era. According to one estimate, they constituted two-thirds of that revenue on the eve of the French Revolution (Scott 1987, p. 439).

The Church assessed tithes "on the natural yield"—that is, as a percentage of physical produce. A levy of about 10 percent was typical (Le Roy Ladurie and Goy 1982, p. 15). Ecclesiastics collected tithes directly or leased the right to collect them to "tithe farmers," who paid their lessors cash up front for the privilege.

Enforcing tithe payments was difficult. The government recognized the Church's right to collect them. And churchmen could—and sometimes did—use the state's coercive power to enforce tithe payment. But state enforcement had limited usefulness. It was most useful for preventing blatant refusal to pay. Tithe refusal was easy to detect and thus prosecute. In contrast, state enforcement was often useless for preventing surreptitious, partial underpayment. Tithe evasion was extremely hard—and, in many cases, impossible—to detect and thus prosecute.

Citizens developed "1,001 ruses" to evade their tithes (Le Roy Ladurie and

Goy 1982, p. 27; Scott 1987, pp. 444–46). Some of these ruses were simple. For example, citizens opened new plots of land and did not declare them. Similarly, they hid portions of their harvests from tithe collectors before the collectors came to assess them.

A more elaborate ruse was crop switching. Producers substituted sowing crops tithable at higher rates with crops tithable at lower rates or crops that were not tithable at all. Alternatively, they interplanted higher- and lower- (or non-) tithable crops in the same field. If planted cleverly, this permitted producers to pay a lower rate on the entire field.

Citizens also exploited loopholes in the tithe system. Personal gardens were often exempt from tithing, so citizens expanded their gardens' size. Similarly, the sheaves that formed the bases of crop stacks were customarily nontithable. So producers enlarged their stack bases too.<sup>8</sup>

Natural variation in agricultural output from plot to plot, laborer to laborer, and so on, facilitated even the coarsest of evasive strategies tremendously. It thwarted tithe collectors' ability to discern whether the small harvest that a citizen declared reflected a genuinely poor crop or tithe evasion.

Tithe collectors did their best to monitor harvests and prevent such abuses. And they were not totally clueless. They had an idea of what the weather was like that year and what size harvest a certain-sized plot was capable of producing. This helped collectors develop lower-bound estimates of tithable harvests for individual plots, even if they could not determine the actual tithable harvests that they confronted in particular cases. Still, the fact that the Church levied *la dîme ecclésiastique* on products whose nature was so amenable to producer dissimulation and manipulation "presented almost insurmountable obstacles to tithe collectors, who had only so many carts, so many assistants, and so much time" (Scott 1987, pp. 444–45).

### 3.2. Supernatural Sanctions

Insurmountable obstacles to enforcing tithe compliance through external monitoring and detection required the Church to find a way to make tithe compliance self-enforcing. That way was supernatural sanction. Unlike traditional sanctions, supernatural ones execute automatically. God's omniscience and omnipotence ensure perfect monitoring and detection of proscribed behaviors.

The Church supernaturally sanctioned persons who defied its orders by claiming to estrange them from God. Divine estrangement lay on a spectrum. At one end was the simple sinner. The Church claimed that by violating its orders, a person sinned, thereby distancing himself from the Lord. Unabsolved sin sub-

<sup>8</sup> Another tithe loophole that citizens abused was called the *rompu* (the portion of the harvest that was not divisible by the tithe rate). For instance, if the tithe rate was one-twelfth and a farmer harvested 17 sheaves of wheat, the five sheaves that remained was the *rompu*. According to custom, the *rompu* was not tithable. To evade their tithes, producers manipulated their sheaves' size.



tracted from the sinner's time with God in the afterlife and added to his time in purgatory.

At the other end of the spectrum was the excommunicant. In excommunicating someone, a Church official separated that person from God and His Church—the ordinary channel to salvation. Excommunication had three degrees of severity: minor, major, and anathema. A minor excommunication severed the excommunicant from the sacraments. A major excommunication severed him from God and the Church completely. Anathema was a kind of aggravated major excommunication—a major excommunication with gusto. It involved a dramatic ceremony, cursing the excommunicant, and making the delivery of his soul to Satan explicit.

The Church could level its supernatural sanctions at particular individuals, whole communities (interdiction), or generically against all persons who engaged in particular proscribed behaviors. For example, heretics became excommunicants when they took up heretical thinking, regardless of whether the Church identified them individually as heretics. Such excommunication *latae sententiae* excommunicated offenders in the act. Formal proclamations of excommunication or anathema that might follow merely publicly recognized the offenders' preexisting spiritual state.<sup>9</sup>

Unable to enforce payment of tithes through external pressures, the Church deployed supernatural sanctions to enforce tithe payments through internal pressures.<sup>10</sup> It declared tithe evasion a sin—going as far as to include in the Church commandments citizens' moral obligation to pay their tithes (Villien 1915, pp. 348–49). And it incessantly reminded citizens that tithe evasion was sinful (Jackson 1911, p. 454).

Ecclesiastics maximized the sin accomplished in evading tithes by rendering the obligation to tithe not merely an obligation to God's Church, but an obligation to God. As twelfth-century pope Alexander III put it, tithes were “instituted not by men, but by God Himself” (Lansdell 1906, p. 191). A century later, the Fourth Lateran Council reaffirmed this position. “[T]he Lord,” the Council decreed, “has reserved tithes unto himself as a sign of his universal lordship” (Tanner 1990, 1:258). They “are indeed to be paid of necessity, inasmuch as they are owed in virtue of divine law” (Tanner 1990, 1:256). Thus, to evade tithes was to steal from God.

Ecclesiastics also used excommunication and anathema to enforce tithe compliance (Baumgartner 1995, p. 35). They pounded the pulpit, excommunicating

<sup>9</sup> The pope and his bishops commanded authority to define sins, excommunicate, and anathematize. Lower-level clerics hurled supernatural sanctions under the former's jurisdiction. The pope or bishops granted them permission to do so individually or en masse through synods and councils.

<sup>10</sup> In some times and places in the early modern period, the traditional tithe collected on agricultural output was not important or did not exist. In these cases, ecclesiastics relied on the sacramental tithe to earn revenue, charging for Easter communion, baptism, funerals, and so on (Torre 1992, p. 54). Of course, those whose beliefs were weak, who were less likely to seek such sacraments, were also less likely to pay these tithes. Thus, here too, bolstering belief in ecclesiastics' supernatural sanctions was important for collecting revenue.

and cursing *generaliter* all tithe evaders in their parishes. They excommunicated tithe evaders *latae sententiae* in synods and provincial councils (Tausiet 2003, p. 441). And at the Council of Trent, they prescribed excommunication for persons who did not pay their tithes in full: “[W]hereas the payment of tithes is due to God; and they who refuse to pay them, or hinder those who give them, usurp the property of another. Wherefore, the holy Synod enjoins on all . . . that they henceforth pay in full the tithes, to which they are bound in law, to the cathedral church. . . . And they who either withhold them, or hinder them (from being paid), shall be excommunicated” (Waterworth 1848, p. 269).<sup>11</sup>

Citizens could evade their tithes. But they could do so only under the pain of churchly imprecations that estranged them from God.

#### 4. A Theory of Vermin Trials

The Church’s supernatural sanctions had the potential to prevent tithe evasion. But there was a problem: people had to repose sufficient belief in those sanctions for them to work. Ecclesiastics therefore sought a way to bolster citizens’ belief in their divine punishments where citizens’ belief in them was weakened. That way was vermin trials.

The ecclesiastics who administered vermin trials connected the pest infestations with which citizens asked them to assist to citizens’ tithe compliance directly. Vermin trials not only threatened prosecuted pests with the same supernatural punishments that ecclesiastics used to threaten tithe evaders. The courts that conducted them used the trials to exhort citizens to pay their tithes in full explicitly.

For example, in anathematizing some bugs convicted of property destruction in 1516 in Troyes, France, the court made sure to remind the plaintiffs that they must “pay, moreover, the tithe without fraud and according to the custom recognised in the locality” (Vizetelly 1882, p. 25; Evans 1906, p. 107; Dinzelbacher 2002, p. 409). A French court issued the same injunction 4 years earlier, when the vineyard owners of Saint-Jean-de-Maurienne sued some weevils for eating their grapes. “The people [were] admonished to turn to the Lord with pure and undivided hearts to repent of their sins with unfeigned contrition, and to resolve to live henceforth justly and charitably, and above all to pay tithes” (Evans 1906, p. 39). “[T]he payment of due tithes” also appeared regularly among the displays of extrareligiosity in which justices instructed plaintiffs to engage when they ordered pretrial piety or plaintiff penance in lieu of convicting vermin (Cohen 1986, p. 13). Even Chassenée (1531) identified paying “tithes with exactness” as an antidote to vermin infestation (Berriat-Saint-Prix 1829, p. 227).

It is likely that tithing was not the only behavior that ecclesiastics sought to influence through vermin trials. But given tithe revenue’s importance to Church income, it is unsurprising that tithe compliance in particular featured promi-

<sup>11</sup> Excommunication of tithe evaders goes back centuries before the Council of Trent, for instance, at the Council of Mâcon in 585 and the Fourth Lateran Council in 1215.

nently and explicitly in these trials. Further, unlike some other behaviors that the Church may have desired to influence by manipulating the belief of citizens, tithing compliance was not observable. Tithing behavior therefore depended more strongly on the belief of citizens in the validity of ecclesiastics' supernatural sanctions than many other behaviors important to the Church, which could be influenced through ordinary incentives.

Vermin trials' power to influence citizens' belief in the legitimacy of the Church's supernatural sanctions resided in their power to produce outcomes that evidenced those sanctions' validity. These trials had two possible outcomes: prosecuted vermin could flee or die, ceasing to plague the plaintiffs' property, or they could remain on the plaintiffs' property, continuing to plague the plaintiffs.

Only trials that led to the first of these outcomes evidenced the validity of ecclesiastics' supernatural sanctions. Prosecuted vermin that fled or died during or shortly after their trials did so under ecclesiastic conjurors' imprecations or those imprecations' threat. Thus, ecclesiastics could claim credit for the pests' departure.

Trials that led to the second outcome evidenced the bogus nature of the Church's supernatural sanctions. Prosecuted vermin that remained on plaintiffs' property did so despite ecclesiastic conjurors' imprecations, therefore casting doubt on the validity of ecclesiastics' conjurations.

A crucial feature of trying vermin is that the court conducting such a trial can influence which of these two outcomes the trial yields. Rodents and insects are itinerant. A pack of rats that ravages some fields is likely to depart those fields when feeding prospects begin to look better elsewhere. A swarm of locusts may move on for similar reasons. Alternatively, the pests may be killed or driven away by predators or flee or die naturally for other unobserved reasons. Because of this, over even reasonably short periods, vermin under an ecclesiastic court's imprecations could "miraculously" cease to harass the persons they formerly plagued.

The probability that a vermin problem will remedy itself in one of these ways increases as the period of time in question lengthens. Thus, by protracting the vermin's trial, an ecclesiastic court could improve the chances that the pests would depart under its imprecations or their threat.

Courts had a variety of means at their disposal for prolonging trials. Indeed, since courts determined which legal plays vermin trials consisted of and the amount of time convicted species had to comply with their judgments, ecclesiastics could ensure any trial durations that they desired. For example, a court could minimize a trial's length by immediately judging the vermin guilty. Or it could prolong the trial in various degrees by appointing lawyers for the vermin, entertaining more arguments from opposing legal counselors, ordering the vermin to answer summonses, surveying the plaintiffs' infested property, negotiating with the vermin through their lawyers, granting the vermin continuances, giving convicted pests time to comply with court directions or judgments, and so on.

A sufficiently long trial achieved through such tactics guarantees that vermin

will depart under ecclesiastics' imprecations or their threat. In the limit, winter arrives, killing the pests. The problem for courts is that the positive relationship between the amount of time that passes (and thus trial duration) and a vermin problem remedying itself is well understood. Even ill-informed farmers recognize that insects and rodents must die or move on eventually. A vermin trial long enough to coincide with vermin's certain departure is therefore also a trial that does nothing to increase citizens' belief in ecclesiastics' supernatural sanctions. More generally, the longer a vermin trial lasts, the less convincing evidence it supplies for the validity of the Church's power to imprecate if the vermin depart.

Conversely, the shorter a trial's duration, the more convincing evidence it provides of the Church's power if the vermin depart and thus the greater the boost that such an outcome gives to citizens' belief. The most convincing evidence and thus the greatest boost to belief is produced by the shortest trial that succeeds—that is, that in which the court immediately declares the vermin guilty and the pests quickly depart. But the shorter a trial is, the less likely it is to produce this outcome and the more likely it is to produce the outcome ecclesiastics want to avoid: the vermin's persistence.

Given this trade-off, how did ecclesiastics use vermin trials to bolster citizens' belief on average? My theory of how they did so applies the theory of Bayesian persuasion from Kamenica and Gentzkow (2011). Kamenica and Gentzkow demonstrate how, by choosing how much information to reveal about the state of the world, one person can persuade another to take an action he would prefer over the action the target of his persuasion originally planned to take. This is true even though both persons are rational Bayesians and even though the target of persuasion knows that the persuader makes the choice of how much information to reveal with the goal of manipulating the behavior of the target for his own benefit.

The key feature of Bayesian rationality that permits this result is the fact that Bayes's rule restricts only the expectation of posterior beliefs. Bayes's rationality requires that an individual's expected posterior belief equal his prior belief but otherwise puts no constraints on his posterior beliefs' distribution. Thus, as long as a target of persuasion does not act linearly in his beliefs, a persuader can influence the target's behavior in his interest. The persuader does so by manipulating the target's distribution of posterior beliefs, which he achieves by controlling the information he conveys to the target.

To understand how ecclesiastics leveraged this logic through vermin trials to convince citizens to pay more tithes, consider an ecclesiastic court and a risk-neutral, fifteenth-century French farmer, Pierre. Pierre's community is plagued by beetles and seeks the court's supernatural assistance to remove the pests. Pierre and the ecclesiastics who compose the court are rational Bayesians.

There are two unknown states of the world  $\omega \in \{0, 1\}$ : ecclesiastics' supernatural sanctions are real or they are bogus. Let  $\omega = 1$  denote the former case, where ecclesiastics have the power to end the beetle plague and thus evasion of

tithing is costly for Pierre's soul. The court and Pierre share a common prior that  $\omega = 1$ , where  $\mu_0 = (0, 1]$ .

Upon the appeal of Pierre's community, the court chooses a trial duration  $\sigma = [0, 1]$ . Its choice of duration affects the trial outcome  $s \in \{\text{depart, not}\}$  conditional on the state. If  $\omega = 0$ , the beetles flee or die ( $s = \text{depart}$ ) with probability  $\sigma$ . If  $\omega = 1$ , the beetles are expunged by God, so  $s = \text{depart}$  with probability 1. The duration  $\sigma$  and the outcome  $s$  are publicly observed.

Note that the court's choice of trial duration is a choice of how much information about the state of the world to reveal to Pierre. We may say that  $\sigma$  is the court's signal to Pierre about that state. A minimal trial duration,  $\sigma = 0$ , is a completely informative signal about the state of the world. The court declares the guilt of the beetles immediately, and the beetles either depart or persist. In this case, Pierre learns about the validity of ecclesiastics' supernatural sanctions definitively.

A maximal trial duration,  $\sigma = 1$ , is completely uninformative. By protracting the trial to the point at which the beetles reach their natural life spans, the court fully obfuscates the reason for the beetles' departure. Indeed, a maximal trial duration is equivalent to not conducting a trial at all or, what is also equivalent, to exonerating the beetles. In this case, Pierre learns nothing about the validity of ecclesiastics' supernatural sanctions.

Ecclesiastics want to maximize tithe revenue from Pierre. Doing so requires optimizing  $\sigma$ . What trial duration maximizes Pierre's expected tithe payment as a function of his prior belief in the validity of ecclesiastics' supernatural sanctions,  $\mu_0$ ? To find out, we need to derive Pierre's optimal tithe payment as a function of his posterior belief in that validity,  $\mu_s$ , after observing a trial's outcome,  $s$ .

Suppose that Pierre's total tithable harvest has a dollar value of  $y > 0$ , which faces a tithe rate of  $t \in (0, 1)$ . Pierre chooses how much of that value to declare to the tithe collectors,  $x \geq \underline{y}$ , where  $\underline{y} > 0$  is the minimum tithable harvest value that Pierre can get away with declaring. The vagaries of agricultural production preclude tithe collectors from observing  $y$ . But they have a lower-bound estimate of Pierre's tithable harvest value based on factors they can observe, such as the weather and the size of Pierre's plot.

The Church supernaturally sanctions tithe evaders by claiming to estrange them from God. It declares them to be sinners, excommunicates them, and/or anathematizes them. These sanctions are divine, so they always and automatically execute on evaders who repose any belief in them. The Church's imprecations threaten a (utility) penalty for evaders that scales with the extent of their sin and thus the extent of their tithe evasion,  $\phi(y - x)$ , where  $\phi > 0$ . Tithe collectors do not observe the extent of a citizen's evasion, but God does.

Pierre maximizes

$$\max_x y - tx - \mu_s \phi(y - x).$$

This maximization problem has a simple solution. Pierre declares his actual

tithable harvest value,  $y$ , and thus pays  $ty$ , if and only if  $\mu_s \geq t/\phi$ . Otherwise, he declares the minimum tithable harvest value he can get away with,  $\underline{y}$ , and thus pays  $t\underline{y}$ . Given this behavior, ecclesiastics' expected valuation of Pierre's posterior belief is a step function equal to  $t\underline{y}$  when  $\mu_s < t/\phi$  and equal to  $ty$  when  $\mu_s \geq t/\phi$ .

Since Pierre declares his full tithable harvest value if his prior belief in the validity of ecclesiastics' supernatural sanctions is  $\mu_0 \geq t/\phi$ , ecclesiastics stand to gain nothing by conducting a vermin trial when this is the case. Thus, if  $\mu_0 \geq t/\phi$ , the court chooses  $\sigma = 1$ . It does not conduct a trial. In contrast, if  $\mu_0 < t/\phi$ , there is room for the court to convince Pierre to declare more of his tithable harvest value through a vermin trial. So it conducts one.

Two observations help identify this trial's optimal duration. First, note that when  $\mu_0 < t/\phi$ , a trial of any duration whose outcome is unsuccessful (that is,  $s = \text{not}$ ) has the same effect on Pierre's behavior. Any such trial, which reduces Pierre's posterior belief, leaves his belief too weak to induce tithe compliance:  $\mu_s < t/\phi$ . Since a trial duration that induces a lower posterior belief when an unsuccessful outcome is realized induces a higher posterior belief when a successful outcome is realized (that is, when  $s = \text{depart}$ ), the optimal trial duration if  $\mu_0 < t/\phi$  is a duration that drives Pierre's posterior belief to zero when  $s = \text{not}$ .

Second, note that Pierre's behavior is the same whether his posterior belief is just equal to  $t/\phi$  or is greater than this. Since a trial duration that induces a higher posterior belief when a successful outcome is realized is less likely to produce such an outcome, the optimal trial duration if  $\mu_0 < t/\phi$  is one that increases Pierre's posterior belief to exactly  $t/\phi$  when  $s = \text{depart}$ .

These observations imply that the court's optimal trial duration is one that induces a binary distribution over Pierre's posterior beliefs, generating  $\mu_s = 0$  with some probability and  $\mu_s = t/\phi$  the rest of the time. To find these probabilities, simply recall that Bayes's rationality requires Pierre's expected posterior belief to equal his prior belief. Where  $\tau(\mu_s)$  denotes the probability of  $\mu_s = t/\phi$ ,

$$\mu_0 = \frac{t}{\phi} \tau(\mu_s) + 0[1 - \tau(\mu_s)].$$

Solving this equation for  $\tau$ , the court's optimal trial duration is one that induces  $\mu_s = 0$  with probability  $1 - \mu_0\phi/t$  and induces  $\mu_s = t/\phi$  with probability  $\mu_0\phi/t$ .

From here it is easy to compute the court's optimal trial duration. Using Bayes' rule,

$$\mu_s(\omega) = \frac{\sigma(s|\omega)\mu_0(\omega)}{\sigma(s|\omega)\mu_0(\omega) + \sigma(s|\omega')\mu_0(\omega')}$$

and the fact that

$$\tau(\mu_s) = \sigma(s|\omega)\mu_0(\omega) + \sigma(s|\omega')\mu_0(\omega')$$

produces

$$\mu_s(\omega) = \frac{\sigma(s|\omega)\mu_0(\omega)}{\tau(\mu_s)}.$$

Solving for  $\sigma$  results in

$$\sigma(s|\omega) = \frac{\mu_s(\omega)\tau(\mu_s)}{\mu_0(\omega)}.$$

With this equation, the values for  $\mu_s$ ,  $\tau$ , and  $\mu_0$  from above can be used to find the court's optimal  $\sigma$ . Doing so yields the binary signal

$$\sigma(\text{not}|\omega = 0) = \frac{t - \mu_0\phi}{t(1 - \mu_0)} \quad \sigma(\text{not}|\omega = 1) = 0$$

$$\sigma(\text{depart}|\omega = 0) = \frac{\mu_0(\phi - t)}{t(1 - \mu_0)} \quad \sigma(\text{depart}|\omega = 1) = 1.$$

When  $\mu_0 \geq t/\phi$ , the court conducts no trial and ecclesiastics collect from Pierre tithe revenue equal to  $t\gamma$ . When  $\mu_0 < t/\phi$ , the court conducts a trial and ecclesiastics expect to collect from Pierre tithe revenue equal to  $\mu_0\phi(\gamma - \underline{\gamma}) + t\underline{\gamma}$ . This is more than they collect from Pierre without the trial,  $t\underline{\gamma}$ . Even though Pierre is a rational Bayesian, and even though he is aware that the court manipulates the duration of vermin trials to manipulate his belief, the court is able to use vermin trials to improve Pierre's tithe compliance and thus ecclesiastics' tithe revenue.

This model delivers two predictions. First, when courts conduct vermin trials, they prolong them:  $\sigma = \mu_0(\phi - t)/t(1 - \mu_0) > 0$ . Maximally informative trials reveal too much information to citizens. They permit no scope for producing false positives ( $\text{depart}|\omega = 0$ ). Protracted trials, on the other hand, which are less informative, permit scope for false positives and in doing so enable ecclesiastics to use vermin trials to manipulate citizens' belief. Thus, when ecclesiastics conduct vermin trials, we should observe protracted trials rather than trials in which ecclesiastics immediately render guilty judgments.

Second, when ecclesiastics conduct vermin trials, trial duration is increasing in  $\mu_0$ . This can be seen by inspecting the optimal  $\sigma$  above. When prior belief is low, it is harder to convince citizens to pay their tithes. So ecclesiastics must conduct more informative trials, which are shorter ones. As prior beliefs get closer to the threshold that induces tithe compliance, more frequent and less compelling false positives become more valuable to ecclesiastics. Thus, when ecclesiastics conduct vermin trials, we should observe longer trials where citizens' prior belief in the validity of the Church's supernatural sanctions is stronger.

## 5. Evidence

The historical evidence permits me to examine the first of the foregoing predictions, although not the second. While, as I document below, historical

evidence is available that attests to the length of vermin trials, there is no available evidence on how this length may have varied with the strength of citizens' belief in the validity of ecclesiastics' supernatural sanctions. There are, however, two other implications of my theory of vermin trials on which the available evidence can shed light: the location and the timing of vermin trials.

According to my theory, ecclesiastics use vermin trials to bolster belief in the legitimacy of their supernatural sanctions where and when belief in those sanctions is weak—that is, when  $\mu_0 < t/\phi$ . Thus, if my theory is correct, we should observe vermin trial activity focused in those places where belief in the Church's supernatural power was eroded. Likewise, we should observe vermin trial activity focused in those years in which belief in the Church's supernatural power was under attack.

The results of my efforts to locate vermin trials geographically and in time must be interpreted with caution. There are many reasons, besides that suggested by my theory, why we might expect to find vermin trials focused in locations and times in which belief in the Church's supernatural power was weak that the available evidence is unable to rule out. Further, as I describe below, the data on which I rely to locate vermin trials in time and place are unavoidably crude. The evidence for my theory considered below is therefore far from definitive. It is, however, instructive and, to the extent that it produces patterns that are suggested by the argument developed above, consistent with my theory.

### 5.1. *Vermin Trial Duration*

According to my theory, when ecclesiastics conduct vermin trials, they conduct them with the duration  $\sigma = \mu_0(\phi - t)/t(1 - \mu_0) > 0$ . Thus, rather than observe trials wherein courts immediately convict insects and rodents following plaintiffs' request that they do so, we should observe protracted trials that end only after delay. The evidence regarding durations of vermin trials supports this prediction.

Delays in vermin trials “were frequent and long” (Hyde 1916, p. 705). “The courts would . . . by every reason for delay, evade” concluding them (Jamieson 1988, p. 51). Consider the trial of some weevils prosecuted in 1587 for “depredations and . . . doing incalculable injury” to a community's vines (Evans 1906, p. 42). Their trial lasted 8 months. And it was not exceptional.

One court granted the pregnant members of a convicted species “free and safe-conduct and an additional respite of fourteen days” from predators when it ordered them to depart an afflicted area (Evans 1906, pp. 112–13). Others gave pests 6 days to vacate the premises before imprecating them.

Courts granted vermin repeated continuances throughout their trials. Furthermore, they “conducted [trials] with solemnity, and with a most solicitous attention to the fine points of the judicial process such as was never afforded . . . to human prisoners brought before the courts” (Finkelstein 1981, p. 64). As one court remarked, “The arguments offered by the counsel for the defence against the proceedings instituted by the inhabitants as complainants



are worthy of careful consideration and deserve to be examined soberly and maturely” (Evans 1906, p. 105). Careful, sober, and mature deliberations were undoubtedly slow ones.

The courts’ desire to prolong vermin trials explains the impressive fairness that they displayed toward prosecuted pests—why they “treated [bugs and rodents] with the greatest respect” (Finkelstein 1981, p. 65). Similarly, it explains why courts were so amenable to the endless, and endlessly absurd, dilatory tactics of the defense attorneys assigned to vermin.

For example, Chassenée argued that his rat clients could not attend their trial because the court’s summons was too local. Officials needed to pronounce it over a wider region for the rats to hear. Still, the rats did not come. In his second turn before the bench, Chassenée argued that the rats were absent because some members of the species were old and feeble: they required more time to reach court. Again, the rats did not come. During his third time before the bench, Chassenée argued that his clients were absent because some cats prevented them from attending. The court countenanced each of these arguments.

No excuse for protracting a vermin trial seems to have been too specious to permit. Consider the weevil case mentioned above. Having tired of the trial’s length, the plaintiffs proposed settling with the insects. Their lawyer drew up a contract for the court’s and the weevils’ consideration. The contract suggested a nearby ground, La Grand Fesse, as a place where the bugs could retire in peace. The court happily agreed to consider this request. Then it happily heard the answer from the weevils’ lawyer: La Grand Fesse was wholly unacceptable to his clients. It lacked the basic necessities for their sustenance. The court responded to this nonsense by sending some experts to survey the land. This prolonged the trial still further.

This case’s outcome is unknown. Some vermin destroyed the final page of the corresponding record. But when all the courtroom drama was over, considerable time had passed. “Such trials, argued in exhaustive detail, could drag on for months” (Jamieson 1988, p. 52).

### 5.2. *Vermin Trial Geography*

According to my theory, where  $\mu_0 \geq t/\phi$ , citizens already pay their tithe obligation, so vermin trials do not benefit ecclesiastics. Ecclesiastics use vermin trials to bolster belief in the validity of their supernatural sanctions only where  $\mu_0 < t/\phi$ . In early modern Europe, the chief force that could weaken citizens’ belief to this point was heretics. Heretics held and spread views that undermined faith in the Church’s divine authority. My theory therefore suggests that we should observe vermin trials where heretical activity was significant.

It is tempting to examine this implication by examining variation in the geographic distribution of Protestant reformers. But there is a problem with doing so: the Reformation did not begin until the 1520s and 1530s, some 75 years after we observe the first vermin trials in early modern Europe. Thus, at

least for the 75 years before the Reformation, variation in the geographic distribution of Protestant reformers' potential influence cannot explain variation in the geographic distribution of the use of vermin trials.

But variation in the geographic distribution of proto-Reformation heretics—namely, those known as the Vaudois (also called the Waldenses or the Waldensians)—can. The Vaudois emerged in Lyon, France, in the late twelfth century. Over the subsequent century, they spread to Languedoc in southern France and to Austria, Bohemia, and eastern Germany. The early Vaudois were short-lived. Some of them held only marginally unorthodox views, and inquisitorial pressure suppressed them or led them to reintegrate with fully orthodox Catholics comparatively quickly and easily.

However, a more virulent and, as time would tell, resistant strain of Vaudois, who descended from the Vaudois of Lombardy, persisted. The numbers of these Vaudois grew significantly in the fourteenth and fifteenth centuries. They were likely strongest at precisely the time that vermin trials came into significant usage.

The Vaudois' core beliefs directly challenged ecclesiastic authority. Vaudois were Donatists: according to their thinking, a person's power in relation to the divine, in particular to administer sacraments, did not depend on whether he was an official of the Church. It depended on his personal righteousness.

This view attacked ecclesiastic authority on two fronts. First, it suggested that ecclesiastics did not have the monopoly they claimed on the power to influence one's distance from God. Second, since the Vaudois commonly pointed to what they perceived as ecclesiastics' corruption, their Donatism suggested that many, if not most, ecclesiastics could not wield divine authority.

Waldensian Donatism had important implications for tithing. It put tithing compliance at the individual's discretion. As early sixteenth-century Provence preacher Pierre Griot put it, the Vaudois believed "there is no sin in withholding tithes when the priests do not behave as they should." Or, according to a Vaudois, "God never commanded us to pay tithes" (Audisio 1999, p. 97).

Equally important, the Vaudois rejected clerics' power to excommunicate and anathematize. In doing so, they denied the validity of ecclesiastics' supernatural sanctions explicitly. As a Vaudois excommunicated in 1486 put it, "[T]hey had been taught that the censures of the church could harm no one and should be ignored" (Cameron 1984, p. 81). Among them, "[E]xcommunication and anathema . . . were declared to be worthless" (Audisio 1999, p. 55).<sup>12</sup>

Most seriously, early modern ecclesiastics equated Vaudois with witches. This association "was justified by theologians on the grounds that the Waldensians, though originally devoted to poverty and asceticism, had gradually become committed to witchcraft" (Russell 1972, p. 220). Vaudois often held their meetings in secret and at night. Thus, it was only reasonable to attribute the most out-

<sup>12</sup> The Vaudois had other heretical views, most of which stemmed from their fundamental heresy that questioned ecclesiastics' divine authority. For example, they denied the legitimacy of holy water. They confessed to persons other than priests. They denied the existence of purgatory. And they rejected the practice of praying to saints.

rageous and unfathomable behaviors to them: they participated in orgies, had sexual liaisons with demons, and engaged in all other manner of ludicrous licentiousness.

“By the fifteenth century, witchcraft had not only been firmly defined as heresy but also identified with . . . especially the Waldensians, whose name became almost a synonym for witchcraft” (Russell 1972, p. 243). Indeed, in the Jura mountain region, “[t]he identification was so firmly fixed that *vauderie* came to be a synonym for the sabbat” (Russell 1972, p. 220). And “[t]he term *vau-dois* . . . signified heretic and sorcerer” (Audisio 1999, p. 76; see also Monter 1976, p. 22).

The fact that “witches were often equated explicitly with the Waldensians” was unfortunate for the Vaudois (Russell 1972, p. 248), but it is fortunate for me. “The insistence upon the witches’ heretical nature often caused witches and heretics to be put on trial together” (Russell 1972, p. 219). Thus, together with areas known to be under strong Waldensian influence, I can use areas of intense witch trials to proxy areas of intense heretical and, in pre-Reformation years, in particular Waldensian activity.

To examine the geographic distribution of heretical activity and vermin trials, I collected data on European vermin trials between 1450 and 1700 from the register of such trials that Evans (1906) compiled. These data reflect 46 cases of bug and rodent trials for which records survive and which occurred between 1451 (when citizens in Berne, Switzerland, sued some rats) and approximately 1680 (when citizens in Chur, Switzerland, and Constance, Germany, sued some worms).

I collect witch trial data for France, Italy, and Switzerland using the register of such trials in Carlson (2004) and consider regions where a dozen or more witch trials were conducted between 1450 and 1700. These regions are as follows: in France, southern Burgundy, most of Rhône-Alpes, eastern Lorraine, and north-western and southern Aquitaine; in Italy, Lombardy; and in Switzerland, the cantons of Berne, Vaud, Lucerne, and Neuchâtel. I supplement these data with information on areas with concentrations of Vaudois during the period studied (Cameron 1984, 2000; Treesh 1986; Audisio 1990, 1999). These areas include Dauphiné and Provence in France and Piedmont, Apulia, and Calabria in Italy.<sup>13</sup>

My empirical analysis is unavoidably crude. The vermin and witch trial data on which it relies are incomplete. My samples of both kinds of trials are surely much smaller than the actual number of trials in each case. And my witch trial data consider only trials whose location within a country is known.<sup>14</sup>

Further, although ecclesiastics in France, Italy, and Switzerland commonly

<sup>13</sup> With the exception of Apulia and Calabria, these areas had long histories as enclaves for heretics (Audisio 1999, pp. 33, 61).

<sup>14</sup> Further, Catholics did not monopolize witch trials. After the Reformation, Protestants, who also considered witchcraft heretical, conducted witch trials too. I was unable to exclude observations for witch trials that may have been conducted by Protestants rather than Catholics. The predominantly Protestant or Catholic status of regions in Switzerland changed over time, and even within areas that became dominated by Protestants, Catholics sometimes continued to operate and conduct witch trials.



regions of known Vaudois concentrations or concentrations of witch trials. The circles denote locations of vermin trials. The largest circles mark locations where ecclesiastics conducted three vermin trials. The second-largest circles mark locations where they conducted two vermin trials. The smallest circles mark locations where they conducted a single vermin trial.

Heretical activity and vermin trials clearly “exhibit a correlation of time and space” (Cohen 1986, p. 33; see also Jamieson 1988, p. 51; Dinzelbacher 2002, p. 410). Figure 1 displays this pattern. Vermin trials are concentrated in three major areas: eastern France (along the Saône-Rhône River axis), northern Italy (the Piedmont region), and western Switzerland (the Jura region, which spills over into eastern France). Each of these areas is also a known Waldensian hot spot or location of concentrated witch trials.

### 5.3. *Vermin Trial Timing*

According to my theory, ecclesiastics use vermin trials to manufacture additional belief in the validity of their supernatural sanctions when citizens’ belief in those sanctions is weak:  $\mu_0 < t/\phi$ . As discussed above, this occurred in early modern Europe when heretics—in particular, the Vaudois—challenged the legitimacy of ecclesiastics’ supernatural sanctions. My theory therefore suggests that we should observe vermin trials in the time periods in which heretics were active and observe the end of these trials when heretics ceased to seriously threaten belief.

Figure 2 depicts time-series data for vermin and witch trials in Europe. The data reflect 62 cases of vermin trials and 572 cases of witch trials. The number of vermin and witch trials in each half century are plotted as a share of their particular type of trial for the entire 1,000-year period.

For reasons similar to those discussed in my cross-sectional analysis above, my time-series analysis is also crude. I have imprecise dates for several vermin trials whose century is known but whose date within the century is not.<sup>16</sup> Further, three cases included in my vermin trial data fall outside the region of France, Italy, and Switzerland that my witch trial data consider.<sup>17</sup>

Nevertheless, Figure 2 displays a clear pattern. In periods with more witch trials, ecclesiastics conducted more vermin trials. Significant witch trial activity begins toward the end of the fourteenth century and is followed in the fifteenth century by vermin trial activity. Comparing the two trends suggests that vermin

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Canada, an early eighteenth-century case in Denmark, an early eighteenth-century case in Brazil, an early nineteenth-century case in Denmark, and two cases occurring in Croatia in the second half of the nineteenth century.

<sup>16</sup> In these cases, I have assigned the trials in question to either the first or second half of the century as follows: I assigned a ninth-century trial of serpents in France to the period from 851 to 900, a fourteenth-century trial of flies in Germany to the period from 1301 to 1350, and three fifteenth-century trials (of caterpillars, worms, and beetles) in Switzerland and Germany to the period from 1451 to 1500.

<sup>17</sup> One trial occurred in Mainz, Germany. The second, mentioned above, occurred in Spain. The third occurred in Als, Denmark.

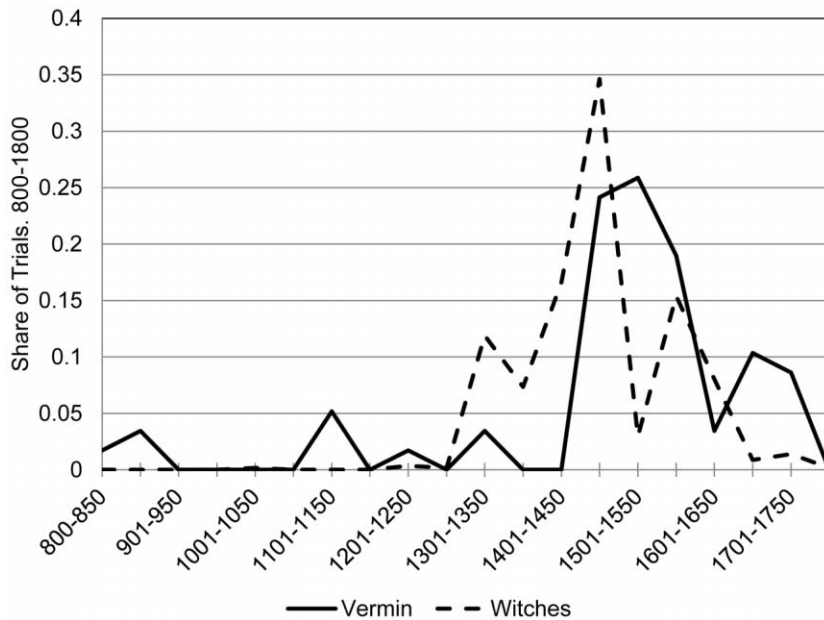


Figure 2. Distribution of vermin trials and heretics over time, 800–1800

trial activity in one 50-year period follows witch trial activity in the previous 50-year period. This implies that vermin trials may be a lagging indicator of heresy. By the second half of the seventeenth century, both sorts of trials become exceptional.

In the second half of the sixteenth century, the Vaudois merged with the Calvinist Reformers. But they existed as a distinct group located predominantly in Piedmont until the end of the seventeenth century. It is therefore unsurprising that five of the nine vermin trials that we are aware of that ecclesiastics conducted in the seventeenth century occurred in Italy.

The close of the seventeenth century corresponds to the time when Vittorio Amedeo II, Duke of Savoy and Prince of Piedmont, officially granted the Vaudois the right to practice their religion. This decision, made in 1690, followed on the heels of Amedeo's attempt to rid his territories of Vaudois permanently. Predictably, the close of the seventeenth century also saw the virtual end of vermin trials.

To consider the relationship between heretical activity and vermin trials across regions and over time explicitly, I use ordinary least squares regression to estimate the following equation:

$$\text{Vermin Trials}_{i,t} = \alpha + \beta \text{Witch Trials}_{i,t} + \varepsilon_{i,t},$$

Table 1  
Heretical Activity and Vermin Trials: Ordinary  
Least Squares Regression

|                      | (1)          | (2)         |
|----------------------|--------------|-------------|
| Witch trials         | .54** (.014) | .41* (.019) |
| Region fixed effects | No           | 2.13        |
| Period fixed effects | No           | 3.11        |
| Adjusted $R^2$       | .14          | .34         |

**Note.** Standard errors are in parentheses.  $F$ -statistics are presented for fixed effects.  $N = 90$ .

\* Significant at the 5% level.

\*\* Significant at the 1% level.

where Vermin Trials and Witch Trials measure the number of trials of each type in region  $i$  in period  $t$ . I consider all trials of both types occurring in France, Italy, and Switzerland for which I have data from 800 to 1800. I divide each country into three regions corresponding to the western, central, and eastern parts of France and Switzerland and the northern, central, and southern parts of Italy, creating nine regions.<sup>18</sup> I divide the 1,000-year period that my data span into centuries, creating 10 time periods that correspond to each century. In an effort to account for unobserved factors that may have influenced vermin trial activity, I also try running this regression including comprehensive region and period fixed effects.

Table 1 presents my estimates. These results support the patterns depicted in Figures 1 and 2. Heretical activity's relationship to vermin trials is positive and highly significant. This relationship is robust to the inclusion of region and period fixed effects.

## 6. Concluding Remarks

My analysis of vermin trials helps resolve the peculiar puzzle that these trials pose: "nobody knows what they were for, and nobody has ever known" (Ewald 1995, p. 1925). We may not know for sure why ecclesiastics conducted vermin trials, but we have a good idea: ecclesiastics conducted vermin trials because they maximized their profit.

Tithe revenues were a central source of the early modern Catholic Church's income. But tithe compliance was difficult to enforce. The vagaries of agricultural

<sup>18</sup> I treat Constance as a Swiss observation. My regional divisions are as follows: western France (Upper Normandy, Lower Normandy, Brittany, Pays de la Loire, Poitou Charentes, and Aquitaine), eastern France (Provence-Alpes-Côte d'Azur, Rhône-Alpes, Franche-Comté, Alsace, Lorraine, and Champagne-Ardenne), central France (all other French regions), western Switzerland (Jura, Neuchâtel, Vaud, Fribourg, Berne, Valais, and Geneva), eastern Switzerland (Schaffhausen, Thurgau, St. Gallen, Appenzell Innerrhoden, Appenzell Ausserrhoden, Graubünden, Glarus, and Constance), central Switzerland (all other Swiss cantons), northern Italy (Aosta Valley, Piedmont, Lombardy, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, and Liguria), southern Italy (Apulia, Basilicata, Calabria, and Sicily), and central Italy (all other Italian regions).

output on which ecclesiastics assessed tithes precluded effective external monitoring and detection for all but the most blatant attempts to avoid payment.

Faced with this difficulty, the Church sought a way to make tithe compliance self-enforcing. That way was supernatural sanction. Supernatural sanctions that imposed moral costs on tithe evaders by allegedly separating them from God were potentially strong motivators for tithe compliance. But those sanctions worked only if citizens held sufficient belief in them.

Vermin trials gave ecclesiastics a way to bolster citizens' belief in the supernatural sanctions supporting tithe compliance where heretics had weakened it. They did so by producing outcomes that supported those sanctions' validity. Vermin that fled or died under the specter of excommunication or anathema evidenced ecclesiastics' power to spiritually sanction tithe evaders.

Insects' and rodents' frequent migration and their precarious position vis-à-vis nature made them excellent targets of ecclesiastic trial and conjuration. The absurdities of those trials—granting rats continuances because cats prevented them from traveling to their trial, creating elaborate contracts with weevils, putting up posters of courts' decisions for vermin to read, and many more—reflected ecclesiastic courts' desire to protract vermin trials in an effort to optimally produce false-positive outcomes. Similarly, the absurd punishments with which courts threatened vermin—excommunication and anathema—reflected ecclesiastics' desire to evidence the legitimacy of the same punishments they used to address tithe evasion.

My analysis of vermin trials suggests that one reason why superstitions may persist is that some persons benefit from them. Ecclesiastics constituted such a group in early modern Europe. This view, according to which superstitions are variables of conscious decision making, challenges the traditional view of superstitions that sees them as inexplicably lingering beliefs. The traditional view might characterize some superstitions correctly, but it manifestly mischaracterizes others. Producers of superstition deliberately manufacture and manipulate these beliefs for private purposes. The persistence of some superstitions is the product of rational choice.

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