Military Conflict and the Rise of Urban Europe*

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Abstract

We present new evidence about the relationship between military conflict and city population growth in Europe from the fall of Charlemagne's empire to the start of the Industrial Revolution. Military conflict was a main feature of European history. We argue that cities were safe harbors from conflict threats. To test this argument, we construct a novel database that geocodes the locations of 1,091 conflicts and 676 cities between 800 and 1799. We find a significant, positive, and robust relationship that runs from conflict exposure to city population growth. Our analysis suggests that military conflict played a key role in the rise of urban Europe.

Keywords: warfare, cities, political and economic development, Europe

JEL codes: C20, O10, N40, N90, P48, R11

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1 Introduction

One thousand years ago, the few towns that existed in Europe were Roman relics (Hohenberg and Lees, 1995, p. 1). Now well over half of Europe's population lives in urban zones (Bairoch, 1988, p. 219). Indeed, scholars argue that cities played a central role in the political and economic rise of Europe.[1]

What explains Europe's dramatic urban growth over the past millennium? This paper tests the role of a key feature of European history: military conflict. Tilly (1992, p. 72) estimates that early modern Europe was at war in 90 percent of all years. To the best of our knowledge, our paper is among the first to systematically test for this relationship.

We argue that historical cities were "safe harbors" from conflict threats (Glaeser and Shapiro, 2002). This argument dates back to at least Pirenne (1925), who saw city origins in fortifications to protect local populations. Section 2 develops our argument and provides historical background.

To test this argument, we construct a novel database that spans the fall of Charlemagne's empire to the start of the Industrial Revolution. We identify the geographic locations of all conflicts fought on land from 800 to 1799 in Europe, the Ottoman Empire, and the Middle East. In total, our data include 1,091 conflicts and 676 cities. To measure city exposure to conflict threats, we geocode conflict and city locations at the local (grid cell) level. Section 3 describes our data and measurement.

The results of our econometric analysis show a positive and significant relationship that runs from conflict exposure to city population growth. We find that conflict exposure was associated with a 5-12 percent average increase in city populations per century. To put such magnitudes into perspective, average per-century city population growth between 800 and 1800 was 22 percent. Our estimates thus suggest that conflict-related city population growth was responsible for 23-53 percent of average per-century city population growth over this period, and for 9-21 percent of its standard deviation.

We show evidence that this relationship is robust. Our benchmark model accounts for time-invariant local characteristics (e.g., geography) and widespread shocks (e.g., the Black Death) through fixed effects. To further address the possibility of omitted variable bias, we modify the benchmark model to include country-century interaction effects, which help

[1] See among others Weber (1922), Pirenne (1925), Mumford (1960), Bairoch (1988), Hohenberg and Lees (1995), and Glaeser (2011). Mokyr (1995) and Stasavage (2014) provide critiques of this view.

account for the evolution of country-level features (e.g., nation-state building), and grid-cell specific time trends, which help account for unobservable time-varying local features (e.g., rural-urban wage differences). In addition, we interact century fixed effects with observable time-invariant local characteristics (e.g., Atlantic trade potential) that may influence city population trends. Finally, we control for city-level observable features including urban networks and political, educational, and religious characteristics.

Larger cities may be more attractive targets for attackers. Country-century interaction effects and grid-cell specific trends help account for demographic trends at the national and local levels, respectively. To further address the possibility of reverse causation from urban size to conflict exposure, we control for pre-existing trends and mean reversion effects by interacting initial city populations with century fixed effects. In addition, we perform placebo tests and other tests for reverse causation. Sections 4 and 5 detail our econometric analysis.

Our paper contributes to the literature on the political and economic transformation from countryside to city (Bates, 2009). To explain historical urbanization, scholars highlight a variety of factors, including geographical features (Rokkan, 1975, Abramson and Boix, 2014), political institutions (De Long and Shleifer, 1993, Acemoglu et al., 2005, van Zanden et al., 2012, Stasavage, 2014), technological innovations (White, 1962, Dittmar, 2011), educational improvements (Cantoni and Yuchtman, 2014), and social capital (Guiso et al., 2008, Greif and Tabellini, 2010). Our paper complements this literature by bringing the role of military conflicts to bear. We are not aware of any other study that explores the relationship between military conflict and urban growth over the long run.[2]

Our paper offers new evidence about the political and economic legacy of warfare. Warfare is the main explanation for nation-state formation (Mann, 1986, Downing, 1992, Tilly, 1992, Besley and Persson, 2009, Gennaioli and Voth, 2014). To defend against survival threats, states made investments in extractive capacity that enabled them to finance greater military efforts. Scholars link military competition and state formation to modern political and economic development (Brewer, 1989, Hoffman, 2011, O'Brien, 2011, Rosenthal and Wong, 2011, Dincecco and Prado, 2012, Voigtländer and Voth, 2013a,b). Institutional innovations at the city level were often historical precursors to country-level innovations (e.g., Stasavage, 2011). Our paper thus complements this literature by testing the relationship between warfare and urban – rather than national – performance.

[2] An antecedent is Glaeser and Shapiro (2002), which shows cross-country evidence for a positive and significant relationship between terrorism and urbanization over the 1970s.

The paper proceeds as follows. The next section develops our argument. Section 3 describes the database and measurement. Section 4 presents the econometric methodology and the main results. Sections 5 tests for robustness. Section 6 concludes.

2 Conceptual Framework

2.1 City Origins

Scholars trace urbanization in medieval Europe to the ninth-century break-up of Charlemagne's empire (Rosenthal and Wong, 2011, Stasavage, 2011). van Zanden (2009, p. 33) estimates that the number of independent states in Europe grew from less than 10 in 800 to more than 200 by 1300. Political fragmentation created instability and warfare, which van Zanden (2009, p. 34) describes as follows:

> This decentralization of political power often resulted in continuous warfare among the local lords, but at the same time led to an intensification of power at the local level.

Urban fortifications enabled rural populations to escape from some of the most destructive effects of medieval warfare. In a chapter entitled "City Origins", Pirenne (1925, p. 71) writes:

> In the midst of the insecurity and the disorders which imparted so lugubrious a character to the second half of the ninth century, it therefore fell to the towns to fulfill a true mission of protection. They were, in every sense of the word, the ramparts of a society invaded, under tribute, and terrorized.

Mumford (1960, p. 248) states:

> But from the eighth century to the eleventh, the darkness thickened; and the early period of violence, paralysis, and terror worsened with the Saracen and the Viking invasions. Everyone sought security. When every chance might be a mischance, when every moment might be one's last moment, the need for protection dominated every other concern. Isolation no longer guaranteed safety. If the monastery had conducted the retreat, the city led the counter-attack.

Current scholars also see defense as key to the origins of cities. According to Hohenberg and Lees (1995, p. 31):

> Often, topographical difficulties were actually sought out for their defensive value. A marsh (Venice) or a hilltop (Langres) would serve well. Note, too, that a fortified castle often formed the town nucleus, again pointing up the primacy of strategic factors.

The city of St. Omer in France provides an example of the relationship between military conflict and city origins (Mumford, 1960, p. 250). The Vikings plundered the monastery of St. Omer in 860 and 878. In response, the abbey built walls and was able to defend itself against the Viking attack of 891. By the tenth century, St. Omer had developed into a town.

2.2 City Growth

Beyond city origins, scholars draw links between military conflict and city growth in general. Glaeser and Shapiro (2002, p. 208) write:

> The first, and probably most important, interaction between warfare and urban development is that historically cities have provided protection against land-based attackers. Cities have the dual advantages of large numbers and walls and thus, holding the size of the attack constant, it is much better to be in a city than alone in the hinterland. Indeed, the role of cities in protecting their residents against outside attackers is one of the main reasons why many cities developed over time.

Glaeser and Shapiro (2002) call this effect the "safe harbor effect". In medieval Europe, scale advantage was key to military victory. Difficult-to-surmount city walls enabled small groups of defenders to fend off even large groups of attackers. Mumford (1960, p. 250) states: "Against sudden raids a wall, on guard at all hours, was more useful than any amount of military courage". Furthermore, city walls engendered a scale economy. As city size increased, there was a sharp drop in the required length of wall per person (Glaeser and Shapiro, 2002).

Military campaigns could inflict numerous costs on rural populations. Hale (1985, p. 196) writes: "In terms of personal impact the burdens of war certainly afflicted the rural more than the urban population". There was manpower losses in the fields, first because peasants were war recruits and second due to campaign-related deaths (Gutmann, 1980, p. 75). Crops, farms, and homes were destroyed due to arson. Peasants were responsible for large tax burdens during conflicts and for repair costs for damages to physical infrastructure (Caferro, 2008, p. 187). Because peasants had to billet soldiers, peacetime preparations for future campaigns were costly (Hale, 1985, p. 197). To escape the most destructive effects of warfare, we may thus expect to observe rural inhabitants under the threat of conflict to relocate behind the safety of city walls.

Rural populations sometimes sought urban protection from long distances. Pirenne (1925, p. 70-1) tells the story of monks from St. Vaast who found refuge from Viking invaders at Beauvais (walking distance 307 km) in the late ninth century. To escape from the advancing Ottoman army, a large population of Albanians who became known as the Arberesh crossed the Adriatic sea and relocated to towns in Southern Italy in the fifteenth century (Vickers, 1999, p. 9).

The safe harbor effect was widespread (Mumford, 1960, p. 248-53). According to Rosenthal and Wong (2011, pp. 115):

> By the Renaissance the most urbanized areas of Europe were also those where conflict had raged most often: the band of territories from Flanders to Rome, including the Burgundian estates, western Germany, and northern Italy.

2.3 Target Effect

The safe harbor effect implies that there should be a positive relationship that runs from military conflict to city population growth. Glaeser and Shapiro (2002) also identify a "target effect", whereby larger cities were more attractive targets for attackers. Since urban density facilitates plunder, attackers will prefer large urban concentrations, ceteris paribus. According to this argument, the logic runs from city population size to military conflict. If the target effect dominates the safe harbor effect, then we may not observe a positive relationship between military conflict and city populations. Our econometric analysis ahead will seek to account for a target effect.

2.4 Alternative Explanations

Beyond the safe harbor effect induced by threats of military conflict, scholars highlight other factors that help explain historical urbanization.

Initial conditions are one such factor. Rokkan (1975) argues that key river trade routes led to early urban growth. Tilly (1992) emphasizes early commercial activities. Abramson and Boix (2014) argue that urban clusters were most likely to form in productive agricultural zones. White (1962) and Andersen et al. (2013) relate the adoption of the heavy plow to greater urbanization in zones with clay soils.

Another strand of literature highlights political factors. De Long and Shleifer (1993), Acemoglu et al. (2005), and van Zanden et al. (2012) link representative government, which they argue protected private property rights, with greater urbanization. By contrast, Stasavage (2014) argues that, due to their oligarchic structures, self-governing cities had negative long-run consequences for urbanization.

Other scholars focus on human and social capital. Dittmar (2011) shows evidence that urbanization was fastest where the moveable type printing press, which promoted new merchant skills, was adopted. Using city-level data, Cantoni and Yuchtman (2014) find that university training improved legal infrastructure and reduced trade costs. Greif and Tabellini (2010) argue that weak kin relations led to urban growth as a way to facilitate wide-scale cooperation. Guiso et al. (2008) show evidence that the medieval establishment of free cities had consequences for the development of social capital.

Voigtländer and Voth (2013a,b) study the dynamic interactions between warfare, disease, and urbanization in the aftermath of the fourteenth-century Black Death. They argue that this population shock set off a sequence of events, starting with greater demand for manufactured goods and urbanization, that enabled Europe to emerge from a Malthusian economy (Galor and Weil, 2000).

Our econometric analysis ahead will seek to account for these sorts of economic, geographic, political, and social factors. For example, we will control for physical geography at the city level, and will control for local political institutions.

3 Data and Measurement

Our urban population data are from Bairoch et al. (1988), which provides population data for all European cities that ever reached 5,000 inhabitants at century intervals for 800 to 1700 and half-century intervals for 1750 to 1850.[3] To help maintain estimation intervals of equal lengths, we focus our analysis on century (rather than the half-century) intervals. Our sample period runs from 800, just before the ninth-century fall of Charlemagne's empire, to 1800, just before the start of the Industrial Revolution in Continental Europe.[4] We linearly interpolate missing observations. To account for city-level features, we merge the Bairoch et al. data with data from Bosker et al. (2013), which leaves us with an unbalanced panel of 676 cities.[5]

Our historical conflict data are from Bradbury (2004) and Clodfelter (2002).[6] Bradbury (2004) provides data on all military conflicts in the medieval West. The Bradbury data are organized into chapters, each of which covers a different geographical area of medieval warfare. Within each chapter, there is a summary of each military conflict fought, including a description of the conflict's location, approximate date, and type. The Bradbury data end in 1525. We use the Bradbury data for military conflicts over 800-1499. The Clodfelter data start in 1500; we use these data for military conflicts over 1500-1799. The Clodfelter data are organized into chapters by century and geographical area. We focus on military conflicts fought in Europe, the Ottoman Empire, and the Middle East.

The historical conflict data may be subject to measurement error. Even if Bradbury and Clodfelter are unable to record all conflicts, however, it is likely that they include the most important conflicts as documented by historians. Still, the quality of data documentation may differ by place. To help account for local differences in data quality, our econometric analysis ahead will always include city fixed effects.

Our unit of analysis for military conflict is an individual conflict (e.g., battle, siege), which

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[3] The Bairoch et al. data do not include 1100. de Vries (1984) is an alternative data source for European historical urban populations. However, the de Vries data do not start until 1500. Bosker et al. (2013) compare the Bairoch et al. and de Vries data for each century from 1500 to 1800. They find very similar estimates for urban populations; the correlation coefficients range between 0.986 and 0.992.

[4] The nature of warfare changed dramatically over the nineteenth century due to improvements in transport and communications technologies and the rise of the mass army (Onorato et al., 2014).

[5] We updated the urban population data according to Bosker et al. (2013) for Bruges, Cordoba, London, Palermo, and Paris.

[6] Tilly (1992) and Jaques (2007) are two other sources for historical conflict data, both of which support the argument that military conflict was a defining feature of European history.

could be a one-off event or part of a larger war. The Bradbury data categorize military conflicts as individual conflicts. However, the Clodfelter data categorize military conflicts under war headings. Each war heading has an entry of several paragraphs that describe the war's details. To identify the locations of the individual conflicts that comprise each war, we read through each entry in Clodfelter and compiled a list of all individual conflicts. Table 1 displays an example using the Thirty Years' War (1618-48), which by our reading is comprised of 37 individual conflicts.

Historical accounts cannot pinpoint the exact geographical locations of military conflicts. We thus approximate conflict locations by the settlement (i.e., hamlet, village, town, city) nearest to where they took place. This method is both feasible, given the lack of available historical information, and intuitive, because conflicts were typically named after nearby settlements. For example, according to the Bradbury data, the Battle of Mons-en-Pévèle was fought on July 18, 1304 between Philip IV of France and William of Jülich of Flanders. This battle took place near the commune of Mons-en-Pévèle in northern France. We thus assign the geographical coordinates of Mons-en-Pévèle to it (50° 28′ 49.08″ N, 3° 6′ 11.16″ E).

Table 2 summarizes the historical conflict data. Military conflict was a key feature of European history: 1,091 land-based conflicts took place from 800 to 1800, for an average of 109 per century. The tenth century saw the least conflict, with 18 recorded conflicts, while the eighteenth century saw the most, with 398. Breaking the data down by modern-day countries, France saw the most conflict over this period, at 172, followed by Italy (140), England (108), Germany (106), and the Low Countries of Belgium and the Netherlands (66).

To measure city exposure to military conflicts, we use 150 km x 150 km grid-scale cells.[7] This size of grid cell roughly corresponds with NUTS2 units (e.g., county, province, region), the intermediate division of economic territory devised by Eurostat, the statistical office of the European Union. For example, the Tuscany region in Italy is approximately 150 km x 150 km. There are 192 grid cells in our sample. Over 90 percent of grid cells saw 0 or 1 conflicts. Thus, in line with the approach taken by Besley and Reynal-Querol (2014), we construct a dummy variable for each grid cell that equals 1 if there was a military conflict in that cell for each century from 800 to 1800, and 0 otherwise. This approach reduces the influence of unobservable factors that can affect the total number of conflicts to which sample cities were exposed. As an alternative, we construct an ordered variable for conflict exposure that

[7]We use a cylindrical equal area map projection with geometric center (longitude, latitude)=(10.00735, 46.76396), near Davos, Switzerland.

assigns a value of 0 to each century that a grid cell saw peace, a value of 1 to 1 conflict, and a value of 2 to 2 or more conflicts. Figure 1 maps the 1,091 conflicts between 800 and 1800 along with the 676 cities that we will exploit in this analysis.

4 Econometric Analysis

4.1 Methodology

The linear specification that we estimate is

$$P_{i,g,t} = \alpha + \beta C_{i,g,t} + \mu_i + \lambda_t + \boldsymbol{\gamma}' \mathbf{X_{i,g,t}} + \epsilon_{i,g,t}, \quad (1)$$

where $P_{i,g,t}$ is log population for city i in grid cell g at century t, $C_{i,g,t}$ is the conflict dummy that equals 1 if there was a military conflict in grid cell g over the previous century, μ_i and λ_t are fixed effects by city and century, $\mathbf{X_{i,g,t}}$ is a vector of city-level controls that we will include in a robustness check, and $\epsilon_{i,g,t}$ is a random error term.[8] All standard errors are robust, clustered at the grid cell level to account for any within-grid serial correlation in the error term. Table A1 displays the descriptive statistics for the regression variables.

Our benchmark modeling approach accounts for unobserved features that may influence city population growth and conflict exposure alike. City fixed effects account for initial conditions and time-invariant characteristics (e.g., geography). Century fixed effects account for widespread shocks (e.g., the Black Death). However, methodological challenges remain.

A first concern is omitted variable bias. There may be unobserved time-varying factors that influence city population trends. We address this concern in several ways. First, we modify our benchmark model to include country-century interaction effects, which help account for changes in country-level variables, including total populations, urbanization rates, economic activity, and nation-state building. Second, we include grid cell-specific time trends, which help account for unobservable local features that change over time, including rural-urban wage differences and urban amenities. Third, we interact century fixed effects with a variety of observable time-invariant city characteristics, including Atlantic trade potential, soil quality, and terrain ruggedness. Fourth, we control for observable time-varying

[8]Thus, the first observation of $P_{i,g,t}$ is for 900, because the first observation of $C_{i,g,t}$ measures conflict exposure over 800-99.

city features, including urban networks, political institutions, university hosts, and bishop or archbishop seats.

A second concern is reverse causation. As described, Glaeser and Shapiro (2002) identify a target effect whereby larger cities may be more attractive targets. We address this concern as follows. First, country-century interaction effects and grid-cell specific trends control for demographic trends at the national and local levels, respectively. Second, to further account for pre-existing trends and mean reversion effects, we include initial log city population-century interaction effects.[9] Third, we perform placebo tests equal to the first lead of our variable of interest. Fourth, we regress lagged city populations on (future) conflicts.

We conclude this discussion with a word of caution. The historical record suggests that the causes of the Europe's urban rise are complex. Thus, while we document a robust relationship that runs from conflict exposure to city population growth, we still cannot rule out the possibility of omitted variable bias or reverse causation.

4.2 Main Results

Table 3 presents our estimates for the relationship between conflict exposure and city population growth. City fixed effects account for initial conditions (economic, demographic, political, social) and local geographical features that may influence conflict patterns. Century fixed effects control for common shocks across time. Column 1 shows the results for this benchmark specification. There is a significant relationship (at the 1 percent level) between military conflicts that took place within the same 150 km x 150 km grid cell in which a city was located and city populations. Conflict exposure was associated with a 12 percent average increase in city populations per century.

Fixed effects by city and century account for unobserved features that were constant for each city and across each century. To account for changes over time in country-level variables, column 2 adds country-century interaction effects. The estimate for conflict exposure is similar in magnitude and significance as the benchmark case. To control for unobserved factors that had time-varying local consequences for urbanization patterns, column 3 adds grid cell-specific time trends. The result for conflict exposure remains significant; the point estimate falls to 5 percent. Column 4 adds country-century interaction effects and grid-cell specific trends to the same specification. The estimate for $C_{i,g,t}$ is significant at the 5 percent

[9] Initial log city populations refer to the first available observation for each sample city.

level, with a point estimate of 7 percent.

City fixed effects control for initial demographic conditions. Country-century interaction effects and grid-cell specific trends control for national and local demographic trends, respectively. Still, it is possible that cities with larger or smaller initial populations grew at different rates. To control for pre-existing trends and mean reversion effects, columns 5 and 6 add initial log city population-century interaction effects and re-estimate the fixed effects specification from column 1 and the specification with city and century fixed effects, country-century interaction effects, and grid-cell specific trends from column 4. Including initial log city population-century interaction effects is a demanding way to account for pre-existing trends and mean reversion effects (Acemoglu et al., 2011). The results are similar in magnitude and significance to the previous cases, with point estimates ranging from 7 to 8 percent.[10]

Overall, Table 3 shows evidence for a significant relationship that runs from conflict exposure to city population growth in Europe from the fall of Charlemagne's empire to the start of the Industrial Revolution. The results are robust to a variety of checks for omitted variable bias and reverse causation. Given that average per-century city population growth over the 800-1800 period was 22 percent, our estimates suggest that conflict-related city population growth was responsible for about one-quarter to one-half of average per-century city population growth over this period, and for 9-21 percent of its standard deviation.

5 Robustness

The evidence that we have shown in the previous section supports the argument that cities were safe harbors in European history. In this section, we use a variety of techniques to further test the robustness of our results. First, we control for a range of observable city characteristics that may have influenced city population trends. Second, we perform placebo tests and other tests for a target effect. Finally, we assess how robust our estimates are to sample changes and an alternative conflict exposure measure.

[10] As an alternative, we introduce the lagged dependent variable, $P_{i,g,t-1}$, as a regressor. To ensure consistency, we use GMM estimation (Arellano and Bond, 1991), instrumenting for $P_{i,g,t-1}$ with lagged observations from $t-2$ backward. The results for conflict exposure are qualitatively identical to those reported in Table 3.

5.1 Controls for Observables

Atlantic Trade

Acemoglu et al. (2005) show evidence that Atlantic traders (Britain, France, the Netherlands, Portugal, Spain) saw significantly faster urbanization rates from 1500 onward. To account for the rise of Atlantic trade on city population growth, column 1 of Table 4 interacts Atlantic port cities with century dummies in the specification with city and century fixed effects, country-century interaction effects, and grid-cell specific trends. Column 2 adds initial log city population-century interaction effects to this specification. The results for conflict exposure are robust to the inclusion of Atlantic port city-century interaction effects, with point estimates of 8-9 percent.

Heavy Plow

White (1962) and Andersen et al. (2013) argue that the breakthrough adoption of the heavy plow in 1000 led to greater urbanization in European regions with clay soils. To control for technological changes in agriculture on city population trends, columns 3 and 4 of Table 4 interact city-level soil quality according to Bosker et al. (2013) with century dummies. The soil quality data use climate information to calculate the probability that a region can be cultivated.[11] The estimates for $C_{i,g,t}$ are similar in magnitude and significance to the previous specifications.

Ruggedness

Hohenberg and Lees (1995) note that, for defensive purposes, city locations were often in difficult-to-reach places. Columns 5 and 6 of Table 4 interact terrain ruggedness, another city-level geographical feature from Bosker et al. (2013), with century dummies. The ruggedness data calculate the standard deviation of the elevation of the terrain that surrounds each sample city for a radius of 10 km. The results for conflict exposure are again similar as before.

[11] These data are available for grid cells of roughly 55 km x 40 km. Bosker et al. match the soil quality data to cities based on latitudes and longitudes.

City-Level Features

Distances to other cities may influence urbanization patterns. City fixed effects control for distances between cities. Standard errors clustered at the grid cell level account for spatial correlation. Grid-cell specific trends help control for changes in urban networks and transportation technology over time. As an additional way to account for urban clusters, we control for the number of cities with populations of at least 10,000 that were located within 100 km of each sample city. To account for political institutions, we include a dummy variable for whether a city was a self-governing commune. To account for education, we include a dummy variable for whether a city hosted a university. To account for religion, we control for whether a city was a bishop or archbishop seat. We code the city-level variables according to Bosker et al. (2013).

Columns 7 and 8 of Table 4 add these city-level controls. The estimates for $C_{i,g,t}$ remain significant; the point estimates fall to 5-6 percent. Dense urban networks and self-governing communes were associated with significant increases in city populations.

5.2 Placebo Tests

To this point, we have shown evidence for a robust relationship that runs from conflict exposure to city population growth. To further test the strength of this relationship, we create a conflict exposure placebo equal to the first lead of our exposure measure. For example, if the dependent variable $P_{i,g,t}$ measures log population for city i in grid cell g in 1500, then the conflict exposure placebo measures conflict exposure over 1500-1599 (in contrast to the original conflict exposure measure $C_{i,g,t}$, which measures conflict exposure over 1400-1499). If the placebo coefficient is not significant, then this analysis will provide further evidence in favor of our preferred interpretation of the results.

Column 1 of Table 5 shows the results for the one-century conflict exposure placebo for the specification with city and century fixed effects, country-century interaction effects, and grid-cell specific trends. The conflict exposure placebo is not significant; the point estimate is 0.038. For comparison, if we estimate this specification for the original conflict exposure measure for the same set of observations as for the placebo sample, then the point estimate (0.072) is nearly twice the size of the placebo estimate and is highly significant (not shown). Column 3 adds initial log city population-century interaction effects to the column 1 specification. The conflict exposure placebo is again not significant, with a point estimate of 0.043; the point estimate for the original conflict exposure for the same set of observations is nearly double and is significant at the 1 percent level (not shown). Overall, the placebo tests reinforce our preferred interpretation of the results.[12]

5.3 Target Effect Test

We control for demographic trends in several ways (i.e., country-century interaction effects, grid-cell specific trends, initial log city population-century interaction effects). To explicitly test for the target effect, we regress our conflict exposure measure $C_{i,g,t}$ on lagged city populations, $P_{i,g,t-1}$. This test is a way to evaluate whether larger cities are more attractive targets. Table 6 shows the results of this analysis for the specification that includes city and century fixed effects, country-century interaction effects, and grid-cell specific trends (column 1), and initial log city population-century interaction effects (column 2). The coefficients for $P_{i,g,t-1}$ are not significant in either specification. This test provides further evidence that the target effect does not drive our results.

5.4 Alternative Samples

Exclude Britain

Country-century interaction effects and grid-cell specific trends control for unobserved time-varying factors at the national and local levels, respectively. To further control for the influence of early industrialization, columns 1 and 2 of Table 7 exclude British (along with Irish) cities. The results for conflict exposure are robust to this sample change.

Exclude Capitals

To test for the importance of capital status, columns 5 and 6 exclude grid cells that contain a capital city. The estimates for $C_{i,g,t}$ remain significant at the 1 percent level, with point estimates of 10-11 percent.

[12]As a different test, we regress lagged city populations, $P_{i,g,t-1}$, on our conflict exposure measure $C_{i,g,t}$ for the two specifications in Table 5. The safe harbor argument says nothing about this relationship: conflict exposure should influence future, but not past, city populations. In fact, the estimates are not significant. This test provides further evidence that our results are not spurious.

Exclude 1700s

The 1700s saw over 35 percent of all sample conflicts. To further test – beyond century fixed effects – the influence of eighteenth-century conflicts, columns 3 and 4 restrict the sample to conflicts from 800 to 1700. The estimates for conflict exposure on city populations are similar as before.[13]

Conflict Types

Battles and sieges comprise over 90 percent of our historical conflict data. To test the relationship between conflict type and city population outcomes, columns 1 and 2 of Table 8 restrict the conflict sample to battles, of which there were 590 over the 800-1800 period. The coefficient for conflict exposure is positive but not significant for the column 1 specification that includes city and century fixed effects, country-century interaction effects, and grid-cell specific trends. This estimate becomes significant at the 10 percent level in the column 2 specification that adds initial log city population-century interaction effects.

Columns 3 and 4 repeat the previous two specifications for an alternative conflict sample that includes sieges only, of which there were 434. The estimates for $C_{i,g,t}$ are positive and significant at the 10 percent level. This evidence suggests that the influence of battles and sieges on city population growth was relatively similar.

5.5 Alternative Conflict Exposure Measure

Our benchmark measure for conflict exposure is a dummy variable. As an alternative, we construct an ordered variable that takes a value of 0 for each century that a grid cell saw 0 conflicts, a value of 1 for 1 conflict, and a value of 2 for 2 or more conflicts. Column 1 of Table 9 shows the results for the ordered variable approach for the specification that includes city and century fixed effects, country-century interaction effects, and grid-cell specific trends; column 2 adds initial log city population-century interaction effects. The results are robust to this alternative conflict exposure measure.

[13]For further robustness, we restrict the sample to 1200-1800. The results for conflict exposure remain unchanged.

5.6 Summary

Overall, the robustness checks described in this section reinforce the validity of our main result, namely that there is a strong and significant relationship that runs from conflict exposure to city population growth in European history.

6 Conclusion

This paper presents new evidence about the relationship between military conflict and city population growth in Europe from the fall of Charlemagne's empire to the start of the Industrial Revolution. Military conflict was a defining feature of European history. Our argument follows a distinguished line of scholars that view historical cities as safe harbors from conflict threats.

To test our argument, we perform an econometric analysis on a novel database that spans 1,000 years. Our analysis accounts for potential biases from omitted variables and reverse causation. We show evidence for a positive, significant, and robust relationship that runs from conflict exposure to city population growth. Our estimates suggest that conflict-related city population growth was responsible for 23-53 percent of average per-century city population growth between 800 and 1800.

To the best of our knowledge, our paper is among the first to provide systematic evidence that military conflicts played a key role in the rise of urban Europe. Does the legacy of historical conflict persist? Systematic study of the long-run consequences of historical conflict for urban prosperity in Europe is an exciting topic for future work.

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Table 1: Military Conflicts Comprising the Thirty Years' War

	Conflict Name	Year	Nearest Settlement	Country
1	Sablat	1619	Budweis	Czech Rep
2	White Hill	1620	Prague	Czech Rep
3	Fleurus	1622	Fleurus	Belgium
4	Hochst	1622	Frankfurt am Main	Germany
5	Wimpfen	1622	Bad Wimpfen	Germany
6	Stadtlohn	1623	Stadtlohn	Germany
7	Breda	1624	Breda	Netherlands
8	Bridge of Dessau	1625	Dessau	Germany
9	Lutter	1626	Lutter am Barenberge	Germany
10	Stralsund	1626	Stralsund	Germany
11	Wolgast	1628	Wolgast	Germany
12	Madgeburg	1630-1	Madgeburg	Germany
13	Breitenfeld	1631	Leipzig	Germany
14	Frankfurt (Oder)	1631	Frankfurt (Oder)	Germany
15	Werben	1631	Werben (Elbe)	Germany
16	Lützen	1632	Lützen	Germany
17	Nuremberg	1632	Nuremberg	Germany
18	River Lech	1632	Rain	Germany
19	Nordlingen	1634	Nordlingen	Germany
20	Tornavento	1636	Oleggio	Italy
21	Wittstock	1636	Wittstock	Germany
22	Breda	1637	Breda	Netherlands
23	Leucate	1637	Leucate	France
24	Breisach	1638	Breisach	Germany
25	Fuenterrabia	1638	Hondarribia	Spain
26	Rheinfelden	1638	Rheinfelden	Switzerland
27	Casale	1640	Casale Monferrato	Italy
28	2nd Breitenfeld	1642	Leipzig	Germany
29	Lérida	1642	Lérida	Spain
30	Rocroi	1643	Rocroi	France
31	Freiburg	1644	Freiburg im Breisgau	Germany
32	Allerheim	1645	Allerheim	Germany
33	Jankau	1645	Jankov	Czech Rep
34	Mergentheim	1645	Bad Mergentheim	Germany
35	Lérida	1647	Lérida	Spain
36	Lens	1648	Lens	France
37	Zusmarshausen	1648	Zusmarshausen	Germany

Source: Clodfelter (2002).

Table 2: Military Conflicts, 800-1799

800s	900s	1000s	1100s	1200s	1300s	1400s	1500s	1600s	1700s	Total	Avg
29	18	61	51	48	60	77	149	200	398	1,091	109

Sources: Bradbury (2004) for 800-1499 and Clodfelter (2002) for 1500-1799.

Note: All land-based conflicts in Europe, Ottoman Empire, and Middle East included.

Table 3: Military Conflict and City Population Growth, 800-1800: Main Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable is log city population					
Conflict exposure	0.116	0.116	0.054	0.072	0.071	0.079
	(0.038)	(0.038)	(0.031)	(0.032)	(0.033)	(0.031)
	[0.003]	[0.002]	[0.080]	[0.026]	[0.031]	[0.011]
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Century FE	Yes	Yes	Yes	Yes	Yes	Yes
Country x century FE	No	Yes	No	Yes	No	Yes
Grid cell time trends	No	No	Yes	Yes	No	Yes
Initial log city pop x century FE	No	No	No	No	Yes	Yes
R-squared	0.250	0.406	0.478	0.570	0.454	0.653
Observations	3,479	3,479	3,479	3,479	3,479	3,479

Note: Estimation method is OLS. All regressions include fixed effects by city and century. Robust standard errors clustered at grid cell level in parentheses, followed by corresponding p-values in brackets.

Table 4: Military Conflict and City Population Growth, 800-1800: Controls for Observables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable is log city population							
	Atlantic trade		Soil quality		Ruggedness		City-level controls	
Conflict exposure	0.076	0.086	0.073	0.079	0.069	0.075	0.057	0.064
	(0.031)	(0.031)	(0.032)	(0.031)	(0.032)	(0.030)	(0.031)	(0.029)
	[0.016]	[0.005]	[0.023]	[0.010]	[0.030]	[0.014]	[0.071]	[0.032]
Atlantic port x century FE	Yes	Yes	No	No	No	No	No	No
Soil quality x century FE	No	No	Yes	Yes	No	No	No	No
Ruggedness x century FE	No	No	No	No	Yes	Yes	No	No
City-level controls	No	No	No	No	No	No	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Century FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country x century FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grid cell time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial log city pop x century FE	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.581	0.663	0.571	0.655	0.571	0.655	0.581	0.661
Observations	3,479	3,479	3,479	3,479	3,479	3,479	3,479	3,479

Note: Estimation method is OLS. All regressions include fixed effects by city and century. City-level controls for urban networks and centuries for which cities were self-governing communes, university hosts, or bishop or archbishop seats. Robust standard errors clustered at grid cell level in parentheses, followed by corresponding p-values in brackets.

Table 5: Military Conflict and City Pop Growth, 900-1800: Placebos

	(1)	(2)
	Dep var is log city population	
Future conflict exposure	0.038	0.043
(100-yr placebo)	(0.036)	(0.032)
	[0.291]	[0.179]
City FE	Yes	Yes
Century FE	Yes	Yes
Country x century FE	Yes	Yes
Grid cell time trends	Yes	Yes
Initial log city pop x century FE	No	Yes
R-squared	0.509	0.602
Observations	2,806	2,806

Note: Estimation method is OLS. All regressions include fixed effects by city and century. Robust standard errors clustered at grid cell level in parentheses, followed by corresponding p-values in brackets.

Table 6: Military Conflict and City Pop Growth, 800-1800: Target Effect

	(1)	(2)
	Dep var is conflict exposure	
Log city population (lagged)	0.024	0.033
	(0.022)	(0.025)
	[0.295]	[0.182]
City FE	Yes	Yes
Century FE	Yes	Yes
Country x century FE	Yes	Yes
Grid cell time trends	Yes	Yes
Initial log city pop x century FE	No	Yes
R-squared	0.430	0.434
Observations	2,806	2,806

Note: Estimation method is OLS. All regressions include fixed effects by city and century. Robust standard errors clustered at grid cell level in parentheses, followed by corresponding p-values in brackets.

Table 7: Military Conflict and City Population Growth, 800-1800: Alternative Samples

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable is log city population					
	Exclude British cities		Exclude capital grids		900-1700 sample	
Conflict exposure	0.083	0.088	0.104	0.108	0.072	0.079
	(0.033)	(0.032)	(0.037)	(0.034)	(0.030)	(0.025)
	[0.012]	[0.006]	[0.005]	[0.002]	[0.017]	[0.002]
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Century FE	Yes	Yes	Yes	Yes	Yes	Yes
Country x century FE	Yes	Yes	Yes	Yes	Yes	Yes
Grid cell time trends	Yes	Yes	Yes	Yes	Yes	Yes
Initial log city pop x century FE	No	Yes	No	Yes	No	Yes
R-squared	0.527	0.624	0.561	0.667	0.510	0.603
Observations	3,086	3,086	2,797	2,797	2,806	2,806

Note: Estimation method is OLS. All regressions include fixed effects by city and century. Robust standard errors clustered at grid cell level in parentheses, followed by corresponding p-values in brackets.

Table 8: Military Conflict and City Pop Growth, 800-1800: Conflict Types

	(1)	(2)	(3)	(4)
	Dep var is log city population			
	Battles only		Sieges only	
Conflict exposure	0.042	0.054	0.052	0.058
	(0.031)	(0.029)	(0.031)	(0.031)
	[0.169]	[0.063]	[0.095]	[0.063]
City FE	Yes	Yes	Yes	Yes
Century FE	Yes	Yes	Yes	Yes
Country x century FE	Yes	Yes	Yes	Yes
Grid cell time trends	Yes	Yes	Yes	Yes
Initial log city pop x century FE	No	Yes	No	Yes
R-squared	0.569	0.652	0.569	0.652
Observations	3,479	3,479	3,479	3,479

Note: Estimation method is OLS. All regressions include fixed effects by city and century. Robust standard errors clustered at grid cell level in parentheses, followed by corresponding p-values in brackets.

Table 9: Military Conflict and City Pop Growth, 800-1800: Ordered Variable

	(1)	(2)
	Dep var is log city population	
Conflict exposure (ordered)	0.042	0.047
	(0.021)	(0.020)
	[0.041]	[0.021]
City FE	Yes	Yes
Century FE	Yes	Yes
Country x century FE	Yes	Yes
Grid cell time trends	Yes	Yes
Initial log city pop x century FE	No	Yes
R-squared	0.569	0.653
Observations	3,479	3,479

Note: Estimation method is OLS. All regressions include fixed effects by city and century. Robust standard errors clustered at grid cell level in parentheses, followed by corresponding p-values in brackets.

Table A1: Descriptive Statistics

	Obs	Mean	Std Dev	Min	Max
City population (1,000s)	3,479	17.413	31.795	1	948
Log city population	3,479	2.382	0.922	0	6.854
Conflict exposure	3,479	0.356	0.479	0	1
Conflict exposure (ordered)	3,479	0.563	0.812	0	2
Atlantic port	3,479	0.094	0.292	0	1
Soil quality	3,479	0.725	0.233	0.011	0.999
Ruggedness	3,479	68.685	74.928	0.466	559.450
Urban network	3,479	2.699	3.635	0	27
Commune	3,479	0.491	0.500	0	1
University	3,479	0.111	0.314	0	1
Bishop seat	3,479	0.496	0.500	0	1
Capital city	3,479	0.064	0.245	0	1

Sources: See text.

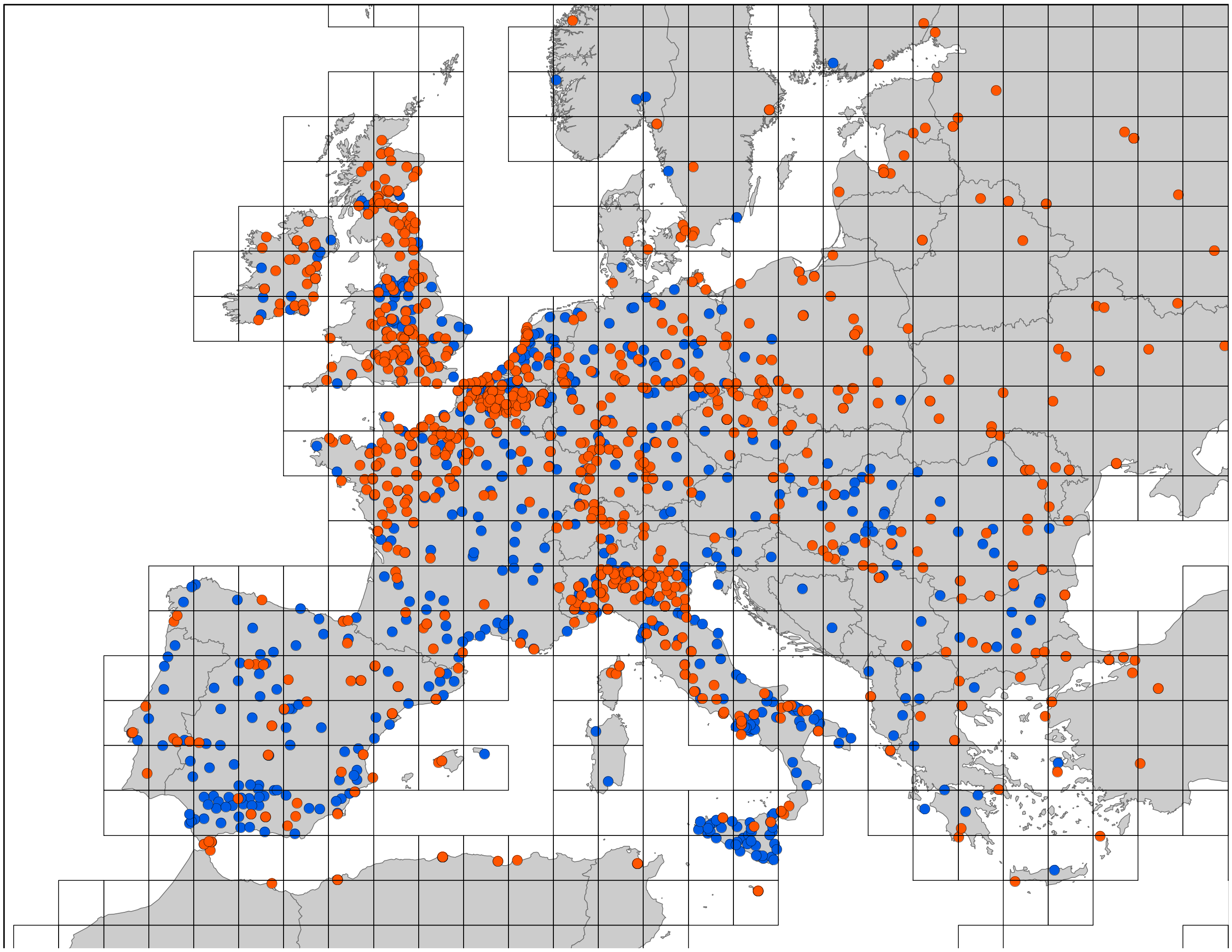

Figure 1: Conflict and City Locations, 800-1800. 1,091 conflicts (red circles) and 676 cities (blue circles) included. Grid-scale cells are 150 km x 150 km.