Economic Shocks, Inter-Ethnic Complementarities and the Persecution of Minorities: Evidence from the Black Death

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January 6, 2017

Abstract

The Black Death pogroms (1348-1353) were among the largest persecutions against a minority group in premodern history. Minorities are often persecuted as scapegoats for negative shocks. However, the incentive to persecute a minority group also depends on patterns of economic complementarity and substitutability between the majority group and the minority group. We use the Black Death as a natural experiment to evaluate the importance of scapegoating and interethnic complementarities as mechanisms shaping the incentives to persecute Jewish communities at a local level. At a macro-level, the scapegoating hypothesis was highly relevant. However, cities which experienced more severe plague outbreaks were less likely to persecute their Jewish community. In particular, when comparing towns with a similar mortality rate, Jewish communities were most likely to avoid persecution in: (i) Towns where Jews had been recently allowed to settle (ii) Towns that reached a critically low population level in the immediate aftermath of the Black Death. and (iii) Cities that were connected to land-based trade networks. Conversely, Jews were more likely to be persecuted when the arrival of the plague coincided with Easter and in towns relying on sea-based trade or university towns.

JEL Codes: J15; D74; Z12; N33; N43; O1; R1

Keywords: Ethnic Conflict; Religious Conflict; Minorities; Persecutions; Jewish Economic History; Black Death; Middle Ages; Epidemics.

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1. Introduction

This paper investigates what factors make certain religious and ethnic minorities vulnerable to violence and persecution? To answer this question we study Europe during the Black Death. The Black Death provides a unique natural experiment as it was an unprecedented demographic and economic shock to Europe's economy. Between 1348 and 1353 the Black Death swept though Europe killing about 40% of the population, initially severely disrupting the economy (Benedictow, 2005; Jebwab, Johnson and Koyama, 2016). The ravages of the Black Death were then accompanied by a wave of antisemitic violence (Cohn, 2007; Voigtländer and Voth, 2012).

Understanding the causes of these persecutions is important in its own right. The Black Death pogroms were among the largest in European history. A recent survey describes these massacres as "precursor(s) of the Holocaust" (Goldhagen, 2013, 38). While this may be an overstatement, research has shown that they left a legacy of antisemitism that was associated with twentieth century violence against Jews, support for Nazism, deportations, and modern indicators of antisemitism (Voigtländer and Voth, 2012, 2013). Studying this episode of antisemitic violence is also important because of the light it sheds on other episodes of interethnic violence both in the past and today. As numerous studies have documented, minority groups remain targets of violence across many parts of the world (see Horowitz, 2001; Chua, 2004; Wilkinson, 2004; Miguel, 2005; Jha, 2013; Diaz-Cayeros and Jha, 2014; Yanagizawa-Drott, 2014).

The Black Death (1347-1353) provides the ideal context to study the interaction between economic and other cultural and psychological explanations for interethnic violence. Two mechanisms have been proposed as explanations for why some groups are particularly vulnerable to violent persecutions: (i) *Scapegoating:* In the wake of the Holocaust a large literature arose in philosophy, psychology and sociology investigating the importance of scapegoating as mechanism responsible for violent persecutions. According to the theory, members of the same group experiencing difficult, negative experiences may settle on one specific target, in this case another group, to blame for their problems. By doing so, in-group members believe that social order is restored, since they have suppressed the origin of their problems by removing the scapegoated out-group. Scapegoating also provides psychological relief for the in-group. (ii) *Inter-ethnic economic complementarities:* According to this thesis, patterns of economic complementarity and substitutability determine the ability of two different ethnic communities to coexist (Jha, 2007, 2013). In that case, negative shocks for a powerful in-group may lead to persecutions against out-groups whose skills are easily substitutable. Conversely, out-groups that are economically needed by the in-group will tend to be protected by the latter.

We develop a simple model that captures both the scapegoating mechanism and the inter-ethnic complementarity mechanism. Using a dataset of 383 Jewish communities and the location of persecutions across all of Europe for the period 1100-1500 and data on Black Death mortality rates for 263 localities we are able to provide a novel test of both mechanisms.

We find evidence for the presence of both mechanisms. The Black Death shock provided the initial impetus for antisemitic violence, but it was patterns of economic complementarity that explain local variation in persecutions. Consistent with the *scapegoating* mechanism, at the macro-level the Black Death lowered the threshold for antisemitic violence and was accompanied by widespread pogroms. Looking at the microlevel, however, we find a different pattern. Cities which experienced more severe plague outbreaks were not more likely to persecute. On the contrary, a one standard deviation increase in the Black Death mortality rate is associated with a 0.41 standard deviation decrease in the probability of a persecution. That is, Jewish communities were most likely to avoid persecution in communities where the plague was particularly severe, thus highlighting the role of mechanisms other than scapegoatism.

We believe that this effect is causal. First, we provide evidence that the spread of the plague and its virulence was due to factors largely exogenous to Jewish persecutions. Second, we show that the parallel trends assumption is verified in that prior to 1347, there was no difference in persecutions against Jews between cities most affected and those comparatively unaffected by the Black Death. Third, our results are robust to the inclusion of controls for physical geography, economic geography and institutions, as well as controls for past Jewish presence and persecutions. Lastly, an instrumental variable approach based on the randomness of the timing of infection suggests that our baseline estimate indeed reflects the causal impact of the plague on persecutions.

Moreover, we shed light on the mechanisms by which plague mortality caused fewer persecutions at the local level. To do so, we interact the Black Death mortality rate with various pre-Black Death city characteristics, and study how the "protective effect" of the mortality shock was accentuated or attenuated depending on these characteristics.

In particular, when comparing towns with a similar mortality rate, Jewish communities were most likely to avoid persecution in: (i) Towns where Jews had been recently allowed to settle, possibly due to the economic benefits that they may bring, (ii) Towns that reached a critically low population level in the immediate aftermath of the Black Death, possibly due to these towns being concerned about their demographic and economic survival, and (iii) Towns that were connected to land-based trade networks.

This perhaps reflects the importance of Jewish moneylending in extending the credit that complementing local trade.

Conversely, Jews were more likely to be persecuted in: (iv) Towns relying on sea-based trade and (v) in university towns. The former effect may both the fact that Jews were typically excluded from seaborne and the development of merchant-based credit instruments which meant that trade in these cities was not dependent on Jewish moneylending. Universities were producers of local human capital (Cantoni and Yuchtman, 2014) and it is likely the Jews played a less important economic role in university towns. These results provide suggestive evidence on the *inter-ethnic economic complementarity effect*: When Jews were economically important, they were less likely to be persecuted.

Lastly, we also find that social norms and culture matter. When comparing towns with a similar mortality rate, Jews were more likely to be persecuted in: (vi) Towns that belonged to the Holy Roman Empire in central Europe. Pope Clement VI issued papal bulls instructing Christians not to blame the Jews for the plague. This position was seconded by Charles IV, the Emperor of the Holy Roman Empire. However, the Holy Roman empire was political fragmented and local authorities, notably bishops and the Free Imperial Cities seized the opportunity to persecute Jews, steal their property and destroy their debt records (Finley and Koyama, 2015a). We find that the protective effect of high mortality rates was weaker there. We also find: that (vii) Jews were more likely to be persecuted in towns that had a long history of persecutions against Jews, indicating that entrenched antisemitism in the town reinforced the scapegoat effect in the face of high mortality rates. Furthermore (viii), following a historical literature that observed that religious tensions were often elevated over the Easter period, we find that when the plague arrived in April, the relationship between Black Death mortality rates and the probability of a persecution was stronger.

The importance of scapegoating is well established in the philosophy, political science, psychology and sociology literatures (Dollard, 1939; Hovland and Sears, 1940; Berkowitz, 1969; Girard, 1978; Allport, 1979; Staub, 1992; Glick, 2009), and supported by recent empirical research in economics which has shown that negative economic shocks do indeed increase the probability of persecution for individuals targeted as witches (Oster, 2004; Miguel, 2005) and for Europe's Jewish communities (Anderson, Johnson and Koyama, 2016). Minority groups like the Jews in medieval Europe were easy targets who could be blamed for poor harvests or for disease (as was the case in the Black Death). Similar findings have been obtained for late nineteenth century Russia (Durante et al., 2015) and historians have long argued that Jews in 1930s Germany were scapegoating for defeat in World War I and the Great Depression.

The scapegoating mechanism predicts that negative shocks will increase the likelihood of a persecution. However, on its own, it does not take into account how the economic relationships between a minority and a majority community can affect the probability of a persecution. Jha (2007, 2013) argues that a minority group is more likely to enjoy toleration if it provides non-replicable and non-expropriatable economic services whereas minorities who either directly compete with the majority group or provide easily substitutable economic services are more likely to be expropriated. This theory of inter-ethnic complementarities predicts that highly valued minorities who are difficult to replace are less vulnerable to persecution (see Jha, 2007; Diaz-Cayeros and Jha, 2014). Recent and ongoing work has begun to provide evidence for this hypothesis in the context of the Jewish experience. Becker and Pascali (2016) provide evidence that this mechanism can account for why in post-Reformation Germany antisemitic persecutions were more likely in Protestant than in Catholic areas as it was in the former that there were individuals who could substitute for the economic role that Jews had previously played. Similarly, Durante et al. (2015) show pogroms in nineteenth century Russia were more severe in localities where Jews were concentrated among creditors.

Our contribution to this nascent literature is to introduce data on Black Death mortality in order to provide a clean test of both predictions. The Black Death provides an ideal natural experiment because it was an exogenous shock of truly historic proportions. The theory of scapegoating predicts that Black Death mortality should be positively related to persecution probability. The theory of inter-ethnic complementarities suggests that if Jews played an important and non-substitutable economic role then if the shock of the Black Death was large enough it may have raised their economic value and hence made them less vulnerable to persecution.

We find that at the macro-level the scapegoating mechanism is indeed highly relevant: the Black Death was associated with the most intense persecutions of Jews of the premodern period. This is inline with existing historical studies of the Black Death persecutions (e.g. Voigtländer and Voth, 2012; Finley and Koyama, 2015b). At the micro-level, however, we obtain novel results. We find evidence for the importance of inter-ethnic complementarities: if the Black Death killed a large enough proportion of the population, it could make the presence of Jewish communities sufficiently valuable that they became less vulnerable to persecution. Our findings suggest that while the scapegoating mechanism is indeed a powerful explanation for violence against minorities, it interacts in potentially critical ways with economic incentives.

Our contributions are threefold. First, we add to the literature on the determinants of persecutions. A number of papers have shown that negative economic shocks are associated with increased conflict in general (Bai and Kai-sing Kung, 2011; Chaney, 2013) and increased persecution of minority groups in particular. Oster (2004) finds that cold weather shocks were associated with witchcraft trials in early-modern Europe while Miguel (2005) finds that extreme levels of precipitation were associated with a higher number of witchcraft deaths in Tanzania. Leeson and Russ (2015) show that religious competition predicts witchcraft trials in early modern Europe. Christian (2016) shows that cotton price shocks predict lynchings in the American South. Related to our context, Anderson et al. (2016) show that colder weather increased the probability of a Jewish community being persecuted.[1] Our analysis is closely related to Durante et al. (2015) who study the role of economic shocks and economic specialization in explaining the pattern of pogroms in late nineteenth century Russia. They find that shocks as proxied by hot weather in the growing season increased the likelihood of violence against Jews and that a higher share of Jews among creditors further increases the likelihood of a pogrom.

Second, we contribute to a recent literature that emphasizes the role played by economic complementarities between different groups in society. As we have noted, Jha (2007) developed a theory of the importance of inter-ethnic complementarities. To substantiate this argument, Jha (2013) examines cities in southern India where Muslim merchants played a role in trade in the medieval period and looks at how this historical legacy of economic interaction affected intolerance between 1850 and 1950 and 1950 and 1995. He finds that religious toleration is indeed more prevalent in cities where the minority group provided non-replicable and non-expropriable economic services. According to this argument trade does lead to greater religious toleration but only when the benefits of trade accrue to the majority as well as the minority community.

Related research has found results that are consistent with this theory. Chaney and Hornbeck (2015) found that after the expulsion of the Moriscos from Spain, incomes increased. This is inline with the fact that the Moriscos were unskilled peasant farmers and hence easily substitutable so, as a Malthusian model would predict, their expulsion increased wages and decreased rents. Similarly, Jebwab et al. (2015) finds little negative effects from the expulsion of white farmers from Kenya. This is in keeping with the view that these groups were not providing a highly complementary and hard to replicable set of services. Relatedly, a body of literature that finds women have made greater gains in terms of political rights and access to economic and employment

[1] Hsiang and Burke (2013) and Hsiang et al. (2013) survey a range of quantitive studies that find a casual link between climate change and social conflict.

opportunities in environments where they provide an important economic service (e.g. Goldin, 1991; Acemoglu et al., 2004; Fernandez et al., 2004; Goldin and Olivetti, 2013; Xue, 2016). Lastly, several papers find that anti-immigrant sentiment is stronger when immigrant workers are substitutes for native-born workers (e.g. Scheve and Slaughter, 2001; Mayda, 2006; Facchini and Mayda, 2009; Hainmueller et al., 2015). These findings provide further weight to the argument that economic complementarities play a critical role in determining the political treatment received by a minority group.

Third, we contribute to a growing literature on Jewish economic history. However, the bulk of this research has focused on the consequences of Jewish persecutions, while we study their causes. Voigtländer and Voth (2012) use data from the massacres that followed the Black Death to explore the local persistence of antisemitic cultural traits from the fourteenth century through to the early twentieth century. Grosfled et al. (2013) examine the persistence of anti-market sentiments in Imperial Russia's Pale of Settlement. Jews were confined in the Pale of Settlement from the end of the eighteenth through to the early twentieth century where they specialized in urban economic activities. Grosfled et al. (2013) find that within the Pale, non-Jews developed a set of anti-semitic and anti-market values which remain in evidence today. Acemoglu et al. (2011) also find a negative lasting impact of the Holocaust in Russia, as it shrunk the middle class. Pascali (2015) studies the long-run consequences of the expulsion of Jews for financial development in nineteenth century Italy. D'Acunto et al. (2014) study how medieval Jewish persecutions affect attitudes towards finance in Germany today. Finley and Koyama (2015b) find that jurisdictional and political fragmentation within the Holy Roman Empire weakened the incentives of rulers to protect Jewish communities and led to more intense persecutions during the Black Death period.

A final contribution of this paper to the literature that studies the role of high-skilled ethnic or religious minorities. In particular, we build on Botticini and Eckstein (2012)'s analysis of the importance of human capital in explaining Jewish history. Botticini and Eckstein (2012) argue that high levels of human capital determined the occupational specialization of Jews in medieval Europe as traders, merchants, doctors, and above all as moneylenders.[2] Johnson and Koyama (2016) provide evidence that Jewish communities contributed to European city growth in the preindustrial period. They find that in the middle ages there was no relationship between city growth and the presence or absence of a Jewish community; however, in the period after 1600 positive

[2]For an analysis for the role of Jews in moneylending, see Koyama (2010b). There is an extensive literature in sociology on the role played by ethnic and religious minorities in economic history going back to Max Weber (see Weber, 1922, 1968; Sombart, 1962, 1911; Braudel, 1979, 1982; Kahan, 1986). For a study of Jewish prominence in medicine see Shatzmiller (1994).

relationship emerges between the presence of a Jewish community and city growth. Constructing an instrumental variable based on the network of Jewish cities, they argue that this positive correlation reflects the causal impact of Jewish communities on growth.

The structure of the remainder of the paper is as follows. Section 2. provides a conceptual framework for thinking about the incentives facing local authorities in the face of the Black Death shock. In Section 3. we provide historical background on the nature of the Black Death shock and introduce our data on Jewish persecutions and Black Death mortality. Our main results are outlined in Section 4(b). We explore the most important mechanisms relating Black Death mortality to persecution probability in Section 5.. We conclude in Section 6..

2. Conceptual Framework

To explain violence against minorities we focus on two mechanisms: a *scapegoating* mechanism and the *inter-ethnic complementarity* effect. These two mechanisms deliver two distinct sets of predictions.

The scapegoating mechanism Scapegoating is the subject of a considerable literature in psychology, sociology, political science, and economics. The classic psychological theory of scapegoating that became prominent in the wake of the Holocaust distinguished between internal and external theories of scapegoating. The internal theory of scapegoating focused on characteristics that were specific to particular individuals that made them more likely to develop prejudices whereas the external theory emphasized the role of shocks and crises in generating prejudices against specific groups. These classic theories were criticized because they did not predict the specific target of the desire to scapegoat (see Zawadzki, 1948; Cowen et al., 1959).[3] More recently, the ideological theory of scapegoating advanced by Glick (2002, 2005) attempts to address criticisms of this form. It argues that scapegoating becomes likely when it builds on preexisting envious stereotypes that suggest that the targeted group to be scapegoated have the ability and desire to cause the harm attributed to them.

The Black Death pogroms have been studied as a classic example of ideological scapegoating. The Jews were directly blamed for spreading the disease via poisoning wells (Cohn, 2007; Aberth, 2010, 2000). Prior to the Black Death pogroms, there was a long history of blaming Jews and other marginalized groups for misfortune

[3]From the perspective of psychological theory, scapegoating attempts are counterproductive because individuals should conserve scarce cognitive resources into discovering the real source of the disaster.

(Moore, 1987). Accusations of ritual murder, host desecration, and poisonings had been permeating for centuries (Trachtenberg, 1943; Rubin, 2004). Therefore, the Jews were ready stereotypes who could easily be blamed in the event of a massive disaster such as the Black Death.

The interethnic complementarities mechanism The interethnic complementary effect was first elucidated by Jha (2007, 2013) who argues that peaceful coexistence among different ethnic groups is more likely when the minority community provides economic services that complement the economic activity of the majority. Members of the majority understand that if the minority community is destroyed, the price of the services they provide will go up. In contrast, if the minority community provide substitute economic goods or services this can be an additional motivation to engage in persecutions or violence either to destroy the providers of rival goods or to encourage their outward migration in order to reduce competition. This theory predicts that instead of class violence, in societies where different ethnicities specialize in the substitutable economics services, groups who compete are likely to exhibit greater ethnic violence. Jha (2007) places this analysis in the context of a repeated game. He shows that if, over time, the comparative advantage of the minority group is easy to acquire, this makes coexistence less likely to survive in the long-run.

Scapegoating and inter-ethic complementarities are not mutually exclusive. Scholars have argued that large shocks lower the threshold for violence against minorities and thus create an atmosphere were violence becomes perceived as morally permissible (Goldhagen, 2009; Voigtländer and Voth, 2012). However, in a environment when the threshold for violence is lowered due to a shock, economic factors may still be relevant: valuable minorities who provide highly complementary economic services to the majority population may find it easier to find protection than those minorities whose economic services are close substitutes to those of the majority population.

In medieval Europe, Jews provided specialized economic services. Botticini and Eckstein (2012) provide evidence that Jewish specialization in trade, crafts, medicine and moneylending was not the direct product of being prohibited from owning land but rather was the consequence of their high levels of human capital. The economic value of Jewish communities was clearly perceived at the time. Their economic value provides one explanation for the survival of Jewish communities throughout much of medieval history but it also provided an incentive for rulers to raise large and arbitrary taxes on them, exploiting them as "fiscal sponges" (Baron, 1965a,b, 1967a,b; Koyama, 2010b). But current research has not explored how the distinctive economic role played by Jews in medieval Europe interacted with negative economic shocks.

Prediction 1 (Scapegoating) *Higher Black Death mortality should be associated with higher subsequent persecution probability. This should be especially the case when the moral, and thus non-economic, costs of persecuting are lower.*

Conversely, if the economic complementarity effect dominates we have the following prediction.

Prediction 2 (Inter-Ethnic Complementarities)

i *Higher Black Death mortality should be associated lower subsequent persecution probability.*

ii *The relationship between Black Death mortality and lower persecution probability should be stronger in areas where Jews provided more complementary skills to the local economy relative to those areas where the skills of Jews were substitutable.*

Our empirical tests are able to discriminate between these two main explanations for antisemitic violence in Europe.

3. Data and Historical Setting

3.1. Data

Main Sample. Our sample consists of 116 towns with a Jewish community at the onset of the Black Death (circa 1347) and for which we know the Black Death mortality rate (%, 1347-1353). For these 116 towns, we also know whether a persecution against Jews occurred during the Black Death period, and of which type and in which year.

Black Death Mortality. Data on Black Death mortality come from Christakos et al. (2005) who compile information from a wide array of historical sources.[4] These data yield estimates of mortality for 263 localities. We have a percentage estimate of the mortality rate for 166 of these 263 localities. For example, Florence had an estimated mortality rate of 60%. In other cases the sources report more qualitative estimates (e.g. that about half or at least half of the population died) in which case we code our estimate as 50% or that the city was desolated or abandoned in which case we attribute a mortality rate of 80%. Further details on how these data were assembled are provided in the Web Appendix. Figure 1 shows the spatial distribution of the 263 localities as well as their mortality rates. Figure **??** then shows our imputed mortality rates for the

[4]We checked these data by consulting Ziegler (1969), Russell (1972), Pounds (1973), Gottfried (1983), and Benedictow (2005).

Black Death for the whole of Europe using spatial extrapolation from the non-imputed mortality rates of the 263 localities. In our analysis, we will also obtain from Christakos et al. (2005) data on the timing of the infection. For many towns, we know the year of infection, and for fewer of them, we also know the specific month of first infection.

Jewish Presence. We use the *Encyclopedia Judaica* that comprises 26 volumes and provides comprehensive coverage on Jewish life for all of Europe. This is the same source as used by Anderson et al. (2016) and Johnson and Koyama (2016). We have identified 383 towns in which Jews were present in 1300-1346, and thus likely to be present at the onset of the Black Death in 1347. Note that data does not exist on the size of the Jewish communities in the 14th century, so we have no choice but to capture Jewish presence by a simple dummy only. Of the 383 Jewish towns, we can match 116 locations to our database of mortality rates. Figure **??** shows the 116 towns.

Jewish Persecutions. Data on persecutions is also from the *Encyclopedia Judaica*, as it provides information on whether a Jewish community suffered a persecution. Our main dependent variable is whether a community was the victim of a persecution. Our definition of a persecution encompasses both a pogrom or an expulsion. A pogrom describes a violent riot aimed at the massacre of a specific group. An expulsion involves the formal exclusion of a community for a city or region. Throughout the empirical analysis, we will distinguish between both pogroms and expulsions. Note that no consistent data exists on the intensity of the persecution (beyond the simple pogrom vs. expulsion dichotomy) for the whole of Europe, and we only know how many Jews died for a handful of towns.

Controls. To control for factors that might affect both the spread of the plague, or the probability that a Jewish community might be persecuted, we employ an array of control variables. We group these controls as measures of geography, trade, human capital and institutions. Our geographic controls include average temperature, elevation, soil suitability, access to coasts and rivers, and longitude and latitude.

To control for factors related to trade and human capital, we employ data on populations in 1300 from Chandler (1987), Bairoch (1988) and Jebwab et al. (2016). We also control the the presence of major and regular Roman roads (and their intersections) from McCormick et al. (2013), medieval trade routes (and their intersections) from Shepherd (1923), the presence of medieval market fairs and a dummy for the Hanseatic league based on Dollinger (1970). Finally, to control for different levels of human capital, we include a dummy for whether or not a city contained a university.

To control for factors related to institutions, we distinguish between cities that were located in monarchies and autonomous cities which include either city republics or cities which had de facto self-governance around 1300. We also control for whether the city belonged to the Holy Roman Empire around 1300, was a state capital around 1300, had any parliamentary activity around 1300 and was located within 100 km from a battle that took place between 1300 and 1350. Further details of the construction of these data are contained in our Web Appendix.

3.2. Historical Setting

The Black Death. The Black Death arrived in Europe in 1347. Over the next five years it spread across the continent killing between 30% and 50% of the population.[5] Recent discoveries in plague pits across Europe have confirmed that the Black Death was primarily Bubonic plague.[6] It was transmitted by the fleas of the black rat (*rattus rattus*). The bacterium *Yesina Pestis* is primarily a disease of animals. The primary vector of transmission occurs when the esophagus of infected fleas become blocked. These 'blocked' fleas are unable to sate themselves and continue to bit animals or humans, regurgitating the bacterium into the bite wound. Within less than a week, the bacteria is transmitted from the bit to the lymph nodes producing the buboes from which bubonic plague is named.[7]

Since rat populations are territorial, the number of black rats was not necessarily correlated with population density. As such, similar death rates are recorded in urban and in rural areas.[8] When studying variation in mortality rates between cities, historical accounts have been unable to rationalize the patterns they observe (Ziegler, 1969; Gottfried, 1983; Theilmann and Cate, 2007; Cohn and Alfani, 2007). Jebwab et al. (2016) confirm this stylized fact and establish that the spread of the plague was indeed exogenous to observable city-level characteristics. To illustrate, Venice had extremely high mortality (60%) while Milan escaped comparatively unscathed (15% mortality).[9] Highly urbanized Sicily suffered heavily from the plague. However, equally urbanized Flanders had relatively low death rates, while the more rural northern Netherlands was

[5]Conventionally the death rate was estimated at 1/3 of Europe's population. More recent studies suggest that the overall death rate was considerably higher than this (see Benedictow, 2005, 2010; Aberth, 2010, 2000). Benedictow (2005, 2010) argues for a death rate as high as 60%.

[6]We provide a more detailed discussion of Bubonic plague and its transmission in the Appendix.

[7]See Benedictow (2005, 2010). As Campbell (2016) discusses, the precise importance of blocked fleas as the main vector of transmission is currently under debate. Other vectors such as human lice may also have been at work. However, the literature agrees that person-to-person transmission of the plague was probably rare and cannot account for the transmission of the Black Death (Campbell, 2016, 235).

[8]See for example Herlihy (1965) on rural and urban death rates in Pistola.

[9]There is no indication that variation in sanitation or hygiene explains this pattern. Gottfried notes 'it would be a mistake to attribute too much to sanitation' given the 'failure of Venice's excellent sanitation to stem the deadly effect of the plague' Gottfried (1983, 69).

devastated. Southern Europe and the Mediterranean was hit especially hard, but so were the British Isles and Scandinavia. Consistent with these stylized facts, Figure **??** illustrates the lack of a relationship between mortality rates and city population in 1300.

The spread of the plague was rapid and its precise trajectory was largely determined by chance. As we confirm in our analysis, the only systematic predictor of plague virulence was latitude, as the plague spread from southern to northern Europe. In many respects, however, the spread of the plague had a considerable random component (see Jebwab et al., 2016). For example, it was largely coincidence that the plague spread first from Kaffa in the Black Sea to Messina in Sicily rather than elsewhere as the ships carrying the plague could have stopped at other ports in the Mediterranean. Similarly, it was partly coincidental that the plague spread first from Messina to Marseilles. The early arrival of the plague in Marseilles ensured its speedy transmission through much of western Europe in the year 1348 (Theilmann and Cate, 2007).

The Black Death affected all segments of the population. Prior to the Black Death there had been no major outbreak of epidemic disease for several centuries and as a result neither the medical profession nor political authorities were able to respond effectively. Medical knowledge was rudimentary and ineffective: Boccaccio, for instance, wrote that "all the advice of physicians and all the power of medicine were profitless and unavailing" Boccaccio (2005, 1371). Individuals, regardless of wealth, were largely unable to protect themselves from the disease. Institutional measures of prevention were nonexistent: the practice of quarantine was not employed until later in the fourteenth century.[10] As such, the Black Death had a tremendous impact medieval society in both the short-run and the long-run (Herlihy, 1997). Historians report that the immediate outbreak was accompanied by outbreaks of crime, sexual and religious excess (Ziegler, 1969; Gottfried, 1983; Aberth, 2010, 2000; Campbell, 2016). It was also accompanied by widespread pogroms and expulsions, which we now turn to.

Jewish Persecutions. The Black Death persecutions have been studied by a number of scholars including historians (Nohl, 1924; Lowenthal, 1964; Ziegler, 1969; Cohn, 2007; Aberth, 2010, 2000) and more recently by several economists. For example, Voigtländer and Voth (2012) and Finley and Koyama (2015b) have focused on the persecutions that took place within the German-lands using data from the *Germania Judacia*.

The original spark for the persecutions was the rumor that Jews were responsible for causing the Black Death by poisoning the wells. Herman Gigas, Franciscan Friar in Franconia reported that '[s]ome say that it was brought about by the corruption of

[10] The term quarantine was first used in the city of Ragusa, part of the Venetian empire in 1377. It was adopted as a standard policy by Venice in 1423 Gensini et al. (2004, 257).

the air; others that the Jews planned to wipe out all the Christians with poison and had poisoned wells and springs everywhere. And many Jews confessed as much under torture: that they had bred spiders and toads in pots and pans, and had obtained poison from overseas' (quoted in Horrox, ed, 1994, 68).

Traditional accounts emphasized the spontaneity of mob violence against Jewish communities (e.g. Nohl, 1924). More recent accounts such as Cohn (2007) have pointed out that local authorities often colluded in the elimination of the local Jewish community. In his study of the pogroms that took place in the Holy Roman Empire, Breuer (1988) focused on contemporary chronicler accounts that attributed the massacres to economic factors. Certainly local authorities and rulers had a choice: to give way to demands to persecute the Jews or to resist such demands and in some instances they were responsible for stoking antisemitic sentiments. Finley and Koyama (2015b) focus on the political economy determinants of pogrom intensity within the Holy Roman Empire. In this paper, we instead focus on the importance of the shock to the economies of towns in the wake of the plague.

In Figure 9(a), we plot all the persecutions in our dataset between 1100 and 1600. It is evident that the Black Death saw the most widespread and numerous persecutions through medieval history. Figure 9(b) focuses on the Black Death era (1347-1353). The majority of persecutions took place in 1348 and to a lesser extent in 1349. These persecutions comprise both pogroms (organized acts of violence against Jews) and expulsions (the forcible ejection of a Jewish community from a town or territory). As Figure 9(b) makes clear, the majority of persecutions in the Black Death period were pogroms.

4. Results

4.1. Specification

We estimate a series of regressions based on:

$$P_i = \alpha + \beta \text{Mortality}_{i,1347-52} + \mathbf{X}_i' \delta + \epsilon_i \quad (1)$$

where P_i is the probability of a persecution in town i, and Mortality$_{i,1347-52}$ is a measure of the city-level mortality rate of the Bleak Death (%). $\mathbf{X}_i$ is a vector of city-specific controls.

4.2. Main Results

We present our main results in Table 1; Panel A focuses on the impact of the plague on any persecution. The baseline effect of the Black Death on the probability of a persecution reported in row 1 is large and negative, at -0.011***. The mean mortality rate in our sample of 116 Jewish towns is 38.6%. This result implies that the likelihood of a persecution is 43.7% lower at the mean. Alternatively, a 1 standard deviation in mortality is associated with a 0.41 standard deviation reduction in the likelihood of a persecution. Rows 2-5 explore the potential long-run impact of the plague. We find an effect that is half size, at -0.005**, in the period between between 1360 and 1400 (row 3) but no effect in the following centuries (rows 4-5). Therefore, the Black Death had some long-run effects, but these effects faded over the course of 50 years.

In Panels B and C of Table 1 we show that the same relationship holds for pogroms and for expulsions. The effect we find is strongest for pogroms (row 1, Panel B) and weaker for expulsions (row 1, Panel C). This may reflect a slightly different data-generating process for pogroms verses expulsions. An expulsion was sometimes just from the city to suburbs and Jews could be invited back at a low cost. In contrast, a pogrom could led to the outright destruction of a community. We find that there was a long-run effect up to 1500 for pogroms, but this is largely driven by the 1354-1400 period (rows 3-4, Panel B) as the coefficient for the 15th century is close to zero and statistically insignificant (row 5, Panel B). The Black Death, in contrast, had no long-run impact on the probability of an expulsion (rows 2-5, Panel C).

Figures 10(a) and 10(b) depict these results non-parametrically. Cities that were hit harder by the plague were less likely to persecute Jewish communities (Figure 10(a)). This result applies to both pogroms and persecutions (Figure 10(b)). The figure also confirms that the intensity of the plague mattered more for pogroms than for expulsions.

These results are consistent with historical accounts. For example, in Aragon where the impact of the plague was severe, and Jews had been targeted as 'plague spreaders', king Pedro strove to protect the Jews and in the wake of the plague 'was determined to restore the Jewish *aljamas* to a healthy economic state'. He barred creditors from bringing law suits against Jews or collecting debts against them for a year while individuals who moved into settle land left empty due to the mortality associated with the plague were forced to inherit the debts owed to the Jews (Shirk, 1981, 363).[11]

[11]Shirk writes: 'Despite their protests that the amount was too large, the heirs of a Christian in Catatayud had to pay what the deceased owed to a Jewish toll collector. In 1351, officials from San Lorenzo de Salanca ill-advisedly petitioned the king to release their impoverished town from a debt of

4.3. Investigating Causality

Historical accounts suggest that the spread of the plague was not explained by economic or geographic characteristics of the cities and towns affected. We now provide further evidence that the impact of the Black Death was indeed exogenous to the likelihood of a persecution during the Black Death period (1347-1353).

Biases. A downward bias is more problematical than an upward bias as we then overestimate the "protective effect" of the plague. In other words, the true effect is not as negative as our estimated effect (-0.011). The effect is downward biased if towns where the persecutions would have occurred anyway, during that very specific period, were also coincidentally or non-coincidentally affected by higher mortality rates. An upward bias is less of an issue because we then underestimate the protective effect (the true effect is even more negative than our estimated effects). We discuss below various of these potential biases and how our identification strategies minimize them.

Exogeneity Assumptions. In Table 2, we show that Black Death mortality rates were largely exogenous to city characteristics that could have also have caused persecutions in 1347-1353. We define our city level characteristics according to whether they proxy for geography, trade, human capital or institutions. Latitude is the only geographical variable associated with Black Death mortality. The Black Death indeed spread from the South, Sicily more precisely, and the plague was initially more virulent.

Parallel Trends. In rows 6-8 of Panels A-C in Table 1, we find that Black Death mortality is not associated with persecution, pogrom or expulsion probability in the period prior to the Black Death, whether we use: (i) 1340-1346 (i.e. six years before 1347, because the Black Death also lasted six years), (ii) 1300-1346, and (iii) 1200-1346.

Jewish Hygiene Practices. Some contemporaries argued that Jews were less exposed to the plague perhaps because they had better hygiene practices or lived in isolated areas within cities.[12] This may cause various biases.

First, the fact that we capture Jewish presence via a dummy only could bias our estimate. If the probability of a persecution is also mechanically higher in towns with a larger Jewish community, simply because it is larger, this then creates a downward bias. Conversely, larger Jewish communities may have been better able to defend themselves against potential persecutions, thus reducing the probability of persecution,

17,000 sueldos owed to the Jews of Perpignan. To their surprise and dismay, the king ordered them to tax the citizens and pay the debt within the specified period' (Shirk, 1981, 363).

[12] For example, Primus of Görlitz argued in 1464 that "Jews died less than Christians" because "they don't expose themselves [as much] to the air morning and evening nor walk around as often in the outside air, which is worse during a pestilential time [and] when the stats exert bad influences' (quoted in Aberth, 2010, 2000, 187).

and leading to an upward bias. In rows 2-3 of Table 3, we show that the results are the same if we control for how many years Jews have been present in the town, as a proxy for the size of the Jewish community, thus assuming that the longer Jews have been living there, the larger the community must have been by 1347 (see notes under the table for details on how we construct our two main measures of "Jewish antiquity").

Second, a related question is whether our mortality rates do not also include the deaths caused by the persecutions, thus mechanically causing an upward bias. An upward bias is less of an issue since it actually provides us with a conservative estimate of the protective effect. However, Jewish communities were generally comprised only a small population share of the towns, which should minimize these concerns. In addition, we have already shown in rows 2-3 that adding a proxy for the size of the Jewish community did not change the results. In row 4, we also drop 7 towns for which we know that a significant number of Jews were persecuted, which could have then affected overall Black Death mortality rates.[13]

Third, towns where there have been more persecutions in the past could have had a smaller Jewish community by 1347, and thus higher mortality rates overall in 1347-1353. Then, towns with a long history of persecutions could have more anti-Semitic residents, which would then raise the probability of persecution, and lead to an upward bias. Conversely, towns with more persecutions in the past may have been less likely to persecute their community during the Black Death, as there may have been fewer Jews left to persecute, thus leading to a downward bias. In rows 5-10, we control for previous persecutions, via a dummy if there has been any persecution or the percentage share of years with a persecution, whether in the six years before the Black Death (that lasted six years), in the first half of the 14th century, or even since 1200.

Outliers. In rows 11-12, we drop the cities with the highest and the lowest mortality rates to ensure that our results are not driven by outliers, whose mortality rates may have been low or high for specific reasons that may have also affected the probability of persecution. Historians report that some cities such as Milan were exceptional in their low mortality rates. Similarly, the low mortality experienced by Nuremberg is speculatively attributed by some historians to their natural springs and baths (Ziegler, 1969). These cities may have been special in some ways that could have also affected the probability of persecution. For this reason we drop Milan, Nuremberg, and also Venice as a robustness check; our results are unaffected (row 13).

[13]We do not know how many Jews were persecuted in other towns with a persecution in our sample. However, the fact that we could not find a number of victims for these other persecutions potentially suggests that the numbers were not as high as for the 7 towns that we drop, since persecutions involving more victims must have been better documented than persecutions with fewer victims on average.

Controls. We directly control for geographic characteristics in row 14 of Table 3, trade and human capital related factors in row 15 and for institutions in row 16; in row 17 we include all of our controls. The size of our coefficient remains negative and significant though smaller in size (-0.006 compared to -0.011 when we include all controls at once).
IV1: Months of First Infection. Timing provides exogenous variation in mortality as there is evidence that plague virulence was correlated with time. Cities that were affected earlier, all else equal, tended to experience higher death rates. According to Berngruber et al. (2013): "Theory predicts that selection for pathogen virulence and horizontal transmission is highest at the onset of an epidemic but decreases thereafter, as the epidemic depletes the pool of susceptible hosts [...] In the early stage of an epidemic susceptible hosts are abundant and virulent pathogens that invest more into horizontal transmission should win the competition. Later on, the spread of the infection reduces the pool of susceptible hosts and may reverse the selection on virulence. This may favor benign pathogens after the acute phase of the epidemic." Figure 11 provides support for this IV strategy. For 109 cities of the main sample for which we have data on the onset of the Black Death, it plots mortality rates against the date that the city was first infected (here, the number of months since October 1347, when Messina was first infected). Cities infected later had indeed lower mortality rates.

Using the number of months since October 1347 as an IV we obtain a coefficient of -0.035*** (row 18 of Table 3, F-statistic of 29.7). This is precisely estimated, however, this unconditional IV estimate is also significantly larger than our OLS coefficient (-0.011). The Black Death spread from the south and the urban network of medieval Europe was still centered around the Mediterranean Sea. Therefore, it is likely that month of first infection is partially correlated with latitude, trade and city size, as well as other factors that could also affect the probability of persecution. We therefore employ month of first infection conditional on our control variables as our preferred IV specification. By including the controls of Table 2, as well as a quartic in latitude and a quartic in longitude to control for the geographical origins of the plague, we hope to be able to isolate the random component of the spread of the infection. Our conditional IV yields a coefficient that is closer to our OLS estimate, but still high at -0.028** (row 19, F-statistic of 4.5).

4.4. Robustness

Preventive Persecutions. Historians note that 'In most cities the massacres took place when the Black Death was already raging but in some places the mere news that the plague was approaching was enough to inflame the populace' (Ziegler, 1969, 103). Some communities heard accusations that the Jews were poisoning the wells and were the source of the Black Death and took action to kill or expel their Jews prior any outbreak of plague. These "preventive persecutions" cause various problems for our analysis.

First, our hypothesis is that people and local authorities observe how many other people are dying in their town, and then decide to persecute or protect their Jewish community. If most of the persecutions that took place in our sample were preventive persecutions, our results, however interesting they are, may still be coincidental.

Second, preventive persecutions reduce the size of Jewish communities before the Black Death hits. If having a larger Jewish community lowers mortality rates thanks to better hygiene practices and segregation, preventive persecutions will increase mortality rates, and cause an upward bias. However, an upward bias is not an issue for our analysis.

Third, preventive persecutions are likely to occur in the later years of the Black Death (1347-1353), since the plague must have been raging somewhere else before, for people and authorities to decide that persecuting their community is a good preventive measure to adopt. But places that were infected later also had lower mortality rates, as the disease became less virulent over time (as explained in Subsection 4.3.). Preventive persecutions could then lead to a downward bias, which would be problematical.

Table 4 considers the issues raised by these so-called preventive persecutions (Panel A), pogrom (Panel B) and expulsions (Panel C). Baseline results are shown in row 1. We first drop the four observations where it is likely that a persecution preceded the Black Death (row 2), and then four more observations where it is possible that it did so (row 3).[14] We also drop observations where we are relying on imputed data for the year of first infection in towns with a persecution (row 4). In row 5 we implement a fixed effects specification which controls for the year of infection (in addition to dropping the towns identified above). By looking within a year, we are able to address the possibility that persecutions in say 1350 were based on knowledge of plague outbreaks in other areas in preceding years. As explained above, later years were mechanically more likely to see preventive persecutions. However, results hold when doing so. In row 6, we go even further by adding instead fixed effects for the semester of first infection (e.g.,

[14]The first four towns are Erfurt, Magdeburg, Nuremberg and Wuerzburg. Their persecution took place in 1349, but the Black Death did not hit these towns before 1350. However, note that we use different sources of data for the year of the persecution and for the year of first infection. It could well be that the persecution actually took place after the town was hit. The four other towns are Bielefeld, Bremen, Frankfurt an der Oder and Muenster, which were first infected in 1350, but whose persecutions took place in either 1349 or 1350, although we cannot be sure of the year due to conflicting sources.

second semester of 1348). Effects are still strong and significant for any persecution and pogroms, despite not having much variation to exploit within these 6 months windows.

Measurement Concerns. Table **??** investigates the robustness of our findings with respect to various potential measurement concerns. Row 1 reports our baseline estimate for comparison purposes. As there may be measurement error in our variable recording the presence of a Jewish community in 1300-1346, in rows 2-4 we include different ways of estimating the presence of a community. Row 2 reports our coefficient for the sample of towns for which we are sure that there was a Jewish community between 1347-1353. We lose 15 observations for which we find it very likely, but cannot entirely be sure that there were Jews there in 1347. Rows 3 and 4 report our estimates for all cities which had a Jewish community at some point between 1200 and 1346 and 1100 and 1353 respectively. The sample size then increases to 142-143 observations.

In rows 5 and 6 we drop seven cities where it is ambiguous whether or not a Jewish community was present in 1347. Indeed, the status of some French communities was uncertain between 1322 and 1394. For the same reason, row 7 includes two additional possible towns which we did not include in our main sample, due to a lack of additional information about the status of their Jewish communities. In row 8 we use as an alternative dependent variable the share of the number of years in 1347-1353 with a persecution, rather than a dummy for whether there has been any persecution.

Another possible concern relates to the veracity of our mortality estimates. To ensure that such concerns do not impact our findings in row 9 we include dummies for the different sources of mortality data: raw number (N = 67), literary description (N = 25) and desertion rates (N = 24). In rows 10-12, we exclude estimates based on descriptions (row 10), numbers based on desertion rates (row 11) and numbers based on numerical mortality rates (row 12) respectively. For similar reasons, in row 13 we employ only numerical based mortality rates. To alleviate possible concerns about the 'heaping' of mortality estimates, we also drop mortality rates of 25 or 50% in row 14.

Sampling Issues. Table 8 demonstrates that our results are robust to dropping cities based on which modern country they belong to (row 2-7). In general, the negative effect of Black Death mortality is robust to the exclusion of specific groups of towns.

As we do not have death rates for every Jewish town we also create estimates of Black Death mortality based on spatial extrapolation. The intuition behind this strategy is analogous to spatial econometrics. While Black Death mortality was not correlated with city level characteristics, we know from the epidemiological literature that it was spread by the fleas of Black rats. Hence there was an unobserved spatial element to the spread and intensity of the plague between 1347-1353. We exploit this spatial element to estimate mortality rates for 383 - 116 = 267 Jewish towns for which we do not have direct mortality data. Figure **??** reports the resulting imputed mortality rates based on the mortality rates of 263 localities. Further details on this procedure are provided in the web appendix. In row 8 of Table 8, we use these extrapolated estimates based on 263 localities to see if our analysis holds for the full sample of Jewish towns. Our results remain very robust. Actually, the protective effect is even stronger now, at -0.015***. This is also the case when we reconstruct different estimates of extrapolated mortality based on either the 166 localities for which we have numerical estimates of mortality (row 9) or whether we construct our measure based only on those 116 towns in our main sample (row 10) or those 67 towns in our main sample that report numerical mortality estimates (row 11). This confirms that our results are not driven by sample selection.

5. Mechanisms

We now shed light on the mechanisms by which plague mortality caused fewer persecutions at the local level. To do so, we interact the Black Death mortality rate with various pre-Black Death city characteristics, and show in Table **??** how the "protective effect" of the mortality shock was accentuated or attenuated depending on these characteristics. In other words, when comparing towns with the same mortality rate, do we find that some town characteristics matter for the relationship between plague mortality and persecutions? Row 1 reports our baseline of -0.011. We next ask if this 'protective effect' of plague mortality was weaker or stronger where Jews were more economically needed, in order to test the "inter-ethnic complementarity" mechanism. We then investigate if social norms and culture matter, in order to test the "scapegoatism" mechanism. Note that in all regressions we simultaneously control for both the mortality rate and the characteristic, but we do not show the coefficient of the latter. Finally, the fact that our baseline effect is negative (-0.011) implies that the inter-ethnic complementarity effects dominate the scapegoating effects at the town level.

Acculturation v. Recent Immigration. In rows 2-3, we control for how long a Jewish community had existed prior to the plague. One possible view is that older communities were likely to be better embedded in local communities and hence attracted less hostility. We can call this the *acculturation hypothesis*. Another possibility is that Jewish communities who were recent immigrants to a town were there because they provided essential economic services. Indeed, Jews were sometimes invited by local authorities to settle in their town, due to the economic benefits that they could provide. This can be termed an *economic hypothesis*. We find no evidence for the first hypothesis, instead the results are in line with the economic hypothesis; the positive interaction effect suggests that Jewish communities were more likely to be protected when mortality rates were high and they were recent migrants to the town (see the table notes for details on how we construct our measures of Jewish antiquity).

Non-Linearities and City Populations. About 40% of Europe's population died of the Black Death, and the mean mortality rate in our sample of 116 Jewish towns was 38.6%. But many towns lost an even higher share of their population, and their economies initially collapsed. There is evidence that these towns, and especially their local authorities, were concerned about their demographic and economic survival in the wake of the Black Death. In those conditions, it is plausible that these towns actually sought to protect their Jewish community, especially as Jews may have had occupational skills and also financial capital useful to the economic resurgence of the town.

We first test whether cities with disproportionately high mortality rates protected relatively more their Jewish community. To do so, we simply interact the mortality rate with itself. However, the interacted effect is zero and not significant (row 4). Nevertheless, it does not necessarily mean that the extent of the shock did not accentuate or attenuate the protective effect of the plague, as what matters is whether the town reaches a critically low population level in the immediate aftermath of the Black Death.

When interacting the mortality rate with a dummy equal to if the population of the town is larger than 5,000, 10,000 or 15,000 in 1300 (rows 5-7), we find a negative but not significant effect. However, when we perform the same tests but using the estimated population of the towns in 1353 (rows 8-10), we find negative and significant effects for the 5,000 and 10,000 thresholds (rows 8-9), but the negative effect when using 15,000 inhabitants as a threshold is not significant.[15] This implies that cities whose population fell to between 5,000 and 15,000 inhabitants due to the plague protected Jews relatively more, possibly because these cities needed to survive economically. Towns whose population may have fallen under 5,000 became potentially too small to hope for any recovery, and may have decided that it was in their best interest to kill or expel their Jewish residents, in order to capture their assets. And towns with about 15,000 inhabitants, while being more economically diverse, may be large enough that they did not need their Jewish residents for their future resurgence, so they were also more likely to persecute them.

[15]The population in 1353 is constructed as the population in 1300 $\times$ (100-mortality rate)/100.

Sea-based v. Land-based Trade. Jewish merchants played a crucial role intercontinental trade in the early middle ages (e.g. Goitein, 1967; Greif, 2006). However, by the fourteenth century, they had ceased to play a role in long distance, sea-based, trade which was controlled by guilds of Christian merchants. Instead, by the late middle ages Jews across Europe were specialized in moneylending (Botticini and Eckstein, 2012).[16]

Credit was vital for trade in medieval Europe as it was extremely costly to move bullion over long distances. So merchants relied on credit networks to fund both sea-based and land-based trade (see Spufford, 1988, 2002). Lending money openly at interest between Christians was forbidden, however, and Jewish lending was regulated and controlled. From twelfth century onwards, merchants across Europe began to innovate contractual forms that would allow them to evade the prohibition on usury (Koyama, 2010a). Many of these contractual innovations were designed to enable merchants to borrow money for seaborne trade. The sea-loan or *foenun nauticum*, for example, allow lenders to earn a return about the principle to compensate for the risks involved in sea voyage (Hoover, 1926; de Roover, 1945). Similarly, bills of exchange made possible exchange contracts in which the debt was repaid at a future date in a different currency thereby disguising any interest charged (de Roover, 1944; Bell et al., 2016).

All of this suggests that the relative importance of the financial intermediation provided by the Jews would have lower in cities engaged in long-distance seaborne trade. In these cities by the 1340s, merchants were already developing sophisticated financial controls that would enable them to lend and borrow without reliance on Jewish traders (De Lara, 2001; Rubin, 2010). This was not yet the case for inland trade, however. These trade routes were still in the hands of less sophisticated local merchants who would still have relied on Jewish moneylenders for credit.

To further test for the importance of interethnic complementarities, we therefore explore the importance of commerce and trade in shaping the vulnerabilities of Jewish communities to the persecutions that accompanied the plague. The interaction coefficient for coastal cities along the Mediterranean and North Sea and Baltic is positive implying that the result we obtain was weaker in these cities (rows 11-12). However, as seen in row 13, it is not access to any coast that mattered, as proximity to the Atlantic coast was not yet an important economic asset. If Jews were

[16]Roth (1961) argued that it was the guilds who pushed Jews out of trade and manufacturing into moneylending. However, Botticini and Eckstein (2012, 238) argue that the guilds cannot explain the shift towards moneylending because 'by the time the guilds became powerful, the Jews in western Europe had entered and then become specialized and prominent in moneylending for at least two centuries'. Instead **?** argue that Jews shifted away from trade to due to their comparative advantage in complex intermediation. For our purposes the precise cause of this shift is irrelevant. What matters is that by the fourteenth century, the key economic role that the Jews played was in moneylending.

less important for sea-borne trade, these results are consistent with the inter-ethnic economic complementaries mechanism. Conversely, for non-maritime trade, more precisely for rivers, medieval trade routes and market fairs, we find do not find any positive interaction effect (rows 14-16). This suggests that persecutions were less likely in towns that were connected to land-based trade networks. This is consistent with the historical evidence we have reviewed concerning the relative importance of Jewish intermediation in local trade in comparison to long-distanced, sea-based, trade.

Human Capital. As Botticini and Eckstein (2012) have established, Jews had higher levels of human capital than did Christians throughout the medieval period. This gave them a comparative advantage, not only in moneylending and trade, but also in medicine and in other skilled professions.

In addition to moneylending, Jews played an important role as doctors throughout European society, and especially in southern Europe where one historian notes 'one can hardly find at least one community that did not count at least one medical doctor among its members' (Shatzmiller, 1994, 1). Medicine was one of the key areas where Jews had a comparative advantage over Christians due to their human capital. According to Shatzmiller (1994), this advantaged stemmed from a greatly increased demand for medical services in western Europe after 1200 and a shortage of skilled Christian doctors; Jews came to specialize in medicine because they had access to more advanced Arabic medicinal knowledge.[17] The interethnic complementaries mechanism predicts that Jewish communities were likely to be more vulnerable where their services were easily substitutable. Row 17 provides some evidence for this: in university towns Jews were no less likely to be persecuted where Black Death mortality was high.

One reason for this may have been the prevalence of university-trained doctors of medicine in university towns. There was also frequent but evidently ineffectual legislation prohibiting Christians from relying on Jewish doctors. Jewish doctors were sometimes limited to practicing particular types of medicine or requiring that they pay for licenses. University towns were less likely to be dependent on Jews for medical knowledge and this might explain why the mortality effect is mitigated in these towns.

Political Institutions. We then turn to political institutions. The direct effect of Black Death mortality is unchanged regardless of whether a city was a self-governing city (row 20). However, the relationship we find between Black Death mortality and the probability of a persecution was attenuated in monarchies (row 21). This likely reflects

[17]And we know of individual Jews such as Profayt Duran who were both moneylenders and physicians (see Emery, 1968).

the fact that the decision to tolerate or persecute Jewish communities was less likely to be made at a local level (and hence be sensitive to local economic conditions) within monarchies. Towns within monarchies also belonged to a network of cities, between were trade may have been facilitated and encouraged. In those conditions, these towns may have been economically less reliant on their Jewish community, hence the higher probability of persecution.

The Holy Roman Empire. When comparing towns with a similar mortality rate, Jews were *more* likely to be persecuted in towns that belonged to the Holy Roman Empire in central Europe (row 20). This is in keeping with the historical literature that has documented how Holy Roman Empire saw the largest and most extensive persecutions against Jews. Indeed it is these persecutions that have been the focus of the majority of earlier work on this subject (e.g Voigtländer and Voth, 2012; Finley and Koyama, 2015b). Pope Clement VI issued two papal bulls instructing Christians not to blame the Jews for the plague. Charles IV, the Emperor of the Holy Roman Empire, also denouncing the well poisoning libel. However, the authority of the Emperor was weak across much of the Holy Roman empire and local authorities had the leeway to perpetrate persecutions against their Jewish community.[18] Consistent with this analysis, we find that the protective effect of high mortality rates was, in fact, stronger in the Holy Roman Empire, probably because the moral cost of committing these persecutions was lower there. In other words, the decision to tolerate or persecute Jewish communities was more likely to be made at a local level (and hence be sensitive to local economic conditions) within the Holy Roman Empire.

Past Persecutions. Rows 21-23 use data on persecutions prior to the Black Death as a potential measure of latent antisemitism. If, as historians have argued, a culture of antisemitism was a vital perquisite for the Black Death to increase the probability of persecution we expect this coefficient to be positive (e.g Trachtenberg, 1943). When we include an interaction term for the proportion of years with persecutions, we find a positive and significant interaction term for persecutions in the 46 years prior to the plague (row 21). However, the interaction effect is not significant if we consider the periods 1200-1346 (row 22) or 1200-1299 (row 23). This is suggestive as it implies that a recent history of persecutions i.e. of antisemitic violence committed by ones' parents or grandparents made a difference and helped to diminish the 'protective effect' we find associated with high levels of plague mortality. But antisemitism in the previous century

[18]Finley and Koyama (2015b) explore this in detail and show that persecutions were most severe in bishoprics and free imperial cities.

had no effect.

Easter Massacres and Lent Restraint? Throughout the middle ages and into the modern era, Easter was a period of heightened religiosity and tensions between Christians and Jews. The Easter celebration involved dramatic reenactments of the passion of Christ. These passion plays could help to incite antisemitic sentiments as medieval tradition blamed the Jews for the death of Christ. Moreover, as Staliūnas (2012, 501) notes, Easter 'created conditions that favored acts of violence, since huge crowds of people gathered for the occasion'. Werner of Womrath was alleged to have been ritually murdered in Easter 1287 and this inspired a wave of persecutions. In Pulkau in Austria accusations of Host desecration in 1338 lead to pogroms in 30 towns (Müller, 2014, 256).[19] And during the pogroms that took place in late nineteenth century Tzarist Russia, historians have argued that the religious tensions around Easter made violence against Jews particularly likely (Klier, 2002; Staliūnas, 2012, 2013).

Numerous local studies suggest that this was a factor during the Black Death. The Jewish community of Toulon were massacred on 12-13 April 1348, at the same time as the plague reached the city (Cremieux, 1930). Shatzmiller (1974) notes that the pogrom in Provence coincided with the last day of Easter when the resurrection or rising of Jesus Christ against his "enemies" was expected.

In terms our model, the utility of persecution was thus particularly high around Easter—which fell in April or early May according to the Julien Calendar then in use. To test whether this impacted the probability of a persecution taking place in Row 24 we interact Black Death mortality with whether or not the plague began in April. The coefficient we obtain with respect to the interaction term is 0.014 is positive and statistically significant; in terms of magnitude it is comparable to the negative direct effect we obtain with respect to mortality. This implies that when the moral cost of targeting Jews was lower—that if the plague arrived around Easter—the protective effects of Black Death mortality were wiped out.

If this hypothesis is correct we should expect the opposite effect to hold during Lent when Christians are supposed to fast and to reflect on their sins. In Row 25 we include an interaction between February and Black Death mortality. The coefficient we obtain is negative and significant suggesting that if the Black Death arrived during Lent then this further strengthened the protective effect of Black Death mortality on persecution probability.[20]

[19]The tensions around the month of April were further heightened by the fact that Passover typically coincides with Easter and Jews were accused of ritually murdering and sacrificing Christian children as part of this festival (Rubin, 2004).

[20]We obtain the same results as in Row 24 of Table **??** if we include the interaction of April + May with

Summary of Findings Overall, the results related to recent immigration, city size, trade, human capital, political institutions and the Holy Roman Empire are in line with the inter-ethnic economic complementarity effect. Yet, we cannot entirely discard non-economic factors, such as social norms and culture. Indeed, we find that a culture of antisemitism in the town attenuates the protective effect of high plague mortality.

6. Conclusion

This paper investigates the causes of violence against minority groups. We explore how a major demographic and economic shock, the Black Death, affected the incentive to persecute Jewish communities in medieval Europe.

Our historical setting allows us to distinguish between two mechanisms: the scapegoating mechanism, and a mechanism based on inter-ethnic economic complementarities. We find that as predicted by the scapegoating mechanism, the Black Death shock made Jewish communities particularly vulnerable to violence. However, given this shock, the intensity of the Black Death had a strong counter-veiling effect. Cities that were hit especially hard by the Black Death faced a demographic and economic crisis. This made them less likely to destroy their demographically and economically useful Jewish communities. These results suggest more generally that policies that increase the economic value of minorities and make their skills more complementary to those of other communities may be a powerful way to reduce inter-ethnic violence.

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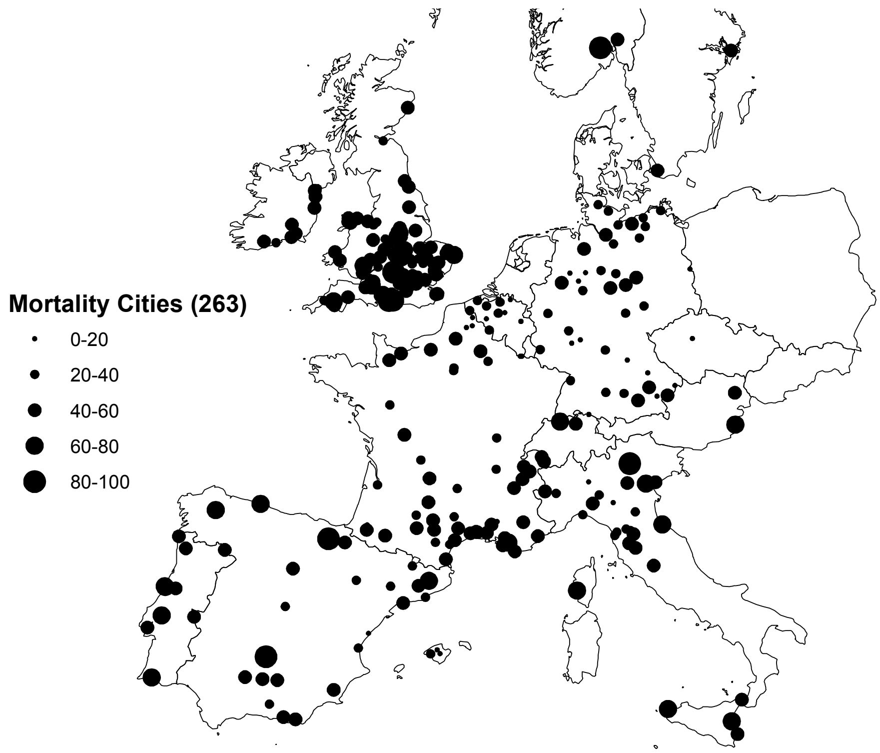
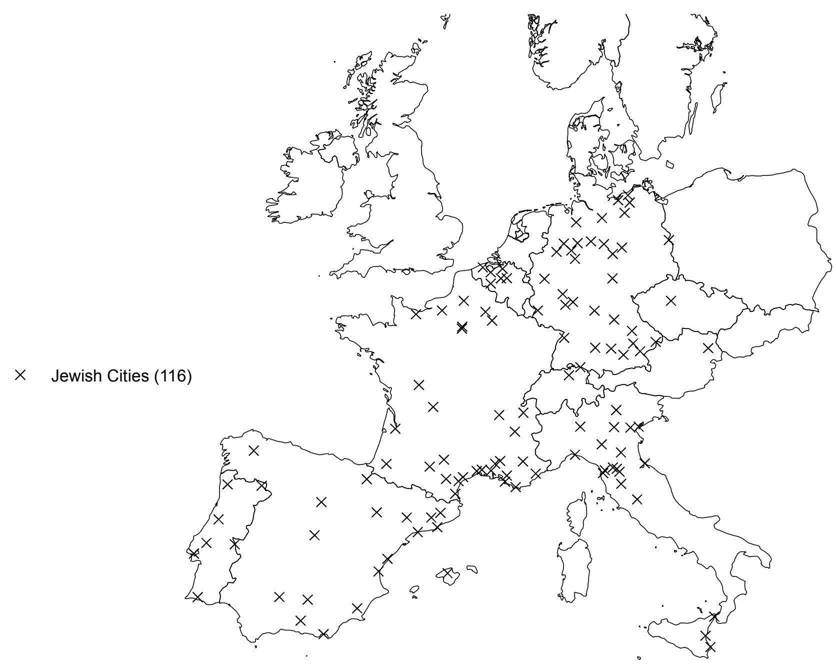
Figure 1: Cumulative Black Death Mortality Rates (%) in 1347-1352



Notes This map depicts Black Death mortality rates (%, 1347-1352) for 263 localities. The main source for the mortality data is Christakos et al. (2005). See Web Data Appendix for more details on data sources.

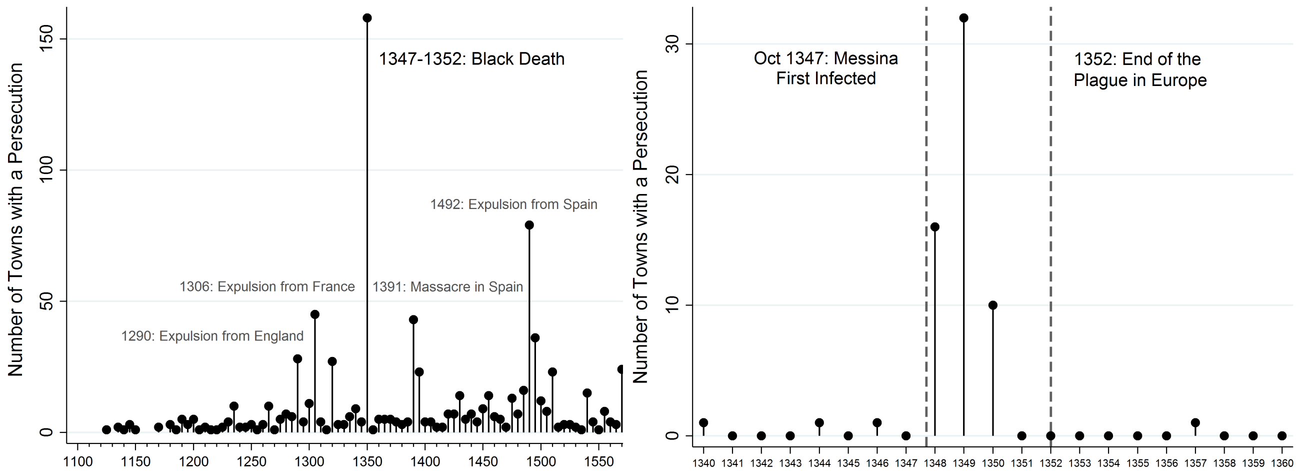
Figure 2: TBC Main Sample of 124 Jewish Towns with Mortality Data TBC



Notes: This map shows the 124 towns of our main sample, i.e. the towns with Jews present at one point in 1347-1352 and for which we know the Black Death mortality rate (%, 1347-1352). These 124 towns belong to 9 countries using today's boundaries: Austria, Belgium, the Czech Republic, France, Germany, Italy, Portugal, Spain and Switzerland. See Web Data Appendix for more details on data sources.

Figure 3: Total Number of Jewish Persecutions in 1100-1600 and 1347-1352

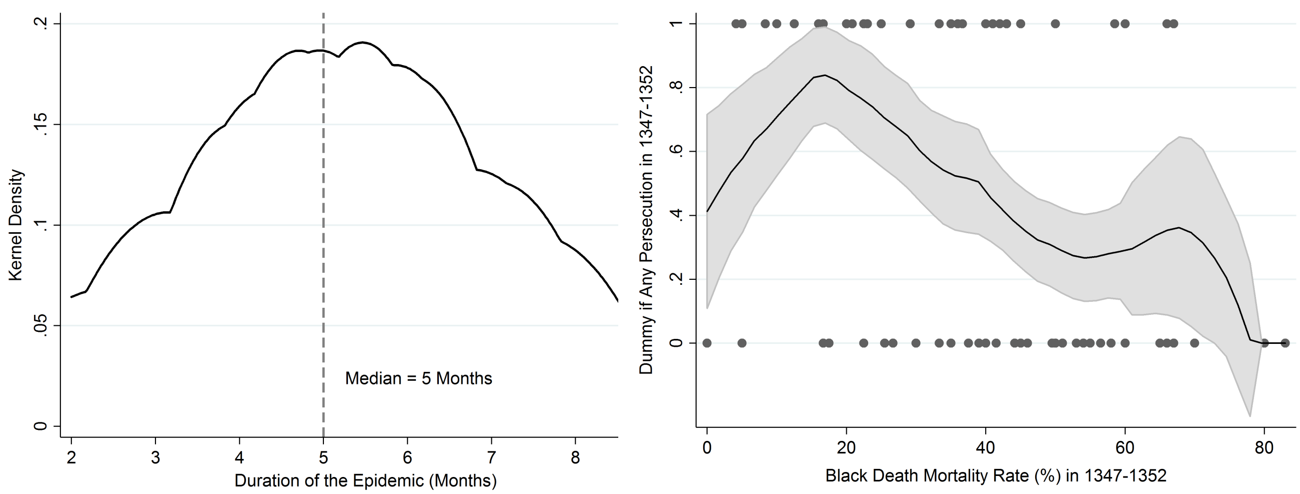
(a) All Persecutions, 1100-1600 (b) Black Death Persecutions, 1347-1352



Notes: Panel (a) depicts all persecutions recorded in the full sample of 1,873 towns, when the year is rounded to the nearest decade (year ending in 0) or mid-decade (year ending in 5). It shows that the Black Death period (1347-1352, rounded in 1350) witnessed the greatest number of persecutions in medieval European history (here, 1100-1600). Panel (b) focuses on the 124 towns of the main sample and persecutions that took place within the five-year Black Death period and seven years before and seven years after (here, 1340-1360). See Web Data Appendix for more details on data sources.

Figure 4: Distribution of the Duration of the Black Death, and Relationship between Black Death Mortality and the Likelihood of a Persecution in 1347-1352.

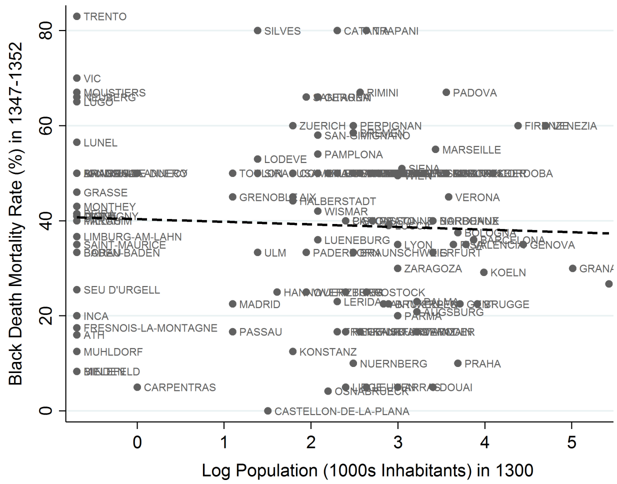
(a) Duration (b) Persecution



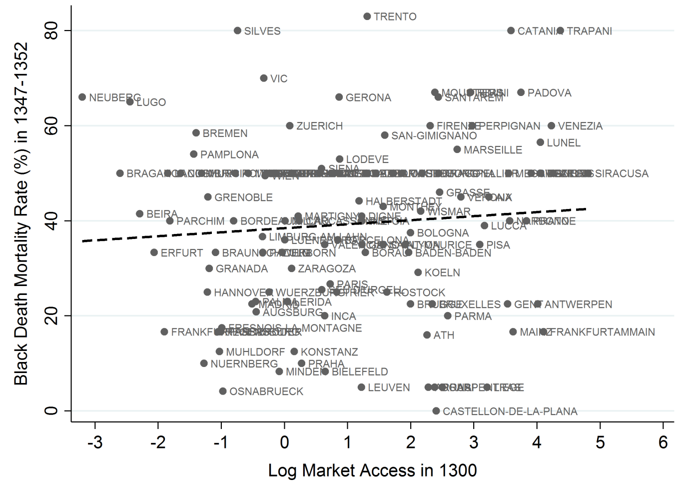
Notes: Panel (a) shows the Kernel distribution of the duration of the Black Death in each city, i.e. the time difference between the month of the first infection in the city and the month of the last infection in the city (information available for 39 out of the 124 towns of the main sample). The mean and median durations were 5 months. Panel (b) shows that for the main sample of 124 Jewish towns for which we have data on Black Death mortality there is a negative correlation between the likelihood of a persecution and the mortality rate in 1347-1352. See Web Data Appendix for more details on data sources.

Figure 5: Black Death Mortality, Locality Size and Market Access in 1300

(a) Locality Size



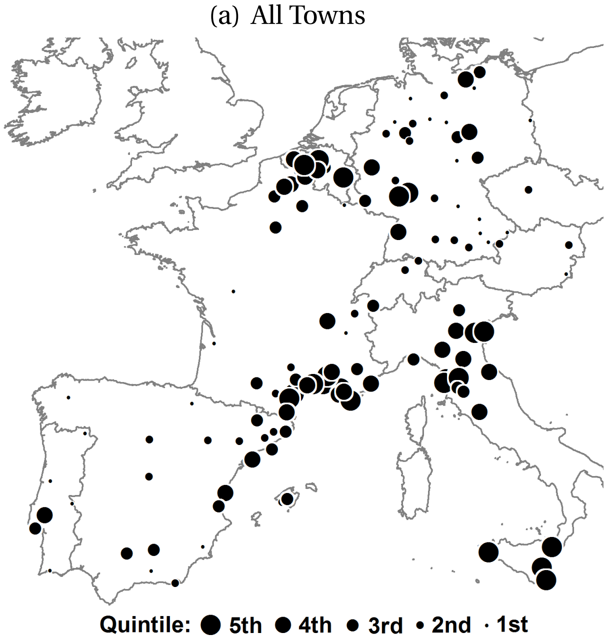
(b) Market Access



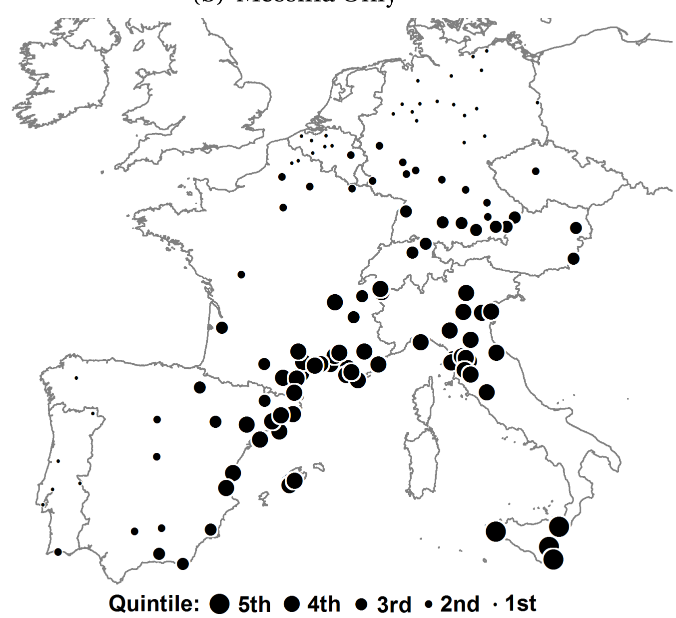
Notes: Panel (a) depicts the relationship between mortality rates (%, 1347-1352) and log population size in 1300 for our main sample of 124 Jewish towns (Y = 40.36*** -0.55 X; Obs. = 124; R2 = 0.00). Panel (b) depicts the relationship between mortality rates (%, 1347-1352) and log market access to all 1,873 towns in 1300 for our main sample of 124 Jewish towns (Y = 38.45*** +0.85 X; Obs. = 124; R2 = 0.01). Market access for city i is defined as $MA_i = \Sigma_j \frac{P_j}{D_{ij}^{\sigma}}$, with P_j being the population of town $j \neq i$, D_{ij} the travel time between city i and city j, and $\sigma = 3.8$. To obtain the travel times, we use ArcGIS to compute the least cost path via four transportation modes – by sea, by river, by road and by walk – with the transportation speeds from Boerner & Severgnini (2014). See Web Data Appendix for more details on data sources.

Figure 6: Market Access to All Towns vs. Market Access to Messina Only, 1300.

(a) All Towns

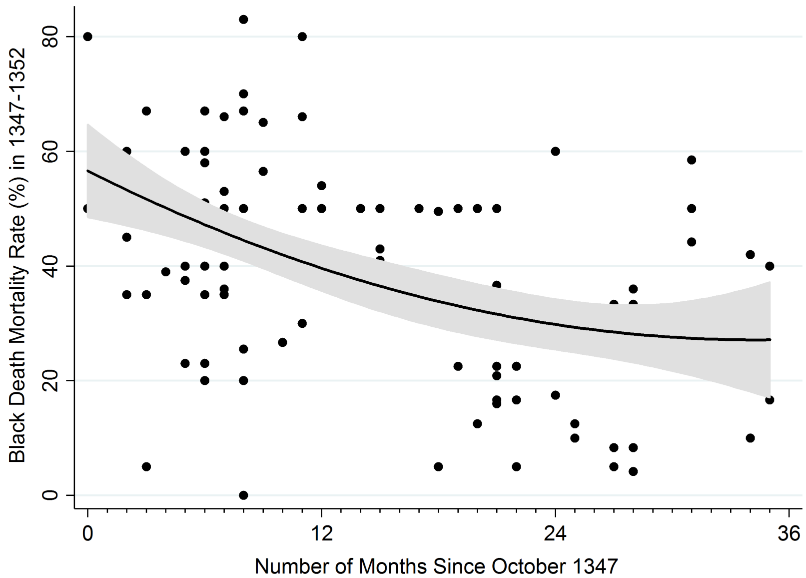


(b) Messina Only



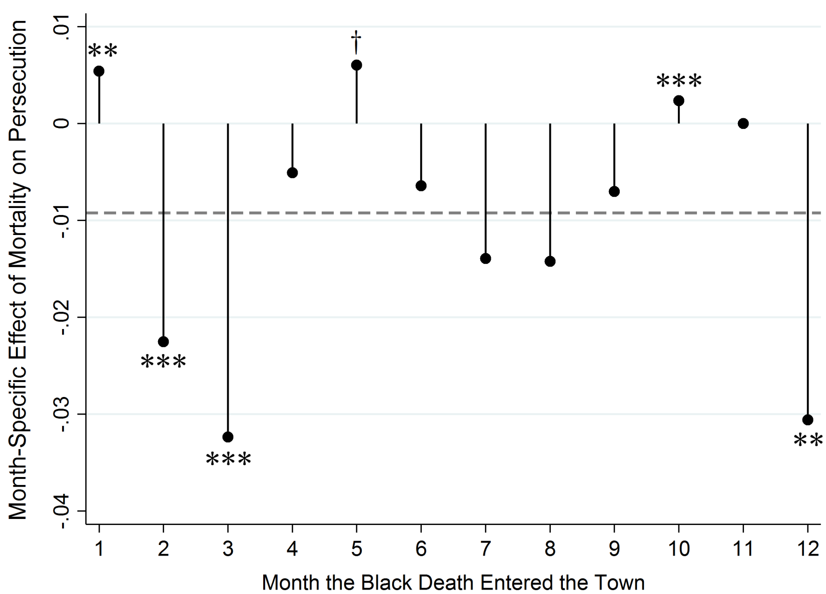
Notes: Panel (a) shows for the 124 towns of the main sample their log market access to all towns in 1300. Panel (b) shows for the same 124 towns their log market access to Messina in 1300. See notes under figure 5(b) for details on how market access is calculated. We use as an instrument log market access to Messina, conditional on log market access to all towns. See Web Data Appendix for more details on data sources.

Figure 7: Timing of the Onset of the Black Death and Black Death Mortality



Notes: This figure shows for the 124 towns of the main sample the relationship between Black Death mortality rates (%) in 1347-1352 and the specific timing of the onset of the Black Death in the town, here the number of months since October 1347, the month Messina – the port of entry of the Black Death in Europe – was first infected by it. Towns which were infected earlier had higher mortality rates (Y = 52.01*** -0.87*** X; Obs. = 124; R2 = 0.22). See Web Data Appendix for more details on data sources.

Figure 8: Effects of the Black Death Mortality Rate by Month of First Infection



Notes: This figure shows for each month of first infection the effect of the Black Death mortality rate (%) in 1347-1352. These effects are conditional on the individual effects of the month of first infection on the persecution dummy (see text for details). We test that each coefficient is significantly different from the average effect across all months, i.e. the baseline effect of -0.009*** (see Row 1 of Table 1): Robust SE's: † $p<0.15$, * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Data Appendix for more details on data sources.

Table 1: BLACK DEATH MORTALITY RATES AND JEWISH PERSECUTIONS, 1200-1500

	Effect of Black Death Mortality Rate (%) in 1347-1353:				
	Coeff.	SE	Obs.	R2	Jews Present in Period s:
Panel A:	*Dependent Variable*: Dummy if Any Jewish Persecution in Period t:				
1. t = [1347-1353]	-0.011***	[0.002]	116	0.171	s = [1300-1346]
2. t = [1354-1360]	0.001	[0.001]	79	0.003	s = [1354]
3. t = [1354-1400]	-0.005**	[0.002]	79	0.053	s = [1354]
4. t = [1354-1500]	0.001	[0.002]	79	0.001	s = [1354]
5. t = [1400-1500]	0.002	[0.002]	86	0.008	s = [1400]
6. t = [1340-1346]	0.000	[0.000]	116	0.000	s = [1300-1339]
7. t = [1300-1346]	-0.001	[0.002]	135	0.002	s = [1200-1299]
8. t = [1200-1346]	-0.002	[0.004]	82	0.003	s = [1100-1199]
Panel B:	*Dependent Variable*: Dummy if Any Jewish Pogrom in Period t:				
1. t = [1347-1353]	-0.012***	[0.002]	116	0.189	s = [1300-1346]
2. t = [1354-1360]	0.000	[0.000]	79	0.000	s = [1354]
3. t = [1354-1400]	-0.006**	[0.002]	79	0.089	s = [1354]
4. t = [1354-1500]	-0.007***	[0.003]	79	0.080	s = [1354]
5. t = [1400-1500]	-0.003	[0.002]	86	0.019	s = [1400]
6. t = [1340-1346]	0.000	[0.000]	116	0.000	s = [1300-1339]
7. t = [1300-1346]	0.000	[0.002]	135	0.000	s = [1200-1299]
8. t = [1200-1346]	-0.001	[0.003]	82	0.002	s = [1100-1199]
Panel C:	*Dependent Variable*: Dummy if Any Jewish Expulsion in Period t:				
1. t = [1347-1353]	-0.005**	[0.002]	116	0.055	s = [1300-1346]
2. t = [1354-1360]	0.000	[0.000]	79	0.000	s = [1354]
3. t = [1354-1400]	-0.000	[0.001]	79	0.001	s = [1354]
4. t = [1354-1500]	0.004	[0.003]	79	0.020	s = [1354]
5. t = [1400-1500]	0.002	[0.003]	86	0.008	s = [1400]
6. t = [1340-1346]	0.000	[0.000]	116	0.000	s = [1300-1339]
7. t = [1300-1346]	0.000	[0.002]	135	0.000	s = [1200-1299]
8. t = [1200-1346]	0.000	[0.003]	82	0.000	s = [1100-1199]

Notes: This table shows the effect β_t of the Black Death mortality rate (%) in 1347-1353 on a dummy equal to one if there has been any Jewish persecution (Panel A), any Jewish pogrom (Panel B), and any Jewish persecution (Panel C) in various periods t, for the sample of cities for which we have mortality data and in which we know that Jews were present in period s preceding period t. Rows 1 show the baseline results for the main sample of 116 Jewish cities. Rows 2-5 show the effect of the Black Death mortality rate in periods t after the Black Death took place. Rows 6-8 show that the parallel trend assumption is verified for the periods t before the Black Death took place. Robust SE's: † p=0.17, * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Data Appendix for data sources.

Table 2: CITY CHARACTERISTICS AND BLACK DEATH MORTALITY RATES

Dependent Variable:	Black Death Mortality Rate (%, 1347-1353)							
	(1)		(2)		(3)		(4)	
Geography:								
Average Temperature 1500-1600 (d)	-2.08	[1.58]					-2.52	[1.97]
Elevation (m)	-0.02	[0.01]					-0.01	[0.01]
Cereal Suitability Index	1.31	[1.40]					1.89	[1.56]
Pastoral Suitability Index	2.39	[5.29]					-0.41	[6.31]
Coast 10 Km Dummy	-2.69	[5.10]					-9.20	[6.35]
Rivers 10 Km Dummy	0.75	[3.43]					-0.36	[3.90]
Longitude (d)	0.37	[0.31]					0.97**	[0.42]
Latitude (d)	-3.05***	[0.97]					-3.35***	[1.12]
Trade & Human Capital:								
Log City Population in 1300			1.22	[1.46]			1.80	[1.92]
Maj.Roman Rd (MRR) 10 Km Dummy			-5.55	[8.18]			-8.03	[7.62]
MRR Intersection 10 Km Dummy			12.84	[9.26]			10.18	[9.74]
Any Roman Rd (ARR) 10 Km Dummy			10.83**	[5.11]			7.51	[6.28]
ARR Intersection 10 Km Dummy			-3.25	[5.74]			0.40	[6.54]
Medieval Route (MR) 10 Km Dummy			-4.56	[3.68]			-5.72	[3.77]
MR Intersection 10 Km Dummy			-2.40	[5.25]			-2.50	[5.97]
Market and Fair Dummy			-5.01	[3.97]			-1.23	[4.79]
Hanseatic League Dummy			0.88	[5.97]			8.37	[7.00]
Aqueduct 10 Km Dummy			-3.70	[4.56]			-6.15	[4.47]
University Dummy			3.58	[6.00]			0.87	[6.83]
Institutions:								
Monarchy in 1300 Dummy					4.36	[6.42]	4.43	[6.81]
Holy Roman Empire 1300 Dummy					-9.10	[6.91]	-11.33	[7.65]
State Capital in 1300 Dummy					-1.21	[4.90]	-3.19	[5.58]
Autonomous City in 1300 Dummy					-0.98	[4.17]	2.77	[4.29]
Parliamentary Activity in 1300-1400					-4.00	[5.52]	-8.48	[5.50]
Battle w/i 100 Km in 1300-1350 Dummy					-0.96	[3.98]	-4.66	[4.51]
Obs.; R^2	116; 0.23		116; 0.14		116; 0.09		116; 0.34	

Notes: This table shows the effects of various characteristics proxying for locational fundamentals, increasing returns and institutions around 1300-1350 on the Black Death mortality rates (%) in 1347-1352. See the text for a description of the variables. We use the main sample of 116 cities for which we have mortality data and in which Jews were present in 1300-1346. Columns (1)-(4) represent four different regressions. Robust SE's: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Data Appendix for data sources.

Table 3: MORTALITY RATES AND PERSECUTIONS, INVESTIGATION OF CAUSALITY

Effect of Mortality Rate (%) on Dummy if Any Jewish Persecution in 1347-1353:				
	Coeff.	SE	Obs.	R2
1 . Baseline (see Row 1 of Table 1 Panel A)	-0.011***	[0.002]	116	0.171
2 . Control: Log Years Jews Present: 1st Version (1200,1300)	-0.011***	[0.002]	116	0.205
3 . Control: Log Years Jews Present: 2nd Version (1250,1325)	-0.011***	[0.002]	116	0.188
4 . Drop If High Number of Victims	-0.011***	[0.002]	109	0.170
5 . Control: Dummy if Persecution 1340-1346	-0.011***	[0.002]	116	0.176
6 . Control: Dummy if Persecution 1300-1346	-0.011***	[0.002]	116	0.210
7 . Control: Dummy if Persecution 1200-1346	-0.012***	[0.002]	116	0.180
8 . Control: Share of Years w/ Persecution 1340-1346	-0.011***	[0.002]	116	0.176
9 . Control: Share of Years w/ Persecution 1300-1346	-0.011***	[0.002]	116	0.206
10 . Control: Share of Years w/ Persecution 1200-1346	-0.012***	[0.002]	116	0.200
11 . Drop Top and Bottom 10% in Mortality	-0.015***	[0.004]	97	0.145
12 . Drop Top and Bottom 25% in Mortality	-0.013*	[0.007]	71	0.059
13 . Drop Milan, Nuremberg, Venice	-0.011***	[0.002]	113	0.170
14 . Controls: Geography	-0.006**	[0.002]	109	0.395
15 . Controls: Trade & Human Capital	-0.009***	[0.002]	109	0.313
16 . Controls: Institutions	-0.009***	[0.002]	109	0.341
17 . Controls: All (Rows 5-7)	-0.006**	[0.003]	109	0.513
18 . IV w/ # Months of Infection Since Oct 1347 (F: 29.7)	-0.035***	[0.007]	88	0.212
19 . IV w/ # Months of Infection Since Oct 1347 (F: 4.5)	-0.028**	[0.013]	88	0.412

Notes: This table shows the effect of the mortality rate (%) on a dummy equal to one if there has been any Jewish persecution in 1347-1353, for the main sample of 116 Jewish towns. Row 1 shows the baseline results. Rows 2-3: Controlling for the log of the number of years Jews have been present, here calculated as the difference between 1347 and the earliest year Jews have been present in the town (Row 2: We use 1200 and 1300 as the earliest year for 1200-1300 and 1300-1346 respectively; Row 3: We use 1250 and 1325 as the earliest year for 1200-1300 and 1300-1346 respectively). Row 4: Dropping 7 towns for which we know that a high number of Jews were persecuted. Rows 5-7: Controlling for a dummy equal to one if there is any persecution in 1340-1346, 1300-1346 and 1200-1346 respectively. Rows 8-10: Controlling for the share of years with a persecution in 1340-1346, 1300-1346 and 1200-1346 respectively. Rows 11-12: Dropping the top and bottom 10% and 25% mortality rates respectively. Row 13: Dropping three cities with a better hygiene system. Rows 14-17: Adding the same controls as in Table 2 (these are described in the text). Rows 18-19: Instrumenting by the number of months between the city-specific date of first infection and Oct 1347 (Row 16: Also adding the controls of row 8, as well as quartics in latitude and longitude). Robust SE's: † p=0.17, * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Data Appendix for data sources.

Table 4: MORTALITY RATES AND "PREVENTIVE" JEWISH PERSECUTIONS

	Effect of Black Death Mortality Rate (%) in 1347-1353:			
	Coeff.	SE	Obs.	R2
Panel A: Dependent Variable: Dummy if Any Jewish Persecution in Period t:				
1. Baseline (see Row 1 of Table 1 Panel A)	-0.011***	[0.002]	116	0.171
2. Row 1 + Drop if Likely that Precedes the Black Death	-0.011***	[0.002]	112	0.167
3. Row 2 + Drop if Possible that Precedes the Black Death	-0.011***	[0.002]	108	0.176
4. Row 3 + Drop if Imputed Year of Infection for Persecution	-0.010***	[0.002]	100	0.145
5. Row 4 + Fixed Effects for Year of Infection	-0.006**	[0.002]	94	0.303
6. Row 4 + Fixed Effects for Semester of Infection	-0.004*	[0.002]	94	0.466
Panel B: Dependent Variable: Dummy if Any Jewish Pogrom in Period t:				
1. Baseline (see Row 1 of Table 1 Panel B)	-0.012***	[0.002]	116	0.189
2. Row 1 + Drop if Likely that Precedes the Black Death	-0.011***	[0.002]	112	0.186
3. Row 2 + Drop if Possible that Precedes the Black Death	-0.012***	[0.002]	108	0.197
4. Row 3 + Drop if Imputed Year of Infection for Pogrom	-0.010***	[0.002]	100	0.166
5. Row 4 + Fixed Effects for Year of Infection	-0.007***	[0.002]	94	0.292
6. Row 4 + Fixed Effects for Semester of Infection	-0.006**	[0.002]	94	0.408
Panel C: Dependent Variable: Dummy if Any Jewish Expulsion in Period t:				
1. Baseline (see Row 1 of Table 1 Panel C)	-0.005**	[0.002]	116	0.055
2. Row 1 + Drop if Likely that Precedes the Black Death	-0.004**	[0.002]	112	0.040
3. Row 2 + Drop if Possible that Precedes the Black Death	-0.005***	[0.002]	108	0.071
4. Row 3 + Drop if Imputed Year of Infection for Expulsion	-0.007***	[0.002]	100	0.112
5. Row 4 + Fixed Effects for Year of Infection	-0.003*	[0.002]	94	0.290
6. Row 4 + Fixed Effects for Semester of Infection	-0.001	[0.002]	94	0.530

Notes: This table shows the effect β_t of the mortality rate (%) in 1347-1353 on a dummy equal to one if there has been any Jewish persecution (Panel A), any Jewish pogrom (Panel B), and any Jewish persecution (Panel C) in 1347-1353, for the sample of cities for which we have mortality data and in which Jews were present in 1300-1346. Rows 1 show the baseline results for the main sample of 116 Jewish cities. Row 2: We drop 4 cities for which it is likely that the persecution took place before the city was infected by the Black Death. Row 3: We also drop 4 cities for which it is possible that the persecution took place before the city was infected. Row 4: We also drop 9 cities for which the year of infection was imputed using other sources than Christakos et al. (2005) (only 8 cities are dropped because 1 of them was already dropped in row 3). Row 5: We also include four "year of first infection" fixed effects. We lose 6 cities that did not experience a persecution and for which we do not know the mortality rate. Note that the year of infection was imputed for 19 of the cities without a persecution. Row 6: We add seven "semester of first infection" fixed effects (e.g., second semester of 1348) instead. Robust SE's: † p=0.17, * p<0.10, ** p<0.05, *** p<0.01. See Web Data Appendix for data sources.

Table 5: MORTALITY RATES AND JEWISH PERSECUTIONS, MEASUREMENT ISSUES

Effect of Mortality Rate (%) on Dummy if Any Jewish Persecution in 1347-1353:

	Coeff.	SE	Obs.	R2
1. Baseline (see Row 1 of Table 1 Panel A)	-0.011***	[0.002]	116	0.171
2. Jews Present in 1347-1353	-0.012***	[0.002]	101	0.188
3. Jews Present in 1200-1346	-0.012***	[0.002]	142	0.171
4. Jews Present in 1100-1353	-0.011***	[0.002]	143	0.169
5. Drop if Unsure about Jews Present in 1347	-0.011***	[0.002]	109	0.155
6. Also Drop if Unsure about Jews Ever Present by 1347	-0.011***	[0.002]	106	0.154
7. Add Cities where Jews Could Have been Present by 1347	-0.011***	[0.002]	118	0.167
8. Share of Years with a Persecution in 1347-1353	-0.003***	[0.001]	110	0.197
9. Dummy for Sources of Mortality Data	-0.007***	[0.002]	116	0.300
10. Drop Description-Based Mortality Data	-0.012***	[0.003]	91	0.168
11. Drop Desertion-Based Mortality Data	-0.007**	[0.003]	92	0.066
12. Drop Number-Based Mortality Data	-0.015***	[0.003]	49	0.317
13. Use Only Number-Based Mortality Data	-0.006*	[0.003]	67	0.051
14. Drop if Mortality Rate = 25% or 50%	-0.011***	[0.002]	75	0.189

Notes: This table shows the effect β_t of the mortality rate (%) on a dummy equal to one if there has been any Jewish persecution in 1347-1353, for the main sample of cities for which we have mortality data and in which Jews were present in 1300-1346. Row 1 shows the baseline results for the main sample of 116 Jewish cities. Rows 2-4: The Jewish presence dummy is defined in 1347-1353, 1200-1346 and 1100-1353 respectively. Rows 5-6: We drop French cities for which Jews may have not been present in 1347 and also ever present by 1347 respectively. Row 7: We add two French cities where Jews may have been present in 1300-1346. Row 8: The dependent variable is the share of the number of years in 1347-1353 with a persecution. Row 9: Including dummies for the source of mortality data: raw number (N = 67), literary description (N = 25) and desertion rates (N = 24). Rows 10-12: Excluding the description-based, desertion-based or number-based mortality rates respectively. Row 13: Only using the number-based mortality rates. Row 14: Dropping mortality rates of 25% and 50%. Robust SE's: † p=0.17, * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Data Appendix for data sources.

Table 6: MORTALITY RATES AND PERSECUTIONS, SAMPLING CHECKS

Effect of Mortality Rate (%) on Dummy if Any Jewish Persecution in 1347-1353:

	Coeff.	SE	Obs.	R2
1 . Baseline (see Row 1 of Table 1 Panel A)	-0.011***	[0.002]	116	0.171
2 . Drop if Germany in 2015 (N = 33)	-0.006**	[0.003]	83	0.077
3 . Drop if France in 2015 (N = 30)	-0.012***	[0.002]	86	0.218
4 . Drop if Italy in 2015 (N = 19)	-0.011***	[0.003]	97	0.156
5 . Drop if Spain in 2015 (N = 18)	-0.013***	[0.002]	98	0.215
6 . Drop if Portugal in 2015 (N = 7)	-0.011***	[0.002]	109	0.153
7 . Drop if Belgium in 2015 (N = 6)	-0.010***	[0.002]	110	0.131
8 . Extrapolated Mortality Based on 263 Cities	-0.015***	[0.002]	383	0.199
9 . Extrapolated Mortality Based on 166 Cities (Number-Based)	-0.015***	[0.002]	383	0.199
10 . Extrapolated Mortality Based on 116 Cities	-0.016***	[0.002]	383	0.201
11 . Extrapolated Mortality Based on 67 Cities (Number-Based)	-0.013***	[0.002]	383	0.111

Notes: This table shows the effect of the mortality rate (%) on a dummy equal to one if there has been any Jewish persecution in 1347-1353, for the main sample of cities for which we have mortality data and in which Jews were present in 1300-1346. Row 1 shows the baseline results for the main sample of 116 Jewish cities. Rows 2-7: Dropping the cities belonging to the six countries (defined in 2015) with the most cities among the main sample of 116 cities. Rows 8-11: Using the extrapolated mortality rates (%) based on the 263 localities for which we have mortality data (Row 8), 166 localities for which we only have number-based mortality data (Row 9), the 116 cities of the main sample (Row 10), and 67 cities among the 116 cities of the main sample and for which we only have number-based mortality data (Row 11). The sample size increases to 383 because 383 cities had Jews in 1300-1346 and we now have an estimate of their mortality rate. Robust SE's: † p=0.17, * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Data Appendix for data sources.

Table 7: MORTALITY RATES AND JEWISH PERSECUTIONS, INTERACTION EFFECTS

Effects of Mortality Rate (%) and Mortality Rate (%) x Variable in Each Row 2-27
on Dummy if Any Jewish Persecution in 1347-1353:

		Mortality		Mortality x Variable	
		Coeff.	SE	Coeff.	SE
1 .	Baseline (see Row 1 of Table 1 Panel A)	-0.011***	[0.002]	_	_
2 .	Log Years Jews Present - 1st Version (1200, 1300)	-0.056**	[0.022]	0.009*	[0.004]
3 .	Log Years Jews Present - 2nd Version (1250, 1325)	-0.057***	[0.018]	0.009**	[0.004]
4 .	Mortality Rate (%)^2	-0.011	[0.008]	-0.000	[0.000]
5 .	Pop. Above 5,000 in 1300 Dummy	-0.009**	[0.003]	-0.005	[0.004]
6 .	Pop. Above 10,000 in 1300 Dummy	-0.010***	[0.003]	-0.004	[0.005]
7 .	Pop. Above 15,000 in 1300 Dummy	-0.010***	[0.003]	-0.004	[0.006]
8 .	Pop. Above 5,000 in 1353 Dummy	-0.008**	[0.003]	-0.009*	[0.005]
9 .	Pop. Above 10,000 in 1353 Dummy	-0.009***	[0.003]	-0.008*	[0.005]
10 .	Pop Above 15,000 in 1353 Dummy	-0.011***	[0.002]	-0.007	[0.007]
11 .	Mediterranean Coast 10 Km Dummy	-0.013***	[0.003]	0.014**	[0.006]
12 .	North-Baltic Coast 10 Km Dummy	-0.011***	[0.002]	0.011***	[0.002]
13 .	Coast 10 Km Dummy	-0.012***	[0.003]	0.008	[0.007]
14 .	Rivers 10 Km Dummy	-0.010***	[0.003]	-0.003	[0.005]
15 .	Medieval Route (MR) 10 Km Dummy	-0.011***	[0.003]	0.000	[0.005]
16 .	Market and Fair Dummy	-0.011***	[0.003]	-0.002	[0.007]
17 .	University Dummy	-0.011***	[0.002]	0.011***	[0.002]
18 .	Autonomous City in 1300 Dummy	-0.009***	[0.003]	-0.005	[0.005]
19 .	Monarchy in 1300 Dummy	-0.012***	[0.003]	0.009**	[0.004]
20 .	Holy Roman Empire 1300 Dummy	-0.005*	[0.003]	-0.008*	[0.004]
21 .	Share of Years (%) with Persecution in 1300-1346	-0.012***	[0.002]	0.005**	[0.002]
22 .	Share of Years (%) with Persecution in 1200-1346	-0.012***	[0.002]	0.004	[0.003]
23 .	Share of Years (%) with Persecution in 1200-1299	-0.012***	[0.002]	0.003	[0.006]
24 .	Easter (April)	:-0.012***	[0.002]	0.014***	[0.002]
25 .	Lent (February)	-0.010***	[0.002]	-0.012***	[0.003]

Notes: This table shows the effects of the mortality rate (%) and the mortality rate (%) times a variable shown in each row 2-23 on a dummy equal to one if there has been any Jewish persecution in 1347-1353, for the main sample of 116 Jewish towns. Each row represents a separate regression. The independent effect of the dummy used for the interaction is not shown. Rows 2-3: Log of the number of years Jews have been present, here calculated as the difference between 1347 and the earliest year Jews have been in the town (Row 2: We use 1200 and 1300 as the earliest year for 1200-1300 and 1300-1346 respectively; Row 3: We use 1250 and 1325 as the earliest year for 1200-1300 and 1300-1346 respectively). Row 4: The mortality rate itself. Rows 5-10: Dummy if population is above 5,000, 10,000 and 15,000 in 1300 and 1353 respectively (the population in 1353 is constructed as the population in 1300 x (100-mortality rate)/100). Rows 11-20: The variables are the same as in Table 2 and are described in the text. Rows 21-23: Percentage share of years with any persecution in 1300-1346, 1200-1346 and 1200-1299 respectively (Rows 22-23: Also adding a dummy if Jews were present in 1200-1299). Row 24: the interaction between Easter and persecution probability. Row 25: the interaction between Lent and persecution probability. Robust SE's: † p=0.17, * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Data Appendix for data sources.