WEB APPENDIX - NOT FOR PUBLICATION

1. Conceptual Framework

We now describe how a shock can affect the probability that an outgroup is persecuted. Per capita income y depends on population L. In line with the historical discussion, it also depends positively on the value of the economic services provided by the minority x: $y = f(L, x)$.

$$y = f(L, x) \; .$$

The utility of in-group members has three components: income, the death of in-group members δ, and preferences over diversity z (i.e. preferences over the out-group).

$$u_i = g\big(y, \delta, z\big)$$

For simplicity, we work with a linear, separable, version of this function (thereby ignoring cross-effects): $u_i = y + \delta + z$. The effect of the Black Death mortality M on the utility of a representative member of the in-group (who survives the plague) depends on how these three components are affected.

$$\frac{du_i}{dM} = \frac{dy}{dM} + \frac{d\delta}{dM} + \frac{dz}{dM} \tag{1}$$

The first component, the effect of the Black Death shock on per capita income could be positive due to the Malthusian effect on per capita income ($\frac{dL}{dM}\frac{\partial y}{\partial L}$). However, as we will describe below, Black Death mortality disrupted production causing incomes to decrease. The second component ($\frac{d\delta}{dM}$) is negative: the death of family, friends and others reduces utility. The third effect is context specific. If the minority is held responsible for the shock, then it is negative ($\frac{dz}{dM}$), and the in-group resents the presence of the out-group more, the larger the shock.

We now consider the incentive of the in-group to persecute or not persecute the minority. Clearly, if the minority group provides no economic services ($x = 0$), then there will always be an incentive to persecute the minority so long as they are held responsible for the shock (i.e. $dz/dM < 0$). However, if the minority provides important economic services whether or not a persecution will take place depends on the relative size of the effects.

To analyze the decision to persecute, we employ the method of comparative statics. We fix the threshold level of utility $\bar{u}$ at which the representative member of the in-group is indifferent between persecuting or not persecuting the minority:

$$\bar{u} = \bar{u}\big(y(L, x), \delta, z\big) = \bar{u}\big(y(L), \delta\big) \tag{2}$$

where x and z are set to zero on the RHS as this is their value when there is no minority community. By revealed preference we know that prior to the plague: $u_i > \bar{u}$ for all cities with minority communities. To see how the decision to persecute is affected by the Black Death shock we take the total derivative of this indifference condition with respect to M:

$$\frac{d\bar{u}}{dM} = \frac{dL}{dM}\frac{\partial y(L,x)}{\partial L} + \frac{dx}{dM}\frac{\partial y(L)}{\partial x} + \frac{d\delta}{dM} + \frac{dz}{dM} - \frac{dL}{dM}\frac{\partial y}{\partial L} - \frac{d\delta}{dM}\,. \tag{3}$$

The positive direct effects of plague mortality on income per capita cancel out. Therefore, the representative individual will be more likely to persecute the minority if the following holds:

$$\Big|\underbrace{\frac{dL}{dM}\Big(\frac{\partial y(L,x)}{\partial L} - \frac{\partial y(L)}{\partial L}\Big)}_{\text{Complementarities Effect}}\Big| < \Big|\underbrace{\frac{dz}{dM}}_{\text{Scapegoating Effect}}\Big|\,. \tag{4}$$

If relative size of the complementarity and scapegoating effects vary from city to city then a given mortality shock could have differential effects. Moreover for a given set of city characteristics, the size of the mortality shock might give rise to differential effects. Specifically, it is natural to assume that the effects of M on z are linear. If dx/dM is convex. That is, if the economic role of the minority community becomes more important in the presence of a large mortality shock, then the effects of the mortality shock on $\bar{u}$ might be negative for small values of M and become positive for higher values of M. This would generate an inverted U-shaped relationship between Black Death mortality and the probability of a persecution.

Example with a Cobb-Douglas Production Function

For illustrative purposes, consider a Cobb-Douglas production function: $Y = L^{\alpha}(1+x)^{1-\alpha}$. Per capita income is therefore: $y = L^{\alpha-1}(1+x)^{1-\alpha}$. We also assume a linear relationship between plague mortality and labor: $L = -M$, and linear expressions for the disutility of relatives dying: ($\delta = -\pi M$) and over preferences over diversity ($z = -\Psi M$).

In this case, the indifference condition (equation 2) can be written as:

$$\bar{u} = L^{\alpha-1}(1+x)^{1-\alpha} - \pi M - \Psi M = L^{\alpha-1} - \pi M \tag{5}$$

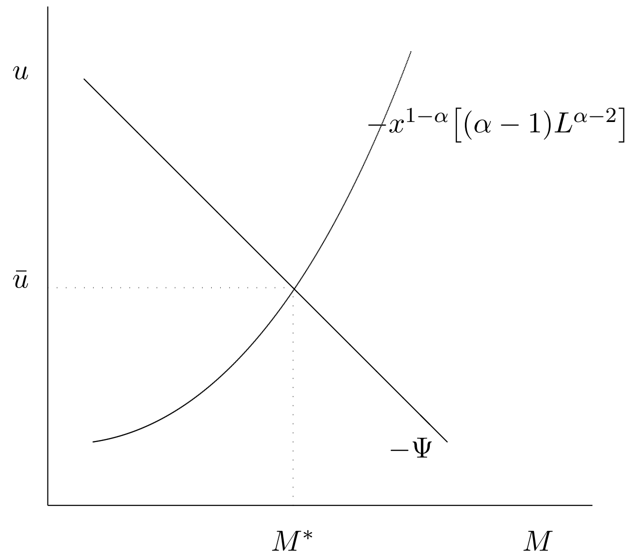
Totally differentiating this equation with respect to plague mortality M and simplifying, we obtain:

$$\frac{d\bar{u}}{dM} = -x^{1-\alpha}\big[(\alpha-1)L^{\alpha-2}\big] - \Psi \tag{6}$$

The first term is the *complementarities effect*; it is positive. The second is the scapegoating effect; it is negative. This is illustrated in Figure A.1.

To summarize, the shock-persecution relationship ultimately depends on the scapegoating and complementarity effects. Below, we will use the insights from this framework when exploring econometrically the mechanisms explaining the observed shock-persecution relationship.

Figure A.1: Relationship between Mortality and the Scapegoating and Complementarities Effects.



2. The Main Sample of 124 Towns

Among the 1,869 Western European towns that reached 1,000 inhabitants at one point between 800 and 1850 in the Bairoch (1988) database and/or belong to the Christakos et al. (2005) database of mortality rates, we have identified 363 towns in which Jews were present at the onset of the Black Death in 1347. Of these 363 Jewish communities, we can match 124 locations to our database of mortality rates. Our main sample thus consists of 124 towns with a Jewish community at the onset of the Black Death (1347) and for which we know the Black Death mortality rate (%, 1347-1352).

3. Black Death Mortality Rates

Our data on cumulative Black Death mortality rates (%) for 263 localities for the whole period 1347-1352 is based on the estimates collected by Christakos et al. (2005) which come from a wide range of historical sources. We verify and supplement these where possible with data from other sources including Ziegler (1969), Russell (1972), Pounds (1973), Gottfried (1983), and Benedictow (2005). These localities belong to 13 countries of Western Europe using today's boundaries: Austria, Belgium, the Czech Republic, France, Germany, Ireland, Italy, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. We have a percentage estimate of the mortality rate for 166 of these 263 localities. For example, Cologne, Granada, Milan and Zurich and had an estimated cumulative Black Death mortality rate of 35%, 30%, 15% and 60% respectively. For the 96 other localities, the sources report more qualitative estimates: (i) For 49 towns, Christakos et al. (2005) provide a literary description of mortality. We rank these descriptions based on the supposed magnitude of the shock, and assign each one of them a numeric mortality rate: 5%

for “spared” or “escaped”, 10% for “partially spared” or “minimal”, 20% for “low”, 25% for “moderate”, 50% for “high”, 66% for “highly depopulated”, and 80% if the town is “close to being depopulated” or “decimated”; (ii) For 19 towns, we know the mortality rate of the clergy in the town. Christakos et al. (2005, p.138) cite Ziegler (1969), who argues that “it would be reasonable to state as a general rule that the proportion of benefited clergy who died in any given diocese could not possibly have been much smaller than the corresponding figure for the laity and is unlikely to have been very much bigger. Arbitrary limits of 10% less [mortality among benefited clergy] and 25% more [mortality among benefited clergy] seem to provide a reasonable bracket within which the correct figure must be encompassed.” This suggests that clergy mortality was on average 8% higher than general mortality. We thus divide the clergy mortality rates by 1.08 to obtain the mortality rate of these 19 towns; and (iii) For 29 towns, we know the desertion rate of the town, which includes both people who died and people who never came back. Christakos et al. (2005, p.154-155), using data on both desertion rates and mortality rates available for 10 towns, show that the desertion rate is on average 1.2 times higher than the mortality rate. We thus divide the desertion rates by 1.2 to obtain the mortality rate of these 19 towns.

4. Black Death Spread

We use the raw data from Christakos et al. (2005) to obtain for 95 towns among the 124 towns of our main sample the year and month of first infection in the town (the day is almost never available). For the other 29 towns, we rely on information for very neighboring towns in the data and maps of the epidemic available in Christakos et al. (2005, Figures 3-4), as well as extra sources to impute the year-month of first infection. For example, for Landshut in Germany, we learn from Benedictow (2005, 190) that the epidemic went from Mühldorf to the neighboring town of Landshut (50 km). From Christakos et al. (2005), we know that Mühldorf and Regensburg were first infected in June and July 1349, respectively. Since Landshut is about one-half of the way between Mühldorf and Regensburg, it must have been infected in June or July 1349, but most probably in June 1349. Another example is Monthey in Switzerland, which is less than 10 Km from Saint-Maurice, a town that was infected in January 1349. We thus use January 1349 for Monthey. A last example is Pamplona in Spain. We know from the raw data from Christakos et al. (2005) that Navarra was first hit in October 1348. We thus use October 1348 for Pamplona. Information is sparser for the year-month of last infection, and thus the duration of the epidemic in each town, and only available for 39 towns among the 124 towns of our main sample.

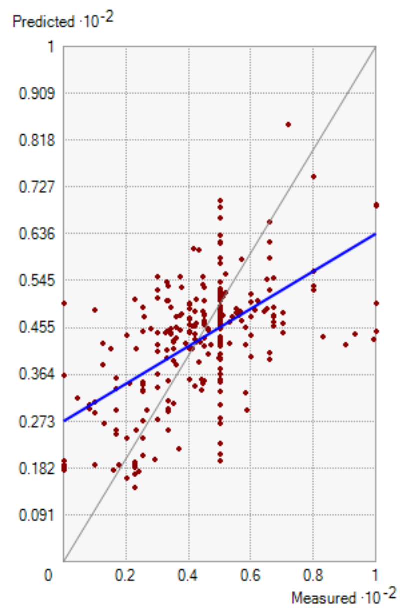
5. Missing Black Death Mortality Rates

Our full sample consists of 1,869 Western European towns that reached 1,000 inhabitants at one point between 800 and 1850 in the Bairoch (1988) database and/or belong to the Christakos et al. (2005) database of mortality rates. These towns belong to 18 countries: Austria, Belgium, the Czech Republic, Denmark, France, Germany, Ireland, Italy, Luxembourg, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, The Netherlands and the United Kingdom. Data on Black Death mortality rates for the other 1,869 - 263 = 1,606 cities do not exist.

In order to extend our analysis to these other cities, we use spatial analysis to impute the missing values. Our assumptions in doing this are that (1) there exist some underlying causes of mortality rates which are unobserved, (2) these causes have a large random component (i.e. are external to our model of persecution), (3) these causes are also spatially correlated. For example, it is widely acknowledged that fleas living off of rat populations were a primary vector for the plague. It is highly plausible that a latent variable measuring the suitability of a city's surrounding region for sustaining large rat populations satisfies the three criteria laid out above.

Using mortality rates from neighboring towns. Using GIS, we calculate the Euclidean distance between each town and each other town in our sample of 1,869 towns. For the towns for which mortality is missing, we proxy their mortality rate by the mortality rate of the closest neighboring town with mortality data and if this town is within 10 km or 50 km.

Figure A.2: Predicted vs. Measured Mortality Rates at the Optimal Power.

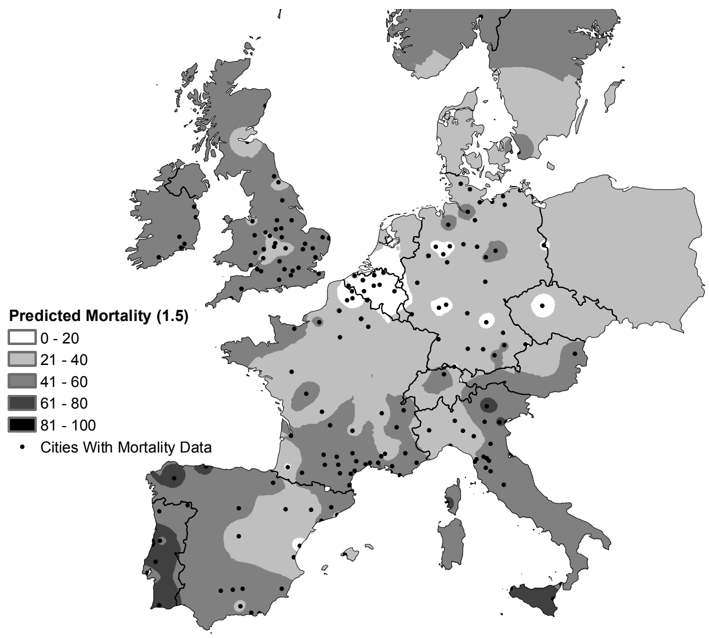


Using spatially extrapolated mortality rates. We create a two-dimensional surface of predicted plague mortality using an inverse distance weighted function of known mortality rates. For every point on the surface a predicted mortality rate is generated using the closest 15 cities within an approximately 1,000 km radius circle around the point. For a point on the surface, x, with unknown mortality the influence of city, i, with known mortality diminishes with its distance from x according to the weights used. These weights are determined by a parameter, $p \geq 0$, referred to as *power*. As the power decreases, the influence of more distant points increases. If $p = 0$, then all points receive equal weight in determining all other points on the map. The influence of more distant points decreases exponentially as p increases. To create our mortality estimates we choose an optimal p using cross-validation techniques. The procedure begins by choosing some power, $\bar{p}$. Then, using the sample of n localities with known mortality rates, we create a predicted mortality rate surface using all of the cities except for city j. We then predict the mortality rate for city j

as $\hat{m}_j$ using our mortality surface and create it's residual as $(\hat{m}_j - m_j)$ where m_j is the known mortality rate for city j. This procedure is then repeated to create predicted mortality rates and residuals for all the remaining cities. We then calculate the Root Mean Square Error (RMSE) of the residuals created as $\text{RMSE}(\bar{p}) = \sqrt{\frac{\sum_{i=1}^{n}(\hat{m}_i - m_i)^2}{n}}$, where i indexes the cities with known mortality rates. This procedure is repeated for a large number of choices of p and then the optimal power is chosen as the one which minimizes the RMSE.

We generate optimal mortality surfaces using the 263 localities for which we know the mortality rate. The cross-validation exercise chooses an optimal power for creating the mortality surface as 1.0136. Web Appx. Fig. A.2 shows the measured versus predicted values using the optimal power. Web Appendix Figure A.3 shows the location of the 263 localities for which we know the non-extrapolated mortality rate and the optimal mortality surfaces with the extrapolated rates.

Figure A.3: Extrapolated Black Death Mortality for Western Europe.



Using mortality rates from provinces. Christakos et al. (2005) report cumulative mortality rates for selected provinces (e.g., "Languedoc"). Using information from Wikipedia, we assign each town to the province it historically belonged to and attribute to each town with missing mortality data the mortality rate of its province. We obtain a mortality estimate for 35 towns, using Aragon (7 towns), Bohemia (5), Castile (4), Catalonia (2), Duero Valley (3), Hesse (5), Languedoc (1), Mallorca (1), Navarra (1), Palencia (1), Pomerania (1), Savoy (1) and Sicily (3).

6. Jewish Presence and Jewish Persecution

The main source of information for Jewish presence and Jewish persecutions and expulsions is the *Encyclopedia Judaica* (Berenbaum and Skolnik, 2007). We supplement the *Encyclopedia Judaica* using a variety of sources which we detail below. The *Encyclopedia Judaica* is a multi-volume

English language encyclopedia of the history of the Jewish people. We use the most recent and comprehensive 2007 edition which comprises 22 volumes in print as is available online.

City-Level Entries. An example entry of the *Encyclopedia Judaica* reads as follows:

> In the 13th and 14th centuries the Krems community was one of the most important in Austria. The Jews were moneylenders and they were not restricted to dwellings in any one quarter of the city. Persecutions occurred in 1337 and 1347. On Sept. 29, 1349, inflamed by rumors that the Jews had caused theBlack Death, the populace of Krems and the nearby villages massacred most of the Jews and plundered their homes. A few escaped to the fortress. Duke Albrecht V ordered his soldiers to punish the attackers, laid penalties on the city, and sentenced three of the ringleaders to death. In 1355 Jews are recorded as living in Krems, owning houses all over the city,

This entry provides information about the presence of a Jewish community, the economic role they played in the city, what restrictions on residency they faced and details about persecutions both before and during the Black Death. The entry also makes it clear that the Jews were scapegoated for the Black Death and that it was the mob who were responsible for the massacre while the local ruler attempted to protect them.

The entry for Toulon is as follows:

> TOULON, port in the Var department, S.E. France. In the second half of the 13thcentury the Jews made up an appreciable proportion of the population of Toulon: at a general municipal assembly held in 1285, 11 of the 155 participants were Jews. They shared the same rights and duties as the other citizens. The community came to a brutal end on the night of April 12/13, 1348 (Palm Sunday), when the Jewish street, "Carriera de la Juteria," was attacked, the houses pillaged, and 40 Jews slain; this attack was probably related to theBlack Deathpersecutions. Faced with an enquiry set up by a judge from Hyères, the assailants fled; however, they were soon pardoned. After this date, in addition to a few converted Jews, there were in Toulon only individual Jews who stayed for short periods; one such man was Vitalis of Marseilles, who was engaged as a town physician in 1440.

Other entries in *Encyclopedia Judaica* do not provide as much information. In many cases we cross referenced the data using a host of different sources. The most important supplementary sources we use are Beinart (1992). In particular, the detailed maps provided by Beinart (1992) provide information on a number of communities that are not mentioned by the *Encyclopedia Judaica*.

For every entry in the *Encyclopedia Judaica* we collect information on the date at which Jews were first mentioned in a city. For entries where the entry date was unclear or unrecorded we assume that a Jewish community had been present for the 50 years (two generations) or 25 years (one generation) prior to their first mention in an entry, depending on the information available. We recorded information on every subsequent entry to or exit from a city mentioned in the Encyclopedia and collected data on every single persecution for the period up to 1600.

Region-Level and Country-Level Entries. To supplement the individual city/community entries in *Encyclopedia Judaica* we also collect information from the country and regional level entries. For example, the entry for Alsace contains the following information:

> The first evidence of Jews in Alsace is reported by Benjamin of Tudela who mentions (c. 1170) Jews in Strasbourg. From the beginning of the 13th century, Jews are also mentioned in Haguenau, Obernai, and Rosheim, and later, during the same century, in Wissembourg, Guebwiller, Colmar, Marmoutier, Rouffach, Ensisheim, Molsheim, Mulhouse, and Thann. Probably many refugees expelled from France in 1306 went to Alsace. Jews are henceforward found residing in some 40 additional localities there, notably, Ribeauvillé, Sélestat, Bouxwiller, Kaysersberg, and Saverne. The Jews of some 20 communities in Alsace were victims of the Armleder massacres, principally at the beginning of 1338. Further anti-Jewish persecutions affected the communities of Colmar, Sélestat, Obernai, Rosheim, Mulhouse, Kaysersberg, Turckheim, and Munster in 1347. Later, the Jews were accused of spreading the Black Death , even before the epidemic began to ravage Alsace. A gathering of nobles and representatives of the imperial cities of Alsace discussed the subject in Benfeld at the beginning of 1349, and the city of Strasbourg alone defended the Jews. Subsequently, the Jews were cruelly put to death in some 30 towns in Alsace. After the artisans gained control of the municipal council of Strasbourg, having eliminated the patricians, the important Jewish community of this city met the same fate. These events left their mark on the folklore and the toponyms of Alsace. The Jews reappeared in several towns of Alsace after a short while, apparently with an improved legal status.

Other sources. Due to possible concerns about the depth of coverage in the *Encyclopedia Judaica* we supplemented this core dataset with information from the *Jewish Encyclopedia* published in 1906 (Adler and Singer, eds, 1906) and a range of specialized studies for different cities, regions and countries. These include Abulafia (2002); Baron (1965a,b, 1967a,b); Benbassa (1999); Botticini (1997); Chazan (2006); Cluse, ed (2004); Emery (1959); Foa (2000); Golb (1998); Jordan (1989); Jordon (1997); Kisch (1949); Klein (2006); Levenson (2012); Nahon (2002); Quesada (2004); Ries (1995); Roth (1950, 1961, 2014); Schwarzfuchs (1967); Shank (1988); Spector and Wigoder, eds (2001); Segre (1986); Shatzmiller (1974); der Pfalz, ed (2005); Taitz (1994); Toch, ed (2003). When using such sources, there are 12 observations where we cannot be entirely certain that there was a Jewish community intact in 1347. These 12 observations include 8 French towns for which information is sparse following the general expulsions of 1306, 1315 and 1322 (since the expulsions only concerned cities belonging to the Kingdom of France, whose territory covers much less than France's territory today), as well as 3 Tuscan towns in which Jews settled in the 14th century but for which we cannot be sure of the year. There are also 20 observations where we cannot be entirely certain about the fate of the community during the Black Death period. The 20 observations include towns for which one or several sources mentioned a persecution during one of the Black Death years, but without providing corroborating details about it.

7. Main Control Variables

Average Growing Season Temperature 1500-1600. We use temperature data from Luterbacher et al. (2004). They reconstruct seasonal European temperatures (celsius degrees) since 1500 using proxy data from ice cores, tree rings, and written records. The data cover 0.5° x 0.5° grids which is approximately 50km x 50 km at European latitudes. The data extend from 25° W to 40° E and 35° N to 70° N which includes all of the cities in our full sample. We extract the growing season (summer) temperature for each of our cities during the 16th century as this is the closest century to the Black Death period for which we have data. No comparable data exist for earlier centuries.

Elevation. City elevation data come from Jarvis et al. (2008) which is available at http://srtm.csi.cgiar.org. This data reports elevation in meters. The spatial resolution between 1 and 3 arc-seconds. Where there is missing data we have supplemented it using Wikipedia.

Cereal Suitability. Our data are from the FAO Global Agro-Ecological Zones (GAEZ) dataset as described in Fischer et al. (2002). We use these in preference to the Ramankutty et al. (2002) as the latter does not have full coverage for all of Western Europe. We use the GAEZ's overall cereal suitability data assuming low inputs and rain-fed irrigation. The data are available for a resolution of 5 arc minute cells, or approximately 10 km X 10 km at the equator. We then extract the average soil suitability for the closest cell to the city. Overall cereal suitability is scaled from 1-9 where 1 is best, 8 is unsuitable and 9 is water (seas and oceans are treated as missing values).

Pastoral Suitability. We control for the potential suitability of a region surrounding a city for pastoral farming with a variable measuring grazing suitability. This variable come from Erb et al. (2007) who create land use measures at a resolution of 5 arc minute cells, or approximately 10 km X 10 km at the equator. This records how land is used in each cell in 2000. The five categories they code for are: cropland, grazing, forestry, urban, and areas without land use. Their grazing category is calculated as a residual after accounting for the percentage of area taken up by the other four uses. As part of this analysis, they also generate a variable measuring the suitability of each cell for grazing (as opposed to actual present-day use). The suitability measure is created by first separating grazing land into three categories based on cover: "high suitability of cultivated and managed areas, medium suitability of grazing land found under tree cover, and low suitability if shrub cover or sparse vegetation is detected in remote sensing" (Erb et al., 2007, 199). They then further subdivide the first two of these categories into areas with a net primary productivity of Carbon per meter squared is greater than 200 grams and those in which it is less than 200 grams. This results in five categories which they regroup into four categories with 1 = most suitable and 4 = least suitable. There is a fifth category which is "no grazing" which we re-code as 5. We then extract the average soil suitability for the closest cell to the city.

Distance to the Coast and Major Rivers. We create a variable to measure distance to the coast and major rivers in meters using ArcGIS. We base these distances on the 1300 shape file downloaded from Nussli (2011). We verify the information for some cities using Google Earth.

Town Population Estimates. Our main source of urban population data is Jebwab et al. (2016), who combine data from both Bairoch (1988) and Chandler (1987). The last two sources represent attempts to collect information on population for all towns with at least 1,000 inhabitants. More precisely, the Bairoch (1988) dataset of city populations. The Bairoch dataset reports estimates for 1,797 cities between 800 and 1850. This dataset has been widely used by a range of scholars studying premodern urbanization and economic development. We follow Bosker et al. (2013) and Voigtländer and Voth (2013) in updating the Bairoch dataset where a consensus of historians have provided revised estimates of the population of a particular city, including Bruges, Paris, and London. We supplement Bairoch with Chandler (1987) which is in some cases more specific in the sources used to measure city population. For the 1,869 - 1,797 = 72 towns that are not in the extended Bairoch (1988) data set but belong to the Christakos et al. (2005) data set, we sometimes use for the year 1300 information on pre-plague population available in Christakos et al. (2005). For the town-year observations for which population is still not available, we believe that it must be less than 1,000 and thus arbitrarily assume that their population was 500.

Roman Romans. Data on Roman roads is provided by the *Digital Atlas of Roman and Medieval Civilizations*: http://darmc.harvard.edu/icb/icb.do?keyword=k40248&pageid=icb.page601659. We use this shape file to create two distances: (1) distance to all Roman roads and (2) distance to "major" Roman roads. Since major settlements often formed along the intersections of the Roman road network, we also use GIS to create a variable for (1) distance to all Roman road intersections and (2) distance to major Roman road intersections. We then create a dummy variable that takes the value of 1 if a city is within 10 kilometers of a road or an intersection.

Medieval Trade Routes. We use Shepherd (1923) to obtain the path of major medieval land trade routes. We use ArcGIS to create a shape file that allows us to measure distance to medieval routes or the intersection of two major trade routes. We create a dummy variable that takes the value of 1 if a city is within 10 kilometers of a medieval trade route or an intersection.

Medieval Fairs. We obtain data on the location of important medieval fairs from two sources. The first source is Shepherd (1923). The second source is the *Digital Atlas of Roman and Medieval Civilizations*: http://darmc.harvard.edu/icb/icb.do?keyword=k40248&pageid=icb.page188865. Using this information, we create a dummy equal to one if there was a fair in the town.

Hanseatic League. We document whether or not a city was a member of the Hanseatic League. We do this by matching where possible the extended Bairoch city data with available lists of cities which belonged to the League. We include only cities which were members of the League and do not include cities with Hansa trading posts or Hansa communities. Our main source is Dollinger (1970). Using this information, we then create a dummy if the town belonged to the League.

Market Access to All 1,869 Towns. Following Donaldson (2017), we calculate market access for city j as $\mathrm{MA}_{jt} = \sum_{i \neq j} \mathrm{N}_{it} \tau_{ji}^{-\sigma}$, where city i is any other city in the full sample of 1,869 cities and N_{it} is the time-varying measure of city i's population. We calculate market access by assigning the least cost itinerary across cells of 10x10 km between city i and city j. To measure the τ we employ data on travel speeds as this reflects the time it took for merchants or other travels to move from city to another (and hence potentially for infected rats and fleas to be transported from one city to another) (see Boerner and Severgnini, 2014). We normalize all travel speeds to the most expensive form of transport (portage). Our benchmark travel speeds are from Boerner and Severgnini (2014) and based on discussions in Pryor (1992); McCormick (2001). Normalizing the speed to porters to 1, this assigns a travel cost of 0.5 to road and river transport and 0.18 to sea transport. Sea transport and road/river transport were thus about 5 and 2 times faster than portage respectively. Lastly, in our benchmark analysis we set $\sigma = 3.8$ (also from (Donaldson, 2017)).

Aqueducts. We use GIS to create a shape file for whether or not a town was within 10 km from a Roman aqueduct using the map provided by Talbert, ed (2000) as well as information from two Wikipedia webpages: https://en.wikipedia.org/wiki/List_of_aqueducts_in_the_Roman_Empire and https://fr.wikipedia.org/wiki/Liste_des_aqueducs_romains.

Medieval Universities. Bosker et al. (2013) provide data on the presence of medieval universities for European cities with populations greater than 10,000 (at some point between 800 and 1800). We consulted Wikipedia and other sources to find evidence of medieval universities in European cities with smaller populations. There are five medieval universities missing from the list in Bosker et al. (2013): Angers, Greifswald, Ingolstadt, Tuebingen, and Uppsala. However, as none of these universities were established prior to the Black Death, we do not include them in our analysis.

Monarchy in 1300. We construct information on whether or not a city was ruled by a major kingdom using the shape files provided by Nussli (2011) who report political boundaries in Europe for every century. We then assign each city to its political boundary in 1300 by hand. We assign a city as belonging to a monarchy in 1300 if it belonged to the Kingdom of Bohemia, the Kingdom of Denmark, the Crown of Castile, the Kingdom of France, the Kingdom of Norway, the Kingdom of England, the Kingdom of Sicily in Naples, the Kingdom of Granada, the Kingdom of Scotland, the Kingdom of Hungary, the Kingdom of Sicily, the Kingdom of Galicia-Volhynia, the Crown of Aragon, the Kingdom of Portugal, the Kingdom of Majorca, the Kingdom of Sweden.

State Capital in 1300. We use the data provided by Bosker et al. (2013) who collect data on capital cities from McEvedy and Jones (1978).

Parliamentary Activity and Distance to Parliament. Our data on parliamentary activity is from Zanden et al. (2012). This measures the number of times that Parliaments met at a regional level in 1300–1400. We create a dummy variable based on whether or not a town is in a region/country which had above the median number of parliamentary meetings. We also obtain a list of whether the parliaments were held for each region/country. We then use GIS to compute for each city the minimal Euclidean distance to a parliament.

Self-governing City. Bosker et al. (2013) provide information on the existence of communes for a subset of the cities in the Bairoch dataset. Bosker et al. (2013) create a variable"commune" that takes a value of 1 if there is indication of the presence of a local urban participative organization that decided on local urban affairs. Stasavage (2014) provided us with data on 169 cities that where autonomous at some point between 1000 and 1800. We utilize the variable for 1300-1400.

Stasavage (2014) defines autonomous cities in the following terms:

> 'I have defined an "autonomous city" as being one in which there is clear evidence that such institutions of self-governance existed, and in addition there is also clear evidence of exercise of prerogatives in at least one of the policy areas referred to above. In the absence of such evidence the default is to code a city as non-autonomous (6).'

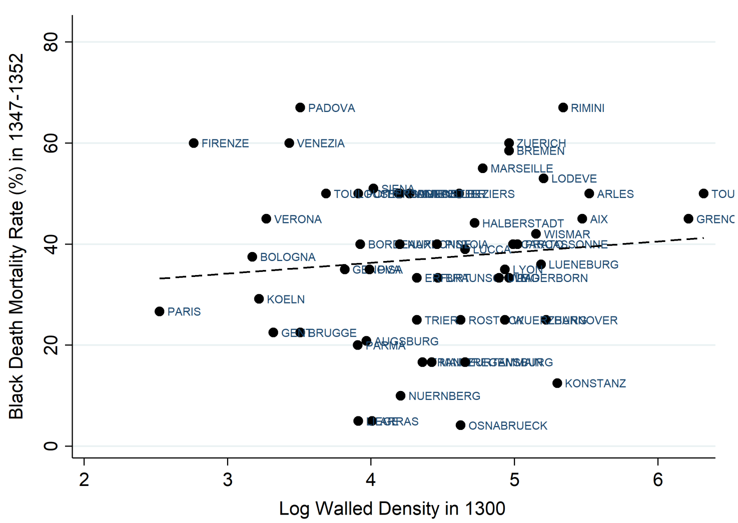
As Stasavage (2014) notes, his definition of city autonomy is stricter than the definition of commune used by Bosker et al. (2013). We create a dummy equal to one if the city is a commune in the Bosker et al. (2013) data set or a self-governing city according to Stasavage (2014).

Battles. As our main source we use Wikipedia's list of all battles that took place between 1300 and 1350. https://en.wikipedia.org/wiki/List_of_battles_1301-1800. This is a highly reliable source for the most important battles of the period. We are not concerned about sample selection here as Wikipedia's coverage of European history is extensive; battles not listed on Wikipedia are likely to have been extremely small. For each battle we assign a geo-coordinate based on either the location of the battle or the location of the nearest town or city mentioned in the entry. We exclude naval battles and conflicts which cannot be located (such battles were typically extremely minor).

8. Investigation of Causality

Density. Data on walled density (population divided by walled area) for 56 towns comes from (Cesaretti et al., 2016). Web Appendix Figure A.4 shows there is no relationship between mortality and log walled density for these 56 towns (mort. = 27.85** + 2.12 log.wall.dens.; R2 = 0.01).

Figure A.4: Black Death Mortality and Walled Density 1300.



Panel. Since the Black Death lasted 6 years, we create panel data for 10 six-year periods t both before 1347 (1297-1302, ..., 1341-1346) and after 1352 (1353-1358, ..., 1398-1403). For 172 towns i that had Jews at one point in 1297-1403 and for which we know the mortality rate, we regress a dummy if there was a persecution in town i in period t on the mortality rate in the same town and period, for the town-periods where Jews were present. We include town fixed effects and period fixed effects, and posit the mortality rate is equal to 0 outside 1347-1352. Column 1 of Web Appendix Table A.1 shows that the baseline effect remains unchanged when doing so. Column 2 shows that this result holds even if we drop the ten post-1352 periods, since there have been plague reoccurrences after the Black Death and consistent data does not exist on the specific mortality rate associated with each reoccurrence, so mortality could be mismeasured.

Table A.1: MORTALITY RATES AND PERSECUTIONS, PANEL (1297-1403)

Dependent Variable: Dummy if Any Jewish Persecution in Town i in Period t:				
Period:	(1) 1297-1403		(2) 1297-1352	
1. Effect of Mortality Rate Town i Period t	-0.009***	[0.002]	-0.009***	[0.002]
Town-Period Observations	2,581		1,346	
Town Fixed Effects, Period Fixed Effects	Yes		Yes	

Notes: Robust SE's clustered at the town level: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Spatial Fixed Effects. Our towns belonged to many small states circa 1347, and we do not have enough observations to be able to include historical state fixed effects or modern country fixed effects. However, rows 1-3 of Web Appendix Table A.2 show that the baseline effect remains significantly negative when including a dummy for the Holy Roman Empire (row 1), three cultural areas fixed effects (row 2; Southern Europe, Western Europe and Central Europe; source: Wikipedia (2018) article "Cultural Area") or three linguistic areas fixed effects (row 3; "latin", "germanic" and "slavic"; source: Wikipedia (2018) article "Linguistic regions of Europe").

Table A.2: MORTALITY AND PERSECUTIONS, SPATIAL FIXED EFFECTS

Dependent Variable: Dummy if Any Jewish Persecution in 1347-1352:					
	Mortality 1347-1352		Constant		Obs.
1. Including Holy Roman Empire Fixed Effect (N = 1)	-0.008***	[0.002]	0.659***	[0.126]	124
2. Including Cultural Area Fixed Effects (N = 3)	-0.005***	[0.002]	0.681***	[0.098]	124
3. Including Linguistic Area Fixed Effects (N = 3)	-0.005**	[0.002]	0.651***	[0.097]	124

Notes: Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Size of the Jewish Community. The majority of entries in the *Encyclopedia Judaica* do not contain information on the size of Jewish communities. The information that is available suggests that in general these communities were small. Using the *Encyclopedia Judaica* and the *Jewish Encyclopedia*, as well as various historical sources, we obtain for 30 towns in our main sample of 124 towns the percentage share of Jews in the town circa the Black Death or the decades just before the Black Death. In some cases, the source directly gives this percentage share. For example, in Aix we are told that they were estimated to have been 9.1% of the population in 1341. In other cases, we know the population size of the Jewish community. For example, we learn that the community of Montpellier had 2,250 residents — 6.4% of the population — just before the Black Death.

Web Appendix Table A.3 show that results are also unchanged if we limit our sample to towns

Table A.3: JEWISH COMMUNITY SIZE, MORTALITY RATES AND PERSECUTIONS

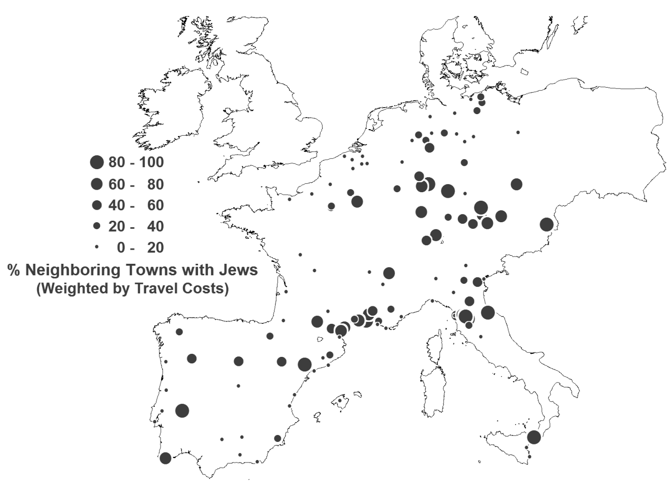
Dependent Variable: Dummy if Any Jewish Persecution in 1347-1352:					
	Mortality 1347-1352		Constant		Obs.
1. Keep if Jewish Cemetery, Quarter or Synagogue	-0.009**	[0.004]	0.841***	[0.163]	59
2. Keep if First Year of Entry in the Town $\leq$ Median (= 1155)	-0.008**	[0.004]	0.694***	[0.164]	62
3. Keep if Last Year of Entry in the Town $\leq$ Median (= 1200)	-0.009***	[0.003]	0.831*	[0.140]	67
4. Keep if Jewish Centrality Index $\geq$ Median (= 20.7%)	-0.011***	[0.003]	0.981*	[0.130]	62
5. Drop if Jewish Cemetery, Quarter or Synagogue	-0.009***	[0.003]	0.822***	[0.154]	65
6. Drop if First Year of Entry in the Town $\leq$ Median (= 1155)	-0.010***	[0.003]	0.960***	[0.130]	62
7. Drop if Last Year of Entry in the Town $\leq$ Median (= 1200)	-0.009***	[0.003]	0.833*	[0.157]	57
8. Drop if Jewish Centrality Index $\geq$ Median (= 20.7%)	-0.008***	[0.003]	0.713***	[0.148]	62
9. Drop if Year of Last Entry During 1347-1352 (Parchim in 1350)	-0.009***	[0.002]	0.827***	[0.103]	123

Notes: Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

where the community was likely large or small, i.e. long before 1347. In particular, we keep or drop the cities, (i) with a Jewish cemetery, quarter or synagogue (rows 1 and 5), (ii) whose year of first entry or last reentry in the town was below the median in the sample (rows 2-3 and 6-7), and (iii) whose Jewish centrality index was above the median in the sample (rows 4 and 8).

Note that we calculate our measure of the network centrality of a Jewish community using our data on Jewish presence from Berenbaum and Skolnik, eds (2007). For town i, and other towns $j \in J$ (363 towns with a Jewish community circa 1347) or $j \in A$ (all 1,869 towns), the Jewish centrality index is equal to $\sum_{j \in J} D_{ij}^{-\sigma} \div \sum_{j \in A} D_{ij}^{-\sigma} * 100$ with D_{ij} the travel time between city i and city j. If all surrounding towns have a Jewish community, it will be close to 100, and 0 otherwise. Web Appendix Figure A.5 depicts this measure of Jewish centrality.

Figure A.5: Jewish Centrality Index for the 124 Towns of our Main Sample.



In Web Appendix Table A.4, we show that mortality was not correlated with the population share of Jews and the log of their population (column (1)), for the 30 towns among our main sample of

124 towns and for which we have data on the size of the community. We then show that mortality is not correlated with various proxies for the size of the community, for our main sample of 124 towns: three dummies equal to one if the town had a Jewish cemetery, a Jewish quarter or a Jewish synagogue (column (2)), the year of first entry ever and the year of last reentry in the town (column (3)), the Jewish centrality index (column (4)), and two dummies equal to one if there was a persecution in the town in 1321-1346 or 1300-1346 (column (5)). We simultaneously test all these controls in column (6). Likewise, for a sample of 172 cities with mortality data and that do not belong to the British Isles and Scandinavia, we find no correlation between mortality and whether there was a Jewish community in the town (column (7)). Note that we exclude the British Isles and Scandinavia because there was a blanket ban on the presence of Jews for their whole territory.

Table A.4: INTENSIVE AND EXTENSIVE MARGIN OF JEWISH PRESENCE AND MORTALITY

Dependent Variable	Black Death Mortality Rate (%, 1347-1352):						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Population Share of Jews (%)	0.29					0.27	
	[0.33]					[0.46]	
Log Number of Jews	3.34					3.62	
	[3.78]					[4.77]	
Dummy if Jewish Cemetery		1.12				2.52	
		[4.48]				[8.61]	
Dummy if Jewish Quarter		-2.27				4.88	
		[4.14]				[9.45]	
Dummy if Jewish Synagogue		-1.06				-3.09	
		[3.90]				[11.82]	
Year of First Entry			0.00			0.02	
			[0.00]			[0.06]	
Year of Last Entry			-0.00			-0.03	
			[0.01]			[0.06]	
Jewish Centrality Index				0.01		-0.10	
				[0.05]		[0.13]	
Dummy if Persecution 1321-1346					-5.06	-34.79	
					[8.01]	[25.96]	
Dummy if Persecution 1300-1346					0.48	26.53	
					[5.69]	[23.59]	
Dummy if Jews Present 1347-1352							-2.80
							[3.30]
Observations	30	124	124	124	124	30	172

Notes: Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Endogeneity of Jewish Presence. One could worry that Jewish presence circa 1347 is endogenous. If Jewish presence is better measured in towns with high mortality and low persecution or low mortality and high persecution, results are not valid. In our sample, there is only one town when Jews came after 1347, Parchim, in 1350. The Black Death broke out there after Jews came. Row 9 of Web Appendix Table A.3 shows results hold if we drop that city, to only rely on towns whose Jewish presence was predetermined to the Black Death (1347). Results are also unchanged if we limit our sample to towns where Jews were historically present, i.e. long before 1347. In particular, we keep the cities, (i) with a Jewish cemetery, quarter or synagogue (row 1), (ii) whose year of first entry or last reentry in the town was below the median in the sample (rows 2-3), and (iii) whose Jewish centrality index was above the median in the sample (row 4). These tests allow us to only keep the cities and regions where Jews were likely to be well-established.

Number of Victims For the vast majority of towns we do not know either the size of the Jewish community or the number of victims. However, information on the number of victims is available for a limited number of cities. We consulted the Berenbaum and Skolnik, eds (2007) and a range of other sources including Adler and Singer, eds (1906) to collect what information is available on the number of victims for some cities. For example, in Brussels, 600 Jews are said to have been killed. In Grenoble the number given is 74, while 40 Jews are said to have died in Erfurt.

Table A.5: FIRST STAGE OF THE MAIN INSTRUMENTAL VARIABLES REGRESSIONS

Dependent Variable:	Black Death Mortality Rate (%, 1347-1352):			
IV Strategy:	IV1: Proximity to Messina		IV2: Month of First Infection	
Table 4 in the Paper:	Row 2	Row 3	Row 7	Row 8
Log MA to Messina	4.42***	3.46**		
	[0.79]	[1.67]		
#Months between Oct 1347 and First Infection			-0.87***	-0.83***
			[0.15]	[0.31]
Log MA to All 1,869 Towns	-1.75*	-0.32		
	[0.94]	[0.93]		
Longitude		-1.54**		-0.87**
		[0.62]		[0.41]
Latitude		8.23		-1.94
		[6.94]		[7.88]
Longitude Squared		0.13***		0.13***
		[0.04]		[0.03]
Latitude Squared		-0.09		0.02
		[0.08]		[0.09]
F-stat	31.0	4.3	33.3	7.32
Observations	123	123	124	124

Notes: Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

IV1: Proximity to Messina. For the 124 towns, we construct an instrumental variable based on a town's log market access to Messina, conditional on a town's log market access to all 1,869 towns. Market access to Messina m for town i is defined as $MA_{im} = \Sigma(L_m \div \tau_{im}^{\sigma})$, with L_m being the population of Messina in 1300, τ_{im} the computed travel time between town i and Messina, and $\sigma = 3.8$. To compute the travel times, we use the travel speeds from Boerner and Severgnini (2014), the same way we did for market access to all 1,869 towns (see paragraph *Market Access to All 1,869 Towns* in Section 7.). The first stage is shown in Web Appendix Table A.5.

IV2: Month of First Infection. We use as our second instrument the number of months between October 1347 and the month of first infection in the town. We describe how we obtain the month of first infection in Section 4.. The first stage is shown in Web Appendix Table A.5.

IV1 & IV2: Non-Correlation with Past Town Population Growth. In Web Appendix Table A.6, we verify that in our sample of 124 towns the IVs — log market access to Messina (IV1, see column (1)) and number of months between October 1347 and the month of first infection in the town (IV2, see column (2)) — are not correlated with the log growth rate of town population in 1200-1300, conditional on log market access to all 1,869 towns and log initial population in 1200.

Table A.6: INSTRUMENTAL VARIABLES AND TOWN GROWTH IN PREVIOUS CENTURY

Dependent Variable:	Log Change in Town Population in 1200-1300:			
IV Strategy:	(1) IV1: Proximity to Messina		(2) IV2: Month of First Infection	
Log MA to Messina	-0.051	[0.049]		
#Months between Oct 1347 and First Infection			0.014	[0.011]
Log MA to All 1,869 Towns	0.130**	[0.059]	0.127**	[0.055]
Log Town Population in 1200	-0.329***	[0.053]	-0.323***	[0.053]
Observations	123		124	

Notes: For our main sample of 124 towns, we regress the log change in town population in 1200-1300 (i.e., log town population in 1300 - log town population in 1200) on: Column (1): Log market access to Messina in 1300 (IV1); and Column (2): Number of months between October 1347 and the month of first infection (IV2). We simultaneously control for log market access to all 1,869 towns and log initial town population in 1200. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

IV1: Other Controls. In Web Appendix Table A.7, we show the results of the first IV strategy — using log market access to Messina as an IV, conditional on market access to all towns — hold if we: (i) Control for proxies for community size and past persecutions (cemetery, quarter, synagogue, years of first and last entry, centrality index, and dummies if persecution in 1321-1346 and 1300-1346) (rows 1-2); (ii) Control for log market access to Genoa (rows 3-4). Kaffa was a trading colony established by Genoa on the Black Sea. The ships carrying the plague from Kaffa were bound to Genoa, and stopped in Messina because sailors were sick. By additionally controlling for log market access to Genoa, we capture the fact that the North-West of Italy was one of the wealthiest areas of Europe then, and we exploit the fact that the ships stopped in Messina and not a different city; and (iii) Control for log market access to the main cities of the Middle-East and North Africa (MENA) (rows 5-6). The cities j that we consider to construct this market access variable were the largest MENA cities in 1300 according to Chandler (1987): Cairo (450,000) whose port was Damietta, Damietta itself (90,000), Fez (200,000) and Marrakech (100,000) whose port was Ceuta, and Istanbul (100,000) and Tunis (75,000) which were their own port. To obtain the travel times, we compute the least cost travel paths to the ports of Damietta, Ceuta, Istanbul and Tunis, respectively, via four transportation modes by sea, by river, by road and by walking with the transportation speeds from Boerner and Severgnini (2014). In rows 7-8, the instrument is log distance to Messina, conditional on average log distance to all towns. In rows 9-10, it is log market access to Messina, conditional on log market access to all towns *except* Messina.

Plague Reoccurrences. Using the data from Schmid et al. (2015) based on Biraben (1975), we study the relationship between plague reoccurrence and the persecution of Jews. We focus on 415 towns

Table A.7: ROBUSTNESS CHECKS FOR THE IV1 STRATEGY

Dependent Variable: Dummy if Any Jewish Persecution in 1347-1352:					
	Mortality 1347-1352		Constant		Obs.
1. IV1: Log MA Messina, Ctrls Log MA & Size & Pers. (F: 36.0)	-0.016***	[0.005]	1.253***	[0.334]	123
2. Row 1 + Latitude, Longitude and their Squares (F: 4.6)	-0.024*	[0.012]	12.015**	[4.738]	123
3. IV1: Log MA Messina, Ctrls Log MA & Log MA Genoa (F: 19.2)	-0.016***	[0.004]	1.185***	[0.284]	122
4. Row 1 + Latitude, Longitude and their Squares (F: 4.9)	-0.020*	[0.012]	13.866**	[6.626]	122
5. IV1: Log MA Messina, Ctrls Log MA & Log MA MENA (F: 23.1)	-0.016***	[0.006]	1.1275***	[0.178]	123
6. Row 3 + Latitude, Longitude and their Squares (F: 4.7)	-0.020*	[0.011]	5.353	[4.922]	123
7. IV1: Log Dist. Messina, Ctrl for Avg. Log Dist. All Towns (F: 7.2)	-0.028**	[0.014]	-22.190	[17.298]	123
8. Row 5 + Latitude, Longitude and their Squares (F: 5.6)	-0.027**	[0.011]	-21.377	[16.037]	123
9. IV1: Log MA Messina, Ctrl Log MA All Towns Excl. Messina (F: 31.7)	-0.021***	[0.005]	1.243***	[0.220]	123
1. Row 8 + Latitude, Longitude and their Squares (F: 5.1)	-0.036**	[0.018]	6.351	[6.556]	123

Notes: In Rows 3-4 we instrument by log market access to Messina, controlling for log market access to all 1,869 towns (IV1) and log market access to Genoa. Rows 5-6: Instrumenting by log market access to Messina, controlling for log market access to all 1,869 towns (IV1) and log market access to Middle-East and North Africa (MENA). Market access for city i is defined as $MA_i = \Sigma_j P_j / D_{ij}^{\sigma}$, with P_j being the population of town $j \neq i$, D_{ij} the travel time between city i and city j, and $\sigma = 3.8$. The cities j that we consider were the largest cities of the MENA region in 1300 according to Chandler (1987): Cairo (450,000) whose port to Europe was Damietta, Damietta itself (90,000), Fez (200,000) and Marrakech (100,000) whose port was Ceuta, Istanbul (100,000) which was its own port, and Tunis (75,000) which was also its own port. To obtain the travel times, we compute the least cost travel paths to the ports of Damietta, Ceuta, Istanbul and Tunis, respectively, via four transportation modes — by sea, by river, by road and by walking — with the transportation speeds from Boerner & Severgnini (2014). Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

i with Jews at one point in 1353-1598. Since the Black Death lasted 6 years, we create 41 six-year periods t (1353-1358, …, 1594-1598). We then regress a dummy if there was a persecution in town in period t on the number of years with a plague outbreak within 5 km, or 100 km, from the town during the period, for the town-periods where Jews were present. We include town fixed effects and period fixed effects. Note that we also use outbreaks within 100 km because Biraben recorded plague outbreaks for large cities only (Roosen and Curtis, 2018), hence the need to rely on local buffers around these. There is also no data on the mortality rate associated with each outbreak, so our intensity measure is very imperfect. Nonetheless, Web Appendix Table A.8 shows there is a negative effect on plague reoccurrences on persecution probability, which is however not significant when using 5 km (column 1) but significant when using 100 km (column 2).

Table A.8: PLAGUE REOCCURRENCE INTENSITY AND PERSECUTIONS, PANEL (1353-1598)

Dependent Variable: Dummy if Any Jewish Persecution in Town i in Period t:				
Reoccurrence Dummy Defined Using Plague Outbreaks:	(1) Within 5 Km		(2) Within 100 Km	
1. Effect of Plague Reoccurences Town i Period t	-0.006	[0.005]	-0.005***	[0.002]
Town-Period Observations	13,187		13,187	
Town Fixed Effects, Period Fixed Effects	Yes		Yes	

Notes: Robust SE's clustered at the town level: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

9. Preventive Persecutions

Distance to Chillon Castle, Towns Warned of a Conspiracy, the Rhine River, and the Path of the Flagellants. We use GIS to calculate the Euclidean distance to: (i) the origins of the well poisoning libel (the town of Chillon, whose geographical coordinates we obtain from Wikipedia); (ii) the first 10 towns to be warned by letter of a Jewish conspiracy (the towns of Chambéry, Geneva, Lausanne, Bern, Solothurn, Zofingen, Basel, Feiburg, Strasbourg and Koeln, whose geographical coordinates we obtain from our data set or Wikipedia); (iii) the Rhine Towns (all the towns within 10 Km from a GIS file of the Rhine that we obtain from http://www.eea.europa.eu/data-and-maps/data/wise-large-rivers-and-large-lakes) along which the well poisoning libel spread; and (iv) the path of the flagellants, which we recreate in GIS based on the map in (Barnavi, 1992).

Date of the Persecution. We know the year of all persecutions. Since we know the year of first infection, we can identify persecutions that were likely preventive (if the year of persecution appears to be the year before the year of infection) or possibly preventive (if the year of persecution is the same year as the year of first infection) based on the year. We then know the year and month of persecution for many towns. Since we know the year-month of first infection, we can identify persecutions that were likely preventive (if the year-month of persecution appears to be before the year-month of infection) or possibly preventive (if the year-month of persecution is close to the year-month of first infection) based on the year and month.

10. Alternative Outcomes

Pogroms vs. Expulsions. In our main sample of 124 cities, there were 53 pogroms and 13 expulsions. In 8 cases, communities suffered both a pogrom and an expulsion. For example in Berlin: "In 1349, the Jews were accused of starting the Black Plague that was sweeping through Europe, and were expelled but not before many were killed, and had their houses burned down".

Expulsions or Annihilations. In 32 cases a community was either expelled or is recorded as being either "destroyed" or "annihilated". For example, the entry for Breisachamrhein reads: "Jews are first mentioned there in 1301. The community was *annihilated* during theBlack Death in 1349. Subsequently, Jews again settled in Breisach but were expelled in 1424". This indicates that the town in question lost the economic services of the Jewish community as a result of the persecution. We also take annihilation as a measure of the intensity of persecution. Thus we distinguish between cases such as Passau where the *Encyclopedia Judaica* records "TheBlack Deathpersecutions of 1349 caused *considerable loss* to the community" or Gotha where "The community *suffered* during the Black Death persecutions (1349)" from cases where the destruction of the entire community is clearly mentioned. An example of the latter is Frankfurt am Main where

> "The outbreak of the Black Plague in 1349, however, changed the Jews' protected status. Jews were killed and expelled throughout Germany and Europe, and Frankfurt was no exception. The community was *completely massacred*, and many Jews chose to burn down their own houses while still inside rather than face death from the angry mob."

Burnings. We also distinguish cases where Jews are said to have been burned to death. Burning alive was a particularly brutal punishment reserved in medieval Europe for relapsed heretics or women guilty of murdering their husbands. For example, the entry for Basle (Basel) is as follows:

> "During the Black Death they were accused of poisoning the wells; the members of the city council attempted to defend them, but finally yielded to the guilds who demonstrated before the town hall. Six hundred Jews, with the rabbi at their head, were *burned at the stake*; 140 children were forcibly baptized. This ended the first Jewish community in Basle (Jan. 16, 1349)."

Mob Involvement. We also record whether or not the mob were listed as being the driving force in persecuting the Jews. In Oppenhiem, for example the *Encyclopedia Judaica* reports that "the end of July 1349, during the persecutions that followed the Black Death, most of the Jews of Oppenheim were murdered, while others chose martyrdom (kiddush ha-Shem) and burned themselves to death in order to escape forced conversion at the hands of the mob". In Ulm the entry reads: " on Jan. 30, 1349, during the *Black Death persecutions, the Jewish quarter was stormed by a mob and the community was all but destroyed". In our sample there are 11 persecutions in which mob involvement is specifically mentioned.

Preventions. We also record whether or not there were attempts by the authorities to prevent persecutions for taking place. In Prague and Avignon, for example, the Emperor and the Pope successfully protected the Jews from violence. Elsewhere however, attempts at protection failed. In Cologne, the Jews had letters of protection signed by the archbishop but this did not avail them:

> "Disaster overtook Cologne Jewry during the Black Death. The plague had reached the city in the summer of 1349; the mob stormed the Jewish quarter on St. Bartholomew's Night (Aug. 23-24), *letters of protection* notwithstanding. Part of the community had assembled in the synagogue; they themselves set fire to it and perished in its flames. The rest were murdered. Among the martyrs were the last three 'Jews' bishops' of Cologne (see below) and a number of distinguished rabbis."

We find 3 persecutions that would have happened had they not been prevented by the authorities (as they reveal the demand for a persecution). Additionally, we find 8 persecutions that happened despite the fact that the authorities attempted to protect the community. In total, there are 11 cities where the authorities successfully or unsuccessfully prevented a persecution.

"Residual" Population. We estimate the residual population in the immediate aftermath of the plague in the town as the population of the town in 1300 multiplied by (100 - the Black Death mortality rate (%) of the town)/100.

11. Sampling

Dropping selected countries. To further address concerns about sample selection, in Web Appendix Table A.9 we show that our results are robust to dropping cities in the major European countries. Using modern country borders, we first drop cities in France (row 2), Germany, (row 3), Italy (row 4), Portugal (row 5), and Spain (row 6). The size of the coefficient we obtain on mortality remains more or less stable across specifications.

Table A.9: MORTALITY AND PERSECUTIONS, DROPPING SELECTED OBSERVATIONS

Dependent Variable: Dummy if Any Jewish Persecution in 1347-1352:					
	Mortality 1347-1352		Constant		Obs.
1. Baseline (Row 1 of Table 1)	-0.009***	[0.002]	0.831***	[0.104]	124
2. Drop if France Today	-0.012***	[0.002]	0.984***	[0.098]	95
3. Drop if Germany Today	-0.006**	[0.003]	0.574***	[0.134]	91
4. Drop if Italy Today	-0.007**	[0.003]	0.804***	[0.114]	104
5. Drop if Portugal Today	-0.009***	[0.002]	0.824***	[0.106]	118
6. Drop if Spain Today	-0.010***	[0.002]	0.887***	[0.108]	103

Notes: In rows 2-6 we drop specific countries. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01.

12. Mechanisms: Evidence on Scapegoating and Complementarities

In the main text we focused on the factors that were significantly associated with either strengthening or attenuating the desire to scapegoat Jews. In Web Appendix Table A.10 we report the results of other factors that we explored but which were not systematically related to the probability of persecution at higher mortality rates.

Table A.10: MORTALITY AND PERSECUTIONS, OTHER INTERACTED EFFECTS

Dependent Variable: Dummy if Any Jewish Persecution in 1347-1352:						
Effect of: / Rows 1-16: Dummy Equal to 1 if:	Mortality Rate (β)		Mortality x Dummy (δ)		Sum ($\beta+\delta$)	
1. Close to Path of Flagellants	-0.009***	[0.002]	-0.010	[0.010]	-0.019**	[0.009]
2. Close to Narbonne (Bottom 5th Pctile)	-0.009***	[0.002]	-0.032*	[0.019]	-0.041***	[0.019]
3. Less Recent Entry ($\leq$ 50 Years)	-0.010***	[0.003]	0.003	[0.005]	-0.008*	[0.004]
4. Cemetery, Controls for Community Size	-0.012***	[0.003]	0.009	[0.006]	-0.002	[0.006]
5. Quarter, Controls for Community Size	-0.008***	[0.003]	-0.003	[0.005]	-0.012***	[0.004]
6. Synagogue, Controls for Community Size	-0.010***	[0.003]	0.003	[0.005]	-0.007**	[0.005]
7. Walled Density (Population $\div$ Walled Area)	-0.014**	[0.002]	0.004	[0.008]	-0.009*	[0.006]
8. Recent Persecution in 1321-1346	-0.010***	[0.002]	0.012	[0.008]	0.002	[0.001]
9. Less Recent Persecution in 1300-1346	-0.010***	[0.002]	0.003	[0.007]	-0.006	[0.006]
10. Crusade Pogrom in 1147-1149	-0.009***	[0.002]	0.002	[0.010]	-0.006	[0.009]
11. Crusade Pogrom in 1189-1192	-0.010***	[0.002]	0.007	[0.011]	-0.003	[0.011]
12. Close to Alleged Ritual Murder 1st Half 14C	-0.009***	[0.002]	-0.002	[0.006]	-0.011**	[0.006]
13. Close to Alleged Host Desecration 13C	-0.009***	[0.002]	-0.006	[0.007]	-0.014**	[0.007]
14. Some Jews in the Town are Craftsmen or Traders	-0.009***	[0.003]	-0.002	[0.006]	-0.011**	[0.005]
15. Some Jews in the Town are Doctors	-0.009***	[0.002]	-0.013	[0.011]	-0.021**	[0.010]
16. Jews in the Town Contribute Special Taxes	-0.009***	[0.003]	0.000	[0.005]	-0.009**	[0.005]

Notes: This table shows the respective effects of the mortality rate (β) and the respective interacted effects (δ) of the mortality rate times a dummy variable shown in each row on a dummy equal to one if there has been any Jewish persecution in 1347-1352, for the main sample of 124 Jewish towns. It also shows the combination of the effect of the mortality rate (β) and the interacted effect of the mortality rate and the dummy (δ), to see if the interacted effect is strong effect to offset the protective effect of mortality. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Distance to Chillon Castle, Towns Warned of a Conspiracy, Rhine towns, and the Path of the

Flagellants. See the paragraph *Distance to Chillon Castle, Towns Warned of a Conspiracy, the Rhine River, and the Path of the Flagellants* in Section 9..

Seat of Papacy, Bishoprics and Archbishoprics. The seat of Papacy in 1347 was Avignon. We then obtain in GIS the Euclidean distance from each city to Avignon. We obtain data on the presence of bishoprics and archbishoprics from a variety of sources. Bosker et al. (2013) provide information on the locations of other bishoprics and archbishoprics for all cities in the Bosker et al. (2013) dataset. For additional bishoprics and archbishoprics we used information from Shepherd (1923). In order to ascertain that all the bishoprics in our dataset were in existence in 1300 we consulted the following website: http://www.catholic-hierarchy.org/country/. We then create a dummy equal to one if the city was a bishopric or an archbishopric (but not for Avignon itself).

Path of the Flagellants. Historians have traditionally held the flagellants responsible for massacring Jews. However, we find no evidence that the path of the flagellant movement was systematically associated with either persecutions or with the relationship between plague intensity and persecution probability (see row 1 of Web Appendix Table A.10).

Distance to Narbonne. We investigate proximity to Narbonne as this is where paupers rather than Jews were blamed for the Black Death. Row 2 shows that the protective effect was accentuated very close to Narbonne (i.e., for towns in the bottom 5% of the Euclidean distance to it).

Recent Entrants. We use our data to create dummy variables for Jewish communities that were established either 5 or 50 years prior to 1347. Note that we find no effect for cities where Jews had entered the city in the last 50 years (row 3).

Jewish Community Characteristics. We use Berenbaum and Skolnik, eds (2007) to ascertain whether a Jewish community had a synagogue, cemetery, or whether there was a separate Jewish quarter in a town. We ascertain whether the town was within the area of Ashkenazi settlement in the 13th century based on a map provided by (Barnavi, 1992). Rows 4-6 show that there is no differential effect for each characteristic considered individually when controlling for community size via several proxies (years of first and last entry, centrality index, dummies if persecution in 1321-1346 and 1300-1346).

Walled Density. Row 7 shows that there is no differential effect across towns above and below median walled density.

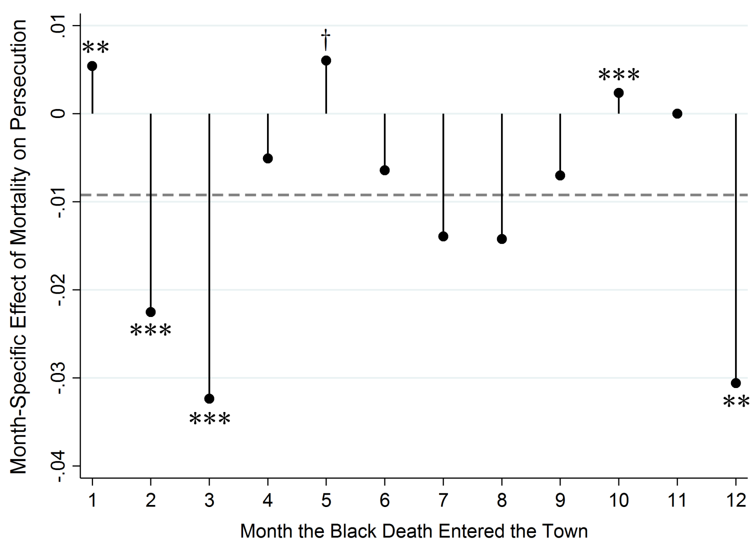
Recent Persecutions. We use data on past persecutions from our data set. Rows 8-9 show this effect is weaker if the past persecution dummy is defined for a past period of 25 years in 1321-1346 (0.012, significant at 15%), and nil if it is defined for a past period of about 50 years in 1300-1346.

Crusader Pogroms, Ritual Murder, and Host Desecration. We obtain a map of both the pogroms associated with the 1st Crusade from Beinart (1992). In the paper we report results using 1st Crusade pogroms. We also collected data on the pogroms that took place during the subsequent Crusades (1147-1149 and 1189-1192) but the later Crusades were not in general characterized by large-scale antisemitic violence (see rows 10-11). We find a strong positive effect for the crusade of 1189-1192, but the effect is not significant. Beinart (1992) is also our source for the location of alleged ritual murder accusations and accusations of host desecration. It provides separate maps for both ritual murder and host desecration allegations as well as the century in which the accusation occurred. Rows 12-13 show the non-results for the charges of ritual murder in the first half of the 14th century and the charges of host desecration in the 13th century.

Month of First Infection. As described above, we use data from Christakos et al. (2005) to obtain data on the spread of the Black Death. We then create dummies equal to one if the month of first infection is December, January, February or March, April or May, or October.

We also investigate the effect for each month individually, by regressing the persecution dummy on the mortality rate, 12 "month of first infection" dummies, and the 12 interactions of these dummies with the mortality rate. The individual and interacted effects of one month, in our case June, are omitted. The coefficient of the mortality rate then captures the effect of mortality in June, whereas the interacted dummies capture the relative effect of mortality in the 11 other months compared to June. By adding the effect for June and the interacted effects, we then obtain the absolute effect of each month, and finally test whether this effect is significantly different from our baseline effect of -0.009*** (row 1 of Table 1). The effects shown in Web Appendix Figure A.6 confirm that the protective effect of mortality was accentuated in February, March and December, and attenuated in January, May (only significant at 15% now) and October. Note that there is no clear effect for April now, but remember that Easter took place in late April in 1348.

Figure A.6: 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 mortality (%) on persecution probability. These effects are conditional on the individual effects of the month of first infection on the persecution dummy. We test whether each coefficient is significantly different from the average effect across all months, i.e. the baseline effect of -0.009***: Robust SE's: † p<0.15, * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for more details on data sources.

Financial Competition and Moneylending. We calculate distance to Cahors, Florence, Genoa, Milan, Sienna and Venice, which played important roles as major centers of moneylending in the middle ages. We also read each entry in the *Encyclopedia Judaica* to see if Jewish moneylending is mentioned in the entry.

Market Access. For information on how we construct overall market access, see paragraph *Market Access to All 1,869 Towns* in Section 7..

Population, Market Access, Coast, Rivers, Medieval & Roman Roads, Hanseatic League. For information on how we construct these variables, see the related paragraphs in Section 7..

Jewish Centrality Index. For information on how we construct this variable, see the related paragraphs in Section 8..

Holy Roman Empire. We use the shapefile in Nussli (2011) to obtain political boundaries for Europe in 1300. We then assign each city in the dataset to its political boundary in 1300 by hand. We create a dummy variable for cities that belong to the Holy Roman Empire.

Occupations. From Berenbaum and Skolnik, eds (2007), as well as Adler and Singer, eds (1906) and other sources for individual cities, we collect information on whether Jews were mentioned as craftsmen, doctors or traders in the town circa the Black Death. Rows 14-15 of Web Appendix Table A.10 show no differential effect of mortality in these towns.

Taxation. From Berenbaum and Skolnik, eds (2007), as well as Adler and Singer, eds (1906) and other sources for individual cities, we collect information on whether Jews paid special taxes in the town circa the Black Death. Row 16 shows no differential effect of mortality in these towns.

13. Jewish Presence, Black Death Persecutions and Town Growth

Jewish Presence and Town Growth. Web Appendix Table A.11 shows that the baseline effect of Jewish presence on town population growth holds if we perform various robustness checks. Row 1 reproduces the baseline results (see row 1 of Table 10). The other rows show that results hold if we include two lags of population (row 2), drop the towns not belonging to the original Bairoch sample (row 3), and do not replace by 0.5 (500 inh.) the population of the towns with a missing population (row 4), presumably because they were below the 1,000 threshold used by Bairoch (or not in his sample because they never passed the 1,000 threshold).

Black Death Persecutions and Town Growth. In Web Appendix Table A.12, we show the year-specific effects of the Black Death persecutions (1347-1352) on town population growth, using our sample of 1,869 towns $\times$ 9 periods $=$ 16,821 observations. The regression is the same as in Panel B of Table 10 except we now interact the Black Death persecution dummy and presence dummy with year fixed effects. This allows us to measure the effects of the persecution dummy for each period. Since we need to omit one period, we omit the century of the Black death, so the year 1400 for the 14th century. Note that the regression includes town fixed effects and year fixed effects, the Jewish presence dummy in each period, and the extrapolated Black Death mortality rate interacted with year fixed effects. Column (1) shows the effects being mostly negative from 1500 (i.e. the 15th century). In column (2), we interact the Black Death pogrom dummy, the Black Death expulsion

Table A.11: JEWISH PRESENCE AND TOWN POPULATION GROWTH

Dependent Variable: Log Town Population in Year t:				
Effect of Jewish Presence in $[t$-1; $t]$ Dummy		Coeff.	SE	Obs.
1.	Baseline: Effect of Jewish Presence Dummy	0.33***	[0.04]	16,821
2.	Row 1 Including Two Lags of Log Town Population	0.22***	[0.03]	16,821
3.	Row 1 Dropping the Non-Bairoch Towns	0.32***	[0.04]	16,128
4.	Row 1 Not Replacing Missing Population by 500 Inh.	0.32***	[0.05]	9,093

Notes: The main sample consists of 1,869 towns × 9 periods = 16,821 observations. The regressions always include town fixed effects and year fixed effects. Row 1: Baseline effect (see row 1 of Table 10). Row 2: We include two lags of the town population in years t-1 and t-2. Row 3: We drop the towns that do not belong to the original Bairoch sample (these towns only belong to the Christakos sample). Row 4: We do not replace by 0.5 (500 inh.) the towns with a missing population. Robust SE's clustered at the town level: *** p<0.01, ** p<0.05, * p<0.10. See Web Appendix for data sources.

Table A.12: BLACK DEATH PERSECUTIONS AND TOWN POPULATION GROWTH

Dependent Variable: Log Town Population in Year t:						
	(1) Year-Specific Effects of Persecution in 1347-1352		(2) Year-Specific Effects of Pogrom and Expulsion in 1347-1352			
			Pogrom		*Expulsion*	
Effect in 1200 (i.e. 1100-1200)	-0.25*	[0.14]	-0.24	[0.16]	0.02	[0.19]
Effect in 1300 (i.e. 1200-1300)	-0.07	[0.09]	-0.05	[0.12]	-0.12	[0.14]
Effect in 1500 (i.e. 1400-1500)	-0.21**	[0.09]	-0.30***	[0.09]	0.25**	[0.12]
Effect in 1600 (i.e. 1500-1600)	-0.38***	[0.12]	-0.45***	[0.12]	0.17	[0.15]
Effect in 1700 (i.e. 1600-1700)	-0.35***	[0.13]	-0.44***	[0.13]	0.17	[0.18]
Effect in 1750 (i.e. 1700-1750)	-0.34**	[0.13]	-0.44***	[0.14]	0.23	[0.20]
Effect in 1800 (i.e. 1750-1800)	-0.37***	[0.14]	-0.47***	[0.14]	0.21	[0.19]
Effect in 1850 (i.e. 1800-1850)	-0.17	[0.15]	-0.33**	[0.16]	0.31	[0.20]
Observations	16,821		16,821			

Notes: Our dependent variable is log town population in year t. We interact dummies equal to one if there has been a persecution/pogrom/expulsion during the Black Death period (1347-1352) with year fixed effects (column (1): only the persecution dummy; column (2) both the pogrom and expulsion dummies). We do not show the effect of each individual dummy. Robust SE's clustered at the town level: *** p<0.01, ** p<0.05, * p<0.10. See Web Appendix for data sources.

dummy and the Black Death presence dummy with year fixed effects. This allows us to measure the year-specific effects of both pogroms and expulsions. Column (2) confirms the (much) more negative effects for pogroms over time. No negative effect is found for expulsions.

REFERENCES

Abulafia, David, "The King and the Jews—the Jews in the Ruler's Service," in Christoph Cluse, ed., *The Jews of Europe in the Middle Ages (Tenth to Fifteenth Centuries)*, Vol. 4 Brepols Turnhout, Beligum 2002, pp. 43–55.

Adler, Cyrus and Isidore Singer, eds, *The Jewish Encyclopedia* Funk and Wagnalls New York 1906.

Bairoch, Paul, *Cites and Economic Development, from the dawn of history to the present*, Chicago: University of Chicago Press, 1988. translated by Christopher Braider.

Barnavi, Eli, *The Historical Atlas of the Jewish People*, New York: Schocken Books, 1992.

Baron, Salo, *A Social and Religious History of the Jews*, Vol. IX: Under Church and Empire, New York: Columbia University Press, 1965.

—, *A Social and Religious History of the Jews*, Vol. X: On the Empire's Periphery, New York: Columbia University Press, 1965.

—, *A Social and Religious History of the Jews*, Vol. XI: Citizen or Alien Conjurer, New York: Columbia University Press, 1967.

Baron, Salo W., *A Social and Religious History of the Jews*, Vol. XII: Economic Catalyst, New York: Columbia University Press, 1967.

Beinart, Haim, *Atlas of Medieval Jewish History*, Jerusalem: The Israel Map and Publishing Company, Ltd., 1992.

Benbassa, Esther, *The Jews of France*, Princeton, New Jersey: Princeton University Press, 1999. translated by M.B. DeBevoise.

Benedictow, Ole J., *The Black Death 1346–1353: The Complete History*, Woodbridge: The Boydell Press, 2005.

Berenbaum, Michael and Fred Skolnik, *Encyclopedia Judaica*, 2nd ed., USA: Macmillan Reference, 2007.

__ and __ , eds, *Encyclopedia Judaica* Macmillan Reference New York 2007.

Biraben, Jean-Noël, *La Peste dans l'Histoire: Les Hommes et la Peste en France et dans les Pays Européens et Méditerranéens*, Vol. I, Mouton, Paris, 1975.

Boerner, Lars and Battista Severgnini, "Epidemic Trade," 2014. LSE Economic History Working Paper No. 212/2014.

Bosker, Maarten, Eltjo Buringh, and Jan Luiten van Zanden, "From Baghdad to London: unravelling urban development in Europe and the Arab world 800-1800," *Review of Economics and Statistics*, 2013, *95* (4), 1418–1437.

Botticini, Maristella, "New Evidence on Jews in Tuscany, CA. 1310–1435: The 'Friends & Family' Connection Again," *Zakhor. Rivista di Storia degli Ebrei d'Italia*, 1997, *1*, 77–93.

Cesaretti, Rudolf, Jos Lobo, Lus M. A. Bettencourt, Scott G. Ortman, and Michael E. Smith, "Population-Area Relationship for Medieval European Cities," *PLOS ONE*, 10 2016, *11* (10), 1–27.

Chandler, Tertius, *Four Thousand Years of Urban Growth*, Lewiston, NY: St David University Press, 1987.

Chazan, Robert, *The Jews of Western Christendom*, Cambridge: Cambridge University Press, 2006.

Christakos, George, Richardo A. Olea, Marc L. Serre, Hwa-Lung Yu, and Lin-Lin Wang, *Interdisciplinary Public Health Reasoning and Epidemic Modelling: The Case of Black Death*, Berlin: Springer, 2005.

Cluse, Christoph, ed., *The Jews of Europe in the Middle Ages*, Turnhout, Belgium: Brepols Publishers, 2004.

der Pfalz, Historisches Museum, ed., *The Jews of Europe in the Middle Ages* Historisches Museum der Pfalz Speyer 2005.

Dollinger, Philippe, *The German Hansa*, London: MacMillan, 1970. translated and edited by D.S. Ault and S.H. Steinberg.

Donaldson, David, "Forthcoming."Railroads of the Raj: Estimating the impact of transportation infrastructure."," *American Economic Review*, 2017.

Emery, Ricard W., *The Jews of Perpignan*, New York: Columbia University Press, 1959.

Erb, Karl-Heinz, Veronika Gaube, Fridolin Krausmann, Chritoph Plutzar, Alberte Bondeau, and Helmut Haberl, "A comprehensive global 5 min resolution land-use data set for the year 2000 consistent with national census data," *Journal of Land Use Science*, September 2007, *2* (3), 191–224.

Fischer, Gunther, Harrij van Nelthuizen, Mahendra Shah, and Freddy Nachtergaele, *Global Agro-Ecological Assessment for Agriculture in the 21st Century: Methodology and Results*, Rome: Food and Agriculture Organization of the United Nations, 2002.

Foa, Anna, *The Jews of Europe after the Black Death*, Berkeley: University of California Press, 2000.

Golb, Norman, *The Jews in Medieval Normandy*, Cambridge: Cambridge University Press, 1998.

Gottfried, Robert S., *The Black Death: Natural and Human Disaster in Medieval Europe*, New York: The Free Press, 1983.

Jarvis, A., H.I. Reuter, A. Nelson, and E. Guevara, "Hole-filled seamless SRTM data V4," 2008. International Centre for Tropical Agriculture (CIAT).

Jebwab, Remi, Noel D. Johnson, and Mark Koyama, "Bones, Bacteria and Break Points: The Heterogeneous Spatial Effects of the Black Death and Long-Run Growth," June 2016. Working Paper.

Jordan, William Chester, *The French Monarchy and the Jews: From Philip Augustus to the Last Capetians*, Philadelphia: University of Pennsylvania Press, 1989.

Jordon, William Chester, "Home Again: The Jews in the Kingdom of France, 1315–1322," in F.R.P. Akehurst and Stephanie Cain Van D'Elden, eds., *The Stranger in Medieval Society*, University of Minnesota Press Minnesota 1997, pp. 27–46.

Kisch, Guido, *The Jews in Medieval Germany: A Study of Their Legal and Social Status*, Chicago: Chicago University Press, 1949.

Klein, Elka, *Jews, Christian Society, and Royal Power in Medieval Barcelona*, Ann Arbor: The University of Michigan Press, 2006.

Levenson, Alan T., *The Wiley-Blackwell History of Jews and Judaism*, London: Wiley-Blackwell, 2012.

Luterbacher, J., D. Dietrich, E. Xoplaki, M. Grosjean, and H. Wanner, "European seasonal and annual temperature variability, trends, and extremes since 1500," *Science*, 2004, *303*, 1499–1503.

McCormick, Michael, *Origins of the European Economy*, Cambridge: Cambridge University Press, 2001.

McEvedy, Colin and Richard Jones, *Atlas of World Population History*, New York: Facts of File, 1978.

Nahon, GÈrard, "Zarfart: Medieval Jewry in Northern France," in Christoph Cluse, ed., *The Jews of Europe in the Middle Ages (Tenth to Fifteenth Centuries)*, Vol. 4 Brepols Turnhout, Beligum 2002, pp. 205–220.

Nussli, Christos, 2011. URL: http://www.euratlas.com/about.html.

Pounds, Norman J. G., *An Historical Geography of Europe: 450 B.C.–A.D. 1330*, Cambridge: Cambridge University Press, 1973.

Pryor, J. H., *Geography, Technology, and War: Studies in the Maritime History of the Mediterranean, 649-1571.*, Cambridge: Cambridge University Press, 1992.

Quesada, Miguel Angel Ladero, "Castile: an overview (Thirteenth to Fifteenth Centuries)," in Christoph Cluse, ed., *The Jews of Europe in the Middle Ages*, Brepols Publishers 2004, pp. 151–161.

Ramankutty, N.J., J. Foley, J. Norman, and K. McSweeney, "The Global Distribution of Cultivable Lands: Current Patters and Sensitivity to Possible Climate Change," *Global Ecology and Biogeography*, 2002, *11*, 377–392.

Ries, Rotraud, "German Territorial Princes and the Jews," in R. Po-Chia Hsia and Hartmut Lehmann, eds., *In and Out of the Ghetto: Jewish-Gentile Relations in Late Medieval and Early Modern Germany*, Cambridge University Press Cambridge 1995, pp. 215–246.

Roosen, J. and D.R. Curtis, "Dangers of Noncritical Use of Historical Plague Data," *Emerging Infectious Diseases*, 2018, *Forthcoming.*

Roth, Cecil, "Genoese Jews in the Thirteenth Century," *Speculum*, 1950, *25* (2), 190–197.

___ , "The Economic History of the Jews," *The Economic History Review*, 1961, *14*, 131–135.

Roth, Front Cover Norman, *Medieval Jewish Civilization: An Encyclopedia*, London: Routledge, 2014.

Russell, Josiah Cox, *Medieval Regions and their Cities*, Newton Abbot, Devon: David & Charles, 1972.

Schmid, Boris V., Ulf Büntgen, W. Ryan Easterday, Christian Ginzler, Lars Walløe, Barbara Bramanti, and Nils Chr. Stenseth, "Climate-driven introduction of the Black Death and successive plague reintroductions into Europe," *Proceedings of the National Academy of Sciences*, 2015, *112* (10), 3020–3025.

Schwarzfuchs, Simon R., "The Expulsion of the Jews from France (1306)," *The Jewish Quarterly Review*, 1967, *57*, 482–489.

Segre, Renata, *The Jews in Piedmont*, Vol. 1, Jerusalem: The Israel Academy of Sciences and Humanities and Tel Aviv University, 1986.

Shank, Michael H., *Unless You Believe, You Shall Not Understand: Logic, University, and Society in Late Medieval Vienna*, Princeton, New Jersey: Princeton University Press, 1988.

Shatzmiller, Joseph, "Les Juifs de Provence pendant la Peste Noire," *Journal of Jewish Studies*, 457–480 1974, *133.*

Shepherd, William R., *Historical Atlas*, New York: Henry Holt and Company, 1923.

Spector, Shmuel and Geoffrey Wigoder, eds, *The Encyclopedia of Jewish Life Before and During the Holocaust*, New York: NYU Press, 2001.

Stasavage, David, "Was Weber Right? The Role of Urban Autonomy in Europe's Rise," *American Political Science Review*, 5 2014, *108*, 337–354.

Taitz, Emily, *The Jews of Medieval France: The Community of Champagne*, Westport, Conn.: Greenwood Press, 1994.

Talbert, Richard J. A, ed., *Barrington Atlas of the Greek and Roman World* Princeton University Press Princeton 2000.

Toch, Michael, ed., *Peasants and Jews in Medieval Germany* Ashgate Aldershot 2003.

Voigtländer, Nico and Hans-Joachim Voth, "The Three Horsemen of Riches: Plague, War, and Urbanization in early modern Europe," *Review of Economic Studies*, 2013, *80*, 774–811.

Zanden, Jan Luiten Van, Eltjo Buringh, and Maarten Bosker, "The Rise and Decline of European Parliaments, 1188–1789," *Economic History Review*, 08 2012, *65* (3), 835–861.

Ziegler, Philip, *The Black Death*, London: Collins, 1969.