Urban population in Germany, 1500 - 1850

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Abstract

In situations where few data are available to document economic activity, the size of the urban population is a valuable indicator for economic development and the spatial pattern of an economy. This study improves the basis for investigations into the quantitative urban history of Germany by constructing a novel database of the population size of 412 cities that had at least 5000 inhabitants between 1500 and 1850. Compared with earlier databases it uses a considerably larger body of sources, and it improves the resolution of data by interpolating and extrapolating annual series. The resulting series of total urban population is consistent with recent work on aggregate demographic trends in Germany. The trajectory of the urbanization rate shows that Germany began its transition from stagnation to growth around 1800, several decades before the onset of industrialization. Regional urbanization rates converged (rather than diverged) in 1815/19–1858, that is, during the transition to the first stage of industrialization. Discussion of individual regional histories suggests state formation, (proto-)industrialization and regional population density as possibly relevant determinants of urban growth in the area and time period studied.

Keywords: Urban growth, economic development, economic demography.

JEL classification: N13, N33, N93, O47.

Contents

1 Introduction

The aim of this study is to improve the basis for investigations into the quantitative urban history of Germany in 1500–1850. In situations where few data are available to document economic activity, the size of the urban population is a valuable indicator for both economic development and the spatial pattern of economic activity. Hence, the urbanization rate has served as dependent variable in research into diverse topics such as the economic effects of the Protestant Reformation, of institutional reforms undertaken at the beginning of the nineteenth century and of infrastructure development (Acemoglu et al. 2011; Cantoni 2015; Hornung 2015; Keller and Shiue 2016).

The principal basis of this and other recent research that involves the urban history of Germany is the handbook compiled by Bairoch et al. (1998). Bairoch et al. list the population of individual towns, rounded to thousand in intervals of 100 years until 1700 and 50 years for later periods. The inclusion criterion is a minimum of 5000 inhabitants; territories are defined according to post-1945 boundaries. For Germany, the *Deutsche Städtebuch* initiated by Keyser (1939; see Appendix A4.2 for the full list of references) constitutes the principal source. This study extends the work of the Bairoch group in three respects. First, I extend the body of consulted works, so that coverage is more complete. Second, I increase the resolution of the available information by documenting all information on the population size of a town and by interpolating and extrapolating annual population series for each town. Finally, regional coverage is made consistent with the boundaries of historical Germany that are applied by recent research in historical demography. This makes it possible to derive robust estimates of the national urbanization rate.

While the main purpose of this study is to serve as a basis for future research into the quantitative economic history of Germany during the premodern era, it also produces several substantive results. The first result relates to the long-term development of the German economy. The urbanization rate was largely constant at slightly below 10 percent during the early modern era and began to increase around 1800. Thus, the transition from stagnation to growth began several decades before the onset of rapid industrialization in the 1830s and 1840s. This finding is consistent with the trajectories of other indicators for economic development. Secondly, I also provide a descriptive overview of regional urbanization rates, mostly for the first half of the nineteenth century, selectively also back to the 1740s. Regional disparities were more marked than for urbanization rates based on a juridical criterion and declined at the beginning of industrialization. State formation, (proto-)industrialization and regional population density turn out as promising explanations of urban growth during this period deserving more intensive research.

The text comes in two main parts. Section 2 gives an overview of the new urban population database. Details are relegated to Appendices 2 and 3. The data themselves are available from the author on request. Section 3 presents national and regional urbanization rates, relates them to a European context and discusses potential forces driving urban growth that merit future research. Section 4 concludes.

2 A database of urban population

2.1 Coverage, sources, and data issues

This study develops annual population series of 412 towns located in Germany and having at least 5000 inhabitants sometime between 1500 and 1850. The database consists of two parts: The first comprises the information on population size given in the sources; it is presented in Appendix A3. The second part is made up of the annual series constructed on the basis of the source information. The database is available from the author on request. What follows describes data coverage, the sources used, and issues with historical population data. Since censuses were taken in shorter and longer intervals, the data drawn from the sources are not contiguous, and constructing annual series requires interpolation and extrapolation. Section 2.2 explains the corresponding rules.

The urban population database covers towns located in historical Germany according to the definition underlying a recent reconstruction of Germany's demographic past. It includes the territories that were part of both the Holy Roman Empire (*Altes Reich*), dissolved in 1806, and the *Kaiserreich* of 1871. Relative to the *Deutsche Bund*, the inter-state organisation founded in 1815 in succession to the early modern *Reich*, this covers all member territories except for the Habsburg lands (Austria, Bohemia and Moravia, present-day Slovenia) and the territories that were part of the Low Countries (Limburg and the Grand Duchy of Luxembourg). Relative to the *Kaiserreich*, this area excludes the Prussian provinces of Posen, Eastern and Western Prussia, the Duchy of Schleswig (the northern half of the Province of Schleswig-Holstein), and Alsace-Lorraine. None of these territories belonged to the early modern *Reich*. In comparison to the Old *Reich*, the present definition excludes the Habsburg lands (which in those days also comprised the southern Netherlands), except for the *Vorderen Lande* (situated in today's extreme southwest of Germany), which are included. Relative to present-day Germany, the area covered by this study excludes South Schleswig but includes Silesia, the parts of Brandenburg and Pomerania situated east of the Oder river, and the small territory of the German-speaking community in eastern Belgium (Fertig et al. 2018: 8–9; Pfister and Fertig 2010: 4, 2020).

The reference point for constructing a database of urban population is the data handbook by Paul Bairoch et al. (1988). Until 1700, they provide estimates for individual towns at intervals of 100 years and at intervals of 50 years from 1750. Their main source is the *Deutsches Städtebuch* initiated by Keyser (1939–1969; see Appendix A4.2 for the full list of references), complemented by material from more recent local studies. The urban population database of this study extends the material of the Bairoch group by broadening the body of sources used and by providing figures for individual towns at the shortest possible intervals. Because censuses were not carried out at intervals of 50 or 100 years, I will proceed in three steps. First, I collect and document all available information on the number of inhabitants for individual towns. Second, I interpolate and extrapolate values between census years to obtain annual population

series for individual towns. In a third step, I use this series to obtain aggregate population and cross-sections for key years in intervals of 50 years.

The *Deutsches Städtebuch* continues to be the main source for information on the number of inhabitants of individual towns, especially for the early modern period. In addition, I draw on material from three types of sources. First, I make use of official statistics published in the nineteenth century wherever possible (see Appendix A4.1). Because tariff revenues were to be distributed according to the population of the member states, the *Zollverein* formed in 1833 decreed that censuses were to be conducted at intervals of three years starting in 1834. Many member states had started regular censuses earlier, sometimes from 1815/16. In most cases I have not been able to go back to the original publications, but I rely on later compilations, including recent studies (on Prussia, see Stat. Pr. in Appendix A4.1 and Matzerath 1985 in the general bibliography). For Prussia, Hanover and Württemberg compilations are available in electronic form; for Hessen and Saxony printed documents also allow good coverage. By contrast, documentation is limited to few years for Baden and Bavaria, which includes much of present-day Rheinland-Pfalz.

Second, I use regional studies on Württemberg, Saxony and the northern half of present-day Germany (between the Rivers Rhine and Oder). They include information for the early modern period and partly conduct a critical analysis of the sources (Blaschke 1967: 130–141; Gehrmann 2000: chapter 7; Keller 2001; von Hippel 2009a, b). Third, to improve coverage of the early modern period, I make use of an exhaustive bibliography of works on German history to cover demographic material contained in local studies; in total, the database includes information from about 60 local studies.[1]

Appendix A3 contains the result of this data collection. It lists population figures for all towns in the territory of historical Germany as defined above that had at least 5000 inhabitants at some point in time between 1500 and 1850. Since many figures are rounded, especially for the early modern period, I include all municipalities that had at least 4,500 inhabitants. Population for census years immediately before and after a period in which a town had more than 4500 inhabitants is also recorded. This is done in view to determine the year in which the population crossed this threshold. The text below and Appendix A2 describe details concerning coverage and data handling. At this point, it should only be noted that the database selectively covers Polish territory that lies outside the boundaries of historical Germany as defined above (town names marked with "x" in Appendix A3). No effort was made to trace the demographic history of these towns back to the moment when they exceeded the threshold of 4500 inhabitants. Nevertheless, these data may contribute to improving estimates of the

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[1]   Bibliographic information is published online by the Institute of Comparative Urban History at the University of Münster: https://www.uni-muenster.de/Staedtegeschichte/bestaende/Bibliographie.html; in particular, see the links to "Forschungsrückblicke" and the "Aktuelle städtegeschichtliche Literatur" (last check on March 3, 2020).

urban population of Poland. I count 89 towns with at least 5000 inhabitants sometime before 1860 located in post-1945 Poland and having been part of pre-1914 Germany. Since many of these towns are missing from the compilation of Bairoch et al. (1988), the urbanization rates shown in Table 2.1 below may grossly misrepresent the likely true level of Poland's urban development during the first four centuries of the modern era.

Essentially, I present the data as they are given in the sources used. This is tantamount to saying that the development and application of a unified approach to deriving historical population estimates is beyond the scope of this study. Rather, I implicitly follow the procedures of the respective authors to develop population estimates for a given town. Thus, the further one moves back in time before 1840, the more imprecise not only the population figures become, but also the method on which the data are based is increasingly heterogeneous. It is therefore important to stress the very limited quality and the tentative nature of the data collected in this study.

There are two broad categories issues relating to the quality of figures for urban population prior to the middle of the nineteenth century. The first relates to the procedures of census taking followed by state authorities in the nineteenth century, the second to methods applied to derive population estimates from early modern documents listing taxpayers, males fit for military service, and so on. The remainder of this section discusses these two topics in turn and describes the procedures for data handling where necessary.

Most German states created statistical offices and began to take regular censuses in the first decades of the nineteenth century. However, only from 1867 did a standard procedure apply to all German states: From then on, censuses recorded the resident population in December based on factual counts on the household level. Before 1867 censuses were oriented on the concept of the *Zollvereinsbevölkerung*—standards defining the collection of population figures that were to form the basis for the distribution of the tariff revenues among the members of customs union formed in 1833. The concept of the *Zollvereinsbevölkerung* was difficult to handle so that population figures between 1833 and 1867 were beset with many errors. Nevertheless, there is consensus that the formation of the *Zollverein* led to a significant improvement of demographic statistics. From 1846 counts on the household level (rather than extrapolation based on earlier censuses and vital events) were the norm, and already from the late 1830s segments of population that were not members of the community where they resided—most notably servants and apprentices—were progressively included in population totals. Consequently, official population statistics are generally believed to be broadly reliable from about 1840 (Michel 1985; Tippach 2000: 8–10, 19; Schneider 2010: chapter 3; Fertig et al. 2018: 9–10; see also the studies by Rolf Gehrmann on nineteenth-century census in Fertig et al. 2018: Online Appendix, GESIS ZA8609).

The improvement in census coverage during the early phase of the statistical era leads to spurious population growth between c. 1815 and 1840. For aggregate population this issue has been partly resolved by correcting census figures based on

information on vital events, whose coverage was more complete. For 1817, the resulting upward correction of the total German population is about five percent.[2] A similar correction of urban population figures is beyond the scope of the present study study, because this would require the construction of series of vital events of the level of individual town. Consequently, the series for total urban population and the urbanization rates developed below (Figures 3.2–3.4, Table 3.2) overstate urban growth from the 1810s to the 1830s, but since the upward correction of total population is modest, the likely error is small.

One particular issue relates to the category of the military population. It is particularly relevant in Prussia, to a lesser extent also in other territories and states. The category included military personnel and their households. Some censuses cover the military population, others do not (Gehrmann 2000: 46–50; Tippach 2000: 10–14). Because it is part of the resident population I used figures including the military population wherever possible. I also discarded information from the censuses in 1822–1837 that clearly did not cover the military population.

Prior to the early nineteenth century some census material subsists from the so-called proto-statistical era, which started around 1740. In order to buttress policy-making with appropriate knowledge, state authorities systematically began to collect information on the economic and social condition of their territories (Härter 2005: 203–212; Behrisch 2016). Although they paid particular attention to collecting and systematising information on vital events, they also carried out irregular censuses of the population over which they ruled (Pfister 1994: 6–7; Gehrmann 2000: 34–83). This led to a rapid increase of the data volume that can be used for the purpose of this study (Table 2.1 below). For the remainder of the early modern period, population estimates are usually extrapolations based on sources other than population censuses. What follows presents and comments on three procedures to derive population estimates based on these sources.

During the pre-statistical era, public authorities collected information on the population in the form of tax lists, lists of hearths, muster lists, the number of houses, and so on (Ditt 1979: 113–120; Rödel 1990; Pfister 1994: 3–6, 68–72). Inflating the number of units mentioned in these lists with a multiplier yields a rough estimate of total population. In the few cases where a source provides only the number of hearths or households and it is not possible to derive a local multiplier based on information from a census for another year I follow widespread practice and use a multiplier of 5 (Keyser 1943: 405; Pfister 1994: 75; von Hippel 2009a: 38–41). Otherwise, I leave the multipliers applied by the studies used as sources unchanged. This is obviously a very crude

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[2] Fertig et al. (2018: 14 and Online Appendix A2, GESIS ZA8609). Their population estimate for Germany in the borders of 1871, but excluding Alsace-Lorraine, in 1817 (end of year) is 2 percent above the corresponding figure (but mid-year) given by Hoffmann (1965: 172), which includes Alsace-Lorraine. In 1871, the share Alsace-Lorraine in German population was about 4 percent.

procedure, and one would like to know whether it introduces a systematic error, particularly in relation to population figures derived from nominative records, such as *status animarum* (*Seelenstandsregister*; lists of all parish members compiled by pastors). Studies on household and family structure have the potential to provide a partial answer, although the available knowledge is too sparse to discern regional differences in the mean household size of urban communities. It appears that household size could vary considerably across time and space, but an average of about four persons per household seems to be the most likely order of magnitude for early modern German towns (François 1982: 25; Sachse 1987: 191; Roeck 1989: 394; Ogilvie 1997: 264–268 [add total figures for Wildberg in 1722]; Jarren and Wex 2002: 119; Brauer and Kroll 1984: 30–31; for a general discussion, see Pfister 1994: 71). However, tax lists, lists of houses, and so on, do not count households and they may omit poor households that are not taxed, lodgers and other categories of the urban population. A multiplier well above 4 to derive a population estimate based on these sources is therefore clearly warranted.

A second method consists in extrapolating the approximate population size on the basis of the number of baptisms derived from parish registers and the assumption of a plausible (constant) crude birth rate (CBR). The number of baptisms is more appropriate for this purpose than the number of deaths and marriages, since births fluctuate less than the other two vital events. A method of this kind was already proposed by Johann Peter Süßmilch in 1742, and contemporary public authorities applied it because numbers of vital events could be collected with relative ease from parish registers, whereas census taking required an additional effort (Süßmilch 1742; Blaschke and Stams 2007: 19–20). Several modern studies on early modern German towns have used this approach Mauersberg 1960; Friedrichs 1979: 36–38; François 1991; Schlöder 2014: 38–39). Again, I have left the (constant) CBR assumed by the authors of the respective studies unchanged although the national CBR declined in the course of the eighteenth century (Pfister and Fertig 2020: Figure 2). The exception is Cologne, where the extrapolation based on the national CBR yielded estimates that were more consistent with other contemporaneous information on population size than the estimate based on an assumed constant CBR undertaken by a previous study (see the entry for Köln in Appendix A3).

A third method is of limited applicability, but it still deserves to be mentioned. In the context of policies to assure the food security of local communities, some public authorities tried to obtain information on grain consumption in their town. Sometimes the volume of urban grain consumption can also be inferred from taxes on sold or milled grain. If one knows per capita consumption of grain it is possible to derive an estimate total population. So far, this method has only been applied to Augsburg in the seventeenth century by Roeck (1987: 304–305). Roeck assumes a constant per capita consumption of 217 kilogram of grain per year, but consumption theory leads us to expect that food consumption varied with income and relative prices (e.g., Allen 2000: 13–14). I attempted to expand this approach both for Augsburg and Cologne using

information on wages and prices, but the resulting estimates did not lead to an improvement over the information derived from other sources.[3]

In conclusion, I would like to point out once again the limited quality and the tentative nature of the data collected in this study. Part of the imperfection of the database stems from the fact that it draws on secondary sources and therefore does not follow a unified approach to estimate population from the sources available for the pre-statistical age. However, at the current state of research it is not clear what such an approach should look like. At the same time, it is unlikely that the procedure followed here introduces a systematic bias. Whereas the margin of error on the level of the individual city widens the farther one moves back in time from about 1840, the database offers a sufficiently reliable basis for research at the aggregate level.

2.2 Creating annual series

The information described so far provides rough estimates of the population of individual towns in particular, non-contiguous years. The analysis carried out in the later parts of this study requires annual population series. Interpolation of missing values using an exponential is appropriate back until the early eighteenth century. For the sixteenth and seventeenth centuries, however, the sparseness of the available information and the likely true course of urban population require the application of some extrapolation as well, at least for some towns in the sample. The present section develops the principles that have been used to construct annual population series for towns with little information on population prior to the early eighteenth century.

Table 2.1 gives an overview of the number of towns in the sample and of the density of available data sources. As many of the figures relating to the earlier part of the period under study are rounded, the inclusion criterion is 4500 inhabitants. The first line indicates the average number of towns recording at least 4500 inhabitants in a particular quarter century ("1500" refers to the quarter century 1500–1524, "1525" to 1525–1549, and so on). In 1850 there were 397 towns with at least 4500 inhabitants. The fact that in the last quarter of the eighteenth century the sample comprises only 153 communities on average is a first indication of the rapid urban growth that began around 1800. In the first quarter of the sixteenth century, there were only 73 towns for

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[3] For Augsburg there is local price and wage information, for Cologne I used national wage and price series (Pfister 2017). For Augsburg, variation of the values of the elasticity that underly the estimate of per capita consumption leads to highly divergent population estimates. For Cologne I used the returns of the milling excise available from 1676 (von Looz-Corswarem 1978: 94–95, 397–398). Short-term fluctuation of the implied quantity of grain partly follows known subsistence crises, suggesting some connection with consumption. However, the quantity of taxed grain tripled between 1699 and 1715, which casts doubt that this series can serve as an indicator of population size. Rather, the series appears to be driven by changes in meal procurement and/or the effectiveness of taxation.

which we know with some certainty that they had at least about 5000 inhabitants. Germany's urban network was still rather loose at the dawn of the modern age.

Table 2.1: Sample size and data density by quarter century

|	1500	1525	1550	1575	1600	1625	1650	1675	1700	1725	1750	1775	1800	1825
sample size	73	77	83	88	93	67	60	73	90	111	131	153	209	326
n data points	65	41	62	65	112	115	82	74	118	123	257	325	781	1894

Source: Urban population database.
Note: The first line gives the average number of towns with a population larger than 4500 (after application of interpolation and extrapolation rules explained in the text) per quarter century, the second line the number of population figures per quarter century present in the source database. "1500" indicates the period 1500–1524, and so on.

The second line of Table 2.1 shows the total number of data points on population per quarter century. In 1825–1849, the ratio of data points to sample size is 5.8, which is not far below the ratio one would expect when censuses were taken in three-year intervals, as stipulated by the *Zollverein* treaty concluded in 1833. Data become less abundant as one moves back in time, especially starting with the second quarter of the eighteenth century, when the ratio of data points to sample size drops markedly below 2. This implies that, prior to the middle of the eighteenth century, we have at best one figure on population size per a quarter century for many towns. The massive improvement of data availability around the middle of the eighteenth century reflects the onset of the so-called proto-statistical age, when state authorities complemented the efforts of churches and local communities to collect information on their subjects (see above, section 2.1).

Producing annual population series with exponential interpolation of values between census years is problematic in the case of towns for which we have little information, particularly during the seventeenth century. This is because population size fluctuated widely in the wake of the Thirty Years' War (1618–1648). Figure 2.1 illustrates this point. The "High data frequency" graph shows aggregate population of the 58 towns for which we have at least one piece of information both for 1600–1624 and 1625–1674. Between 1618/19 and the low point in 1644 population of this group of towns fell by 44 percent. This figure is inflated by censuring the sample at 4500 inhabitants, because the population loss meant that 40 percent of communities that were in the sample in 1618 did not fulfil this criterion for inclusion anymore. For a stable sample of all towns with at least 5000 inhabitants sometime before 1618 or in 1650–1674, the reduction of total population in 1618–1644 is only 34 percent. Massive demographic decline was caused, on the one hand, by repeated outbreaks of epidemics, particularly plague, which were facility by the mobility of military personnel and the concentration of refugees in fortified towns. On the other hand, plundering of animals and seed grain by marauding troops, together with the temporary abandonment of rural

settlements disrupted agricultural production and thereby aggravated food crises (Bog 1952; Pfister 1994: 14–15; Eckert 1996: 132–154; Stier and von Hippel 1996: 235–239).

Figure 2.1: Aggregate population of sub-samples of towns (thousand)
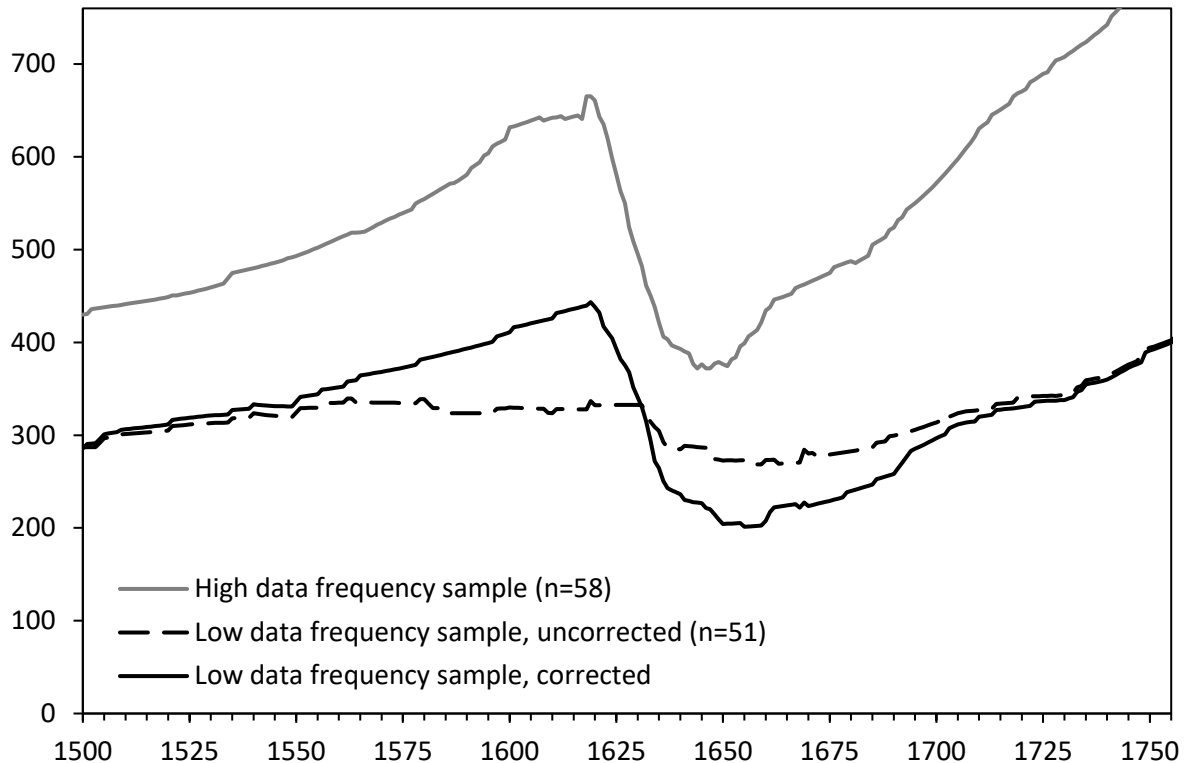
Source: Urban population database.

Note: Samples are censured at 4500, that is, towns with fewer than 4500 inhabitants are dropped from the calculation of total population of the respective subsample.

The broken black graph in Figure 2.1 shows aggregate population for the sub-sample of 51 towns having a population of at least 4500 sometime before the outbreak of the Thirty Years' War but for which there is at best one piece of information in 1600–74. The lower overall level of this graph, despite a roughly similar size of the two sub-samples, indicates that population data is generally sparser for small towns compared to larger ones. Moreover, this graph is much flatter than the one for the high data frequency sample between c. 1550 and 1700. In the case of towns with low data frequency, interpolating annual data with an exponential trend leads to an unrealistic smoothing out of the likely true magnitude of demographic fluctuations in this period. Leaving the data as they are would lead to a misrepresentation of the development of aggregate urban population and would distort comparisons between towns in cross-sections.

To remedy this issue, I apply three rules to the towns in the low data frequency sample. First, if no information on population size is available in 1600–1624, values between the last population figure relating to an earlier year and 1618 are extrapolated using the exponential trend of aggregate population of the high data frequency sample

in 1500–1618.[4] Second, if a population figure is available for 1650–1674, but not for 1625–1649, annual values between 1618 and the respective year are interpolated using exponential trend. Third, if no data are available for the whole period 1625–1674, values in 1619–1644 are set according to the annual growth rates of aggregate population of the high data frequency sample.[5] Values between 1644 and the next year with information on the number of inhabitants are then interpolated using exponential trend.

A fourth rule applies to cases in which the first population figure is considerably later than 1500 and exceeds 4500 inhabitants. In these cases, the aggregate population trend growth rate of the high data frequency sample in 1500–1618 is used to extrapolate values back to 1500. This rule applies to a total of six towns that are in both, the high and low data frequency samples.[6] A notable effect is the reduction of the blip that shows up in the aggregate population series of the high data frequency sample in 1618.

The solid black graph in Figure 2.1 shows total population of the low data frequency sample after the application of these four rules. The peak-to-trough difference in the seventeenth century (1618–1655) is somewhat higher than for the high data frequency sample, namely, -55 percent. A proximate explanation is that the towns in the low data frequency sample were on average smaller, so that a higher percentage dropped below the threshold of 4500 inhabitants (48 percent from 1618 to 1655, as against 40 percent from 1618 to 1644 in the high data frequency sample). Nevertheless, the fact that the trough occurred ten years later than in the high data frequency sample indicates that the negative impact of the Thirty Years' War was more severe and more durable among small than among large towns. This is consistent with the finding that in Württemberg medium-sized communities were the category of localities that suffered the largest demographic loss during the Thirty Years' War (von Hippel 2009b: 44–45).

3 From stagnation to growth: National and regional urbanization rates

3.1 Aggregate urban population and the urbanization rate in a European perspective

The sources underlying the urban population database described in section 2.1, together with the rules for interpolating and extrapolating missing data in section 2.2, form the basis to construct annual series of the population of all towns having at least 5000 inhabitants at one point in time between 1500 and 1850. The remainder of this study describes these data in order to get preliminary insights into the long-term evolution of Germany's economy during the centuries preceding the onset of rapid industrialization that can motivate further study.

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[4] Trend of uncensured sample is used. Its value is 0.00378. In the few cases where interpolated growth rate in 1599/1600 exceeds this rate, no adjustment was made.

[5] Again, the trajectory of the uncensured sample is used.

[6] The six towns are Ansbach, Frankfurt (Oder), Glogau, Merseburg, Salzwedel, and Stargard.

The present section takes a first look at these data through the lens of aggregate urban population and the urbanization rate. A major stylized fact emerging from the urbanization rate shown in Figure 3.3 is that a stable share of a bit less than ten percent of the German population lived in towns with at least 5000 inhabitants during the early modern period. In Central and Western Europe as a whole, urbanization rates were somewhat higher and may have risen from 10–12 percent in c. 1500 to 11–13 percent in 1800. At the turn of the nineteenth century, by contrast, rapid urban growth set in; by 1850, the urbanization rate had attained 17 percent. This was somewhat below the European average (19 percent); only at the beginning of the twentieth century was Germany more urbanized than other countries in Central and Western Europe (for the European comparison, see Table 3.1 and Bairoch 1988: 179, 215 and 221).

In the absence of data on GDP per capita, the urbanization rate can serve as a rough proxy of the level of economic development. This is because only regions with a highly productive agricultural sector and a developed transport infrastructure can support large urban populations. Moreover, there is a close correlation between the urbanization rate and GDP per capita across a number of historical economies (e. g., Acemoglu et al. 2005: 552). Hence, the onset of urbanization around 1800 points to more fundamental economic change, well before the beginnings of rapid industrialization in the 1830s and 1840s. In close chronological parallel with the pickup of the urbanization rate, the vulnerability with respect to harvest shortfalls largely disappeared, and population growth could accelerate without depressing material standards of living. A strong outward shift of labour demand, most notably in the late 1810s, contributed to this phenomenon. Finally, there are signs of the beginnings of labour-augmenting technological progress in agriculture. The trajectory of the urbanization rate thus corroborates the notion that Germany's economy experienced a fundamental structural break around the turn of the nineteenth century, specifically, a transition from (Malthusian) stagnation to the post-Malthusian era (Pfister et al. 2012; Fertig et al. 2018; Pfister and Fertig 2020; Bracht and Pfister 2020: chapter 8).

To take a closer look at the trajectory of the urbanization rate it is useful to inspect its two components—total and urban population—separately. Before 1730, and particularly before 1690, existing estimates of total population are very crude (Figure 3.1). The estimate of total urban population shown in Figure 3.2 constitutes an original contribution to the demographic history of Germany since it presents the first contiguous series over the sixteenth and seventeenth centuries for at least a segment of the population. Of particular interest is its behaviour across the four data points for 1600, 1618, 1650 and 1690. The figure for national population in 1600 rests on an estimate of the household density per square kilometre in a number of regions, which is inflated to national population using a multiplier of 5 and the ratio of the surface of the sample regions to the total territory. Values before 1600 are calculated on the basis of regional growth rates. The figure for 1618 extrapolated with the annual growth rate in 1590–1600 (Pfister 1994: 75–76, 1996: 39–40; Pfister and Fertig 2010: 5–6). Finally, the estimate for 1650 is derived using Günther Franz's conjecture that the population of towns may

have declined by a third and rural population by 40 percent in the wake of the Thirty Years' War (1618–1650). This statement, taken from his book "The Thirty Years' War and the German nation (*Volk*)" first published in 1940, comes at the end of an impressive compilation of regional population data, but the author does not derive his conclusion on the basis of an explicit procedure (Franz 1979: 59; see discussions by Pfister 1994: 76–77, and Theibault 1997).

Figure 3.1: National population (million, logarithmic scale)
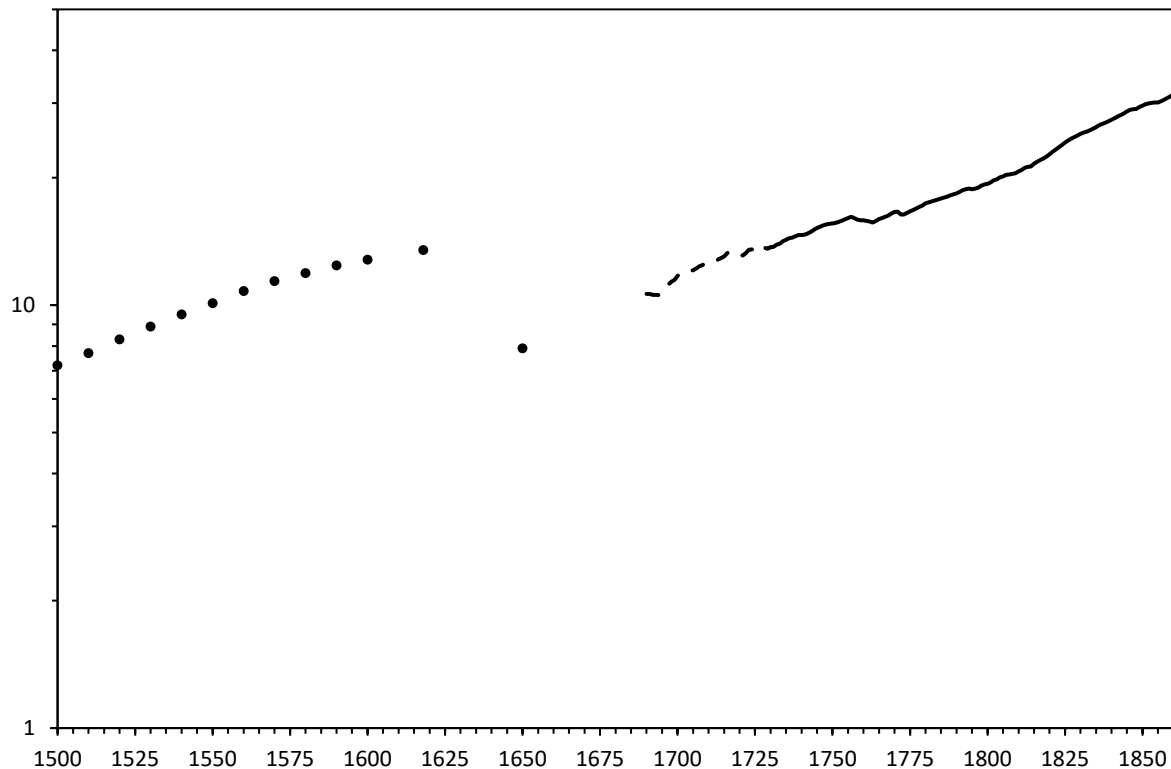
Sources: 1500–1650 Pfister and Fertig (2010: 5); 1690–1870 Fertig et al. (2018: 31–33); Pfister and Fertig (2020: Online appendix B).

The total urban population series of this study is by and large consistent with existing scholarship regarding total population. As mentioned in the previous section, total population of an uncensured sample of towns with a population of at least 5000 sometime before the Thirty Years' War and fulfilling minimal data requirements ("high data frequency sample") fell by 34 per cent in 1618–1644. Aggregate population of the whole uncensured sample (after correction) decreased by 33 per cent in 1618–1650. This result is an unexpected precision landing and buttresses Franz's conjecture with a reproducible basis.

The demographic collapse that occurred during the three decades following 1618 meant that in a number of communities the population fell below the threshold of 5000 inhabitants; the number of towns fulfilling this criterion fell from 92 to 56 in 1648; the nadir came in 1651 with 52 towns. Thus, aggregate population of a sample censured at 5000, shown in Figure 3.2, fell much stronger than aggregate population of the

uncensured sample, namely, by 47 percent in 1618–1650. The reduction of the urbanization rate from 8.2 to 7.3 percent is consistent with this.

Figure 3.2: Total urban population (thousand, logarithmic scale)
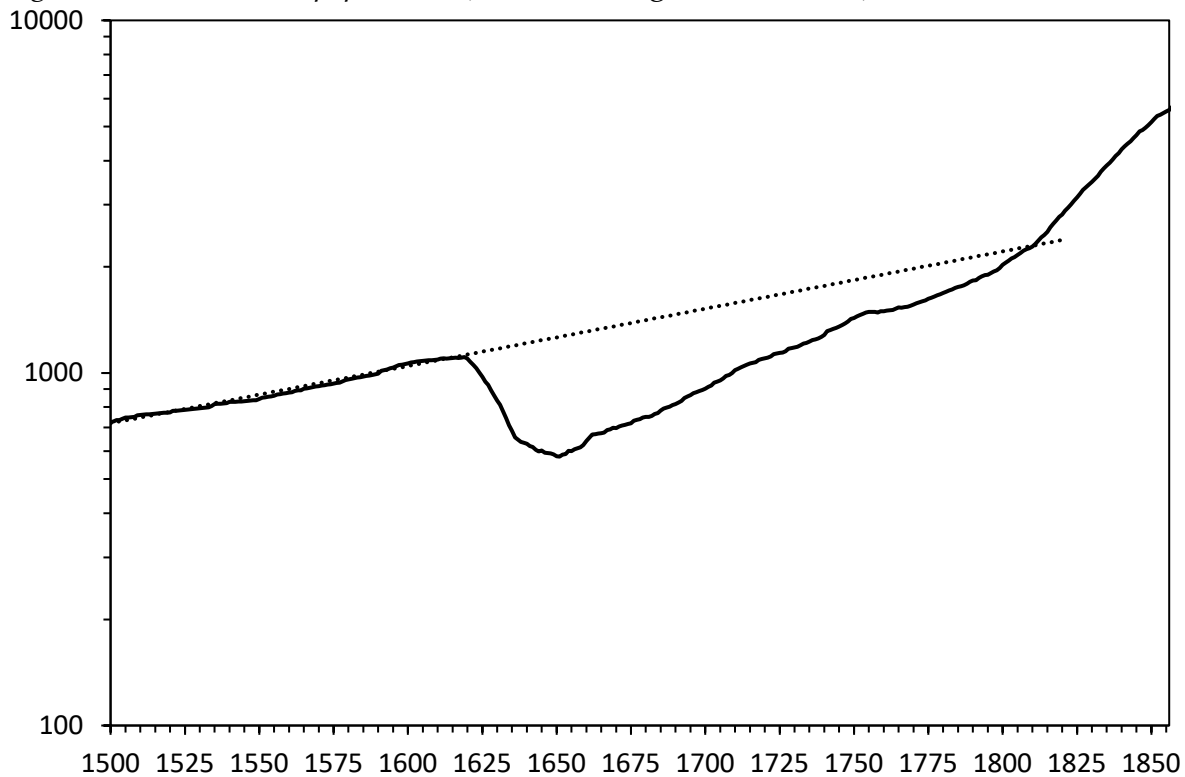
Source: Urban population database; Table A1.1.
Note: Graph shows total population of towns with at least 5000 inhabitants. Broken line is extrapolated trend in 1500–1618; trend growth rate is 0.00374.

More generally, applying a fixed criterion of 5000 inhabitants to classify a community as a town implies that the urbanization rate is positively correlated with population size: as population grows, individual communities cross the threshold of 5000 inhabitants and become classified as a town. Therefore, the increase of the urbanization rate from 7.3 in 1650 to 9.2 percent in 1750 and 10.5 percent in 1800 is consistent with the recovery and continued growth of both, urban and total population after 1650. Likewise, the lower urbanization rate in 1690 (7.7 percent) relative to the one in 1618 (8.2 percent) is consistent with the smaller absolute size of urban population in 1690 compared with 1618. This comparison also implies that existing estimates of national population around 1600 are consistent with the population series starting in 1690.

However, there is one period for which the positive correlation between population and the urbanization rate does not hold, namely, the sixteenth century. Whereas national population may have grown by 66 percent from 1500 to 1600, urban population rose by only 47 percent, resulting in a decline of the urbanization rate from 10.0 to 8.3 percent. The negative association between population growth and the urbanization rate may point to an underestimation of the rate of increase of urban population and/or an overestimation of the one of national population. Nevertheless, one should also

note the parallel decline in the urbanization rate and in the real wage of unskilled urban construction workers over the sixteenth century (Pfister 2017: 314–315). If one considers the urbanization rate as a proxy for GDP per capita, its reduction at the beginning of the modern era is consistent with the contemporaneous fall of the labour income among the urban lower class.

The trend growth rate of aggregate urban population in 1500–1618 can serve as a reference with which one can compare the observed trajectory of urban growth over the rest of the early modern period (dotted line in Figure 3.2). The nadir in the middle of the seventeenth century was followed by a century of recovery, which slowed down temporarily in the wake of the Seven Years' War (1756–1763). Despite a relatively high growth rate in 1650–1755 of 0.9 percent per annum, urban population failed to return to the growth path followed during the century preceding the Thirty Years' War. This finding underscores both the long duration of the recovery from the negative shocks suffered during the second quarter of the seventeenth century and the relatively anaemic state of urban economies in Germany during the second half of the early modern period (Pfister 1994: 77–79; Schilling 1993: 6). Only in 1811 did aggregate urban population cross the sixteenth-century trend, which reasserts the turn of the nineteenth century as a pivotal moment in Germany's history of urban growth.

Let us finally turn to a closer inspection of the urbanization rate proper (Figure 3.3 and Table 3.1). The level of a bit less than 10 per cent during the premodern era is much lower than ratios based on a juridical rather than a demographic criterion. The share of the population living in communities that possessed the rights and privileges of a town was 28 percent in Württemberg (1544), 31 percent in the Electorate of Saxony (1555), 31 percent in Hessen-Kassel (1577/85) and 27 percent in several territories of sixteenth-century Thuringia (Koerner 1959: 331; Blaschke 1967: 78; Schilling 1993: 8–9; von Hippel 2009a: 44). During the eighteenth century, the proportion of the population living in communities enjoying the status of a town in the central territories of the Kingdom of Prussia located between the western shore of the Elbe and the Oder rivers was 37 percent in 1740 and 36 percent in 1786, respectively. The parts of the kingdom located in Westphalia recorded lower values, namely 22 percent in both years, and Braunschweig-Wolfenbüttel 28 percent (1788). The urbanization rate of the Electorate of Saxony was 36 percent in 1750, the one of the Electorate of Bavaria 17 percent in 1771/81 (Blaschke 1967: 91; Denzel 1996: 374; Gehrmann 2000: 247). Thus, urban institutions in Germany did not necessarily go together with a spatial concentration of population and economic activity. While it is relevant to analyse towns on the basis of a demographic criterion in an economic perspective, it is important to acknowledge that this leaves out significant institutional and social aspects of German towns.

Figure 3.3: Urbanization rate of Germany, 1500–1855 (percent)
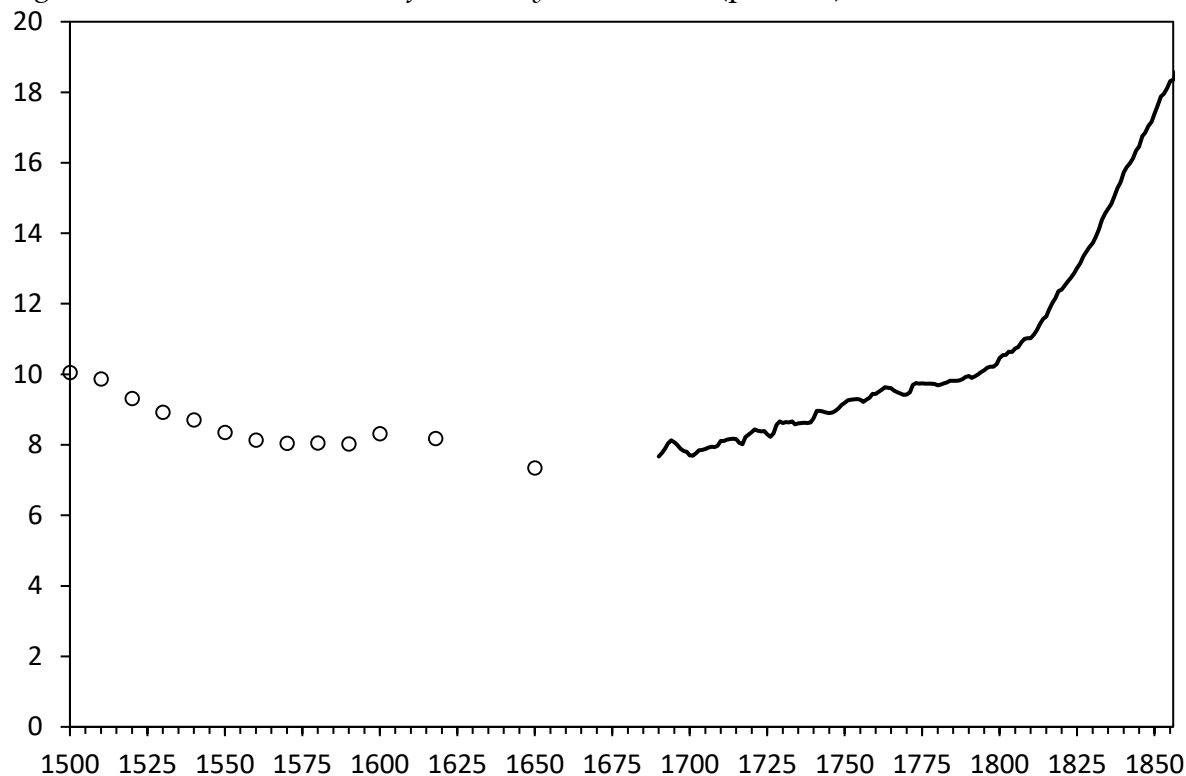
Sources: Figures 3.1 and 3.2; Table A1.1.
Note: Inclusion criterion: Towns with at least 5000 inhabitants.

Table 3.1 compares the urbanization rate of this study with earlier estimates from Bairoch (1988) and with other countries. The values of the new series are broadly similar to those of Bairoch, but there are significant upward revisions for 1500 and 1850. The latter difference is due to a broader coverage of municipalities with over 5000 inhabitants; the difference in 1500 is mainly attributable to a lower estimate of total population. As mentioned earlier, Germany's urbanization rate during the early modern period was low relative to other European countries, and it continued to be so until the middle of the nineteenth century, despite the onset of rapid industrialization from the 1830s and 1840s.[7] A first comparison relates the values for Germany with those for the large neighbouring countries in the inland of the European continent: Poland, the Habsburg Monarchy and France. From 1600, France displayed a higher urbanization rate than Germany, while in Poland and the Habsburg Monarchy the proportion of the population living in towns was lower.[8] Thus, there was a west-east gradient with respect to the level of urbanization that corresponds with the rank regarding population density. This is in line with the finding that in premodern economies differences in the level of technology corresponded with variation in population density (Galor 2011:

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[7] Bairoch (1988: 179, 215 and 221) provides rough estimates of European averages and data for an additional benchmark in 1910.

[8] However, recall from section 2.1 than numerous Polish cities are missing from the database of Bairoch et al. (1988).

chapter 3). Moreover, while France and Germany may have had similar levels of urbanization at the beginning of the modern era, the former country clearly showed a higher urbanization rate by the eighteenth century. The trajectory of the urbanization rate thus suggests a divergence with respect to economic development between these two large countries in the sixteenth and seventeenth centuries.

Table 3.1: Urbanization rates of European countries in key years, 1500–1850 (percent)

	1500	1600	1700	1750	1800	1850
Germany, this study	10	8	8	9	10	17
Germany	8	8	8	9	9	15
Poland	6	8	4	4	5	
Austria, Hungary, Czecho-slovakia	5	5	5	7	8	
France	9	11	12	13	13	19
Belgium (Southern Netherlands)	24	29	31	22	22	34
Netherlands	29	35	39	36	34	39
England	7	10	17	23	29	45
Spain	12	21	11	14	24	32
Northern and Central Italy	21	18	17	18	18	16

Sources: First line: Figure 3.3 above and Table A1.1; Spain: Álvarez-Nogal and Prados de la Escosura (2007: 337); Northern and Central Italy: Malanima (2005: 108); all other countries: Allen (2000: 8–9) based on Bairoch (1988) and Bairoch et al. (1988).
Notes: Urban population refers to towns with at least 5000 inhabitants. The figure for Northern and Central Italy in 1850 refers to 1861. Figures for Spain relate to 1531 (instead of 1500), 1591 (instead of 1600), 1787 (instead of 1800) and 1857 (instead of 1850).

A second comparison focuses on the smaller economies at the north-western and southern margin of the European continent, including England. All these countries enjoyed easy access to sea transport and engaged heavily in long-distance trade. Northern and Central Italy and the Netherlands (both the Southern Netherlands, which correspond to present-day Belgium, and the Northern Netherlands, which formed the United Provinces in the late sixteenth century) constituted the economic heartland of Europe in the fifteenth and sixteenth centuries. In 1500 and 1600 the urbanization rates of these two regions were 20 percent or higher, that is, at least twice the value prevailing in the large inland zones of the continent. This suggests a close connection between access to seaborne trade and economic development in this period (Acemoglu et al. 2005). Whereas the Netherlands kept their leading position until the beginning of the nineteenth century, Northern and Central Italy suffered a decline in the level of urbanization. Divergence was particularly marked in the first half of the nineteenth century: The further reduction of the proportion of the population living in towns in Italy contrasted with a sharp increase in Germany, so that the countries showed similar levels of urbanization by the middle of the nineteenth century. This

comparison underscores the relevance of the structural break in Germany's economic development at the beginning of the nineteenth century.

England's experience contrasts with the one of mainland Europe in that the urbanization rate rose continuously over the sixteenth to nineteenth centuries. England entered the modern age with one of the lowest urbanization rates in Europe. By 1700, the country had a considerably higher urbanization rate than the large economies of mainland Europe and in the first half of the eighteenth century it overtook Italy. Around 1850, it had the highest proportion of the population living in town across Europe. Thus, the trajectory of the urbanization rate traces Britain's ascent from a relatively backward area at the margin of Europe to global technological supremacy. In a wider perspective, the picture that results from comparing urbanization rates across different countries is consistent with evidence on the so-called Little Divergence or the reversal of fortunes within Europe on the basis of real wages and estimates of GDP per capita (Malanima 2013; Broadberry et al. 2015: chapter 10; Pfister 2017). This corroborates the interpretation of the urbanization rate as a proxy for the level of material welfare. Within the European Little Divergence, Germany pursued an unspectacular middle course of relative urban stagnation, rather than decline, during the early modern period, followed by structural break to a more dynamic development path at the beginning of the nineteenth century.

3.2 Contrasting regional experiences

Table 3.2 shows urbanization rates in in sixteen regions from 1815 to 1858. This was a period when administrative boundaries remained stable, and from 1819 there were increasingly regular censuses, usually in intervals of three years. Smaller territories, whose urbanization rate is determined by the population of just one or a few towns, are omitted from the analysis. The largest of them are Anhalt (population in 1000 in 1849: 154), Braunschweig (270), Lippe-Detmold (105), Nassau (426) and Oldenburg (274). The analysis also excludes Berlin and the four independent city states of Lübeck, Hamburg, Bremen and Frankfurt.

In 1849, urbanization rates were moderately correlated with a development index based on information concerning the structure of employment and the relationship between latter and regional GDP per capita in 1913 (Frank 1994: Appendix p. XXX; Pearson r=0.61). The existence of a positive relationship between the two variables confirms the interpretation of the urbanization rate as an indicator of economic development. It is not clear whether the relative weakness of the association should be given substantive meaning—it could be that the two variables measure different aspects of economic development—or whether it simply reflects poor data quality. In particular, early occupational censuses have proven to be very inaccurate (Hoffmann 2013).

At least in part, the pattern of regional urbanization rates in 1815/19–1858 corresponds with longstanding disparities of regional development that continued to persist well into the twentieth century (Frank 1994; Wolf 2019). Saxony—both the industrialized southern part and the more agricultural part in the north located in Prussia—

and the region situated on the lower Rhine (Rheinprovinz) stand out as regions with high urbanization rates both in 1815/19 and 1858. By contrast, Baden, Württemberg, Thuringia, Silesia and Westphalia had shares of urban population below average throughout the entire period under study. Some regions experienced faster than average urban growth, such as Brandenburg, Pomerania, Westphalia and Württemberg, whereas others were marked by relative stagnation, such as Hessen-Kassel, Holstein and the Province of Saxony.

Table 3.2: Regional urbanization rates, 1815–1858 (percent)

	1815	1819	1840	1849	1858
Bayern	9.3	9.4	11.3	11.8	13.8
Baden	4.9	4.9	7.4	8.0	9.4
Württemberg	5.7	6.2	10.3	11.2	11.8
Hessen-Darmstadt	9.9	11.1	12.2	13.4	14.4
Hessen-Kassel	9.7	9.5	11.2	11.7	12.1
Hannover	8.3	9.1	9.7	11.6	14.3
Thüringen	6.6	6.6	10.6	10.8	12.0
Sachsen (Kingdom)	12.9	13.2	18.8	21.0	23.9
Mecklenburg	9.5	9.7	12.5	13.0	15.6
Holstein	13.0	12.8	13.4	15.7	17.0
Kingdom of Prussia					
Pommern	9.3	9.3	13.6	14.9	18.0
Schlesien	7.4	8.4	10.6	11.6	13.2
Brandenburg	9.3	9.0	14.6	16.3	19.8
Sachsen (Prussian Province)	16.4	17.9	21.0	22.1	22.7
Westfalen	5.4	5.6	7.5	9.1	12.7
Rheinprovinz	12.4	14.5	20.0	22.1	24.9
Unweighted mean	9.4	9.8	12.8	14.0	16.0
Standard deviation	3.1	3.4	4.1	4.4	4.7
Coefficient of variation	0.33	0.35	0.32	0.31	0.29

Sources: Urban population database; Fertig et al. (2018: Online Appendix 2, GESIS ZA8609).

Notes: Inclusion criterion: Towns with at least 5000 inhabitants. Brandenburg excludes Berlin.

The presence of contrasting trajectories such as those of Holstein and Westphalia raises the question whether regional urbanization rates converged during the period under study. Figure 3.4 indeed suggests the presence of beta-convergence: Regions with a low urbanization rate in 1819 increased their shares of the population living in towns faster than regions having a high level of urbanization already in 1819.[9] In the lower right quadrant we find regions that had experienced an early development

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9   I prefer 1819 as initial benchmark over 1815 because the information for 1819 is of better quality than for 1815. Results are robust to the choice of the initial year.

either of commercial agriculture (Holstein, Prussian province of Saxony). Near the top left corner of Figure 3.4 we find Baden, Württemberg, Thuringia, Brandenburg and Westphalia and, where low levels of urbanization in 1819 were followed by rapid urban growth during the next four decades. Four regions show higher urban growth than implied by convergence regression line, namely, Westphalia, Brandenburg, the Kingdom of Saxony and the lower Rhineland. Three territories were emerging regions; Brandenburg may have an experienced a development of its service sector in response to the development of commercial agriculture fomented by the growth of Berlin (see below). The particularly strong increase of the urbanization rate in Westphalia can be related to the shift from charcoal to coal as the principal source of energy in iron processing, which went together with a spatial concentration both of energy production and the manufacture of heavy iron goods (Tilly and Kopsidis 2020: chapter 2).

Figure 3.4: Beta-convergence of urbanization rates across sixteen regions, 1819–18
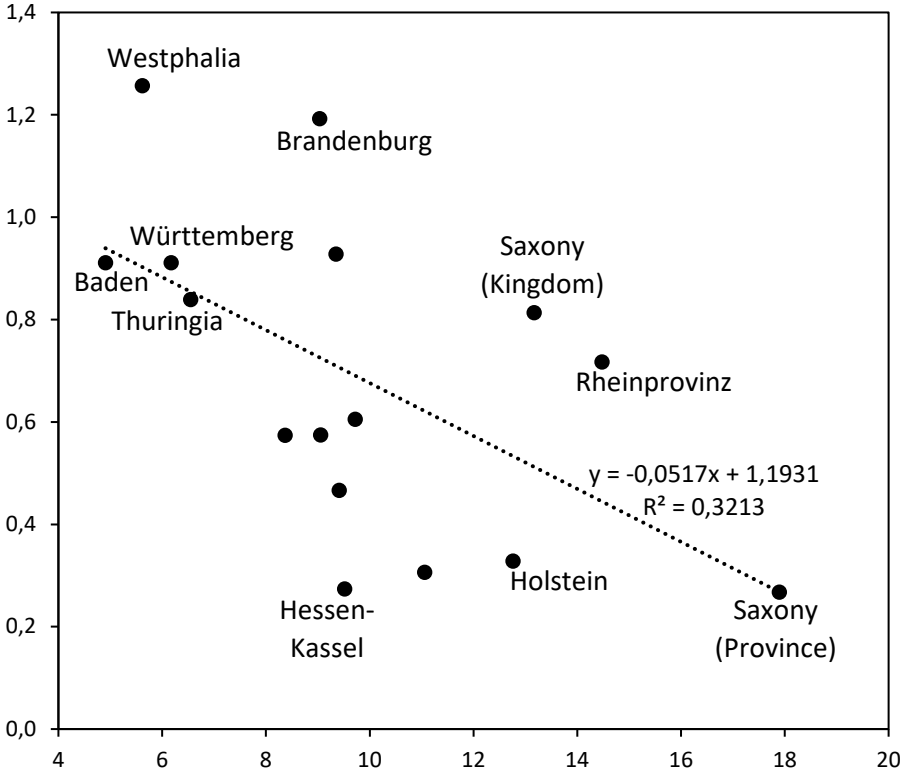
Source: Table 3.2.

Note: Horizontal axis: urbanization rate in 1819; vertical axis: Increase of urbanization rate, 1858 vs. 1819.

Overall, the finding that regional levels of development converged during the transition to the first stage of industrialization is quite surprising. Given that early industry developed in relatively few leading branches of manufacturing and was concentrated in a few regions, one would expect that regional urbanization levels would diverge rather than converge during this era. Future research will have to examine whether, beyond the interplay of the contrasting regional experiences mentioned above, general convergence forces became operative. A first potential candidate is

infrastructure development in the form of road and railroad construction, which may have reduced regional inequalities in terms of the size of the internal market and market access (Hornung 2015; Keller and Shiue 2016). Secondly, the reorganization of Germany's state system in 1803–1815, together with a rationalization of tax collection, not least following the formation of the customs union in 1833, may have favoured a process of decentralized state growth. This argument is possibly relevant because the expansion of regional state capitals represented an important element of urban growth during the first half of the nineteenth century (Pfister 2020: 38–39). Finally, the convergence of urbanization levels in 1815/19–1858 could reflect a long process of reconstruction after the severe shocks of the Revolutionary and Napoleonic Wars, which probably affected individual regions in an asymmetrical manner (Acemoglu et al. 2011: 3298).

Probably as a consequence of beta-convergence, regional heterogeneity measured with the coefficient of variation decreased somewhat from 0.33–0.35 in 1815/19 to 0.29 in 1858 (last line of Table 3.2). In other words, there was also some sigma-convergence. Recall, however, that the analysis does not include Berlin and the independent city states. Several of these towns experienced fast population growth, so that regional disparities in the concentration of the population may not have diminished. The regional variation in urbanisation rates based on the demographic criterion of 5000 inhabitants was significantly higher than that of urbanisation rates based on a legal definition: the regional urbanisation rates mentioned in section 3.1, calculated on the basis of the latter criterion, have a coefficient of variation of only 0.22. Urban institutions were universally available, but the circumstances under which they were conducive to spatial concentration of the population were highly selective.

Figure 3.5 complements the discussion of regional urbanization trends in the first half of the nineteenth century with information on four territories with more or less consistent population estimates reaching back into the eighteenth century. Saxony lost more than half of its territory in 1815 comprising 40 percent of its population, but in the wake of the dissolution of the Holy Roman Empire its status was raised from Electorate to Kingdom. The broken black line in Figure 3.4 shows the proportion of the population of the pre-1815 Electorate living in towns with at least 5000 inhabitants; the solid black line is based on the urban population within the borders of the Kingdom of 1815. It is assumed that this area comprised the same constant proportion of the total population of the Electorate in 1743–1814 as in 1815.

Around 1750, the urbanization rate of the Electorate of Saxony was on a similar level to that of Germany as a whole, and fell slightly during the second half the eighteenth century; in the early 1800s, it was about 1.5 percent below the national figure. Apparently, the decline was mostly due to relative urban stagnation in the southern part of the territory (the part which formed the later Kingdom of Saxony; solid black line in Figure 3.5), where the development of decentralized manufacture production, mostly in textiles, led to a rapid increase of the non-agricultural population in the countryside and small manufacturing towns with less than 5000 inhabitants (Weiss

1993: 104; Keller 2001: 82–86, 432; Schäfer 2016: chapter 2). This, together with additional evidence presented below, suggests that the dominance of decentralized proto-industries in the development of non-agricultural activities constitutes an important factor behind the stagnation of Germany's urbanization rate in the eighteenth century, notably in comparison with England (cf. Table 3.1; for the general argument, see Kriedte 1982).

Figure 3.5: Regional urbanization rates, 1740–1860 (percent)
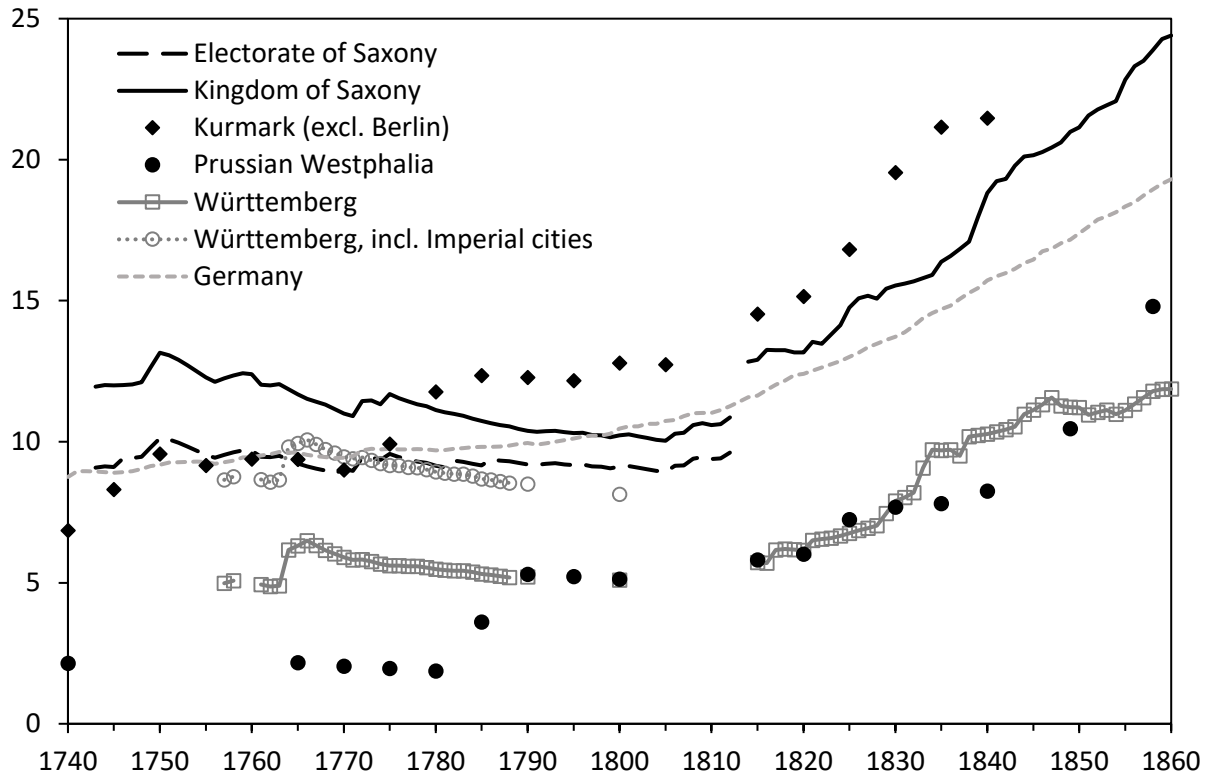
Sources: Urban population: Urban population database. Regional population: Saxony: Schirmer (1996: 57–58); Fertig et al. (2018: Online Appendix 2, GESIS ZA8609). Kurmark and Prussian Westphalia: Gehrmann (2000: 430, 480; civilian population only); population of Westphalia in 1849 and 1858 from Hohorst (1977), downloaded from GESIS ZA8049, Table A.5. Württemberg: Hauptstaatsarchiv Stuttgart A 8 154–156 (1790), 185–188 (1800), 218 (1757–1780); Fertig et al. (2018: Online Appendix 2, GESIS ZA8609).

Notes: Inclusion criterion: Towns with at least 5000 inhabitants. Gehrmann's estimate of the population of the Kurmark in 1815 is 15 percent below the value in 1805 (Gehrmann 2000: 430). Therefore, I omit the towns of the Altmark, which was allocated to the Province of Saxony in 1815, and the newly acquired towns of Lower Lusatia from the calculation of the urbanization rate. Pre-1803 "Westphalian Prussia" refers to Minden-Ravensberg, Tecklenburg and Mark. From 1815 data refer to the Regierungsbezirke of Minden and Arnsberg. "Württemberg, incl. Imperial cities" includes the population of Esslingen, Heilbronn and Reutlingen into the computation of total and urban population. These three towns were surrounded by territory of the Duchy of Württemberg.

In the 1810s, Saxony's urbanization rate crossed the national rate again;[10] over the period 1815–1849 it grew considerably faster than the national rate (1.5 vs. 1.2 percent) and reached 21 percent in 1850. This rapid trend switch can be related to the development of centralized industries, most notably in the wake of the mechanization of cotton spinning (Schäfer 2016: chapters 3, 4).

The Kurmark is the part of Brandenburg situated west of the Oder river, and it constitutes the heartland of the Kingdom of Prussia. In many parts, Medieval colonization was pivotal to the development of agricultural techniques and social institutions comparable to those prevailing in Carolingian Europe. During the early modern era, the territory remained a thinly populated agricultural area; population in 1800 was less than a third compared with the Electorate of Saxony. On this background, both the relatively high urbanization rate and its rapid rise is quite a surprise (diamonds in Figure 3.5). Starting at a level well below the national average in 1740, the proportion of the regional population living in towns with at least 5000 inhabitants rose well above the national average in two steps, namely, in the 1740s and the 1770s. The growth of the king's residence town, Potsdam, constitutes a relevant aspect of this process: From 1770 to 1790 the share of Potsdam in the provincial population rose from 3.1 to 5.1 percent. Nevertheless, the continuous addition of smaller towns crossing the threshold of 5000 also contributed to the growth of the urban population. Whereas the values in 1805 and 1815 are difficult to compare because of changes of administrative boundaries (see note to Figure 3.5) it is noteworthy that the urbanization rate continued to rise at a fast pace after 1815; the trend growth rate in 1815–1840 is a high 1.8 percent per annum (national trend: 1.2 percent).

A possible explanation is the rise of demand for agricultural products resulting from the rapid demographic expansion of Berlin, the kingdom's capital (1.0 percent per annum in 1740–1805 and 2.0 percent in 1815–1849). By 1805, it added a quarter to the population of the Kurmark, and in 1850 44 percent. The resulting rise of commercial agriculture went together with the development of services, which may have been concentrated in urban locations (cf. Harnisch 1984; Kopsidis and Wolf 2012: 646–649). In this view, the rise of Berlin stimulated both, agricultural growth and the development of a regional urban network.

A regional example from northwest Germany is provided by the possessions of Brandenburg-Prussia in Westphalia, for which we have information on the population at several points in the eighteenth century (solid circles in Figure 3.5). These territories include Minden-Ravensberg, Tecklenburg and Mark. To render the urbanization rate

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[10] The gap of the solid grey line is in 1813, for which there is a gap in total population. The strong increase of the urban population rate between 1812 (10.9 percent) and 1816 (13.3 percent) is largely due to the fact that the number of towns with at least 5000 inhabitants increased from nine to fourteen between these two years; therefore, it is largely fortuitous. Without these five towns, the urbanization rate in 1816 would have been only 11.2 percent.

for this area roughly comparable with later periods, the data from 1815 refer to only two of the three administrative districts (*Regierungsbezirke*) of Westphalia, namely Arnsberg and Minden.

Westphalia's urbanization was very low until the last decade of the eighteenth century. This was because only town counted more than 5000 inhabitants—Soest in 1740 and Bielefeld in 1765. The jump to a bit more than 5 percent in 1790 results from the accession of two additional municipalities to the sample—Soest (which counted less than 5000 inhabitants from the 1760s to the early 1780s) and Minden. The pace of urban growth quickened the first half of the nineteenth century; the urbanization rate increased at an annual rate of 1.6 percent in 1815–1849. While this was faster than the national growth rate, Westphalia's urbanization level still remained well below the national average around the middle of the nineteenth century. Only with the transition to deep shaft coal mining and the spread of puddling furnaces from the 1840s did the formation of industrial urban agglomerations really take off (Tilly and Kopsidis 2020: chapter 2).

As in the south-eastern part of Saxony, the Prussian possessions in Westphalia had several regional export industries long before the onset of industrialization. The most important ones were the linen district around Bielefeld, Minden and Tecklenburg, and the iron processing district in the southern Mark (Reininghaus 2018: volume 2). These were mostly decentralized industries: Linen manufacture employed many peasants who grew their own flax, and iron processing required the water power of streams. Towns fulfilled important coordinating functions but hosted only a small part of the work force. Hence many old industrial towns, such as Altena, Iserlohn and Lüdenscheid, which had specialized in the manufacture of iron wire, passed the threshold of 5000 inhabitants only in the course of the nineteenth century. In sum, the example of the parts of Westphalia that belonged to Brandenburg-Prussia already in the early modern era corroborates the view that the development of dispersed manufacture or proto-industries went together with low levels of urbanization.

The last regional example is from southwestern Germany, namely, Württemberg (grey circles and squares in Figure 3.5). Whereas the figures for the nineteenth century refer to the Kingdom of Württemberg, those for the eighteenth century relate to the Duchy of Württemberg, whose population was less than half the population of the kingdom that created during the Napoleonic Wars. Interpreting the figures for the eighteenth century is complicated by the fact that in many parts of Germany, apart from Bavaria and the large territories in the north and north-east, Imperial cities were quite common. These depended solely from the Emperor and constituted an own estate in the Imperial Diet. Territories ruled by princes formed in the surrounding countryside. In Württemberg, this pattern led to a situation in which the lands of the Duke more or less surrounded three Imperial cities, namely, Esslingen, Heilbronn and Reutlingen. Since these towns certainly fulfilled economic functions for the population of the surrounding ducal territory, it makes sense to include them into the calculation of a regional urbanization rate. According to Figure 3.5 this raises the urbanization rate

from about 5 to about 8.5 percent. More generally, it is important to stress that in many parts of Germany state formation initially did not include independent towns. The resulting heterogeneity of legal institutions may have constrained urban growth.

Excluding the neighbouring Imperial cities, Württemberg had a similarly low urbanization rate during the second half of the eighteenth century as the Prussian parts of Westphalia in the 1790s, namely, about 5 percent. The temporary increase in 1764 is related to the (second) relocation of the Duke's residence from Stuttgart to Ludwigsburg. The decline over the following decades may be partly due to the acquisition of small new territories that are not accounted for in the population data. In a national comparison, Württemberg's urbanization rate was low and stagnant during the second half of the eighteenth century. If we include the three adjacent Imperial cities, the level of urbanization around 1760 was similar to the national average, as it probably was in the middle of the sixteenth century: In 1545, the urbanization rate of the Duchy alone was 2.5 percent, as only Stuttgart had more than 5000 inhabitants (von Hippel 2009a: 41). Including the three Imperial cities raises the urbanization rate of that year to 9.9 percent.

In 1803–1810, Württemberg acquired many former Imperial cities, but also many small rural dominions. Consequently, the urbanization rate of the new Kingdom in 1815 was little above the one of the Duchy in 1800 (5.7 vs. 5.1 percent). In the following two decades there was some urban growth in the two decades that followed, but this slowed down again in the early 1830s. The experience of Württemberg with regard to the proportion of the population living in municipalities with at least 5000 inhabitants can be taken as representative for those parts of Germany where non-agricultural activities were slow to develop. To be sure, there were some decentralized proto-industries in the eighteenth century, but they stagnated. In the middle decades of the nineteenth century, Württemberg was largely bypassed by the first wave of industrialization that centred on heavy industry and cotton processing (Tilly and Kopsidis 2020: chapter 2). Hence, apart from state formation there were few forces promoting the agglomeration of the economically active population in central places.

4 Conclusion

The purpose of this study is to improve the basis for research into the quantitative urban history of Germany in 1500–1850. To this end, I enlarge the database of Bairoch et al. (1988) in three respects: First, I extend the body of consulted works, so that coverage is more complete. Second, I increase the resolution of the available information by documenting all information on the population size of a town and by interpolating and extrapolating annual population series for each town. Finally, regional coverage is made consistent with the boundaries of historical Germany that are used by recent research in historical demography. This makes it possible to derive robust estimates of the national urbanization rate.

The resulting estimates for total urban population and the urbanization rate suggest that from about 1500 to 1800 the proportion of Germany's population living in municipalities with at least 5000 inhabitants was constant at somewhat below 10 percent. This is consistent with the stagnation of the real wage and thereby corroborates the validity of the estimate of total population, which is very tentative before 1690. Specifically, I confirm guesses by earlier studies that the urban population fell by 33 percent in the wake of the Thirty Years' War (1618–1648). In the seventeenth and eighteenth centuries, small variations of the urbanization rate were correlated with population growth, which is to be expected in an economy with stagnant per capita GDP but growing population. In the sixteenth century, by contrast, the urbanization rate fell despite vigorous demographic expansion, but this is consistent with the simultaneous sharp decline in real wages.

The proportion of the population living in communities that enjoyed the legal status and the privilege of a town was much higher than the urbanization rate based on the cut-off criterion of 5000 inhabitants: between one fifth and one third vs. less than one tenth in the early modern period. Regional dispersion of the urbanization rate (based on the criterion of 5000 inhabitants) was also higher than that concerning the proportion of the population living in municipalities with the legal status of a town. Obviously, the demographic and juridical definitions of a town capture different aspects of urban phenomena. Urban institutions were universally available, but the circumstances under which they were conducive to spatial concentration of the population were highly selective.

Germany's premodern urbanization rate of slightly below 10 percent was low by European standards. In the (Southern and Northern) Netherlands and Northern and Central Italy, the leading European economies at the dawn of the modern era, urbanization rates were already more than twice as high around 1500. Population density and access to seaborne trade appear as the most important correlates of the urbanization rate at that time. Around 1800, Germany's urbanization rate began to increase, and by the middle of the nineteenth century it surpassed the one of Northern and Central Italy. This is consistent with research into labour demand, the behaviour of the Malthusian checks and the transition from land-augmenting to labour-augmenting technological progress in agriculture. The trajectory of the urbanization rate corroborates the view that the German economy experienced a structural break around 1800, which propelled it from (Malthusian) stagnation to the post-Malthusian era. Note that this process took place several decades before the onset of rapid industrialization in the 1830s and 1840s.

In combination with recent reconstructions of regional population series, the new urban population database can be used to calculate urbanization rates for sixteen regions in 1815–1858 and four regions back to the 1740s. Contrary to intuition, regional urbanization rates converged in 1815/19 to 1858. Since Germany transited to the first stage of industrialization during that time, which saw the emergence of regional manufacturing clusters, one would expect that regional urbanization rates diverged rather

than converged. The trajectory of the urbanization rate of individual regions between the 1740s and the 1850s suggest state formation, (proto-)industrialization and regional population density turn as possible explanations of urban growth during this period. It is left to future research to systematically investigate the forces that drove city size and the spatial pattern of the German economy in first part of the modern era from the sixteenth to the nineteenth centuries.

Appendix

A1 Principal data series

Table A1.1: Total urban population and national urbanization rate (percent)

	Total urban population	Urbanization rate						
1500	723546	10.0	1540	827434	8.7	1583	969590	
1501	729080		1541	827950		1584	973616	
1502	734512		1542	828514		1585	977570	
1503	735455		1543	829483		1586	981251	
1504	740964		1544	830442		1587	983195	
1505	746649		1545	831478		1588	987300	
1506	748096		1546	832768		1589	991601	
1507	749587		1547	834125		1590	995858	8.0
1508	751152		1548	835994		1591	1013455	
1509	758740		1549	837385		1592	1017802	
1510	760084	9.9	1550	843853	8.4	1593	1022139	
1511	761446		1551	850860		1594	1030803	
1512	762745		1552	853127		1595	1034495	
1513	763916		1553	855573		1596	1043311	
1514	765107		1554	858188		1597	1052181	
1515	766317		1555	860832		1598	1055861	
1516	767545		1556	868017		1599	1059689	
1517	768880		1557	870736		1600	1064773	8.3
1518	770505		1558	873521		1601	1071626	
1519	771694		1559	876324		1602	1074009	
1520	773178	9.3	1560	879139	8.1	1603	1076691	
1521	780328		1561	881953		1604	1079359	
1522	780750		1562	889189		1605	1082146	
1523	782352		1563	891956		1606	1084906	
1524	783981		1564	892770		1607	1087712	
1525	785566		1565	902869		1608	1085732	
1526	787039		1566	904205		1609	1088408	
1527	788886		1567	907543		1610	1091040	
1528	790351		1568	910976		1611	1097226	
1529	792116		1569	914447		1612	1099647	
1530	794125	8.9	1570	917677	8.0	1613	1097872	
1531	795695		1571	920713		1614	1100603	
1532	797295		1572	923705		1615	1103042	
1533	798924		1573	926636		1616	1105512	
1534	805122		1574	929679		1617	1102813	
1535	815472		1575	932898		1618	1104897	8.2
1536	816916		1576	936116		1619	1108774	
1537	818382		1577	938773		1620	1099053	
1538	819871		1578	946571		1621	1075211	
1539	821382		1579	954584		1622	1052472	
			1580	958090	8.1	1623	1030296	
			1581	961873		1624	1002663	
			1582	965706		1625	974021	

Year	Value	Rate		Year	Value	Rate		Year	Value	Rate
1626	945036			1674	716420			1722	1114022	8.4
1627	925445			1675	720219			1723	1131643	8.4
1628	892130			1676	732477			1724	1135989	8.4
1629	860829			1677	735822			1725	1140198	8.3
1630	835750			1678	739416			1726	1143486	8.2
1631	812250			1679	747514			1727	1151547	8.3
1632	776291			1680	751131			1728	1172409	8.6
1633	744411			1681	751030			1729	1176722	8.7
1634	710281			1682	755562			1730	1180576	8.6
1635	686177			1683	764762			1731	1187332	8.6
1636	656642			1684	769505			1732	1198788	8.6
1637	646326			1685	783290			1733	1210822	8.7
1638	637263			1686	792616			1734	1216131	8.6
1639	633049			1687	797622			1735	1227467	8.6
1640	629393			1688	802626			1736	1238813	8.6
1641	620712			1689	811372			1737	1245661	8.6
1642	617165			1690	815542	7.7		1738	1252773	8.6
1643	604616			1691	824700	7.8		1739	1264676	8.6
1644	599100			1692	833966	7.9		1740	1281326	8.8
1645	602980			1693	848546	8.0		1741	1313416	9.0
1646	593518			1694	858614	8.1		1742	1323023	9.0
1647	592332			1695	864431	8.1		1743	1332892	8.9
1648	591595			1696	875174	8.0		1744	1342758	8.9
1649	588025			1697	881677	7.9		1745	1352877	8.9
1650	580606	7.3		1698	888443	7.8		1746	1367070	8.9
1651	579069			1699	895231	7.8		1747	1381790	9.0
1652	586404			1700	902655	7.7		1748	1400360	9.0
1653	588857			1701	914252	7.7		1749	1422652	9.1
1654	601115			1702	921421	7.8		1750	1431804	9.2
1655	600008			1703	937838	7.8		1751	1448020	9.3
1656	608149			1704	945198	7.9		1752	1459753	9.3
1657	611905			1705	952853	7.9		1753	1471348	9.3
1658	615777			1706	964232	7.9		1754	1482977	9.3
1659	624270			1707	980444	7.9		1755	1491011	9.3
1660	641975			1708	987388	7.9		1756	1490598	9.2
1661	655143			1709	999171	8.0		1757	1490435	9.3
1662	668467			1710	1017867	8.1		1758	1485152	9.3
1663	670489			1711	1027724	8.1		1759	1497719	9.4
1664	672531			1712	1036783	8.1		1760	1497249	9.4
1665	674725			1713	1045999	8.2		1761	1503877	9.5
1666	677252			1714	1054896	8.2		1762	1505935	9.6
1667	688718			1715	1063595	8.2		1763	1508415	9.6
1668	691624			1716	1068134	8.1		1764	1520468	9.6
1669	699217			1717	1073944	8.0		1765	1533971	9.6
1670	697845			1718	1089276	8.2		1766	1531669	9.5
1671	705511			1719	1095762	8.3		1767	1535901	9.5
1672	709060			1720	1100320	8.4		1768	1540829	9.5
1673	712662			1721	1105193	8.4		1769	1550356	9.4

1770	1564750	9.4	1801	2055039	10.5	1832	3625491	14.1
1771	1577851	9.5	1802	2081068	10.6	1833	3725991	14.4
1772	1586984	9.7	1803	2111372	10.6	1834	3801546	14.6
1773	1596665	9.8	1804	2131488	10.6	1835	3873413	14.7
1774	1607857	9.7	1805	2162528	10.7	1836	3945331	14.8
1775	1623800	9.7	1806	2186853	10.8	1837	4032773	15.1
1776	1632709	9.7	1807	2221647	10.9	1838	4121859	15.3
1777	1646533	9.7	1808	2246914	11.0	1839	4200189	15.4
1778	1660457	9.7	1809	2259997	11.0	1840	4308638	15.7
1779	1670395	9.7	1810	2284122	11.0	1841	4388369	15.9
1780	1685304	9.7	1811	2321763	11.1	1842	4461240	16.0
1781	1697952	9.7	1812	2376708	11.3	1843	4537279	16.1
1782	1714592	9.7	1813	2424671	11.4	1844	4638741	16.3
1783	1726077	9.8	1814	2460850	11.6	1845	4726409	16.5
1784	1741853	9.8	1815	2513279	11.6	1846	4849175	16.8
1785	1753173	9.8	1816	2584970	11.8	1847	4890314	16.8
1786	1761692	9.8	1817	2647785	12.0	1848	4960279	17.0
1787	1773541	9.8	1818	2704170	12.2	1849	5041335	17.2
1788	1792488	9.9	1819	2772991	12.4	1850	5148210	17.4
1789	1812952	9.9	1820	2815962	12.4	1851	5259479	17.6
1790	1827678	9.9	1821	2881954	12.5	1852	5360815	17.9
1791	1833769	9.9	1822	2944364	12.6	1853	5408544	18.0
1792	1858676	9.9	1823	3008185	12.7	1854	5467936	18.1
1793	1877284	10.0	1824	3075176	12.9	1855	5529565	18.3
1794	1895316	10.1	1825	3150324	13.0	1856	5611617	18.5
1795	1900171	10.1	1826	3221464	13.1	1857	5728047	18.7
1796	1920732	10.2	1827	3303684	13.4	1858	5842263	18.9
1797	1937589	10.2	1828	3362417	13.5	1859	5962303	19.1
1798	1954869	10.2	1829	3426077	13.6	1860	6093668	19.3
1799	1982435	10.3	1830	3482887	13.7			
1800	2025392	10.5	1831	3550238	13.9			

A2 Additional details on data handling

A2.1 Towns not included in database

A few towns had more than 5000 inhabitants at some time between 1500 and 1850 but are not included in the database for various reasons. What follows provides the details (figures refer to thousands of inhabitants).

Breisach (Baden) 1697 4.6 plus garrison of up to 10 until the eighteenth century, 1812 2.514 (Keyser 1959: 199). Exact population size unknown.

Eningen unter Achalm (Württemberg) was and extended rural parish. In 1834–1861 it has between 4217 and 4991 inhabitants.

Hückeswagen (Rheinprovinz) was large rural parish, which received the status of a town in 1859.

Krempe (Holstein) 4–5 at the time of maximum prosperity around 1600 (Keyser 1939: 415). Next years with figures are 1803 1.044 and 1855 1.288.

Schorndorf (Württemberg) 1550 4.2, 1618 5, 1636 0.2, 1654 0.907, 1661 1.164, 1676 1.48 (Keyser 1962: 200). I do not consider Kayser's figure for 1618 because it is most likely exaggerated; see von Hippel (2009a: 33, 2009b: 33).

A2.2 Towns located in Posen, East and West Prussia, and Schleswig

These four administrative units are located outside the historical territory defined as Germany in this study (section 2 of the main text). Information provided by contemporary statistical compilations, the database underlying (Matzeratz 1985) and by Kaiser (1939) is included in the database, but it does not enter the analysis. No effort is made to provide complete coverage for these regions. The following list groups these towns according to nineteenth-century administrative borders. Where not stated otherwise, towns located in historical East Prussia, West Prussia and Posen are part of present-day Poland; the three towns in (South) Schleswig are part of present-day Germany.

East Prussia: Braunsberg/Braniewo, Gumbinnen/Gussew (Russia), Heilsberg/Lidzbark Warmiński, Insterburg/Tschernjachowsk (Russia), Königsberg/Kaliningrad (Russia), Memel/Klaipėda (Lithuania), Rastenburg/Kętrzyn, Tilsit/Sowetsk (Russia).

West Prussia: Culm/Chełmno, Danzig/Gdansk, Deutsch Krone/Wałcz, Elbing/Elbląg, Graudenz/Grudziądz, Konitz/Chojnice, Marienburg/Malbork, Marienwerder/Kwidzyn, Preußisch Stargard/Starogard Gdański, Thorn/Toruń.

Posen: Bromberg/Bydgoszcz, Fraustadt/Wschowa, Gnesen/Gniezno, Hohensalza/Inowrocław, Kempen/Kępno, Krotoszyn, Lissa/Leszno, Meseritz/Międzyrzecz, Ostrowo/Ostrów Wielkopolski, Pleschen/Pleszew, Posen/Posnan, Rawitsch/Rawicz, Rogasen/Rogoźno, Schneidemühl/Piła, Schwerin an der Warthe/Skwierzyna.

Schleswig: Flensburg, Husum, Schleswig.

A2.3 Cases with missing first data point

These are cases where there is no information on population size in 1500 and where the first figure is above 4500.

Where possible, a value below 4500 or a value for 1500 is extrapolated using the growth rate between the first and the second estimate. Such was done for Bamberg (1500), Brandenburg (1500), Dessau (1710), Greifswald (1762), Halberstadt (1500), Hof (1758), Mülheim a. d. Ruhr (1806), Remscheid (1791), Saarbrücken (1784), Schwabach (1745), Schwäbisch Gmünd (1770); Speyer (1500), Würzburg (1500).

In the cases of Ansbach, Frankfurt (Oder), Glogau, Merseburg, Salzwedel and Stargard the value in 1500 is extrapolated on the basis of the value in 1600 or 1618 and the exponential trend growth rate of the high frequency sample in 1500–1618 (its value is 0.00378). Special cases are Lauban and Wesel: In the corrected series population in 1500 was set to population in 1427 (Lauban) or 1386 (Wesel). Reasons: (1) There is no information on population size during the sixteenth and seventeenth centuries. (2) Adjustment of growth rate can only be justified for the sixteenth century.

An arbitrary value of 4500 was set in the following cases: Burg (1700), Freising (1740), Langenbielau (1750) and Wuppertal-Cronenberg (1800).

A3 The urban population database

The following list documents the sources of population figures and estimates for towns with at least 4500 inhabitants in 1500–1850 (section 2.1 in the main text). "(x)" behind the name means that the town is located outside the historical German territory as defined in this study; these data are partly incomplete. Until the beginning of the nineteenth century, entries mention population estimates in thousands of inhabitants. For the nineteenth century, when compilations of statistical data constitute the main source, I give the number of data points. Only the figure for the census before the one in which the number of inhabitants surpasses 4500 for the first time is given explicitly. For the source references (in brackets), see Appendix A4.1–A4.3.

Figures are in thousand, sources in brackets; x: outside definition of German territory used in this study.

Aachen 1500 17.5 (Keyser 1955: 33); 1607 14.171 (Poll 75); 1700 14.5 (Müller 1993: 208); 1795 23.413, 1812 30.137 (Poll 112, 119); 1816–1871 19 data points (Stat. Pr.).

Aken (Elbe) 1846 4.428, 1849–1871 8 data points (Matzerath).

Altena 1837 4.295, 1840–1871 11 data points (Matzerath).

Altona 1650 3, 1710 12, 1769 18.05, 1803 23.099 (Keyser 1939: 362); 1834–1871 9 data points (Stat. Pr.).

Alzey 1815 3.193, 1846 5.306, 1871 5.24 (Keyser 1964: 49).

Amberg 1771 4.463, 1795 5.787, 1811–1871 12 data points (Keyser/Stoob 1974: 50–1; Stat. Bay. 1964: 16).

Angermünde 1843 4.284, 1846–1871 9 data points (Matzerath).

Anklam 1350 3, 1565 5, 1722 1.853, 1800 4.47, 1805 4.68, 1812 5.164 (Keyser 1939: 134); 1816–1871 13 data points (Matzerath).

Annaberg 1500 3, 1508 6, 1509 8, 1540 12 (Keyser 1941: 14); 1550 5.411, 1699 3.391, 1750 5.075, 1811 4.643 (Keller 438); 1815–1871 10 data points (Stat. Sx.; Keyser 1941: 14; Keller 438; Blaschke/Stams 50).

Ansbach 1500 3.204 (extrapolated from figure for 1618 and growth rate of high data frequency sample in 1500–1618); 1618: 5, 1648 2.8, 1663 3.3, 1713 6.7, 1750 15 (Bahl 213); 1783 13, 1792 13 (Frank 106, 112); 1713 3.95, 1734 5.894 (figures refer to town burghers only; subjects of territorial authorities not included; Kayser/Stoob 1971: 48); 1807–1871 13 data points (Keyser/Stoob 48; Stat. Bay. 1864: 18).

Arnsberg 1846 4.458, 1849–1871 8 data points (Matzerath).

Aschaffenburg 1668 1.526, 1809–1871 8 data points (Keyser/Stoob 1971: 62; Stat. Bay. 1864: 19).

Aschersleben 1721 3.213, 1756 6.196, 1795 8.22 (Keyser 1941: 420); 1816–1871 19 data points (Stat. Pr.; Matzerath [1849]).

Arnswalde 1840 4.436, 1843–1861 10 data points (Matzerath).

Altenburg 1580 3.709, 1648 5.2, 1672 5.8, 1773 7.792, 1794 9.075, 1806 9.201, 1816–1871 6 data points (Keyser 1941: 265).

Augsburg 1500 50.4, 1600 44.8, 1627 40, 1645 21.018 (Rajkay 252); 1614 45, 1635 16.432 (Roeck 302, 305); 1640 19.96, 1655–1795 extrapolations by decade based on the number of baptisms (François 1991: 252); 1807–1871 17 data points (Möller 43).

Aurich 1845 4.388, 1845–1867 8 data points (Stat. HA).

Bad Cannstadt 1823 3.403 (Keyer 1962: 253); 1834–1861 10 data points (Stat. Württ.).

Bad Dürkheim 1817 4.469 (extrapolated from growth rate 1823–35); 1823–1871 4 data points (Keyser 1964: 70).

Bad Hersfeld 1585 2.785 (n households multiplied with 5), 1616 6.553, 1639 1.835, 1795 4.263, 1817–1871 16 data points (Stat. Hessen; Keyser 1957: 234–5).

Bad Kreuznach 1791 3.92 (Keyser 1964: 78); 1816–1871 13 data points (Matzerath).

Baden-Baden 1830 4.439, 1837–1871 4 data points (Keyser 1959: 187).

Baiersbronn 1837 4.24, 1840–1861 8 data points (Stat. Württ.).

Bamberg 1500 5.724 (extrapolated from growth rate 1522–1561); 1522 7, 1561 10, 1599 11.5, 1653 7, 1672 10, 1731 10.1, 1755 12, 1795 16, 1811–1871 9 data points (Keyser/Stoob 1971: 100–1; Stat. Bay. 1864: 17).

Barmen (*Wuppertal*) 1640 1.9, 1799 12, 1804 12.895, 1810 16.289 (Keyser 1956: 424–5); 1816–1871 19 data points (Stat. Pr.).

Barth 1840 4.47, 1843–1871 10 data points (Matzerath).

Bautzen 1500 5, 1620 5, 1633 3.5, 1750 6.166 (Blaschke/Stams 50); 1815–1875 9 data points (Stat. Sx.; Kalender 83; Keyser 1941: 21; Blaschke/Stams 50).

Bayreuth 1700 3.9, 1715 4.7, 1753 8, 1809–1871 13 data points (Keyser/Stoob 1971: 118; Stat. Bay. 1864: 17).

Bensheim 1831 3.963, 1843–1871 4 data points (Keyser 1957: 63).

Berlin 1450 6, 1600 9, 1649 6, 1709 57, 1719 64 (Engel et al. 584); 1564 6.59 (n hearths multiplied with 5), 1573 7.075 (n households multiplied with 5), 1618 10, 1645 5.985 (n hearths multiplied with 5), 1680 9.8, 1713 61, 1730 58.112 (Ribbe 207, 344, 360–1, 413); 1740–1840 (five-year intervals; Gehrmann 430); 1843–1871 10 data points (Stat. Pr.).

Bernburg 1779 4.018, 1830 5.995, 1858 10.698, 1871 15.709 (Keyser 1841:30).

Beuthen (Oberschlesien) 1840 4.261, 1843–1871 10 data points (Stat. Pr.).

Biberach 1823 4.438 (Keyser 1962: 329); 1834–1861 10 data points (Stat. Württ.).

Bielefeld 1712 2.967 (resident population in 1718; from 1713 the town included a garrison of 1500–2000 men; I add 1750 to the population figures for the eighteenth century), 1718 4.717, 1765 5.11, 1789 5.066 (Keyser 1954: 50); 1812 5.613 (Stat. Westph. 12); 1816–1871 19 data points (Stat. Pr.).

Bingen 1762 2.812, 1815–1871 3 data points (Keyser 1964: 103).

Birkenfeld 1815 3.95, 1831–1861 11 data points (Stat. Old.).

Bocholt 1837 4.364, 1840–1871 11 data points (Matzerath).

Bochum 1843 4.067, 1846–1871 9 data points (Stat. Pr.).

Bonn 1653 3.836, 1690–1790 extrapolations by decades based on the number of baptisms (Schlöder 38–9); 1805 9083 (Höroldt/Ennen 155); 1816–1871 19 data points (Stat. Pr.).

Borna 1840 3.856, 1846–1871 6 data points (Stat. Sx.; Kalender 83; Keyser 1941: 25).

Brandenburg 1500 7.553 (extrapolated using growth rate in 1567–1602); 1567 8.646, 1602 9.279 (extrapolated using figures for the Neustadt quarter from Engel et al. 54 and average share of Neustadt in total population in 1625 and 1645); 1625 12, 1643 2.225, 1645 4.2, 1722 7.856, 1740 8.266, 1770 8.565, 1790 9.135, 1800 10.228 (Engel et al. 54); 1816–1871 19 data points (Stat. Pr.).

Braunsberg/Braniewo (x) 1782 4.37, 1802 5.111, 1810 4.52 (Keyser 1939: 31); 1816–1871 13 data points (Matzerath).

Braunschweig 1500 15 (Moderhack 59); 1550 13 (Keyser 1952: 34); 1620 20 (Kappelhoff 27); 1671 15.57 (Roloff 107); 1758 22.5 (Moderhack 69); 1773 23.395, 1783 20.063, 1793 27.301 (Keyser 1952: 45); 1788 26.154 (Roloff 108); 1800 27.972, 1812 29.95, 1814 29.934 (Roloff 122, 190, 214); 1843–1871 10 data points (Böckh 251–2).

Bremen 1500 18, 1600 20 (Schwarzwälder 148, 184, 307); 1700 21 (Schwarz 107); 1740 30 (Gehrmann 91–2). Average ratio of total population to inner town in 1740 and 1815 is 1.36. Figures for inner town in 1775–1810 (five-year intervals; Gehrmann 399) are multiplied by this factor. 1815–1871 annual series from from Fertig al.

Breslau 1470 21, 1550 23.5, 1618 30, 1633 12, 1675 28, 1710 40, 1747 49.986, 1750 47.861, 1756 54.774, 1763 47.098, 1765 52.633, 1770 58.215, 1780 57.27, 1787 54.917, 1790 55.747, 1816 73.365, 1820 78.93 (Stoob/Johanek 26); 1831–1871 14 data points (Stat. Pr.).

Brieg 1575 4.406, 1796 6.456, 1805 10.041 (Stoob/Johanek 54), 1816 10.283 (Matzerath), 1819–1871 18 data points (Stat. Pr.).

Bromberg/Bydgoszcz (x) 1816–1871 19 data points (Stat. Pr.).

Bruchsal 1787 4.114, 1798 3.856, 1818 5.55, 1825–1871 6 data points (Keyser 1959: 52).

Bunzlau 1816 3.175, 1819–1871 12 data points (Matzerath).

Burg 1700 4.5 (arbitrary value; figures for 1723, which excludes wives, and 1747 suggest a stable population of a little over 4.5 during the first half of the 18th century); 1747 4.681, 1779 7.748 (includes garrison), 1810 7.545 (Keyser 1941: 444); 1816–1871 13 data points (Matzerath).

Burscheid 1807 4.253, 1816–1871 15 data points (von Viebahn 108; Matzerath).

Burtscheid 1816 4.603, 1819–1971 12 data points (Matzerath).

Calbe (Saale) 1819 4.098, 1831–1871 12 data points (Matzerath).

Calw 1823 3.905 (Keyser 1962: 337); 1834–1861 10 data points (Stat. Württ.).

Celle. Before 1810 information is separated between the old town and three suburbs that developed from the seventeenth century (Schuler 106); data source is Schuler, pp. 100–102. I arbitrarily assume that population in Vor dem Westceller Tor was 10 in 1600 (first estimate: 706 in 1664) and in Heelenvorstadt in 1706 also 10 (first estimate: 1750 314). Years for which information is available for individual quarters differ; I use exponential interpolation to produce estimates for key years. Original figures relate to hearths or (more frequently) to houses. I apply a conversion factor of 6.03 (n inhabitants in the old town in 1785 divided by n houses in 1791). This factor is lower than the factor for the whole town in 1821, but produces values

that are closer to earlier estimates of population of the old town reported by Schuler, pp. 100–1. An alternative estimate for the population of the old town using the number of *Schosspflichtige* and a conversion factor of 4.51 (1785; Schuler 94–6, 108) produced an implausibly high estimate for 1750 and broadly similar values for the remaining key years. 1600 2.895, 1631 3.726, 1662 5.766, 1706 6.576, 1750 6.726, 1768 7.757, 1785 7.796, 1810 8.149; 1812–1867 13 data points (Stat. HA).

Charlottenburg 1816 4.105; 1819–1871 18 data points (Stat. Pr.).

Chemnitz 1474 3.523, 1501 4.44, 1530 4.318, 1551 5.616, 1586 5.476, 1610 5.44 (Bräuer 18–9); 1635 2.5, 1657 3 (Lehmann 178, 192; extrapolated from the number of vital events); 1699 4.873, 1750 10.38 (Keller 396, 438); 1815–1871 13 data points (Stat. Sx.; Böckh 251–2; Keller 438; Blaschke/Stams 50).

Clausthal 1637 3, 1687 6, 1700 5.3, 1736 8.93, 1756 8.369, 1783 8.057 (Keyser 1952: 89); 1812–1867 12 data points (Stat. HA).

Coburg 1682 4.261, 1721 4.996, 1741 6.761, 1843–1871 4 data points (Keyser/Stoob 137).

Cottbus 1790 4.317. 1795 4.811, 1800 5.537 (Keyser 1939: 517); 1816–1871 19 data points (Stat. Pr.).

Crimmitschau 1834 3.767, 1843–1871 7 data points (Stat. Sx.; Kalender 83; Keyser 1941: 41).

Crossen 1819 3.631, 1831–1871 12 data points (Matzerath).

Culm/Chełmno (x) 1819 4.372, 1840–1871 11 data points (Matzerath).

Danzig/Gdansk (x) 1550 20 (Albinus 74); 1415 20, 1577 40, 1600 50, 1650 77, 1656 73, 1675 53.2, 1705 50.4, 1730 48, 1745 47.6, 1793 36.231, 1800 41.072, 1806 44.511 (Keyser 1939: 35); 1816–1871 19 data points (Stat. Pr.).

Darmstadt 1721 2.94, 1772 6.602, 1803 9, 1811 17, 1825–1871 6 data points (Keyser 1957: 87).

Delitzsch 1837 4.332, 1840–1871 11 data points (Matzerath).

Demmin 1819 3.92, 1831–1871 12 data points (Matzerath).

Dessau 1710 4.474 (extrapolated from growth rate 1787–1830); 1787 7.787, 1830 10.612, 1861 15.613, 1871 17459 (Keyser 1941: 457).

Detmold 1843 4.137, 1858–1871 3 data points (Keyser 1954: 102).

Deutsch Krone/Wałcz (x) 1849 4.199, 1852–1871 7 data points (Matzerath).

Deutz 1837 2.872, 1840–1871 11 data points (Matzerath).

Dillingen an der Donau 1840 4.04, 1852–1871 5 data points (Keyser/Stoob 1974: 147; Stat. Bay. 1864: 20).

Dinkelsbühl 1750 3.591 (n of households multiplied with 5), 1804 4970, 1811–1871 13 data points (Keyser/Stoob 1971: 150; Stat. Bay. 1864: 18).

Döbeln 1811 3.784, 1815–1871 1 data points (Stat. Sx.; Keyser 1941: 45; Keller 438; Blaschke/Stams 51).

Dortmund 1480 7–8, 1618 6–7, 1650 2, 1700 3, 1795 4 (Keyser 1954: 110); 1819 4.453, 1822–1871 17 data points (Stat. Pr.).

Dresden 1489 3.7 (Blaschke 2005: 360); 1501 4.5, 1546 6.5 (Keyser 1941: 50); 1550 7.693 (Keller 404); 1561 9.165 (Blaschke 2005: 362); 1588 11.5, 1603 14.793 (Keyser 1941:

50); 1618 17, 1635 8.5 (Blaschke 2005: 624); 1700 31, 1727 46.472, 1763 48, 1772 44.76 (Gross/John 23–4, 502, 527); 1750 52.052, 1792 41.914, 1805 42.94 (Blaschke/Stams 39, 50); 1811 46.754 (Keller 420); 1815 50.321, 1832 64.4, 1840 82.042 (Blaschke/Stams 50); 1834 66.133 (Stat. Sx.); 1846–1871 8 data points (Gross/John 528).

Drossen 1846 4.485, 1849–1871 8 data points (Matzerath).

Düren 1798 4.289 (Keyser 1956: 97); 1816–1871 19 data points (Stat. Pr.).

Düsseldorf 1596 3.75 (own extrapolation derived from 512 burghers in the inner town; Keyser's figures for the 17th century suggest that burghers living in the inner town constituted about two thirds of all burghers; moreover, he applies a multiplication factor of about 5); 1632 5, 1673 5, 1689 5.85, 1703 8.578, 1738 8.8, 1746 9.98, 1778 12, 1792 22.097, 1801 19.532, 1809 20.35 (Keyser 1956: 106, 109); 1816–1871 19 data points (Stat. Pr.).

Duisburg 1812 4.14 (Jägers 54); 1816–1871 19 data points (Stat. Pr.).

Durlach 1822 4.137, 1834–1873 6 data points (Stat. Baden 1852; Keyser 1959: 96).

Ebersbach 1790 4.032, 1826–1871 5 data points (Keyser 1941: 62).

Eberswalde 1831 4.388, 1837–1871 12 data points (Matzerath).

Ebingen 1840 4.419; 1843–1861 7 data points (Stat. Württ.).

Edenkoben 1823 4.449, 1835 4.93, 1871 4.777 (Keyser 1964: 133).

Eibenstock 1832 4.454 (Blaschke/Stams 51); 1834–1875 6 data points (Stat. Sx.; Keyser 1941: 65; Keller 439; Blaschke/Stams 51).

Eichstätt 1706 4.137, 1716 5.613, 1719 7.715, 1737 6.808, 1741 7.175, 1785 6.815, 1811–1871 12 data points (Keyser/Stoob 1971: 173; Stat. Bay. 1864: 18).

Eilenburg 1769 2.25 (n household heads multiplied with 5); 1800 4.643, 1810 4.622 (Keyser 1941: 469); 1816–1871 13 data points (Matzerath).

Einbeck c. 1500 7, 1616 6, 1644 2.5, 1673 3.662, 1756 5.012, 1766 3.823, 1784 4.691 (Keyser 1952: 115); 1812–1867 13 data points (Stat. HA).

Eisenach c. 1550 about 4.5, 1600 about 5.4, 1700 about 7, 1823–1880 7 data points (Keyser 1941: 286).

Eisenberg i. Thür. 1818 3.943, 1830–1875 6 data points (Keyser 1941: 289).

Eisleben 1433 4, late 16th c. [1600] 9–10, before the Thirty Years' War [1618] 8, after the War [1648] 4, 1700 5, 1730 6.5, 1763 5 (Keyser 1941: 473); 1816–1871 19 data points (Stat. Pr.).

Elberfeld (*Wuppertal*) 1643 2.925 (n burghers multiplied with 5); 1773 7.5, 179 13.859, 1810–1849 5 data points (Keyser 1956: 420); 1861–1871 4 data points (Stat. Pr.).

Elbing (x) 1772 10.733, 1797 16.487, 1810 16.71 (Keyser 1939: 43); 1816–1871 19 data points (Stat. Pr.).

Emden 1500 5, 1750 15 (de Buhr 161–2); 1608 18.5, 1652 22.5, 1700 10, 1724 9 (Kappelhoff 27–33); 1749–1806 annual series (Schuler 172); 1811–1867 14 data points (Schuler 172; Stat. HA).

Emmerich 1819 4.406, 1825–1871 16 data points (Matzerath).

Ennepetal 1818 3827, 1843–1871 3 data points (Keyser 1954: 128).

Erfurt 1493 18.68, 1511 16.117, 1530 16.208, 1569 18, 1629 18, 1632 13.457, 1664 11.7, 1758 13.602, 1782 14.621, 1792 16.891, 1802 16.580, 1811 18.154 (Keyser 1941: 480); 1816–1871 19 data points (Stat. Pr.).

Erkelenz 1812 4.494 (extrapolated from growth rate 1828–1840); 1828–1858 4 data points (Keyser 1956: 148). After 1858 the community was divided.

Erlangen 1723 3.182, 1752 7.939, 1760 8.14., 1774 7.724, 1792 9.178, 1808–1871 10 data points (Keyser/Stoob 1971: 188–90; Stat. Bay. 1864: 18).

Eschwege 1811 4.298, 1822–1870 13 data points (Stat. Hessen; Keyser 1957: 110).

Eschweiler 1773 3.433, 1823–1855 6 data points (Keyser 1956: 151–2). After 1855 the community was divided.

Essen 1810 3.903 (Keyser 1956: 159); 1816–1871 19 data points (Stat. Pr.).

Essen-Werden 1840 3.873, 1843–1871 10 data points (Matzerath).

Esslingen 1460 6, 1563 6.5–6.8 (Schraitle 80, 92); 1566–1801 annual series, beginning of year (Schraitle 85–8); 1802–1815 annual series, end of year (Schraitle 883); 1822 8.079 (Keyser 1962: 72); 1834–1861 10 data points (Stat. Württ.).

Ettlingen 1834 3.315, 1845–1871 4 data points (Stat. Baden 1852; Keyser 1959: 64).

Eupen 1748 4.494 (extrapolated from growth rate 1816–9); 1816–1871 15 data points (Matzerath).

Finsterwalde 1840 4.469, 1843–1871 10 data points (Matzerath).

Flensburg (x) 1436 3, 1600 6, 1769 6.842, 1803 10.666, 1835–1875 5 data points (Keyser 1939: 377).

Forst 1849 4.21, 1852–1871 7 data points (Stat. Pr.).

Frankenberg 1811 3.663, 1815–1871 9 data points (Stat. Sx.; Keyser 1941: 74; Keller 439; Blaschke/Stams 50).

Frankenthal 1815 3.7, 1823–1871 6 data points (Keyser 1964: 137).

Frankenstein in Schlesien 1795 3.36 (Stoob/Johanek 80); 1816–1871 13 data points (Matzerath).

Frankfurt a. M. 1529 11.5 (Bothe 320); 1450 9.06, 1534 13.232, 1552 12, 1580 15.5, 1586 17.946, 1587 16.126, 1601–9 19.35, 1616 20.2, 1635–9 19.428, 1651–5 16.964, 1675–9 23.918, 1696–1700 27.593, 1721–5 28.719, 1751–5 32.318, 1771–5 30.027, 1796–1800 35.322 1811 40.485, 1817 41.458 (Mauersberg 49–54); 1823, 1837–1871 13 data points (Stat. Ff. 16–7; Stat. Pr.).

Frankfurt (Oder) 1500 3.524 (extrapolated from figure for 1600 and growth rate of high data frequency sample in 1500–1618); 1600 5.5, 1653 2.366, 1727 8.453 (Engel et al. 167); 1730 8.686, 1740 9.304, 1750 9.47, 1770 9.687, 1780 9.892, 1790 10.271 (Keyser 1939: 535); 1800 12.5 (Franke 112); 1816–1871 19 data points (Stat. Pr.).

Fraustadt (*Wschowa*, x) 1789 3.121, 1793 4.579 (Stoob/Johanek 84); 1816–1871 13 data points (Matzerath).

Freiberg 1470 5 (Keyser 1941: 78); 1550 7.359 (Keller 439); 1599 12.248, 1613 11.5, 1626 10.1, 1628 9.5, 1643 7, 1647 6.5, 1677 8.3, 1700 8.2, 1726 9 (Keyser 1941: 78); 1750 9.885 (Keller 439); 1760 8.8, 1776 8.5, 1784 8.7 (Keyser 1941: 78); 1811–1871 10 data points (Stat. Sx.; Keyser 1941: 78; Keller 439; Blaschke/Stams 50).

Freiburg i. Br. 1500 6–6.5, 1620 10, 1632 9, 1650 3.5, 1660 4,8, 1670 5.3, 1693 5.148, 1789 7.916, 1800 9.05, 1812–1871 6 data points (Keyser 1959: 224).

Freiburg in Schlesien/Świebodzice 1846 4.393, 1849–1871 8 data points (Matzerath).

Freising 1740 4.5 (arbitrary choice); 1752 4.954, 1785 3.58, 1811–1871 8 data points (Keyser/Stoob 1974: 192; Stat. Bay. 1864: 13).

Freudenstadt 1837 4.25, 1840–1861 8 data points (Stat. Württ.).

Friedberg 1839 3.949, 1846–1871 4 data points (Keyser 1957: 164).

Friedeberg (Neumark) 1840 4.476, 1843–1871 10 data points (Matzerath).

Friedland 1829 4.443, 1839–1871 4 data points (Keyser 1939: 285).

Fürstenwalde 1837 4.061, 1840–1871 11 data points (Matzerath).

Fürth c. 1600 1, c. 1700 5–6, 1795 12.5, 1803–1871 13 data points (Keyser/Stoob 1971: 208; Stat. Bay. 1864: 18).

Fulda. In 1648/53 and 1800/02 ratio of inhabitants/burghers is 8.06 and 10.93. I use the average (9.5) to inflate numbers of burghers to population in 1525 and 1701. 1525 3.515 (extrapolation), before the Thirty Years' War [1618] 5, 1648 3, 1701 5.13 (extrapolation), 1802 8.559, 1811–1871 15 data points (Stat. Hessen; Keyser 1957: 175).

Gardelegen 1819 4.298, 1831–1871 13 data points (Matzerath).

Gera 1647 2.362, 1794 6.567, 1808 7.373, 1834–1875 5 data points (Keyser 1941: 297).

Gießen 1669 3.531, 1761 6.119, 1791 3.672, 1804 4.946, 1813–1870 7 data points (Keyser 1957: 193–4).

Glatz 1400 4, 1617 7, 1742 3.647, 1786 4.035, 1790 5.001, 1800 6.48, 1810 4.887 (Stoob/Johanek 102); 1816–1871 13 data points (Matzerath).

Glauchau 1550 1.343, 1750 4.58 (Blaschke 1967: 139); 1801 4.062 (Keyser 1941:89); 1819 4.257, 1828–1867 7 data points (Stat. Sx.; Keyser 1941: 89).

Gleiwitz 1822 4.264, 1828–1871 16 data points (Stat. Pr.).

Glogau 1500 7.689 (extrapolated from figure for 1618 and growth rate of high data frequency sample in 1500–1618); 1618 12, 1648 2, 1745 5.481, 1787 8.252 (Stoob/Johanek 102); 1816–1871 13 data points (Matzerath).

Glückstadt 1792 3.5 (Franke 114); about 1800 5.178, 1840–1880 3 data points (Keyser 1939: 385).

Gnesen/Gniezno (x) 1816 3.816, 1819–1871 12 data points (Matzerath).

Göppingen 1810 4.296, 1823 4.549 (Keyser 1952: 99); 1834–1861 10 data points (Stat. Württ.).

Görlitz 1500 8, 1550 9.5 ("almost" 10), 1583 9.069, 1641 5, 1717 5.5, 1781 7.665, 1800 9 (Stoob/Johanek 120); 1816–1871 19 data points (Stat. Pr.).

Göttingen 1500 7, 1600 6.8 (Keyser 1952: 145); 1700 3.5 (Sachse 84); 1756 7.5, 1763 6, 1766 6.3, 1783 8.6, 1795 9.1, 1807 8.05 (Gerhard 189); 1812–1867 13 data points Stat. HA.

Gollnow 1831 4.062, 1840–1871 11 data points (Matzerath).

Goldberg/Złotoryja 1771 3.92, 1782 4.895, 1789 5.157, 1801 5.534, 1812 5.21, 1823 6.399 (Stoob/Johanek 128); 1837–1871 12 data points (Matzerath).

Goslar 1500 6.55, 1577 6.85, 1600 6.25 (Kelichhaus 35); 1812–1867 13 data points (Stat. HA).

Gotha 1543 3.2, 1553 4.5, 1588 3.6, 1665 5, 1715 7, 1732 8, 1760 11.511, 1784 11.307, 1794 11.431, 1802 11.5, 1823–1871 6 data points (Keyser 1941: 301).

Graudenz (x) 1816–1871 19 data points (Stat. Pr.).

Greifenberg i. Pomm. 1843 4.461, 1846–1871 9 data points (Matzerath).

Greifenhagen 1819 3.713, 1831–1871 12 data points (Matzerath).

Greifswald 1762 4.474 (extrapolated from growth rate 1767–80); 1767 4.611, 1780 4.987, 1794 5.372, 1800 5.74, 1808 6.388 (Keyser 1939: 174); 1816–1871 21 data points (Matzerath).

Greiz 1811 3.906, 1833–1871 3 data points (Keyser 1941: 305).

Grimma 1815 4.2 (Blaschke/Stams 51); 1832–1867 6 data points (Stat. Sx.; Keyser 1941: 92; Keller 439; Blaschke/Stams 51).

Großenhain 1699 2.739, 1750 5.037 (Keller 439); 1815–1871 11 data points (Stat. Sx.; Keyser 1941: 96; Keller 439; Blaschke/Stams 50).

Grünberg in Schlesien 1490 2, 1631 19, 1670 4.5, 1740 3.494, 1750 4.706, 1760 4.51, 1770 4.886, 1786 5.797, 1790 6.7, 1800 8.321 (Stoob/Johanek 149); 1816–1871 15 data points (Matzerath).

Guben/Gubin 1600 4, 1648 2, 1725 4, 1752 4.356, 1800 5.467 (Engel et al. 227); 1816–1871 19 data points (Stat. Pr.).

Güstrow 1661 2.435, 1819–1872 7 data points (Keyser 1939: 294).

Gumbinnen/Gussew (x) 1738 2.082, 1780 5.656, 1801 5.284 (Keyser 1939: 57); 1816–1871 13 data points (Matzerath).

Hagen 1837 4.335, 1840–1871 11 data points (Stat. Pr.).

Hainichen 1815 2.829, 1834–1871 7 data points (Stat. Sx.; Kalender 84; Keyser 1941: 99–100).

Halberstadt 1500 5.888 (extrapolated from growth rate 1531–1589); 1531 7.32 (n households multiplied with 5), 1589 11, 1624 12–13, 1643 3, 1717 10-11, 1733 13, 1746 9.972, 1755 11.02, 1763 10.726, 1774 10.233, 1786–1810 5 data points (Keyser 1941: 519); 1816–1871 19 data points (Stat. Pr.).

Haldensleben 1831 4.275, 1840–1871 11 data points (Matzerath).

Halle 1500 9 (Freitag/Thiele 67); 1600 10, 1682 4, 1751 13 (Wünsch 4); 1714 11.5 (Freitag/Hecht 405); 1780 20.2, 1792 20.6, 1800 19.6 (Franke 112); 1816–1871 19 data points (Stat. Pr.).

Hamburg 1500 15 (Mauersberg 31, 40; average), 1542 12.218, 1600 38, 1643 42.7, 1662 75, 1699 70.325 (Mauersberg 40, 47); 1764 93.5 (Gehrmann 90); 1775–1835 (five-year intervals; Gehrmann 399); 1843–1871 10 data points (Böckh 251–2).

Hameln 1763 2.379 (Keyser 1952: 155); 1812–1867 13 data points (Stat. HA).

Hamm 1798 3.065, 1806 4.616 (Keyser 1954: 165); 1816–1871 19 data points (Stat. Pr.).

Hannover 1435 4.27, 1530 7.5, 1542 5.365, 1587 6.43, 1655, 9.3 (Mauersberg 57, 60-1); 1672 8.05 (average of figures for 1670 and 1675), 1689 10.5, 1700 11, 1735 14 (Mlynek 190); 1757 16.791, 1766 15448 (Mauersberg 62); 1781 17 Mlynek (190); 1812–1867 Stat. HA.

Hanau 1618 3.030 (annual average of 100 baptisms / birth rate of 0.033), 1632 5.15, 1707 9.025 (both figures derived by multiplying n households with 5, Bus 290, 293); 1739 11.669, 1754 11.424, 1791 12.045, 1800–1870 17 data points (Stat. Hessen; Keyser 1957: 220).

Harburg 1821 3.929, 1821–1871 13 data points (Stat. HA; Stat. Pr.).

Heidelberg 1439 5.2–5.5, 1588 6.3–6.4, 1717 6.1 (n families multiplied with 6), 1769 6.74 (n households multiplied with 6), 1776 9.828, 1784 10.754 (mean household size is 6.1), 1802 8.919, 1805 9.49, 1810–1871 6 data points (Stat. Baden 1852; Keyser 1959: 224).

Heilbronn 1500 set to value in 1501: 6.168, 1566 4.886, 1618 6, 1648 3.2, 1769 6.077, 1788 6.942, 1803 5.692, 1810 5.919, 1823 7.055 (Keyser 1962: 112); 1834–1861 10 data points (Stat. Württ.).

Heiligenstadt 1831 4.217 1837–1871 12 data points (Matzerath).

Heilsberg/Lidzbark Warmiński (x) 1843 4.458, 1846–1871 9 data points (Matzerath).

Helmstedt 1790 4.5 (arbitrary value; Keyser 1952: 187 gives 4.687 in 1790–3, Wikipedia 4.321 in 1793); 1821–1871 4 data points (Keyser 1952: 187).

Heppenheim 1837 4.17, 1846–1871 3 data points (Keyser 1957: 220).

Herford 1793 2.667 (Keyser 1954: 180); 1819–1871 18 data points (Stat. Pr.).

Herrstein 1831 4.231, 1834–1861 10 data points (Stat. Old.).

Hildesheim 16th c. [1500, 1600] 10–11, 1648 5.5–6, 1803 11.108 (Keyser 1952: 196); 1812–1867 13 data points (Stat. HA).

Hirschberg im Riesengebirge 1670 2.204, 1742 5.819, 1758 6.504, 1768 6.057, 1780 6.082, 1790 6.391, 1801 6.192, 1814 5.219 (Stoob/Johanek 172); 1816–1871 13 data points (Matzerath).

Hof 1758 4.495 (extrapolation from growth rate 1783–91), 1783 4.731, 1791 4.809, 1807–1871 13 data points (Keyser/Stoob 1971: 273; Stat. Bay. 1864: 17).

Hohensalza/Inowrocław (x) 1819 3.933, 1831–1871 12 data points (Matzerath).

Homburg v. d. Höhe 1830 4.044, 1852 5.316, 1865 7.141, 1876 8.237 (Keyser 1957: 259).

Hohnstein 1834 4.325, 1846–1867 3 data points (Stat. Sx.; Kalender 84).

Husum (x) 1372 1, 1582 6, 1625 7, 1700 4, 1769 3.342 (Keyser 1939: 406).

Ingolstadt 15th century [1450] 3, 1558 4.548, 1700 6.5, 1762 8, 1794 4.187, 1811–1871 9 data points (Keyser/Stoob 1974: 272–3; Stat. Bay. 1864: 13).

Insterburg/Tschernjachowsk (x) 1753 3.477 (Keyser 1939: 66); 1816–1871 18 data points (Stat. Pr.) ; 1840 9.317 (Matzerath).

Iserlohn 1786 4.3, 1790 4.73, 1797 3.958, 1798 4.449 (Keyser 1954: 202–3); 1816–1871 19 data points (Stat. Pr.).

Itzehoe 1803 2.659, 1835–1875 5 data points (Keyser 1939: 408).

Jauer 1555 3.5, 1610 4.75, 1739 3.62, 1787 4.042, 1811 4.72 (Stoob/Johanek 180); 1816–1871 13 data points (Matzerath).

Jena 1818 4.459, 1820–1871 7 data points (Keyser 1941: 317).

Jüterbog 1831 4.373, 1840–1871 11 data points (Matzerath).

Kaiserslautern 1815 3.757, 1823–1871 9 data points (Keyser 1964: 170).

Kamenz 1846 4.422, 1849 4.57 (Stat. Sx.); 1867 5.916 (Kalender 84); 1885 7.3 (Keyser 1941: 109).

Karlsruhe 1750s 2.752, 1769–1804 8 data points (Müller 1992: 25); 1820–1871 10 data points (Böckh 251–2; Keyser 1959: 90).

Kassel 1472 4.415, 1585 5.31, 1599 5.265, 1607 5.531, 1622 6.072, 1637 5.744, 1648 6.085, 1678, 7.35, 1681 7.75, 1724 14.57, 1731 15.278, 1751 18.062 (Lasch 69); 1773 17.311, 1781 19.003, 1789 18.45, 1795 17.625 (Keyser 1957: 277); 1812 22.805 (Stat. Westph. 11); 1834–1871 13 data points (Stat. Hessen; Stat. Pr.).

Kempen/Kępno (x) 1816 4.05, 1819–1871 12 data points (Matzerath).

Kempten 1423 3, c. 1618 5, 1635 1.5–3, 1798 3.152, 1818–1871 8 data points (Keyser/Stoob 1974: 293–4; Stat. Bay. 1864: 20).

Kiel 1750 4.5, 1782 6.667, 1803 7.075 (Keyser 1939: 413); 1825–1871 9 data points (Stat. Pr.; Böckh 251–2).

Kirchheim unter Teck 1810 4.131, 1823 4.505 (Keyser 1962: 129); 1834–1861 10 data points (Stat. Württ.).

Kitzingen 1814 3.751, 1830–1871 7 data points (Keyser/Stoob 1971: 297; Stat. Bay. 1864: 19).

Kleve 1532 4.4, 1545 5, 1660 2.6, 1722 4.897, 1755–1812 10 data points (Keyser 1956: 247); 1816–1871 13 data points (Matzerath).

Koblenz 1702 4.28 (Heimes 64); 1744 6.9, 1794 8.4, 1808 9.301 (François 1982: 24–5); 1816–1871 19 data points (Stat. Pr.).

Köln 1500 42.5 (Ebeling/Irsigler XI); 1574 37, 1692 33.21 (Banck 328, 331); 1705 40.665 (Pohl 33; n households multiplied with 5); 1735–1795 baptisms in Cologne (Pohl 25) divided by German crude birth rate, centred five-year periods (Pfister/Fertig 2020). Pohl (1975: 25, 28) applies fixed coefficients and finds that population declined over the eighteenth century. At least in Germany as a whole, the birth rate declined between the 1730s and 1740s. Consequently, my series is largely stable. The value for 1735 is consistent with the estimate derived from a tax register of the same year (36.395; Pohl 33). 1798, 1801–1813 annual figures from Müller (2005: 243); 1816–1871 19 data points (Stat. Pr.).

Königsberg/Kaliningrad (x) 1500 10, 1550 15, 1700 40 (Albinus 74); 1723 39.475, 1755 55, 1766 46.621, 1770 52.196 (Keyser 1939: 69); 1792 54.436 (Albinus 74); 1802 54.535 (Keyser 1939: 69); 1816–1871 19 data points (Stat. Pr.).

Königsberg (Neumark) 1816 4.292, 1819–1871 12 data points (Matzerath).

Konitz/Chojnice (x) 1846 4.36, 1849–1871 8 data points (Matzerath).

Köslin 1809 3.585 (Johanek/Post 108); 1816–1871 13 data points (Matzerath).

Köthen 1758 4, 1788 5.5, 1818 6, 1852–1871 3 data points (Keyser 1941: 570).

Kolberg 1802 4.499 (Johanek/Post 119); 1816–1871 13 data points (Matzerath).

Konstanz 1500 6 (maximum population during the late Middle Ages), 1763 3,714, 1812–1875 6 data points (Keyser 1959: 276–7).

Krefeld 1716 2.542, 1740–1812 10 data points (Kriedte 75); 1816–1871 19 data points (Stat. Pr.).

Krotoszyn (x) 1816 4.406, 1819–1871 12 data points (Matzerath).

Küstrin 1780 4.337, 1790 4.517, 1800–1813 3 data points (Keyser 1939: 567); 1816–1871 13 data points (Matzerath).

Lahr 1700 1.35 (n burghers multiplied with 5), 1804 4.753, 1815–1871 6 data points (Stat. Baden 1852; Keyser 1959: 288).

Landau 1774 3.945, 1791 5.078, 1815–1871 3 data points (Keyser 1964: 231–2).

Landsberg a. W./Gorzów Wielkopolski 1750 4.171, 1763 5.485, 1780 5.08, 1790 5.584, 1801 6.155 (Keyser 1959: 573); 1816 1871 19 data points (Stat. Pr.).

Landshut 15th century [1500] about 9, 1560 8.6, 1671 1.406, 1794 7.272, 1811–1871 10 data points (Keyser/Stoob 1974: 319; Stat. Bay. 1864: 14).

Langenbielau [1750 4.5], 1785 6.698, 1800 5.146, 1825 7.84, 1840 6.812, 1861 12.939 (Stoob/Johanek 218).

Langensalza 1674 3.294, 1755 5.291, 1772 4.975, 1809 5.4 (Keyser 1941: 575); 1816–1871 13 data points (Matzerath).

Lauban 1427 5, 1750 6.5, 1801 5 (Stoob/Johanek 220); 1816–1871 14 data points (Matzerath).

Lauenburg 1849 4.416, 1852–1871 7 data points (Matzerath).

Lauingen 1525 4, 1575 6, 1630 3.2, 1650 2.1, 1771 3.184 (Keyser 1974: 333).

Leer 1660 4–4.5, 1735 4.5, 1755–80 five-year intervals, 1782 4.405, 1785–1806 annual series (Schuler 254–6); 1811–1867 14 data points Stat. HA.

Leipzig 1481 7.741, 1506 8.556, 1529 9.221 (Keyser 1941:123); 1550 8.481 (Keller 438); 1617 15.136, 1623 17.312, 1626 14.496, 1633 12.36, 1636 16.704, 1648 14, 1680 17.44, 1700 21.696, 1709 24.832, 1719 28.448, 1729 29.552 (Keyser 1941: 123); 1750 34.73 (Blaschke/Stams 50); 1756 29.792, 1763 28.352 (Keyser 1941: 123); 1792 28.124, 1805 31.447, 1815 34.035, 1830 39.93, 1832 43.189 (Blaschke/Stams 41, 50); 1834–1871 7 data points (Stat. Sx.; Keyser 1941: 123; Keller 439).

Leisnig 1815 3.72 (Blaschke/Stams 51); 1832–1867 8 data points (Stat. Sx.; Keyser 1941: 129; Keller 439; Blaschke/Stams 51).

Leobschütz 1819 4.123, 1831–1871 12 data points (Matzerath).

Liegnitz 1329 10, 1618 8, 1639 2.442, 1642 4.48, 1740 4.885, 1749 5.601, 1787 6.928 (Stoob/Johanek 240); 1816–1871 19 data points (Stat. Pr.).

Lindau 1840 3.902, 1852–1871 5 data points (Keyser/Stoob 1974: 343; Stat. Bay. 1864: 20).

Linden 1848 3.35, 1848–1867 7 data points (Stat. HA).

Lippstadt 1843 4.161, 1846–1871 9 data points (Matzerath).

Lissa/Leszno (x) 1816 8.395, 1819–1871 12 data points (Matzerath).

Lößnitz 1834 4.108, 1840–1867 5 data points (Stat. Sx.; Kalender 84; Keyser 1941: 139).

Löwenberg in Schlesien/Lwówek Śląski 1846 4.356, 1849–1871 8 data points (Matzerath).

Luckau 1846 4.492, 1849–1871 8 data points (Matzerath).

Luckenwalde 1819 3.713, 1831–1871 12 data points (Matzerath).

Ludwigsburg 1731 4.224, 1733 5.668, 1734 2.343, 1748 4.024, 1763 4.95, 1766 8.815, 1775 5.525, 1803 5.248, 1810 5.47, 1823 5.984 (Keyser 1962: 152); 1834–1861 10 data points (Stat. Württ.).

Lübben (Spreewald) 1840 4.448, 1843–1871 10 data points (Matzerath).

Lübeck 1502/3 [1500] average of 25.444 and 23.672, late 16th c. [1595] 25.389 1651 31.068, 1672 27, 1691 23, 1718 20, 1738 18.667, 1759 18.722 (Arndt 24–5); from 1651 central years of twenty year intervals); 1780 21.6 (Franke 113); 1800–1840 (five-year intervals; Gehrmann 399); 1845 29.234, 1851 29.992, 1857 20.847, 1862 32.052, 1867 36.998, 1871 39.743 (Graßmann 567, 609).

Lüdenscheid 1849 4.245, 1852–1871 7 data points (Stat. Pr.).

Lüneburg 1500 10.206, 1550 9.795 (n houses times 4.283, factor derived from figures for 1600/3), 1603 12, 1620 14, 1650 11, 1680 9, 1710 10, 1740 9.642, 1754 8.714, 1783–91 7 data points (Schuler 284–8); 1812–1867 13 data points (Stat. HA).

Magdeburg 1400 30, 1550 34, 1631 32.5, 1638 2.6, 1684 6, 1722–1806 18 data points (Keyser 1941: 595); 1812 28.517 (Stat. Westph. 8); 1816–1871 19 data points (Stat. Pr.).

Mainz 1500 5.5 (Ott 45); 1600 13 (Rödel 2000: 10); 1644 6.25, 1660 8 (Rödel 1998: 652); 1700 15, 1710 16, 1720 17.2, 1730 18.5, 1740 19.8, 1750 222.5, 1760 22.1, 1770 23, 1780 24, 1790 25 (Rödel 1985: 152); 1815 26.536 (Rödel 1998: 653); 1822–1871 6 data points (Keyser 1964: 267).

Mannheim 1663 3, 1688 11–12, 1716 5, 1721 8.6, 1766–1802 5 data points, 1811–1875 7 data points (Keyser 1959: 112–4).–871

Marburg 1575 3.865, 1618 5.5, 1648 3 (Lasch 49); 1696 3.404, 1781 5.833, 1791 5.594, 1824–1871 14 data points (Stat. Hessen; Keyser 1957: 325).

Marienberg 1840 4.334, 1846–1867 4 data points (Stat. Sx.; Keyser 1941: 144; Keller 439).

Marienburg in Westpreußen/Malbork (x) 1772 3.635, 1774 4.985 (Keyser 1939: 81); 1816–1871 13 data points (Matzerath).

Marienwerder/Kwidzyn (x) 1783 3.17, 1814 4.782 (Keyser 1939: 81); 1816–1871 13 data points (Matzerath).

Mayen 1831 3.815, 1837–1871 12 data points (Matzerath).

Meerane 1834 4.172, 1847–1875 8 data points (Stat. Sx.; Kalender 84; Keyser 1941: 149).

Meiningen 1545 2.2, 1600 4.76, 1634 4.8, 1650 1.3, 1811 4.11, 1820–1871 7 data points (Keyser 1941: 334).

Meißen 1811 4.484, 1815–1867 7 data points (Stat. Sx.; Keller 440; Blaschke/Stams 50).

Memel/Klaipèda (x) 1816 8.264, 1819–1871 12 data points (Matzerath).

Memmingen 1452 4.3–4.7, 1520 5, 1620 6, 1800 7, 1811–1871 12 data points (Keyser/Stoob 1974: 364–5; Stat. Bay. 1864: 20).

Merseburg 1500 3.204 (extrapolated from figure for 1600 and growth rate of high data frequency sample in 1500–1618); 1600 5, 1650 2.5, 1779 5.268 (number inhabitants aged 10 years and older multiplied with 1.3 following Gehrmann 2000: 81; all data so far from Keyser 1941: 607); 1816–1871 13 data points (Matzerath).

Meseritz/Międzyrzecz (x) 1831 4.38, 1840–1871 11 data points (Matzerath).

Mettmann 1816 3.922, 1824–1871 8 data points (Keyser 1956: 300; Matzerath).

Metzingen 1823 3.609 (Keyser 1962: 385); 1834–1861 10 data points (Stat. Württ.).

Minden 1752 3.739, 1784 5.184, 1804 5.236 (Keyser 1954: 248); 1616–1871 19 data points (Stat. Pr.).

Mittweida 1811 4.295 (Keller 440); 1815–1867 7 data points (Stat. Sx.; Keller 440; Blaschke/Stams 51).

Mönchengladbach 1855 4.398, 1861–1871 4 data points (Stat. Pr.).

Mühlhausen i. Th. 1486 7.58, 1505–1619 37 data points, 1649 5.265, 1675 7.218, 1755 8.2, 1792 8.014, 1802 9.288, 1812 9.374 (Keyser 1941: 615); 1816–1871 19 data points (Stat. Pr.).

Mülheim a. Rhein 1831 4.404, 1834–1871 13 data points (Stat. Pr.).

Mülheim a. d. Ruhr 1806 4.467 (extrapolated from growth rate 1816–9); 1816–1871 19 data points (Stat. Pr.).

München 1500 13.44, 600 20, 1632 16.622 (Mauersberg 65–9); 1650 15 (Heimers 211); 1704 20.63 (Mauersberg 68); 1771 31 (Zerback 61); 1782 37.84 (Mauersberg 69); 1810–1871 14 data points (Stat. Bay. 1864: 13; Böckh 252; Zerback 61).

Münden 1777 3.035 (n hearths multiplied with 5; Keyser 1952: 241); 1812–1867 13 data points (Stat. HA).

Münster 1500 9.683 (extrapolated from growth rate 1532–91); 1532 10, 1591 10.613, 1646, 10 (Jakobi 491, 496–7); 1650 6 (Fischer 40, see also Jakobi 497); 1685 10.5 to 11, 1770 10 to 10.5, 1802 14.379, 1810 14.193 (Jakobi 498–500); 1816–1871 19 data points (Stat. Pr.).

Münsterberg 1840 4.139, 1843–1871 10 data points (Matzerath).

Murrhardt 1823 3.9 (Keyser 1962: 170); 1834–1861 10 data points (Stat. Württ.).

Naumburg 1500 5, 1600 8, 1620 8.904. 1648 4, 1700 7 (Keyser 1941: 618); 1755 6.987 (Blaschke/Stams); 1816–1871 19 data points (Stat. Pr.).

Nauen 1843 4.22, 1846–1871 9 data points (Matzerath).

Neisse 1424 4.5, 1551 7.344, 1647 3.7, 168 6.2, 1691 7.1, 1735 5.708, 1757 5.287, 1766 4.426, 1776 4.512, 1787 5.863 (Stoob/Johanek 263 278); 1816–1871 19 data points (Stat. Pr.).

Neubrandenburg 1792 4 (Franke 114); 1797 4.711, 1817–1880 7 data points (Keyser 1939: 308).

Neuburg an der Donau 1718 2.78 (n houses times 5), 1809 5.043, 1811–1871 11 data points (Keyser/Stoob 1974: 454; Stat. Bay. 1864: 20).

Neumünster 1835 3.772, 1845–1871 5 data points (Keyser 1939: 429).

Neurode 1824 4.341, 1831 4.552 (Stoob/Johanek 290); 1840–1871 11 data points (Matzerath).

Neuruppin 1720 3.5, 1770 6.382, 1800 6.047 (Keyser 1939: 603); 1816–1871 13 data points (Matzerath).

Neuß 1798 4.423 (Keyser 1956: 320); 1816–1871 19 data points (Stat. Pr.).

Neustadt-Magdeburg 1780 3.814, 1798 5.755, 1812 3.065 (Hermes/Weigelt 32); 1816–1871 10 data points (Matzerath).

Neustadt an der Weinstraße 1786 4.094, 1815–1871 3 data points (Keyser 1964: 314).

Neustadt O. S. 1819 4.155, 1831–1871 12 data points (Matzerath).

Neustettin 1843 4.154, 1846–1871 9 data points (Matzerath).

Neustrelitz 1816 4.315, 1820–1875 4 data points (Keyser 1939: 313).

Neuwied late 18th c. [1790] 3–3.5 (Keyser 1964: 319); 1816 5.642, 1840–1871 11 data points (Matzerath).

Nienburg 1848 4.202, 1848–1867 7 data points Stat. HA.

Nördlingen 1491 6.15, 1550 7.43, 1600 8.79, 1652 4.345, 1700 5.4, 1800 5.6, 1811–1871 12 data points (Keyser/Stoob 1974: 494–5; Stat. Bay. 1864: 20; for alternative values in 1459–1700, see Friedrichs 36–8, 301–5).

Norden 1806 3.761 (Schuler 328); 1812–1867 13 data points (Stat. HA).

Nordhausen 1360 3, 1550 6.3, 1626 8, 1750 7.8, 1802 8.355 (Keyser 1941: 625); 1816–1871 19 data points (Stat. Pr.).

Northeim 1821 3.302, 1821–1867 12 data points (Stat. HA).

Nürnberg 1485 36, 1622 50.345 (n households multiplied with 5), 1635 20, 1806–1871 12 data points (Ott 47; Keyser/Stoob 1971: 391, 394; Stat. Bay. 1864: 18).

Nürtingen 1846 4.458, 1849–1861 5 data points (Stat. Württ.).

Oberstein 1831 4.017, 1834–1861 10 data points (Stat. Old.).

Oederan 1834 4.155, 1840–1867 5 5 data points (Stat. Sx.; Keyser 1941: 171; Keller 440).

Oels 1800 4 (Stoob/Johanek 310); 1816–1871 13 data points (Matzeratz).

Ohlau/Oława 1837 4.273, 1840–1871 11 data points (Matzeratz).

Offenbach a. M. 1725 1.8, 1790 6, 1800 5, 1816–1871 6 data points (Keyser 1957: 355).

Oldenburg 1769 3.367, 1793 4.549 (Schuler 346; figures relate to community borders in 1858); 1816–1861 13 data points (Stat. Old.)

Oppeln 1816 4.05, 1819–1871 18 data points (Stat. Pr.).

Oschatz 1815 4.1 (Blaschke/Stams 51); 1832–1867 6 data points (Stat. Sx.; Keyser 1941: 176; Keller 440; Blaschke/Stams 51).

Oschersleben 1846 4.004, 1849–1871 8 data points (Matzeratz).

Osnabrück 1500 6, 1580 6.9–7.7, 1623 9.5, 1643 5, c. 1660 8–9.6, 1772 5.923, 1793–1814 13 data points (Schuler 363–6); 1821–1867 12 data points (Stat. HA).

Osterode 1821 3.823, 1821–1867 12 data points (Stat. HA).

Ostrowo/Ostrów Wielkopolski (x) 1819 3.82, 1840–1871 11 data points (Matzeratz).

Paderborn 1763 2.5–3 (Keyser 1954: 283); 1812 5.302 (Stat. Westph. 85); 1816–1871 19 data points (Stat. Pr.).

Papenburg 1821 3.62, 1821–1867 10 data points (Stat. HA).

Parchim 1760 2.5, 1819–1872 7 data points (Keyser 1939: 314).

Pasewalk 1816 4.355, 1819–1871 12 data points (Matzeratz).

Passau 1528 4.019, 1569 8, 1604 4.3, 1633 4.74 (n taxpayers multiplied with 5), 1689 6.273, 1789 8.408, 1803 9.9, 1809 6.161, 1811–1871 12 data points (Keyser/Stoob 1974: 532; Stat. Bay. 1864: 14).

Perleberg 1828 3.456, 1834 4.933 (Keyser 1939: 612), 1840–1871 11 data points (Matzerath).

Pforzheim 1723 3, 1789 4.311, 1800 5.062, 1810–1871 8 data points (Stat. Baden 1852; Keyser 1959: 137).

Pirmasens 1802 3.913, 1816–1871 6 data points (Keyser 1964: 350).

Pirna 1811 4.122, 1815–1871 10 data points (Stat. Sx.; Keyser 1941: 183; Keller 440; Blaschke/Stams 50).

Plauen 1750 4.07 (Blaschke 1967: 140); 1815–1870 14 data points (Stat. Sx.; Böckh 251–2; Keyser 1941: 187; Blaschke/Stams 50).

Pleschen/Pleszew (x) 1837 4.392, 1840–1871 11 data points (Matzerath).

Posen/Posnan (x) 1816–1871 19 data points (Stat. Pr.).

Potsdam 1722 2.6–2.7 (Engel et al. 403); 1730 5.64, 1740 11.708, 1750 14.871, 1770 16.208, 1780 27.896, 1790 27.126, 1801 26.968 (Keyser 1939: 617); 1816–1871 19 data points (Stat. Pr.).

Prenzlau 1666 0.24, 1730 4.996, 1740 4.716, 1750 5.948, 1770 5.941, 1780 6.117, 1790 6.226, 1801 7.12, 1808 7.808 (Keyser 1939 : 620), 1816–1867 12 data points (Matzerath); 1871 15.669 (Engel et al. 419).

Preußisch Stargard/Starogard Gdański (x) 1843 4.176, 1846–1871 9 data points (Matzerath).

Pritzwalk 1840 4.235, 1843–1871 10 data points (Matzerath).

Pyritz 1831 4.151, 1840–1871 11 data points (Matzerath).

Quedlinburg 1500 5, 1600 6, 1763 8.005, 1772 9.382, 1803 7.418 (Keyser 1941: 644); 1816–1871 13 data points (Matzerath).

Radevormwald 1792 4.32, 1816–1871 6 data points (Keyser 1956: 341).

Rastatt 1813 4.204, 1823–1871 6 data points (Keyser 1959: 350).

Rastenburg/Kętrzyn (x) 1840 4.221, 1843–1871 10 data points (Matzerath).

Rathenow 1816 4.073, 1819–1871 12 data points (Matzerath).

Ratibor 1805 3.156 (Stoob/Johanek 348); 1816–1871 19 data points (Stat. Pr.).

Ravensburg 1500 4.5, 1648 2, 1823 3.37 (Keyser 1962: 405); 1834–1861 10 data points (Stat. Württ.).

Rawitsch/Rawicz (x) 1816 8.22, 1819–1871 12 data points (Matzerath).

Regensburg 1500 11.5, 1620 60, 1648 25, 1780 20, 1808 19 (Gömmel 486, 491); 1811–1871 12 data points (Keyser/Stoob 1974: 579; Stat. Bay. 1864: 16).

Reichenbach (Eulengebirge) 1831 4.438, 1840–1871 11 data points (Matzerath).

Reichenbach i. V. 1725 2.528 (Keyser 1941: 196); 1750 4.947 (Blaschke 1967: 141); 1815–1875 10 data points (Stat. Sx.; Kalender 85; Keyser 1941: 196; Blaschke/Stams 51).

Remscheid 1740 4.487 (extrapolated from growth rate 1792–1816); 1792 6.653, 1816–1830 3 data points (von Viebahn 108; Keyser 1956: 352); 1834–1871 13 data points (Stat. Pr.).

Remscheid-Lennep 1792 2.991, 1816 4.608 (von Viebahn 108); 1819–1871 13 data points (Matzerath).

Remscheid-Lüttringhausen 1700 0.7, 1792 5.04, 1808 5.32, 1818 5.5 (Keyser 1956: 358–9); 1852–1871 7 data points (Matzerath).

Rendsburg 1769 3.586, 1803 7.573, 1835–1871 4 data points (Keyser 1939: 443).

Reutlingen c. 1300 4.5, 1542 5.42, 1545 5.445, 1600 5.043, 1649 3.834, 1656 4.376, 1733 6.663, 1803 7.986, 1810 8.292, 1823 9.475; 1834–1861 10 data points (Stat. Württ.).

Rheydt 1822 4.129, 1825–1871 16 data points (Stat. Pr.).

Rochlitz 1846 4.411, 1849 4.545 (Stat. Sx.); 1867 5.194 (Keller 440).

Rogasen/Rogoźno (x) 1840 4.412, 1843–1871 10 data points (Matzerath).

Ronneburg 1831 4.476, 1842–1871 4 data points (Keyser 1941: 352).

Rostock 1473 10.7, 1522 10.4, 1563 13.125, 1566 9.5 (Keyser 1939: 324); 1594 14.865, 1618 15, 1648 15, 1720 11 (Arndt 49); 1773 9, 1792 10.839, 1806–1871 9 data points (Keyser 1939: 324).

Roßwein 1834 4.202, 1840–1867 7 data points (Stat. Sx.; Keyser 1941: 202; Keller 440; Blaschke/Stams 51).

Rothenburg ob der Tauber 1525 3.15 (n taxables times 4.5), 1770 5.8, 1784 5.54, 1803–1871 13 data points (Keyser/Stoob 1971: 463; Stat. Bay. 1864: 18).

Rottenburg am Neckar 1795 4.181, 1810 4.62, 1823 5.481 (Keyser 1962: 424–5); 1834–1861 10 data points (Stat. Württ.).

Rottweil 1834 4.498, 1837–1861 9 data points (Stat. Württ.).

Rudolfstadt 1822 3.927, 1834–1871 5 data points (Keyser 1941: 353).

Rügenwalde 1837 3.941, 1840–1871 11 data points (Matzerath).

St. Ingbert 1840 4.015, 1852–1885 3 data points (Keyser 1964: 536).

Saalfeld 1819 3.497, 1833–1871 5 data points (Keyser 1941: 357).

Saarbrücken 1784 4.472 (extrapolated from growth rate of old town 1802–15; Keyser 1964: 510); 1816–1871 19 data points (Stat. Pr.).

Saarlouis 1816 4.672, 1840–1871 11 data points (Matzerath).

Sagan 1816 4.628, 1819–1871 12 data points (Matzerath).

Salzwedel 1500 4.357 (extrapolated from figure for 1618 and growth rate of high data frequency sample in 1500–1618); before the Thirty Years' War [1618] about 6.8, after the War [1648] about 4.1, 1730 3.589, 1803 4.45, 1805 4.516, 1810 5.41 (Keyser 1941: 657); 1816–1871 13 data points (Matzerath).

Sangerhausen 1819 4.178, 1831–1871 12 data points (Matzerath).

Schleiz 1784 3.873, 1834–1871 5 data points (Keyser 1941: 663).

Schleswig (x) 1555 1.5 (n burghers multiplied with 5), 1769 5.629, 1803 7.823, 1835 11, 1879 15 (Keyser 1939: 446).

Schmalkalden 1663 4.304, 1821 4.474 (J. G. Wagner 1843: 389); 1792 5 (Franke 114); 1834–1864 11 data points (Stat. Hessen).

Schneeberg 1699 3.324, 1750 6.445 (Keller 441); 1815–1867 7 data points (Stat. Sx.; Keller 441; Blaschke/Stams 50).

Schneidemühl/Piła (x) 1843 4.192, 1846–1871 9 data points (Matzerath; see also Johanek/Post 203).

Schönebeck 1792 4.229, 1808 4.769 (Keyser 1941: 675); 1816–1871 14 data points (Matzerath).

Schöneberg 1849 4.147, 1852–1871 7 data points (Stat. Pr.).

Schwabach 1745 4.405 (extrapolated from growth rate 1750–1799); 1750 4.575 (n house owners multiplied with 5), 1799 6.39 (n households multiplied with 5), 1811–1871 11 data points (Keyser/Stoob 1971: 493; Stat. Bay. 1864: 18).

Schwäbisch Gmünd 1770: 4.5 (extrapolated from growth rate 1810–23); 1810 5.341, 1823 5.65 (Keyser 1962: 203); 1834–1861 10 data points (Stat. Württ.).

Schwäbisch Hall 1597 1.123, 1810 5.488, 1823 6.374 (Keyser 1962: 206–7); 1834–1861 10 data points (Stat. Württ.).

Schwedt 1819 4.453, 1831–1871 12 data points (Matzerath).

Schweidnitz 1550 5, 1580 6, 1648 0.2, 1745 7, 1762 4.9, 1780 6.2, 1787 5.494, 1794 9.1 (Stoob/Johanek 398); 1816–1871 19 data points (Stat. Pr.).

Schweinfurt 1557 3.255, 1610 5.015, 1787 6.361, 1798 6.585, 1800 6.045, 1802–1871 10 data points (Keyser/Stoob 1971: 504–6; Stat. Bay. 1864: 19).

Schwerin. In the *Altstadt* there were 5.21 inhabitants per hearth in 1764 and 8.67 inhabitants per house in 1819. These ratios serve to develop estimates for 1782 (*Altstadt*) and 1741/82 (*Schelfe*, the twin town of the *Altstadt*). Population of the *Schelfe* in 1764 is derived with exponential interpolation from the extrapolations for 1741 and 1782. 1764 4.434, 1782 7.044, 1819–1875 8 data points (Keyser 1939: 330).

Schwerin a. d. Warthe/Skwierzyna (x) 1819 3.567, 1831–1871 12 data points (Keyser 1939: 635).

Schwiebus 1837 4.352, 1840–1871 11 data points (Matzerath).

Siegen 1822 4.053, 1825–1871 16 data points (Stat. Pr.).

Soest 15th c. [1500] 10–11 (Ditt 49); 1550 8.5 (Jakob 274); 1614 9.25 (Ditt 60); 1651 4.5 (Jakob 274); 1757 5.143, 1776 3.863 (Ditt 71); 1787 5.188 (Keyser 1954: 333); 1798 5.541 (Ditt 71); 1806 5.444 (Keyser 1954: 333); 1816–1871 13 data points (Matzerath).

Soldin/Myślibórz 1831 4.383, 1837–1871 12 data points (Matzerath).

Solingen 1831 4.38, 1834–1871 13 data points (Stat. Pr.).

Solingen-Dorp 1825 4.216 (von Viebahn 108); 1831 4.792–1871 14 data points (Matzerath).

Solingen-Gräfrath 1849 4.482, 1852–1871 7 data points (Matzerath).

Solingen-Höhscheid 1816 4.054, 1825–1871 15 points (Matzerath).

Solingen-Merscheid 1834 4.305, 1858–1871 5 data points (Matzerath).

Solingen-Wald 1843 4.491, 1846–1871 9 data points (Matzerath).

Sommerfeld 1837 4.402, 1840–1871 11 data points (Matzerath).

Sondershausen 1816 3,129, 1834–1871 5 data points (Keyser 1941: 366).

Sonneberg 1840 3.735, 1852–1880 4 data points (Keyser 1941: 367).

Sorau 1819 3.935, 1831–1871 12 data points (Matzerath).

Spandau 1774 3.559, 1790 6.683, 1800 5.839 (Keyser 1939: 498); 1816–1871 19 data points (Stat. Pr.).

Speyer 1500 6.86 (extrapolated from trend growth rate 1535–99); 1535–1599, 1624 9 data points, 1632 4.384, 1800 3.664, 1815–1871 11 data points (1871 seems to miss out garrison; Keyser 1964: 391, 393).

Spremberg 1837 4.408, 1840–1871 11 data points (Matzerath).

Sprottau 1843 4.196, 1846–1871 9 data points (Matzerath).

Stade 1787 4.427 (Keyser 1952: 339; cf. Schuler 424–6); 1812–1867 13 data points Stat. HA.

Stargard 1500 3.524 (extrapolated from figure for 1600 and growth rate of high data frequency sample in 1500–1618); early 17th c. [1600] 5–6 (Miasta II, 439); 1740 5.529, 1782 5.612, 1794 5.971, 1802 6.749 (Johanek/Post 287); 1816–1871 19 data points (Stat. Pr.).

Stendal 1478 9.235 (1847 taxable units multiplied with 5), 1567 6.26 (1252 hearths multiplied with 5), 1688 0.3, 1724 3.695, 1750 4.13, (lower figure for 1770 omitted, probably excludes garrison), 1780 5.666, 1790 5.552, 1800 5.23 (Keyser 1941: 694); 1816–1871 13 data points (Stat. Pr.; Matzerath).

Stettin 1470 9.5, 1560 13, 1586 11.2, 1592 12.5, 1597 13.5, 1600 12.2, 1623 12.7, 1627 12.5, 1631 10, 1709 10.9, 1711 11.307, 1720 6.081, 1740 12.36, 1750 12.966, 1755 13.357, 1760 11.088, 1770 13.99, 1780 14.984, 1790 16.249, 1812 21.255 (Johanek/Post 255); 1816–1871 19 data points (Stat. Pr.).

Stolberg (Rheinland) 1849 4.464, 1849–1871 8 data points (Matzerath).

Stolp i. Pom. 1802 4.334, 1809 4.539 (Johanek/Post 287); 1816–1871 19 data points (Stat. Pr.).

Stralsund first half of 16th c. [1500] 12.5 (somewhat more in the 14th and 15th centuries), 1677 8.153, 1782 10.606, 1800 11.191 (Keyser 1939: 244); 1816–1871 19 data points (Stat. Pr.).

Strasburg (Uckermark) 1843 4.356, 1846–1871 9 data points (Matzerath).

Straubing 1767 3.935 (n households multiplied with 5), 1807 5.428, 1808–1871 14 data points (Keyser/Stoob 1974: 648; Stat. Bay. 1864: 14).

Strehlen/Strzelin 1837 4.097, 1840–1871 11 data points (Matzerath).

Striegau 1837 3.881, 1840–1871 11 data points (Matzerath).

Stuttgart 1400 4 (Keyser 1962: 226), 1545 5.209, 1898 7.855 (von Hippel 2009a: 43, 259); 1631 8.327, 1648 4.5 (Keyser 1962: 226); 1634 7.795, 1655 5.2 (von Hippel 2009b: 33); 1698 13, 1707 16, 1730 11.3, 1758 12.225, 1768 15.176, 1782–1820 10 data points (Keyser 1962: 226); 1834–1861 10 data points (Stat. Württ.).

Süchteln 1830 4.375, 1840–1871 5 data points (Keyser 1956: 393).

Suhl 1704 4.486 (Keyser 1941: 698); 1816–1871 13 data points (Matzerath).

Swinemünde 1846 4.416, 1849–1871 8 data points (Matzerath).

Tangermünde 1849 4.492, 1852–1871 7 data points (Matzerath).

Thorn/Toruń (x) 1816–1871 19 data points (Stat. Pr.).

Tilsit 1692 4.34 (n adult males multiplied with 5), 1756 5.895, 1781 6.764, 1794 8.637, 1801 8.958 (Keyser 1939: 111); 1816–1871 19 data points (Stat. Pr.).

Tönning 1795 1.5, 1805 6, 1933 3.193 (Keyser 1939: 450).

Torgau 1535 3.5, 1628 6, 1648 2.8 (Keyser 1941: 709–10); 1699 2.806 (Keller 441); 1755 3.56 (Blaschke/Stams 50); 1811 4.811 (Keller 441); 1816–1871 13 data points (Matzerath).

Trebnitz (Schlesien)/Trzebnica 1846 4.291, 1852–1871 7 data points (Matzerath).

Treptow (Rega) 1816 3.916, 1819–1871 12 data points (Matzerath).

Treuen 1846 4.362, 1849–1871 5 data points (Stat. Sx.; Kalender 85; Keyser 1941: 224).

Treuenbrietzen 1831 4.315, 1849–1875 4 data points (Keyser 1939: 662; Engel et al. 518).

Trier 1375 10, 1542 8.5 (Keyser 1964: 425); 1570s/80s 5.5, 1613–1784 taxable persons multiplied with 4.7: 1613 5.3, 1624 5.5, 1653 3.3, 1702 3.7, 1733 6, 1743 6.55, 1753 6.75, 1763 6.75, 1773 6.71, 1784 6.7, 1792 6.9, 1802 8.829 (Düwell 64–6); 1816–1871 19 data points (Stat. Pr.).

Tübingen 1598 3.86, 1634 6.115, 1655 3.94 (von Hippel 2009a: 259, 2009b: 33); 1686 4.2, 1793 6.538, 1803 5.756, 1810 6.363, 1823 6.841 (Keyser 1962: 464–5); 1834–1861 10 data points (Stat. Württ.).

Tuttlingen 1810 3.755, 1823 5.312 (Keyser 1962: 469); 1834–1861 10 data points (Stat. Württ.).

Ulm 1500 17, 1550 19, 1600 21, 1650 13.5, 1750 15. 1780 14, 1796 11.468 (Specker 62, 169, 230); 1810 11.809, 1821–1867 12 data points (Hepach 67; Stat. Württ.).

Unna 1831 4.416, 1840–1871 11 data points (Matzerath).

Velbert 1808 4.417, 1816–1871 3 data points (von Viebahn 108; Keyser 1956: 395).

Verden 1821 4.215, 1824 4.556 (Schuler 454); 1833–1867 11 data points (Stat. HA).

Viersen 1837 4.128, 1840–1871 11 data points (Stat. Pr.).

Warburg. From the late Middle Ages [1500] to the Thirty Years' War [1618] 4–5, 1763 2 (Keyser 1954: 363).

Waren 1819 4.202, 1840–1880 3 data points (Keyser 1939: 341).

Warendorf 1622 3.2, 1683 4.709, 1763 2.873 (Keyser 1959: 366); 1849 4.464, 1852–1871 7 data points (Matzerath).

Weimar 1600 3.5, 1640 2.863, 1762 6.323, 1779 6.041, 1789 6.549, 1801 6.265, 1834–1871 5 data points (Keyser 1941: 389).

Weinheim (Bergstraße) 1812 4.039, 1830–1871 3 data points (Stat. Baden 1852; Keyser 1959: 169).

Weißenburg 1830 3.7, 1840–1871 6 data points (Keyser/Stoob 1971: 571; Stat. Bay. 1864: 18).

Weißenfels 1800 4 (Keyser 1941: 722); 1816–1871 19 data points (Stat. Pr.).

Werdau 1815 3.57 (Blaschke/Stams 51); 1832–1867 7 data points (Stat. Sx.; Keyser 1941: 710; Keller 441; Blaschke/Stams 51).

Wernigerode 1819 3.782, 1831–1871 12 data points (Matzerath).

Wesel 1386 5.748, 1722 8.116, 1740 5.966, 1756 5.615, 1763 4.376, 1777 4.506, 1787 4.428 (Keyser 1956: 404–5); 1816–1871 13 data points (Matzerath).

Wetzlar 1350 6, 1567 1.6, 1712 4.06, 1731 6, 1751 5.8, 1805 5.068, 1810 4.278, 1817 4.275 (Keyser 1957: 443); 1819–1871 13 data points (Matzerath).

Wiesbaden 1816 4.413, 1819–1871 18 data points (Stat. Pr.).

Wismar 1475/7 8–9, 1550 8.5, 1618 8.5, 1648 7.5, 1720 7.5, 1799 5.946 (Arndt 47–8); 1800 6.5, 1815 6.7, 1819 8.1 (Franke 114–5); 1830 10, 1875 15 (Keyser 1939: 345).

Witten 1849 3.965, 1852–1871 7 data points (Stat. Pr.).

Wittenberg 1550 3, 1699 5 (Keller 441); 1797 6.9 (Blaschke/Stams 51); 1811 5.361 (Keller 441); 1816–1871 13 data points (Matzerath).

Wittenberge 1849 4.071, 1852–1871 7 data points (Matzerath).

Wittstock 1816 4.186, 1819–1871 13 data points (Matzerath).

Wolfenbüttel 1643 0.9 (Keyser 1952: 150 citizens), 1748 12–14, 1754 9.212, 1760 6.84, 1770 7.201, 1776 5.832, 1780 5.927, 1790 6.397, 1821–1871 3 data points (Keyser 1952: 391).

Wolgast 1816 4.267, 1819–1871 12 data points (Matzerath).

Wollin 1849 4.417, 1852–1871 7 data points (Matzerath).

Worms 1500 10 (late 12th c. 6–15), 1600 10, 1695 2, 1818 6667, 1828–1871 5 data points (Keyser 1964: 454)

Wriezen 1810 3.918 (Keyser 1939: 676); 1816–1871 13 data points (Matzerath).

Wülfrath 1834 4.472 (von Viebahn 108); 1852–1871 6 data points (Keyser 1956: 415; Matzerath).

Würzburg 1500 4.197 (extrapolated with growth rate 1512–25); 1512 5.365, 1525 7, 1571 8.59, 1621 9.782 (Keyser/Stoob 1971: 598); 1701 13.883, 1788 21.38 (Christoforatou 918, Fn. 15); 1805–1871 18 data points (Stat. Bay. 1864: 19; Böckh 251–2; Keyser/Stoob 1971: 602; U. Wagner 2007: 38).

Wuppertal-Cronenberg 1800 4.5 (arbitrary value); 1840 4.7, 1818 4.371, 1819–1870 7 data points (Keyser 1956: 427).

Wuppertal-Ronsdorf 1819 4.105, 1834–1871 13 data points (Matzerath).

Wurzen 1840 4.1 (Blaschke/Stams 51); 1846–1875 6 data points (Stat. Sx.; Keyser 1941: 236; Keller 441).

Zeitz 1646 1.445, 1774 4.554, 1779 4.68, 1802 5.89 (Keyser 1941: 748); 1816–1871 19 data points (Stat. Pr.).

Zellerfeld 1753 4.576, 1791 3.4 (Keyser 1952: 89); 1839 4.383, 1839–1867 10 data points (Stat. HA).

Zerbst 1500 6, 1600 6.5, 1630 6, 1758 6.3 1775 5.3, 1786 5.9, 1801 7, 1818–1867, 1890 5 data points (Keyser 1941: 754).

Zeulenroda 1828 4.319, 1837–1880 3 data points (Keyser 1941: 393).

Zielenzig 1840 4.301, 1843–1871 10 data points (Matzerath).

Zittau 1400 5 (Keyser 1941: 239); 1550 5 (Blaschke 1967: 141); 1637 6, 1705 9 (Keyser 1941: 239); 1750 8.193 (Blaschke 1967: 141); 1771 7.6, 1790 7.3, 1819–1870 9 data points (Stat. Sx.; Kalender 86; Keyser 1941: 239; Blaschke/Stams 50).

Zschopau 1815 4.285 (Blaschke/Stams 50); 1832–1867 6 data points (Stat. Sx.; Keller 441; Blaschke/Stams 50).

Züllichau 1780 4.437, 1790 4.895, 1801 5.386 (Keyser 1939: 685); 1816–1871 13 data points (Matzerath).

Zweibrücken 1688 1120 (n families multiplied with 5), 1774 5439, 1777 4799, 1795 5012, 1795 5012, 1806 6159, 1823–1871 6 data points (Keyser 1964: 464).

Zwickau 1462 3.9, 1530 7.677 (Keyser 1941: 245); 1550 7.031 (Keller 440); 1611 6.268, 1631 5.374, 1640 2.693 (Keyser 1941: 245); 1699 2.968, 1750 4.18, 1811 4.38 (Keller 440); 1815–1871 11 data points (Stat. Sx.; Böckh 251–2; Keyser 1941: 245; Blaschke/Stams 50).

A4 References

A4.1 Official statistics

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Stat. Bay. 1864 = *Die Volkszählung im Königreiche Bayern vom Dezember 1864* (=*Beiträge zur Statistik des Königreichs Bayern* 13, München: K. Statistisches Bureau, 1865).

Stat. Ff = *Beiträge zur Statistik der Freien Stadt Frankfurt* 2, 1 (1866).

Stat. HA = Büch, Henrike (1998): "Bevölkerung des Kurfürstentums / Königreichs Hannover 1745–1867", in: Karl Heinrich Kaufhold and Markus A. Denzel (eds.), *Historische Statistik des Kurfürstentums / Königreichs Hannover* (St. Katharinen: Scripta Mercaturae, 1998), pp. 6–60; used from GESIS/HISTAT file ZA 8420.

Stat. Hessen = *Beiträge zur Statistik des Kurfürstentums Hessen* 1867/2, pp. 40–1 (contains figures in three year intervals for the period 1834–1864)

Stat. Old. = *Statistische Nachrichten über das Grossherzogthum Oldenburg* 2 (1857), part 1, pp. 12–16, 29, part 2, pp. 4–6; vol. 6 (1863), pp. 2, 8.

Stat. Pr. = Silbergleit, Heinrich (1908): *Preußens Städte: Denkschrift zum 100jährigen Jubiläum der Städteordnung vom 19. November 1808* (Berlin: Heymanns), part C, pp. 2–7 (shows population based on censuses).

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Stat. Westph. = HASSEL, Georg: *Statistisches Repertorium über das Königreich Westphalen* (Braunschweig: Vieweg, 1813).

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A4.2 Deutsches Städtebuch

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A4.3 Secondary works used as data sources

(For works that are not only used as data source but are also referenced in the main text of the study, see A4.4 General bibliography.)

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