Jan Michael Goldberg

Transformation of urban occupational structure and mobility (Leipzig, 1550-1850)

1. Introduction

Since humans began to engage in specialized occupations, these have been subject to constant change. Classic studies in the field of occupational structure analysis primarily illustrate the transition from an agrarian-oriented occupational structure to a developed economy with industrial production (Clark 1951; Kuznets 1966). Today, the transformation of the occupational world remains a topic of scientific and societal debate. Particularly, the influence of technologies is widely discussed, as seen in the German-speaking context, for example, through the debate surrounding the term «Industry 4.0».[1] A similar discussion took place in the 1970s and 1980s with the introduction of computer technology (cf. Heßler 2016, 18).

However, upheavals - not just technological ones - have had the potential to alter the occupational structure previously; thus, they interact with economic development. Various other shocks and trend shifts such as wars, reforms, innovations, changes in religion, etc., may have also had an impact. Altmann and Kammerer categorize these causes into (1.) technical-organizational changes in the production process, (2.) demand-driven economic changes, and (3.) societal conditions such as policies or training structures and their changes (cf. 1970, 9-11).[2] For example, a new technology like the steam engine can lead to the substitution of manual labor with machines. Conversely, new markets can increase demand volume, thus enabling further specialization. The Netherlands provides an example of how such Smithian growth can lead to radical changes in the occupational structure (cf. Shaw-Taylor and Wrigley 2014, 83). A societal condition example is the former guild system, which exerted control over training and professional work.

Cities are particularly suitable for examining changes in occupational structures. They have few agricultural workers, so economic development can only be partially explained by the transition from an agrarian to an industrial society, although a transition from the primary to the secondary and tertiary sectors is observed, for instance, in the case of the Barcelona metropolitan area (1715-1860) (cf. Brea-Martínez and Pujadas-Mora 2018, 241). Surprisingly few studies exist on the occupational structure in individual cities. Watson, based on cities in the 1990s,

[1] In the German-speaking context, a recent trend towards an occupational structural upgrade can indeed be observed, where the ranks of industrial workers and office assistants have thinned out (Oesch 2016, 207).

[2] Wrigley also emphasizes the demand-driven influence on occupational structure (cf. 2016, 74f.).

Jan Michael Goldberg, Martin Luther University Halle-Wittenberg, Germany, goldberg.jan@web.de, 0000-0002-4817-4283
Referee List (DOI 10.36253/fup_referee_list)
FUP Best Practice in Scholarly Publishing (DOI 10.36253/fup_best_practice)

Jan Michael Goldberg, *Transformation of urban occupational structure and mobility (Leipzig, 1550-1850)*, © Author(s), CC BY 4.0, DOI 10.36253/979-12-215-0667-9.12, in Angela Orlandi (edited by), *La mobilità sociale nelle società preindustriali: tendenze, cause ed effetti (secc. XIII-XVIII) / Social mobility in pre-industrial societies: tendencies, causes and effects (13th-18th centuries)*, pp. 205-246, 2025, published by Firenze University Press, ISBN 979-12-215-0667-9, DOI 10.36253/979-12-215-0667-9

identifies a correlation between growth rates and occupational structure: production-intensive cities or those with a large proportion of healthcare workers show lower growth (cf. 2005, 19-20). However, he sees a need for further research into the relationship between immigration, population growth, qualifications, and occupational structure. This raises the question of what influences the employment structure in cities. So far, no study has been found that examines the impact of these various changes using the example of a city. Existing city-specific studies cover short periods and/or periods from the second half of the 20th century onwards (z. B. Khadke, Kharat, and Kamble 2019; Koizumi and Wakabayashi 2015).

Thus, there is a research gap in exploring the occupational structure of individual cities from a long-term, historical perspective. This leads to the question of how a change in the occupational structure in cities is practically carried out. This can happen through (1.) migration, (2.) intragenerational, or (3.) intergenerational change. Due to the latter aspect, the change in the occupational structure is also strongly linked to the question of social or occupational mobility.[3] There are a few studies on the development of occupational mobility based on specific cities: Favre, Floris, and Woitek examine birth cohorts in Zurich between 1780 and 1870. Zurich undergoes significant changes during this period (rapid population growth, industrialization, development of the banking sector, founding of the university, development of the railway system). Contrary to expectations, they observe a slight decline in mobility during the study period. The cause for this is identified in particularly high intergenerational persistence of occupations with low socioeconomic status (cf. Favre, Floris, and Woitek 2018, 25). Another Swiss example can be found in Basel by Häner and Schaltegger (2022). Additionally, Barone and Mocetti measure long-term low social mobility in Florence (1427-2011), which has only significantly increased in recent years. Their data suggest a glass floor that prevents elites from descending (cf. Barone and Mocetti 2020, 1889). Research on mobility structure in connection with the occupational structure of individual cities has been neglected so far. Considering that many changes occur locally and also have their effects locally, it is essential for economic.

In the present study, Leipzig, a German city that has experienced many significant upheavals over the past centuries, is examined. These upheavals have the potential to have influenced the occupational structure. Leipzig is located at the intersection of two significant historical trade routes, the «via imperii» and the «via regia» (cf. Schönfelder and Börngen 2015, 39). Trade thus significantly influences the city's development. It becomes an important trading center, initially as a goods fair, then as a sample fair. Leipzig also develops into a center of printing and book trade (cf. Keiderling 2012, 221). Thus, the city undergoes various changes even in proto-industrial times. It is also assumed that as a trade fair city, Leipzig has been strongly influenced by regional economic shocks.

This changes, while similar to trends in other European cities, are shaped by unique factors makes it a distinct case within the broader European context.

[3] Sorokin already described in 1927 that such shocks can have effects on social mobility without explicitly labeling them as shocks (cf. 1998, 143ff. u. 466ff.). Subsequently, the term occupational mobility will be used, which also implies a social change.

Although many towns experienced economic transformations due to industrialization and population growth, but Leipzig's trajectory was notably influenced by its role as a major hub for trade and intellectual exchange. The town became a leading center for the printing industry after the Thirty Years' War, making it the foremost book trade city in the Holy Roman Empire. Unlike cities driven by early industrialization, Leipzig's growth was tied to intellectual production and commerce. Additionally, the special role of its trade fair economy makes the city something unique as an object for scientific studies. Also the city's strategic location at the intersection of via imperii and via regia trade routes also made it a focal point for economic activity, influencing its occupational structure in ways that differed from more isolated towns. So, its unique combination of trade, intellectual production, and strategic location makes it an exciting case for exploring the complexity of urban development in Europe, providing further empirical insights.

The hypothesis is that significant changes in the city's development also affect the occupational structure and must be accompanied by occupational mobility. These (dis-)continuities are further referred to as shocks or trend breaks. For the study, a population dataset for the period between 1550-1850 is used. This timeframe is chosen because Leipzig also undergoes disruptions in proto-industrial times, which may contain valuable insights into the transformation of occupational structures. The study examines the rise of the printing industry (1680), the Seven Years' War (1763), a population boom (1800), and the beginning of industrialization (1839). From today's perspective, these events may appear shock-like, especially given the focus on specific years, but each transition extended over several years. The defined years are therefore (only) mathematically relevant because they identify the significant turning point. The impact of each upheaval on the occupational structure is examined. Additionally, for this period, there is a dataset on the Leipzig population collected through an innovative citizen science approach. This dataset consists of genealogical, intergenerational links between individuals in Leipzig's urban evangelical communities.

Next, the available data is introduced in detail. Subsequently, the methodological approach to examining the effects of upheavals in Leipzig on the occupational structure is described. A time-series-based structural break analysis is conducted, with cross-tabulations also used to analyze upheavals. Occupational data is coded according to the «Klassifikation der Berufe 2010» (KldB; Paulus & Matthes, 2013) and the «Historical International Classification of Occupations» (HISCO; van Leeuwen, Maas & Miles, 2002). The HISCO assignment also allows classification into the «Historical International Social Class Scheme» (HISCLASS; van Leeuwen & Maas, 2011) and the «Historical Cambridge Social Interaction and Stratification» (HISCAM; Lambert et al., 2013). The resulting analysis results are presented and interpreted before reaching a conclusion.

2. Data

The empirical basis for this study is a new dataset on the population of Leipzig, which was created as part of the «Time Machine Leipzig» project.[4] The data used here was collected through the Data Entry System (DES) of the Society for Computer Genealogy (CompGen) in another citizen science (sub-)project. With the DES, private individuals systematically collect data from historical sources. Using the DES, the «Index of Leipzig Families» (KLF)[5] as well as the «Index of Leipzig District Testament Files» (KLK)[6] have been compiled. The KLF contains data on individual families residing in Leipzig, with information such as life dates, occupations, and children's data recorded on 20,000 index cards. Seidel and Wermes write about the KLF:

> The index includes the council death registers of the city of Leipzig from 1721 to 1851 (excluding illegitimate and non-local entries), the citizen registers of the city of Leipzig from 1501 to 1818, as well as the marriage registers of the Leipzig inner-city parishes of St. Nikolai (from 1541) and St. Thomas (from 1549) up to 1850 in full, and up to 1875 for native Leipzigers, along with the baptismal registers of these parishes for the period 1580 to 1850. Thus, the compiler of the index, Helga Moritz, processed approximately 200,000 baptismal entries and about 20,000 marriage entries from these Leipzig church parishes from 1580 to 1850, 150,000 death entries from the Leipzig council death registers, as well as all citizen entries from the citizen registers of the city of Leipzig for the aforementioned period (Seidel and Wermes 2017, 289).

It is worth noting additionally that Leipzig was almost entirely an Evangelical-Lutheran city at the beginning of the 19th century, and almost all residents belonged to one of these two parishes St. Thomas and St. Nikolai (cf. Hein 2017, 75). Therefore, the KLF likely contains close to a comprehensive survey of the local Leipzig population up to that time. However, in the further discussion of the data, it becomes evident that Helga Moritz did not fully evaluate all the sources.

The KLK, on the other hand, consists of approximately 4,800 index cards documenting around 6,500 individuals. Each testifying individual has a card summarizing references to the individual testament files.[7] It does not provide information about the content of the testaments but serves solely as a finding aid. The index covers the period from 1696 to 1829.

The data from KLF and KLK are merged using record linkage according to the algorithm defined by Goldberg and Mernitz and linked intergenerationally, resulting in an intergenerational dataset (see corresponding chapter). The merging of 241,467

[4] Aims of the Time Machine Leipzig include merging various sources to make them accessible in an appealing format (cf. Müller 2022, 269; cf. Time Machine Leipzig 2022).

[5] Staatsarchiv Leipzig, *Kartei Leipziger Familien, 21959*.

[6] Staatsarchiv Leipzig, *Testamente des Amtes Leipzig, 20009, 5465-5584*.

[7] Spouses who jointly created a will were given two index cards.

records from KLF yields a dataset of 216,085 individuals.[8] Unnecessary columns are deleted, leaving the following information about the individuals (see

Tab. 1). The frequency indicates the proportion of person records where this information is available.

Of particular relevance for the study is the combination of the birth year and an occupation indication, as the birth year provides temporal context. Only 26,453 out of 69,812 individuals with an occupation indication also have information on birth or baptism available. Among the individuals with an occupation indication but no birth year, many cases involve the first known generation: the father is known in only 8.4 percent of cases, whereas the father is included in the dataset for individuals with an occupation indication and birth year in 94.7 percent of cases.

Tab. 1. **Parameters in the merged dataset, their description, and frequency, n=216,085**

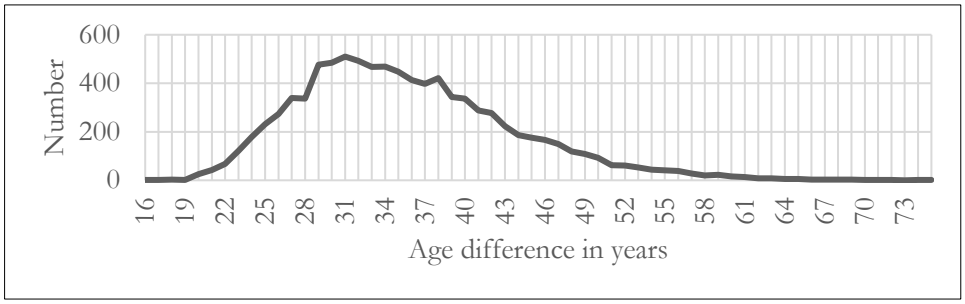
Label	Description	Frequency
id	Identificator of a person	1.00
idFather	Identificator of the father	0.62
idMother	Identificator of the mother	0.47
idSpouse1	Identificator of the first spouse	0.55
idSpouse2	Identificator of the second spouse	0.06
idSpouse3	Identificator of the third spouse	0.01
birthday	Day of birth	0.28
baptismday	Day of baptism	0.29
deathday	Day of death	0.15
burialday	Day of burial	0.00
marriageday1	Year of first marriage	0.49
marriageday2	Year of second marriage	0.05
marriageday3	Year of third marriage	0.01
occupation	Occupation	0.32
firstnameGiven	First name(s)	1.00
surnameGiven	Surname	1.00
sex	Gender (F/M)	1.00
probate	Presence of a will	0.01

For a significant portion of individuals, no birth year is available, and thus, their age is unknown. To include these individuals, an age estimate is made. For each person without a birth or baptism date, it is checked if they have children. If they

[8] The column «probate» is derived by comparing the KLF with the KLK (each compared with itself). Individuals who could be matched between the two were identified as testators (non-0 indicates the presence of a will).

have multiple children (and birth years of the children), the earliest birth year is selected. Then, 30 years are subtracted from this year. This approach is based on the mode of the age difference between fathers and sons (see Graph 1).[9] This method allows estimating the birth year for an additional 23,293 individuals. As a result, there are a total of 49,746 individuals with both an occupation indication and an (estimated) birth year. Thus, a significant portion of data for male individuals in the KLF becomes usable. For most women, there are no occupation indications available.

Graph 1. **Distribution of the age difference between fathers and sons (father's age at the time of birth) in the KLF**



The occupational indications are initially cleaned up, taking into account source-specific peculiarities. Often, the occupational indications contain information about the individual's citizenship status, which is irrelevant for evaluating the occupation in this study. This information is therefore filtered out. Additionally, occasionally there are time indications within the occupational indications, marking the date when citizenship status was acquired. These are also removed. If a person has multiple occupational indications, they are separated from each other and considered equivalent. The remaining indications are classified according to KldB and HISCO. Initially, the automated classification method described by Goldberg and Moeller is used (Goldberg and Moeller 2022). Any occupational indications not classified through this method are manually coded.[10] The KldB coding is performed by the Historical Data Center of Saxony-Anhalt. This results in a coverage of 97 percent of all occupational titles for HISCO and 99 percent for KldB. The KldB coding provides a five-digit code.[11] The first digit of this code indicates the occupational

[9] This assumption is imperfect, also because the mode here does not indicate the age of the father at the birth of the first child, but rather his average age across all children. Since, as will be shown later, broad cohorts of 10 years are used, the deviation at this point can be neglected.

[10] To do this, foreign-language synonyms are searched for in the HISCO database.

[11] The coverage refers to the number of unique job titles. Out of 5,285 unique job titles, there are 5,127 HISCO codes and 5,263 KldB codes. Prior to this, any entries that clearly do not represent job titles, such as location names, are manually filtered out. Since the more common job titles have been coded, the classification of all job entries in the dataset is even higher. However, a complete coding of all job entries is not possible because sometimes abbreviations cannot be deciphered, non-job-related entries are included, or in rare cases, the job could not be manually classified.

field (see Tab. 2). The so-called fifth digit provides information about the skill level of the respective occupation (see Tab. 3).

Tab. 2. **Occupational fields of the KldB**

Key	Occupational areas
0	Military
1	Agriculture, Forestry, Animal Husbandry, and Horticulture
2	Raw Material Extraction, Production, and Manufacturing
3	Construction, Architecture, Surveying, and Building Technology
4	Natural Sciences, Geography, and Computer Science
5	Transport, Logistics, Protection, and Security
6	Commercial Services, Trade, Sales, Hotel, and Tourism
7	Business Organization, Accounting, Law, and Administration
8	Health, Social Services, Teaching, and Education
9	Language, Literature, Humanities, Social Sciences, Economics, Media, Arts, Culture, and Design

Tab. 3. **Levels of Skill Requirements in the KldB**

Key	Levels of requirements
0	No occupational specification (e.g., resident, neighbor, citizen)[12]
1	Helper and apprentice tasks
2	Professionally oriented tasks
3	Complex specialist tasks
4	Highly complex tasks

The coding according to HISCO offers the possibility to separate occupations into so-called main groups (the first digit, see Tab. 4). Additionally, the scales HISCLASS and HISCAM can be utilized, as there is an assignment of HISCO codes to these scales. HISCLASS is a system for classifying occupations into twelve occupational classes (see Tab. 5). In addition, there is HISCAM, a scale of social prestige ranging from 1 (lowest prestige) to 99 (highest prestige). Unlike the scales presented so far, HISCAM is interval-scaled. Various tables adapted to different countries and periods exist for HISCAM (van Leeuwen et al. 2013).[13]

[12] Correct, entries classified in this way are manually filtered out because they do not represent job titles. Therefore, this category does not appear again in the subsequent process.

[13] The authors recommend using the universal scale for the German context, as the table for Germany is based on a less comprehensive dataset. Therefore, for this study, table U2 is utilized, covering only men from 1800 to 1938. There is no assignment for earlier periods. However, it is assumed that occupations from earlier times can also be assigned a HISCAM value using this table. This assumption may introduce bias if the social prestige of occupational groups has changed over time. There is a research gap in extending these tables to earlier periods.

Tab. 4. **Main groups in HISCO**

Key	Main groups
0/1	Professional, technical and related workers
2	Administrative and managerial workers
3	Clerical and related workers
4	Sales workers
5	Service workers
6	Agricultural, animal husbandry and forestry workers, fishermen and hunters
7/8/9	Production and related workers, transport equipment operators and labourers

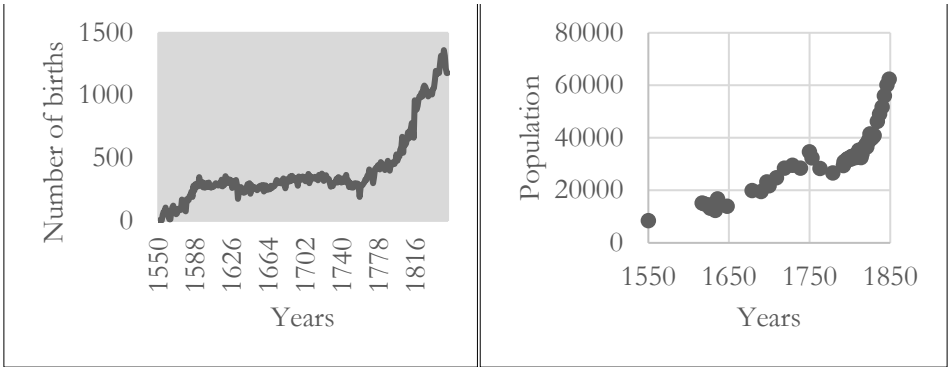
Tab. 5. **HISCLASS classes**

Key	Class
-1	Described only as «workers» (HISCO code 99900)
1	Higher managers
2	Higher professionals
3	Lower managers
4	Lower professionals, clericals and salesmen
5	Lower clericals and salesmen
6	Foremen
7	Skilled workers
8	Farmers
9	Lower skilled workers
10	Lower skilled farm workers
11	Unskilled workers
12	Unskilled farm workers

The temporal distribution of births within the KLF shows that between approximately 1600 and 1800, the number of recorded births roughly ranges from 200 to 300 per year (see Graph 2, left). Estimated birth dates are not included in this graph. After a small local low point in the mid-18th century, birth rates steeply rise and reach their peak in the mid-19th century, with 1,000 births per year. After that, no further births are recorded in the KLF. In comparison with the population development (see Graph 2, right), it is particularly noticeable that, unlike the number of births, it already increases significantly at the beginning of the 18th century: the population doubles from 1699 to 1727. This increase cannot be solely attributed to births in Leipzig. Thus, the significant population growth in Leipzig at the beginning of the 18th century must mainly be explained by migration. After 1800, a strong exponential growth in population is evident. This growth is also reflected in births, but not to the extent that it could explain population growth without migration.

Walther also points out that Leipzig only shows a positive birth surplus from the 1820s onwards; thus, growth was mainly dependent on migration for a long time (cf. 2012, 214f.). However, it is also evident that not all births in Leipzig were recorded in the KLF. Walther records a total of 11,796 live births in Leipzig between 1801 and 1810 (cf. 2012, 215), while the KLF documents only about half of this, namely 4,948 births, during the same period. Walther adopts his numbers from Hasse (1878, 164). Here, it becomes clear that unlike the KLF, Hasse's work includes illegitimate births. The legitimate births amount to 9,190 during this period. Nevertheless, the number significantly deviates from the number of individuals documented in the KLF. This demonstrates that Helga Moritz only partially transferred baptisms to the KLF. The assumption that Hasse includes many children from the (later incorporated) surrounding areas, i.e., children not baptized in St. Nikolai or St. Thomas Church, is implausible. Hasse published his work in 1868, at a time when there had been no incorporations.[14]

Graph 2: **Number of births per year in the KLF (left, without estimated birth years) and population development of Leipzig (right)**



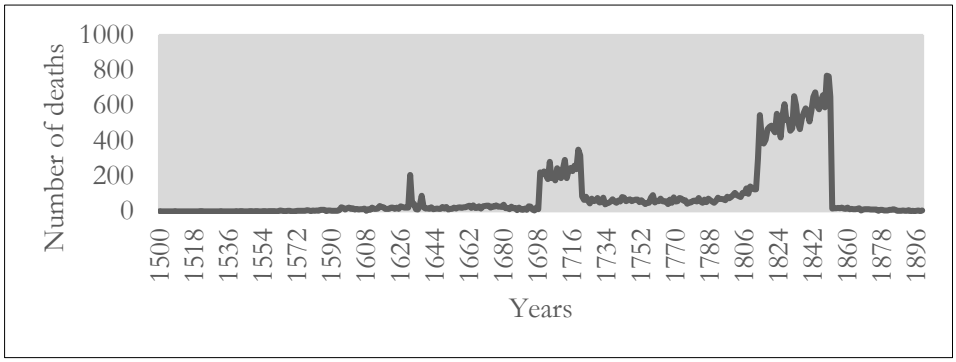
Source: Number of births per year based on a compilation from Süßmilch (1742, 324), Sonnenkalb (1864, 1), Knapp (1872, Tafel 1), Füssler (1955, 105), Blaschke (1967, 140), Walther (2012, 204), Gränitz (2013, 25 u. 83), and Höpel (2016, 97), where the numbers mentioned are subject to critical evaluation, as seen in Homburg (cf. 2000, 173-76) or Füssler (cf. 1955, 123), and are here intended only to roughly indicate the general population trend.

A consideration of the years of death and burial shows that they are only sporadically available (see Graph 3). According to Seidel and Wermes, death information is supposed to have been taken from the «Ratsleichenbücher der Stadt

[14] At this point, however, the special significance of the surrounding area for Leipzig should be noted, especially later in the 19th century. Hasse quotes a statement from 1855: The population around Leipzig belongs much more to the city itself than is the case in Dresden and Chemnitz. In neither of these two cities do you see such crowds streaming in from all gates every evening and pouring into them every morning as in Leipzig. Whole corporations reside in the countryside. The numerous castes of market helpers, typesetters, printers, and so on, largely only reside in Leipzig during working hours. (Hasse 1876, 11)

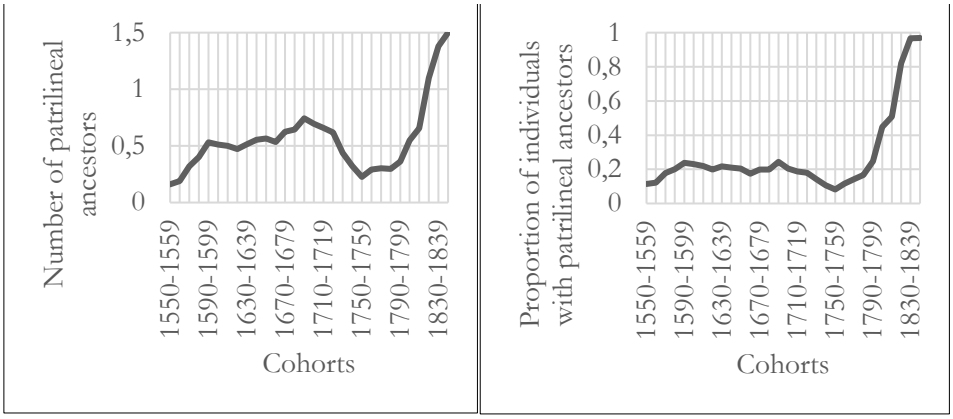
Leipzig von 1721 bis 1851» (cf. 2017, 289). Indeed, the first peak coincides with death data immediately before the beginning of this period. The last peak covers roughly the last 30-40 years of the extent of the Ratsleichenbücher. Obviously, the Ratsleichenbücher were not completely evaluated by Helga Moritz. Another minor peak is found during the time of the Thirty Years' War. Due to this irregular temporal structure, death information is not used in this analysis.

Graph 3. **Number of deaths documented in the KLF per year**



The comparison of birth and population numbers during the observation period indicates significant influx of migrants. If there is simultaneous out-migration, the influx must be even greater. The high spatial mobility poses a challenge to the intergenerational aspects of the discussion of social mobility, as it is possible that few families were resident in Leipzig for many generations. Kessler already noted that Leipzig in the early modern period does not have centuries-old patriciate and the city does not have merchant families that have survived for centuries in the trading profession (1932, 207 u. 226). This fact is also evident in the data: The average number of patrilineal ancestors of individuals with occupation information in the dataset ranges from about 0.5 to 1.5 over much of the observation period (see Graph 4, left). It should be noted that until the 19th century, only about 20 to 40 percent of individuals in the dataset have a known father. After that, this proportion increases significantly: In the last cohort (1840-1849), almost all individuals have a known father (see Graph 4, right). This sharp increase is mainly due to the fact that the birth years of the migrant fathers are rarely in the 19th century.

Graph 4: **Average number of patrilineal ancestors of individuals with occupation information per cohort (left, excluding estimated birth years) and percentage of individuals with occupation information for whom the father is known (right)**



This (geographical) mobility practice poses a challenge to the analysis of shocks due to the restriction that individual families cannot be longitudinally examined across several generations before and after a shock. Instead, an analysis of cohorts - independent of individual families - must be conducted.[15] Implementing a multigenerational approach appears not feasible in this context.[16]

Since the KLF analyzed church registry data, a complete survey of the local evangelical population was conducted. The proportion of other religious communities (especially Catholics and Jews) in Leipzig during the observation period was so small that it can be considered negligible (cf. Löffler 2017, 78f.; cf. Mitzscherlich 2017, 80f.). Additionally, all individuals who neither married nor baptized children in Leipzig are not listed. The proportion of this group consisting of unmarried journeymen and servants would have been significant throughout the observation period. This leads to a distortion. It can also be assumed that numerous merchants were present in Leipzig during trade fair periods, who were also not included in the KLF.

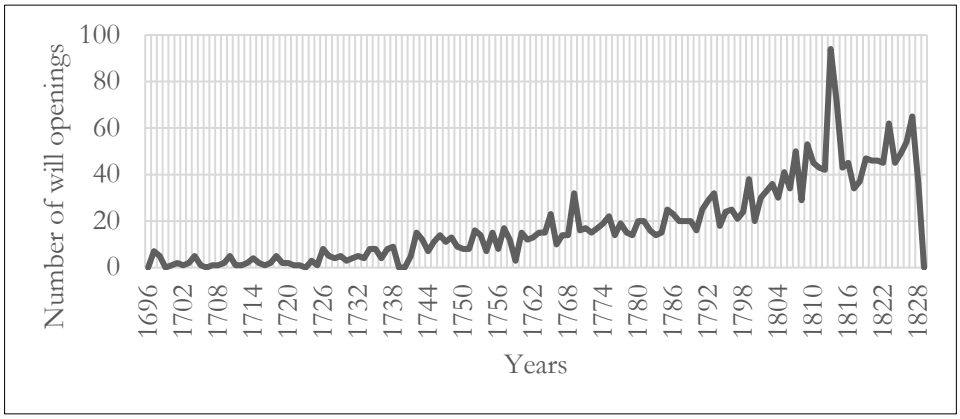
The second data source utilized is the KLK. It is used to generate another binary characteristic for individuals: whether a person has left a will or not. The KLK does not provide any insight into the content of the wills. An occasional examination of the wills also reveals that the content of these documents is difficult to operationalize. It is assumed that particularly among wealthy individuals - the urban elite - there is motivation to create a will. This allows the dataset to be divided (testating elite versus

[15] An alternative approach is to analyze surname groups instead of individual genealogical connections (cf. G. Clark et al. 2015). However, for Leipzig, there are not enough surnames available that have remained constant in the area for a long time.

[16] Multigenerational mobility refers to mobility that extends beyond the horizon of two consecutive generations (cf. Solon 2018, F340). According to Hällsten and Kolk, there is a research gap in this area (cf. 2021, 3).

non-testating population). Any differences in occupational structure and social mobility can thus be separately examined. A temporal comparison of the opening of the wills shows that at the beginning of the KLK, there are few wills available, and this number then exponentially increases until the end of the observation period (see Graph 5). The war year 1813, during which the Battle of Leipzig took place, is characterized by a particularly high number of will openings, indicating a high mortality rate.

Graph 5: **Openings of wills in the KLK over time**



3. Methods

This paper aims to analyze the extent to which past shocks/trend breaks (1) influenced the occupational structure of the city of Leipzig and (2) whether this was accompanied by changes in the nature of occupational mobility (through migration as well as intra- and intergenerational changes). To analyze the changes in the occupational structure, upheavals will be identified based on the city and regional history of Leipzig, which fall into one of the three categories according to Altmann and Kammerer (demand, technology, societal conditions) and thus create the conditions for changes in the occupational structure (cf. Altmann and Kammerer 1970, 9-11). A structural break analysis will be conducted for these upheavals. In a second step, the analysis will focus on the impact of migration as well as intra- and intergenerational changes on occupational mobility. Since comparable studies on the historical changes in occupational structures in cities over a long period in the past are lacking, a new method will be developed here. Consequently, this will also allow an assessment of the suitability of the developed methods for the research question.

3.1 Analysing upheavals in the occupational structure

To implement the structural break test, the Chow test is used (Chow 1960). With this test, structural changes over time can be detected (cf. Wooldridge 2009, 453). To do this, time series are split at the time of the upheaval, and the coefficients of the

linear slopes of the two newly formed time series are examined. If the partial regressions better represent the data than the regression over all data, a structural break is identified. The formula used is visible in (1) (Wooldridge 2009, 247). The sum of squared residuals is denoted as SSR (for the first part of the time series, the second part, or all data). The number of all data points is denoted as n. The library used in the program code can detect breaks with $k = 2$ in simple linear models, thus determining the dimensionality of the regression model. The resulting value can be interpreted similar to an F-test.

$$CHOW = \frac{(SSR_p - (SSR_1 + SSR_2))}{SSR_1 + SSR_2} * \frac{(n - 2(k+1))}{k} \quad (1)$$

To perform the test, a time series is required. In this analysis, the occupation data is operationalized and linked with the birth dates of the individuals. The available variables (KldB, HISCO, HISCLASS, HISCAM) offer various ways to represent occupational changes. For further analysis, the occupational sectors and skill levels of KldB (kldb1, kldb5), the main groups of HISCO (hisco1), HISCLASS classes (hisclass), and the average HISCAM value (hiscam) are utilized.

To illustrate the changes in the occupational structure of the city of Leipzig, the proportions of each manifestation of the variable are compared. This results in a total of 35 time series (kldb1: ten time series, kldb5: four time series, hisco1: seven time series, hisclass: 13 time series, hiscam: one time series).

Next, occupational mobility is examined, with a focus on migration. To analyze which individuals may be driving potential changes in occupational structure, this step considers only the migrants. It is not explicitly clear from the KLF data which individuals migrated. Therefore, it is assumed that the first-listed ancestors of a person are those who came to Leipzig. If their ancestors had also lived in Leipzig, they would have been part of the KLF and linked by the algorithm used.[17]

Next, attention is turned to intragenerational mobility. Many individuals have not just one, but multiple occupational listings. These could have been performed concurrently or sequentially. Unlike in rural settings, urban residents typically did not engage in agricultural side jobs, so it can be assumed that most city residents held one occupation at a time. Additionally, the multiple occupational listings could represent holding multiple offices (e.g., councilor). Therefore, if two occupations are listed, it suggests intragenerational mobility, although the direction of the mobility cannot be determined. To illustrate this mobility, a cross-tabulation is useful. Creating different tables for various cohorts allows for temporal differentiation.

Lastly, intergenerational mobility is examined by comparing fathers and sons. If there is a deviation between the occupation of a son and that of his father, a change is identified. However, a challenge arises when some individuals have multiple occupations, potentially belonging to different classes. A change is only identified if there is no overlap in classes between individuals. By calculating the proportion of

[17] However, not all individuals named in the KLF are Leipzig residents. It's possible that a person may marry into Leipzig, but the listed father never resided in the city. Since this aspect cannot be differentiated here, and all are assumed to be Leipzig residents, this distortion must be accepted.

changes for each cohort, a time series is generated, which can also undergo a structural break test. The directional aspect of the mobility is determined through cross-tabulations.

When analyzing the time series, it's important to consider that the occupation data is linked to the birth years of the individuals. This results in a temporal offset between the practice of the occupation and birth. The exact timing of when a person practiced the assigned occupation cannot be precisely determined. Since the KLF is based on church and citizen registers, occupation information is likely derived from marriage entries (both one's own and those of children), baptismal records of children, one's own burial record, and mention in the citizen register. This period roughly extends from the age of 20 onwards. This complicates the analysis of the impact of structural changes, as there is no exact year for identifying occupational transitions, and structural changes can only be detected with the generational uncertainty of approximately 30 years. This also means that a potential structural break may affect not only those born at the time of the break but also those who are already adults or in training. Particularly, individuals in the process of career exploration may have been affected by a structural change. Therefore, a temporal shift of 20 years is defined. It is assumed that individuals are approximately in this exploratory phase. All time series shown here range from 1550 to 1849. The cohort size is set at 10 years to ensure an adequate number of data points per cohort while maximizing the number of data points per time series. This division results in 30 data points per time series. To analyze a structural break, the dataset is split at the beginning of the respective cohort (not at its end). For example, a shock occurring in 1755 would lead to the splitting of the time series in the cohort containing the year 1735 (in this case, the cohort 1730-1739). In practice, the split for the structural break test occurs at the year transition of 1729/1730.

During the period under consideration, Leipzig experienced various upheavals. Between 1550 and 1849, the following four shocks are identified, which could have influenced Leipzig's occupational structure through technology, demand, and/or changes in societal conditions.[18] These are presented below:

The first upheaval examined here is the **rise of the printing industry** in Leipzig after the Thirty Years' War. While Leipzig had been significant for printing and publishing since the 16th century, it was only after the devastating Thirty Years' War, which also affected Leipzig's economy, that Leipzig emerged as the most important book trade city in the Holy Roman Empire (cf. Fuchs 2016, 234 u. 247f.). Between 1670 and 1700, 44 percent of prints in the German-speaking area were published in Leipzig (Fuchs 2016, 249). This is also because many external publishers had their books printed in Leipzig to sell them directly at the book fair there, without the need for prior transportation (cf. Fuchs 2016, 248). The year 1680 is chosen as the point of structural change for this study. Fuchs writes:

[18] The shocks, however, are not isolated events but extended over years. It's only through the long-term perspective of this analysis that they appear as shocks. For this reason, they will continue to be referred to as such here.

> By 1680, the Leipzig book trade had largely recovered from the consequences of the Thirty Years' War. A multitude of new booksellers and publishers entered the expanding market. The publishing industry was undergoing dramatic changes during this phase. Publishers diversified into companies that primarily served the local and regional market with small-scale literature, and publishers who operated at the fairs and in the nationwide or even international book trade (Fuchs 2016, 248).

The year 1680 does not itself mark the trend break; the end of the Thirty Years' War does (cf. Fuchs 2016, 245). However, Fuchs' analysis of VD17 indicates that about half of Leipzig's printed works of the century are found in its last third. Thus, the shift in 1680 rather describes a trend break in the nature of the demand for printed matter, which gradually becomes evident from that point onwards. Factors identified by Fuchs that favored the expansion of book production include the early Enlightenment, the establishment of national languages, the emergence of literary works, new media types such as newspapers, and an increasingly widespread literacy (cf. 2016, 256). In addition to the local book fair and changing demand, relatively low censorship also contributed to Leipzig's achievement of a leading position in the German-speaking world by the late 17th century (cf. Keiderling 2012, 221).

The second upheaval examined here is marked by the **Seven Years' War** from 1756 to 1763. With the entry of Prussian troops into Leipzig at the beginning of the war, the city began a period of hardship, during which a population loss was recorded (cf. Döring 2016, 94-97). Denzel attributes a downturn in trade during the war, currency destabilization in Saxony, and high tribute payments as contributing factors (cf. 2016, 213). However, significantly more important was the upswing of Leipzig as a trade fair location at the same time. According to Denzel, , Leipzig began its truly flourishing phase as a trade fair venue at the end of the war (cf. 2012, 100). Thus, the number of trade fair visitors after the war was almost double the previous level (cf. Denzel 2016, 214f.). A century earlier, Leipzig played a much less significant role in the European trading system (cf. Denzel 2012, 97f.). In terms of the city's changing function (from a regionally significant trading city to the most important trading center in Central Europe), this could have led to a shift in labor demand, with the execution and organization of trade fairs reflected in Leipzig's occupational structure. While this represents a longer-term trend, the significant temporal upheaval is located during the Seven Years' War, as identified by Denzel, and hence is chosen here as well. The end of the war year 1763 is selected as the year of the structural break.

Around 1800, Leipzig has fewer inhabitants than in 1750 (see Graph 2). This changes rapidly with the beginning of the 19th century. The onset of the **population boom** around 1800 marks a phase in which Leipzig grows from 30,000 inhabitants to approximately 700,000 inhabitants in 130 years. Against the backdrop of the enormous increase in population in the second half of the 19th century, Walther concludes that there is only «slight growth» between 1800 and 1830 (cf. 2012, 205).[19]

[19] This was also interrupted by the Napoleonic Wars. Not only did the decisive Battle of the Nations take place in Leipzig in 1813, but the war also had a profound impact on the population of Leipzig. While few civilians lost their lives due to the hostilities, more significant were the subsequent

Nevertheless, this is significant enough in the context of the period under consideration to merit attention. Henning attributes the reasons for this population development (for the entire German-speaking region) to improvements in medical care, resulting in lower mortality rates, as well as the absence of epidemics, wars, and famines (see 1989, p. 18). Here, a technological shock (in the medical field) is identified, which not only creates new professions but also significantly expands the labor supply. The year 1800 is chosen as the time point for the structural break analysis.

The **intensification of industrialization** marks the last trend break considered here. According to contemporary accounts by Gretschel, around 1836 the Leipzig population was divided into scholars, officials, booksellers, merchants, artists, craftsmen, and those who earned their living either by serving in various capacities or by various handicrafts (cf. 1982, 163).[20] Industrial occupations are not mentioned in this list, although this alone is not evidence that there were no industrial occupations in Leipzig at the time. However, Leipzig was industrialized relatively late compared to other regions in Saxony (cf. Schäfer 2012, 185). Nevertheless, in the 1830s, a series of events can be identified that initiated a stronger industrialization. First, simplifications in the transport of goods are noticeable: Leipzig is affected by Saxony's accession to the Zollverein in 1834 (cf. Schäfer 2012, 190). This created better conditions for domestic trade and thus changed demand. With the opening of the first long-distance railway line to Dresden in 1839, goods could also be transported more easily; a carter needed three days for the journey to Dresden, while the railway took only a few hours (cf. Schötz 2017, 260). Additionally, in the 1830s, steam-powered machines increasingly entered production. For example, in Leipzig in 1834, the first high-speed press was installed, marking the transition to factory production at Brockhaus (cf. Schötz 2017, 247). In general, at the beginning of the 1830s, first factories or businesses transitioning to factories were founded (cf. Zwahr 1996, 157). This shock primarily contains elements of a technological shock (railway, new machines).[21] The year 1839 is chosen as the time point for this structural break, the year of the opening of the long-distance railway line.

The effects of the freedom of trade, which was only fully implemented in the Kingdom of Saxony in 1861 (a shock to social conditions), are unlikely to have had a significant impact on the data due to its relatively late timing compared to the rest of Germany.[22] The identified and to-be-examined disruptions are summarized in Tab. 6.

---

illnesses, which caused the death of ten percent of the population in the first half of 1814 (cf. Schlenkrich 2017, 94). Additionally, many weddings did not take place during the war years and were postponed until afterward (cf. Ludwig 2017, 30). Nevertheless, the events in and after 1813 did at least have the effect of temporarily halting the population boom.

[20] 1836 is also the year of the publication of the original edition.

[21] It should not go unnoticed that Leipzig experienced further upheavals in the 1830s, for example, a revolution in 1830 (siehe dazu auch Zwahr 1996, 152-59).

[22] Before the liberalization of trade, craftsmen were subject to guild restrictions in their work and, for example, could not produce unlimited amounts or pay market-dependent wages (cf. Korge 2012, 212).

Tab. 6. **Overview of the upheavals to be examined**

Year	Upheaval	Time point in time series
1680	Printing industry	from cohort containing year 1660
1763	Seven Years' War	from cohort containing year 1743
1800	Population boom	from cohort containing year 1780
1839	Intensification of industrialization	from cohort containing year 1819

Since many shocks are being investigated here, all of which could potentially have influenced the occupational structure, a split Chow test over all the data is not appropriate. Instead, the time series needs to be narrowed down. For this reason, 100 years or ten cohorts before and after the upheaval are considered. In cases where there are not 100 years before and after, the time series is examined as far as available. The period of 100 years is chosen to detect long-term trend breaks (over approximately three human generations in each direction). As a robustness check, this analysis is also conducted with boundaries of 60 and 140 years.

3.2 Analysing the influx and intra- and intergenerational change

The analysis of the impact of migration, intragenerational change, and intergenerational change on occupational mobility occurs in three steps, each separated according to these three potential factors.

Migration

To analyze migration, it is important to first identify which individuals have migrated. While the dataset occasionally includes information about origins, this information is only partially available. Additionally, the underlying dataset for this analysis does not contain location information. Typically, the KLF does not include location details, suggesting that the respective event took place in Leipzig. Since the dataset is intergenerationally linked, the parents of children born in Leipzig are known. However, this does not imply that all individuals without parents in the dataset have migrated. There are cases where a man, whose parents do not reside in Leipzig, marries in Leipzig and settles there. Since his parents are listed at the time of marriage, there is another generation in the dataset despite him being the migrant. However, these cases are not frequent enough to be of significant relevance. Therefore, it is assumed that all individuals without a known father are migrants. This allows the dataset to be split into (1) migrants without a father and (2) individuals born in Leipzig with a father.

Now, the occupational structure of migrants can be compared with that of non-migrants. When comparing the occupational structure of migrants with that of all individuals, it is important to consider the proportion of migrants within the total population. From

Tab. 1, it can be observed that 67 percent of individuals have a known father. In this case, the proportion of migrants is significant enough that migrants should only be compared with the locally resident individuals.

If the change in the occupational structure of migrants mirrors that of the local residents, then the (percentage) change in the occupational structure is not altered by migrants and is not determined by them. However, if migrants, for instance, have occupations with a high socioeconomic status, and as a result, the average socioeconomic status of the entire city population significantly increases, migrants would be a cause of the change in the city's occupational structure - a deviation would result in less correlation between the variables. Therefore, a Pearson correlation coefficient is calculated between the time series. A high coefficient indicates that a significant portion of Leipzig's occupational change is attributable to migration.

Intragenerational mobility

Intragenerational mobility occurs when a person changes their occupation. In the KLF, this is evident when multiple occupations are listed for a single individual. Since the KLF sometimes includes multiple occupational entries per person, it is assumed that Helga Moritz supplemented various occupational entries for each individual. However, no statement can be made regarding the sequence of occupations. Additionally, the consecutive intragenerational development within an occupation is not reflected (e.g., a master shoemaker was previously an apprentice and journeyman shoemaker). Consequently, only a change or the concurrent execution of two occupations can be identified (especially when mentioning positions such as a council mandate).

To analyze intragenerational mobility, cross-tabulations are used. Only individuals with at least two occupational entries are included in the cross-tabulation. A separate cross-tabulation is created for each variable. Only if the respective occupations have different values are they relevant for the respective cross-tabulation (for example, mobility from KldB skill level 4 to another occupation with the same value is not counted). The number of transitions is then compared to the total number of individuals whose occupation has the respective value (including individuals with only one occupation). This determines the proportion of individuals who exhibit a particular value for a variable for a limited time. A high proportion indicates high intragenerational mobility, while a low proportion indicates the opposite.

Intergenerational mobility

When determining intergenerational mobility, a proportion of mobile individuals is also calculated. However, mobility is not measured for each individual variable value but for the variables as a whole. If a son has the same value as his father for a variable, it is categorized as 1; if the values differ, it is categorized as 0. If multiple values are present and at least one of them matches, a value of 1 is also assigned. This comparison is made between two generations (father and son).

For each time cohort, the average of ones and zeros is calculated, representing the proportion of mobile population. If this value is 1.0, every individual shares the same characteristics as the respective parental generation, whereas a value of 0.0 indicates complete mobility. Through temporal comparison, a time series is generated for each variable. Unlike the analysis of changes in occupational structure, these time series undergo a qualitative analysis where breaks are visually identified and

explained. This approach is feasible due to the limited number of time series and serves as a methodological contrast to the structural break analysis conducted earlier.

4. Result and interpretation

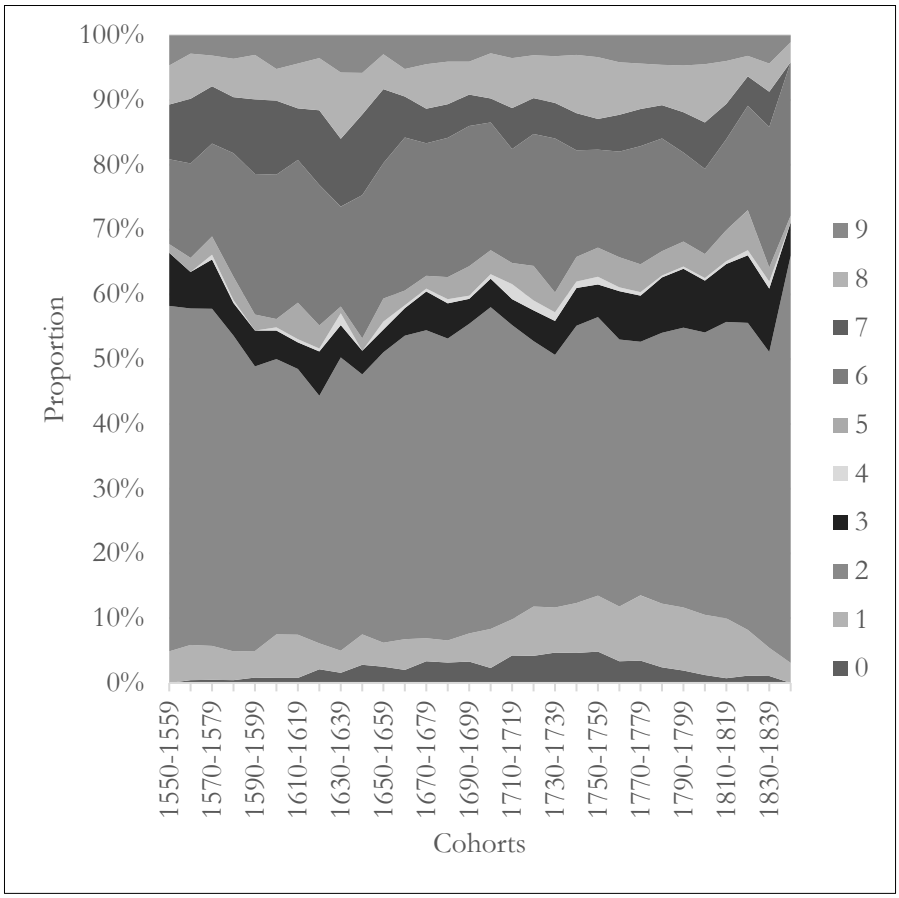
The presentation and interpretation of the results will first address the general changes in the occupational structure before delving into migrations and both intra- and intergenerational mobility.

4.1 Occupational structural change

For depicting occupational change, a stacked area chart can be used (cf. Elvery 2019, 2). This representation is visible for the variable «kldb1» in Graph 6. Initially striking is the surprisingly low level of change in the occupational structure over the long period under consideration. While changes in the proportions of the individual classes of the variable are noticeable, the transformation rarely occurs abruptly but rather gradually over many decades. Thus, the urban structure exhibits significant continuity over the period examined, despite the major upheavals Leipzig undergoes during this time. However, detailed changes are indeed discernible, particularly from the 18th century onwards (e.g., the growth of Group 5: Transport, Logistics, Protection, and Security). The stacked area chart format, however, can lead to overlooking changes in classes with a low percentage and may only be imprecisely detected. Therefore, a stacked area chart format is dispensed with in the following. Instead, each expression of a variable's time series is separately examined.

Based on the five variables described above (kldb1, kldb5, hisco1, hisclass, hiscam), a total of 35 time series are generated, representing the 35 expressions of the variables. A structural break test is conducted for each of these time series at the times of the four defined shocks, resulting in a total of 140 structural break tests within the boundaries of ±100 years of data. Tab. 7 shows the significance of the presence of each structural break. The results need to be examined with nuance. While significant structural breaks can be identified in the time series, no shocks or upheavals are recognized to have a decisive influence on all variables and expressions. Moreover, at the level of abstraction of the variables under study, there is not necessarily a causal inference that a shock or trend break has triggered a structural break in the time series - let alone answering how it managed to do so.

Graph 6. **Change in the occupational structure based on the variable kldb1**



The colour highlights provide information about the results of the robustness check within the boundaries of ±140 and ±60 years. If a field is lightly grayish, it indicates that a significant structural break was also identified in one of the other tests; for a more pronounced colour, significant structural breaks were identified in both additional tests. Notably, in the robustness checks, not a single structural break is identified for the printing trend shift in 1680 when changing the year boundaries. However, for the other three analyzed upheavals, 36 out of 40 structural breaks are confirmed in at least one of the other two tests. In 18 cases, the other tests identify significant structural breaks that remain hidden in the ±100-year test. The structural break test with the boundary of 60 years shows comparatively few significant upheavals (eleven). This could mean that the upheavals do not exhibit short-term effects or that significant changes in the time series occur only after distant changes, which may no longer be associated with the structural break.

Tab. 7. **Significance of structural breaks for various Leipzig shocks or trend breaks, observation of 100 years before and after, null hypothesis: there is no structural break, Chow test, *** p<0.001, ** p<0.005, * p<0.01, light colouring stands for a further significant structural break in the robustness checks, strong colouring stands for two further significant structural breaks in the robustness checks**

Variable: kldb1

	0	1	2	3	4	5	6	7	8	9
Printing industry		***	**				*	***		**
Seven Years' War	***	***					*		*	
Population boom	**	***	**							
Industrialization		*					*			*

Variable: hisclass

	-1	1	2	3	4	5	6	7	8	9	10	11	12
Printing industry			*		*				*	**		**	
Seven Years' War		**			*				*		*	***	
Population boom	***				***				**		*	***	**
Industrialization	***				**				**	*			***

Variable: hisco1

	0/1	2	3	4	5	6	7/8/9
Printing industry	*		**	***		**	**
Seven Years' War				***	***	***	
Population boom				***	***	***	
Industrialization				**		**	

Variable: kldb5

	1	2	3	4
Printing industry	**	*		**
Seven Years' War				
Population boom				
Industrialization		***		**

Variable: hiscam

	Average
Printing industry	***
Seven Years' War	***
Population boom	***
Industrialization	

Upon closer examination of the time series of all variables and cohorts, it is apparent that structural breaks in the time series are not always present at the chosen four time points. Additionally, visually identifiable structural breaks occur at different time points for each time series and are specific to each time series. Therefore, the time series are individual and must be interpreted accordingly. However, it remains evident that there are structural breaks in Leipzig's occupational structure during the observation period. To assess these more precisely, a more detailed analysis is required, which cannot be conducted for all time series at this point. Rather, this result motivates further research.

An exemplary representation of the time series for the HISCAM average is presented below (see Graph 7). The HISCAM scale is designed to have an expected value of 50 and a standard deviation of 10 (cf. Lambert et al. 2013, 81). An average consistently above 60 indicates that the population in the city holds professions with excessively high prestige. Starting from an initial level of around 62, the average HISCAM value increases to about 66 scale points by the 1620s cohort. Then, there is a decrease to about 60 scale points by the cohort of 1780-1789. By the end of the observation period, the average HISCAM value increases again to about 64 points. Structural breaks in this time series are not necessarily related to the mentioned events. For instance, the change in trend in the 1620-1629 cohort could have been caused by the Thirty Years' War, for example. Conversely, the other trend change in the birth cohort of 1780-1789 may indeed be related to the population boom in the period after 1800. Additionally, a general downward trend can be observed between 1620 and 1789, which lasts for a remarkable 170 years.

Graph 7. **Development of the HISCAM average over time in the KLF**

A structural downward mobility can also be observed in rural areas. Weiss analyzes social mobility in Saxony between 1550 and 1880. He shows that the proportion of full-fledged farmers in the rural population steadily decreased from over 80 to about 20 during this period. At the same time, until around 1800, the proportion of individuals classified as smallholders (half-farmers, gardeners, etc.) increased significantly (cf. Weiss 1993, 27). This result cannot be explained without a division of the agricultural estates. Additionally, during this period, the number of

individuals without significant agricultural employment also increased steadily (cf. Weiss 1993, 104). This, in turn, is due to population growth and the inability of every descendant to take over their parents' position, resulting in a general downward mobility. In the city of Leipzig, such a downward trend can also be observed, although the mechanism is different - there is no land to be divided. Moreover, the downward trend is already interrupted at the beginning of the 19th century.

Analyzing the proportion of individuals with highly complex professions, which tend to have a high HISCAM value (category 4 of variable kldb5), can help to better assess this trend. The share of this category decreases from about 25 percent in the cohort 1630-1639 to about ten percent in the last cohort (1840-1849). Put simply, the city council does not expand just because the city grows larger. Therefore, there are not automatically more highly valued positions. Additionally, the sectors where highly complex professions are located change: While individuals at the beginning of the observation period mainly concentrated in sectors 7 (business organization, accounting, law, and administration) and 8 (health, social services, education, and training), by the end of the observation period, professions of this highest level of demand are present in almost all sectors.

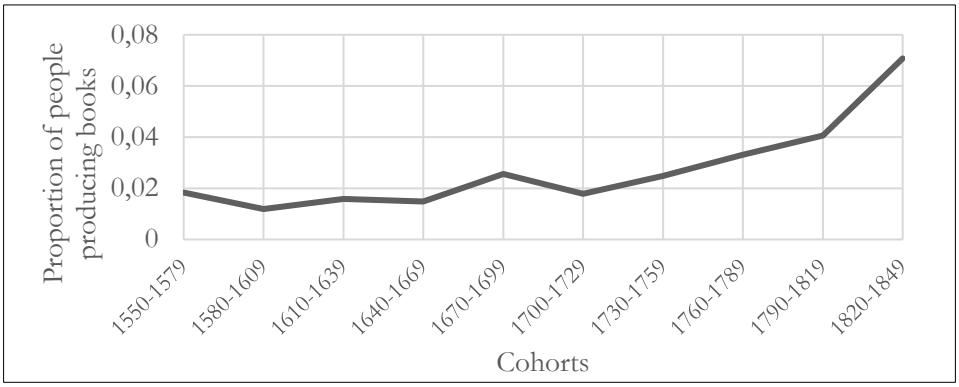
As described, this level of abstraction of the selected variables may not be sensitive enough to analyze shock effects. A more detailed perspective can be gained by examining specific occupations. An example of this is the quantitative development of occupations related to the printing press trend shift of 1680. In Graph 8, the share of printers, bookbinders, typesetters, typecasters, copperplate printers, and engravers is depicted.[23] Indeed, there is an increase from one to almost three percent of the workforce after the Thirty Years' War.[24] Although this share briefly drops to two percent at the beginning of the 18th century, it then steadily rises to about seven percent. This illustrates why the previous structural break analysis did not reveal significant upheaval around 1680 (the rise of the printing industry):[25] If anything, the «shock» of 1680 affected only about one to two percent of the workforce in the second half of the 17th century. Thus, it becomes evident that there is potential in the detailed analysis of individual occupations. This minor change may go unnoticed when examining the KldB occupation group 2 (production), or it may not even be visible when individuals switch between different manufacturing occupations.

[23] Persons who have the following letter combinations in their job description are selected: «uchdr», «uchbin», «riftse», «riftgie», «upferste», or «upferdr».

[24] At this point, it should be noted that Wittmann stated for the mid-18th century: In 1739, Leipzig, with 28,000 inhabitants, had 20 bookstores, 15 printing houses, 22 bookbinders, 11 copper engravers, 8 copperplate printers, and three type foundries. Two to three percent of the city's residents likely lived directly from the book trade. (Wittmann 2019, 93) His estimate of two to three percent aligns very well with the findings presented here.

[25] Only in the KldB occupational area 3 (Construction, Architecture, Surveying, and Building Technology) was such a case found.

Graph 8. **Proportion of book printers, bookbinders, typesetters, type founders, copperplate printers and engravers by year of birth of individuals**



It remains to be noted that until the beginning of the 18th century, little structural mobility is observed in the occupational categories (kldb1). After that, more pronounced shifts can be seen. Overall, there is a trend away from highly complex activities, which over a long period tends to correlate with a downward trend in the assessment of the average social prestige of the occupational structure. However, the four significant shocks examined do not show any recognizable, overarching, shock-like influence on Leipzig's occupational structure at this level of abstraction, although upheavals in Leipzig's occupational structure are present. The application of a Chow test seems to yield inconclusive results due to the double temporal uncertainty - on the one hand, caused by the occupation as a unit of measurement, which can occur at any point in life, and on the other hand, the punctuating of sometimes decades-long trends to a specific year. To make existing changes visible and explainable, detailed and granular data or qualitative explanations of the time series are necessary.

4.2 Influx or intra- or intergenerational change

The highlighted changes can mainly be attributed to three causes: (1.) A changed occupational structure due to migration, (2.) individuals who changed their profession during their lifetime (intragenerational mobility), and/or (3.) a changed occupational structure because sons pursued different professions than their fathers (intergenerational mobility).

To analyze the effect of migration, the 35 time series are generated based solely on individuals for whom no further ancestor is known - the similarity of the migrants to the time series of the local residents is of interest. For this purpose, the Pearson correlation coefficient is calculated between the time series (see Tab. 8). For the HISCAM time series, the correlation coefficient is 0.61**. The results show a mixed picture: Some correlations are low, others are moderate to high, some are even negative, and few are significant. For example, in the hisclass category 4 (lower professionals, clericals, and salesmen), there is a significant correlation of -0.20. This suggests that a significant portion of the changes in this group may have occurred

due to migration. At the same time, the correlation for the farmers (category 8) is high at 0.74, although it is not significant in this case. This analysis appears to be more hypothesis-generating for detailed analysis rather than providing causal conclusions.

Tab. 8. **Pearson correlation coefficients between all persons and those without a father, Mann-Whitney U test, *** p<0.001, ** p<0.005, * p<0.01**

kldb1										
Class	0	1	2	3	4	5	6	7	8	9
Coefficient	0.81	0.61**	0.13	0.33	0.72	0.40	-0.29	0.52	0.59	0.35***

hisco1							
Class	0/1	2	3	4	5	6	7/8/9
Coefficient	0.44**	0.41	0.28	0.01	0.73	0.69	0.35

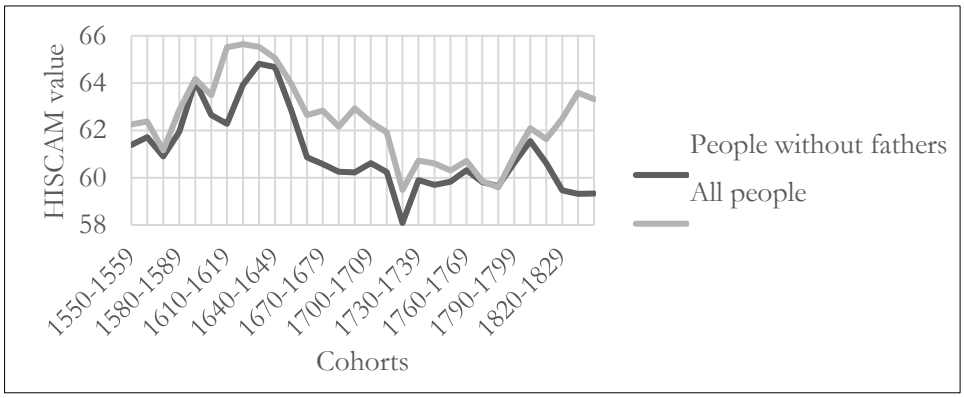
hisclass													
Class	-1	1	2	3	4	5	6	7	8	9	10	11	12
Coefficient	0.38	0.35	0.49*	0.60	-0.20*	0.28	0.69	0.26	0.74	0.73	0.75	0.61	0.43

kldb5				
Class	1	2	3	4
Coefficient	0.12	0.22	0.31	0.43

A high correlation does not mean that the values are identical. Rather, it indicates that the direction in which the values evolve is similar. Further examination of the HISCAM score is particularly interesting. It appears that the social prestige of the occupations of the generation without fathers, according to the HISCAM scale in the dataset, remains constant at the same level or below that of the entire cohort (see Graph 9).[26] Therefore, migration to the city seems to have positively affected the prestige of occupations for the subsequent generations. Perhaps the move to the city was associated with the hope for social advancement - at least on the HISCAM scale, it seems to have worked. Another interpretation is that the migrants are responsible for the steadily declining level.

[26] Here it should be noted that in the graph, «all individuals" also includes individuals without known fathers. The difference is even more pronounced when these are excluded.

Graph 9. **Comparison of the average HISCAM score of all persons and persons without a known father in the data set over time**



Intragenerational mobility can be measured in the dataset when multiple job entries are available for a person. For intragenerational analysis, a cross-tabulation is generated over all the data (see Tab. 9). A person with occupations of different categories increases the count in the corresponding cell of the cross-tabulation. At the same time, the «Total» row indicates the total number of individuals with job entries in that category (including those with only one job entry). This allows for determining the proportion of individuals from one class who also hold another occupation (row «Proportion»).

This proportion varies depending on the category (e.g., for the variable kldb1, it ranges from 0.05% to 0.23%). Multiple entries are particularly common in the «Business organization, accounting, law and administration» category (category 7).[27] Overall, the intragenerational mobility observable in the data is low. A similar conclusion is generally supported by examining the tables for the variables kldb5, hisclass, and hisco1 (see Tab. 10 to Tab. 12).

[27] The individuals in this main group who have multiple professions are engaged in trade in about 40 percent of cases (category 6).

Tab. 9. **Proportion of persons in the KldB occupational areas with several occupational areas**

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0	15	122	19	0	25	32	17	10	13
1	15	0	95	15	5	38	102	77	23	6
2	122	95	0	118	12	131	582	130	90	90
3	19	15	118	0	1	31	91	81	18	12
4	0	5	12	1	0	4	12	22	13	3
5	25	38	131	31	4	0	117	34	32	23
6	32	102	582	91	12	117	0	408	74	70
7	17	77	130	81	22	34	408	0	231	31
8	10	23	90	18	13	32	74	231	0	205
9	13	6	90	12	3	23	70	31	205	0
∑	253	376	1370	386	72	435	1488	1031	696	453
Total	1316	3741	29191	4320	408	2471	12544	4461	5123	3126
Proportion	0,19	0,10	0,05	0,09	0,18	0,18	0,12	0,23	0,14	0,14

Tab. 10- **Proportion of people in the KldB requirement levels with several occupational areas**

	1	**2**	**3**	**4**
1	0	326	34	44
2	326	0	356	979
3	34	356	0	449
4	44	979	449	0
∑	404	1661	839	1472
Total	3998	46213	4792	10655
Proportion	0.10	0.04	0.18	0.14

Tab. 11. **Proportion of people in the HISCLASS classes with several occu. areas**

	-1	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
-1	0	5	2	2	20	14	4	63	7	84	5	23	1
1	5	0	280	92	392	64	2	152	37	86	0	15	0
2	2	280	0	27	246	105	2	42	30	58	1	8	0
3	2	92	27	0	66	12	0	22	6	21	5	11	0
4	20	392	246	66	0	118	1	330	25	202	7	98	4
5	14	64	105	12	118	0	1	40	7	42	0	11	1
6	4	2	2	0	1	1	0	1	1	2	0	0	1
7	63	152	42	22	330	40	1	0	18	219	3	78	3
8	7	37	30	6	25	7	1	18	0	15	3	4	1
9	84	86	58	21	202	42	2	219	15	0	2	100	3
10	5	0	1	5	7	0	0	3	3	2	0	0	0
11	23	15	8	11	98	11	0	78	4	100	0	0	2
12	1	0	0	0	4	1	1	3	1	3	0	2	0
∑	230	1125	801	264	1509	415	15	971	154	834	26	350	16
Total	2273	3775	5433	1044	12418	1604	82	23164	1458	10114	484	3166	149
Proportion	0.1	0.3	0.15	0.25	0.12	0.26	0.18	0.04	0.11	0.08	0.05	0.11	0.11

Tab. 12: **Proportion of people in the main HISCO groups who have several areas of occupation**

	0-1	**2**	**3**	**4**	**5**	**6**	**7-9**
0-1	0	285	168	69	100	34	160
2	285	0	89	328	38	37	114
3	168	89	0	130	55	15	101
4	69	328	130	0	117	18	340
5	100	38	55	117	0	23	569
6	34	37	15	18	23	0	61
7-9	160	114	101	340	569	61	0
∑	816	891	558	1002	902	188	1345
Total	6953	2830	2795	9188	5029	2275	35717
Proportion	0.12	0.31	0.2	0.11	0.18	0.08	0.04

Omitting the HISCAM table due to its size, the information in this format may not be immediately apparent due to its granularity. However, in most categories, only a single-digit percentage of individuals have a second occupation with a different HISCAM value.[28]

The third aspect involves intergenerational mobility, measuring whether a change compared to the previous generation occurs based on various variables.[29] In Graph 10, the proportion per transition per cohort for the different variables is shown. The years between 1550 and 1579 are omitted since there were few individuals born during this period, for whom the father's occupation is known. Initially, the similar development of all variables is noticeable - the difference on the scale is mainly explained by the varying number of variable attributes. Until around the beginning of the 18th century, mobility is comparatively low for all variables (indicating high stability), followed by a phase of steadily increasing mobility until the end of the century. Afterward, mobility stabilizes at a high level. The development is thus divided into three phases: a «stable phase» from 1580-1729, a «transformation phase» from 1730-1789, and a «mobile phase» for those born between 1790-1849.[30]

It is particularly noteworthy to observe the trend of the variable «hiscam». This scale has a large number of possible attributes compared to the others. Yet, during the stable phase, it mainly ranges between 50-60 percent. The fact that a child occupies the same HISCAM value as their father can typically be explained by them having the same occupation. The significant decrease to around 20 percent is a consequence of most sons choosing a different profession than their fathers during the mobile phase.

Due to the high similarity in the developments of the individual variables, the analysis will continue with the variable «kldb1». To understand the extent to which intergenerational transmission has changed, the dataset is divided into three phases and the KldB occupational categories (see Tab. 13). It becomes evident that not all occupational categories are equally affected by this change. For instance, category 9 (linguistics, literature, humanities, social sciences, economics, media, arts, culture, and design) undergoes significant change: Instead of 58 percent maintaining the same characteristics in the stable phase, only 20 percent persist in the mobile phase.[31] However, the sample size in this category must also be considered, as it is particularly low for some attributes, making it less conclusive (e.g., category 4. The absolute number of individuals is provided in parentheses).

---

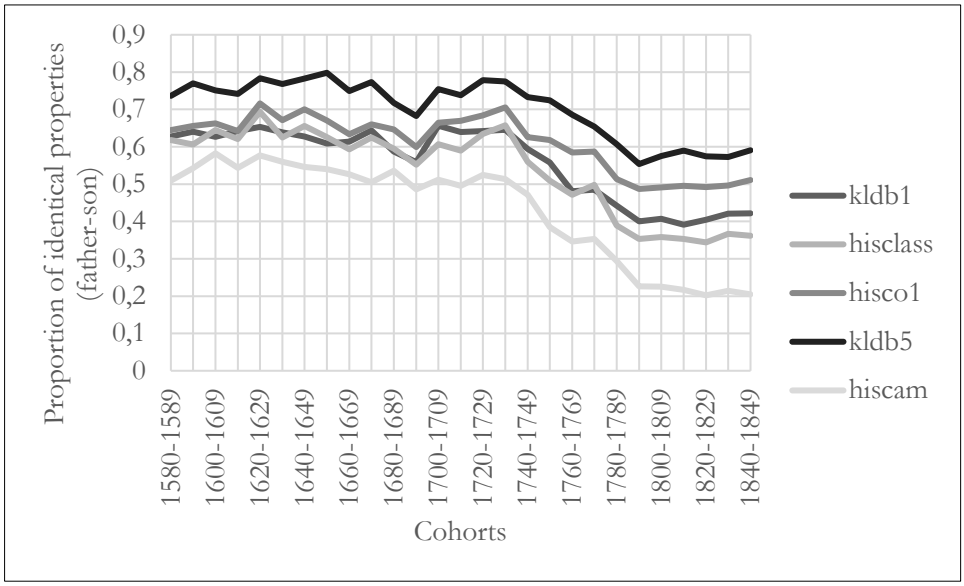
[28] An exception is observed among individuals with a HISCAM value of 93. 40 percent of these individuals have a different value. Slightly more than half of these cases correspond to the value 63, which makes this combination stand out significantly. This is related to the frequent combination of merchant/trader (rated 63) and a seat on the Leipzig city council («Ratsherr», rated 93).

[29] The variable HISCAM is included here, with a change being measured if the exact HISCAM value of the father is not reached.

[30] It should be noted that the mobile phase begins around the time when the structure of the previously mentioned HISCO main groups also undergoes more significant changes (see Graph 6). Thus, there is a change in the occupational structure at that time, and individuals are not merely switching within the same occupations.

[31] The decisive factor here is the manifestation among the children.

Graph 10. **Change over time in the proportion of people who have the same characteristics as the respective father on different scales**



Tab. 13: **Proportion of people working in the same field as their father (kldb1), in per cent by phase, number of absolute persons in brackets, Mann-Whitney U-test, *** p<0.001, ** p<0.005, * p<0.01**

Class	Stable phase	Transformation phase	Mobile phase	Ratio (Mobile/ Stable)	Difference (Mobile-Stable)
0	0.17 (8)	0.13 (14)	0.07 (23)	0.41	0.10***
1	0.47 (82)	0.28 (58)	0.11 (127)	0.23	0.36***
2	0.75 (1663)	0.61 (777)	0.56 (3378)	0.75	0.19***
3	0.33 (69)	0.46 (75)	0.30 (359)	0.91	0.03***
4	0.55 (16)	0.33 (8)	0.15 (11)	0.27	0.40
5	0.13 (15)	0.18 (20)	0.14 (102)	1.08	-0.01***
6	0.57 (612)	0.52 (323)	0.42 (1212)	0.74	0.15***
7	0.36 (159)	0.27 (43)	0.20 (198)	0.56	0.16**
8	0.44 (135)	0.38 (95)	0.25 (269)	0.57	0.19***
9	0.58 (125)	0.40 (48)	0.20 (159)	0.34	0.38***

Building on this, the question arises as to which groups the individuals migrated to. The following presentation illustrates the largest proportional deviation. The number of this largest target attribute is provided in parentheses (see

Tab. 16). It is noticeable that the proportion of the largest migration often increases. The fact that classes 2 (raw material extraction, production, and manufacturing) as well as 6 (commercial services, trade, sales, hotel, and tourism) predominantly accommodate the most individuals is also due to the fact that quantitatively, these are the two largest classes. In some cases, the migration to these attributes exceeds even the proportion of individuals who remain in the father's class. This phenomenon is clearly observable when comparing the three phases directly (see Tab. 15 to Tab. 17). While the cross table in the stable phase still exhibits the typical pronounced diagonal, the image changes towards the mobile phase to two vertical bars mainly representing classes 2 and 6. However, these areas also see a significant number of individuals leaving - in absolute terms, the proportions of the classes are roughly maintained across the phases. Therefore, a significantly increased mobility can be observed in the 18th century, primarily based on exchanges to and from KldB occupational categories 2 (production) and 6 (trade). However, if the proportions of the occupational categories remain roughly the same structurally (as also seen in the diagram presented earlier, see Graph 6), this raises even stronger questions about why occupational mobility has changed so significantly.

Tab. 14. **Largest share of churn in individual areas as share of change, group of largest churn in brackets, variable kldb1**

Class	Stable phase	Trans-formation phase	Mobile phase
0	0.49 (2)	0.40 (2)	0.44 (2)
1	0.19 (2)	0.25 (2)	0.36 (2)
2	0.11 (6)	0.15 (6)	0.18 (6)
3	0.24 (2)	0.26 (2)	0.40 (2)
4	0.14 (7)	0.25 (2)	0.32 (6)
5	0.39 (2)	0.36 (2)	0.38 (2)
6	0.14 (7)	0.18 (2)	0.30 (2)
7	0.27 (6)	0.32 (6)	0.30 (6)
8	0.28 (7)	0.19 (2)	0.25 (6)
9	0.15 (6)	0.30 (2)	0.34 (2)

Tab. 15. **Cross-tabulation of variable kldb1 (proportion per column), stable phase (1580-1729), colour highlighting of high stability, father at the top, son on the left**

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0.17	0.02	0.01	0.01	0.00	0.05	0.02	0.01	0.01	0.02
1	0.02	0.47	0.01	0.00	0.00	0.03	0.01	0.00	0.00	0.00
2	0.49	0.19	0.75	0.24	0.14	0.39	0.09	0.06	0.05	0.09
3	0.02	0.03	0.01	0.33	0.03	0.04	0.01	0.01	0.02	0.02
4	0.00	0.01	0.00	0.00	0.55	0.01	0.00	0.01	0.01	0.02
5	0.06	0.06	0.01	0.00	0.03	0.13	0.01	0.00	0.01	0.00
6	0.06	0.12	0.11	0.12	0.07	0.18	0.57	0.27	0.11	0.15
7	0.02	0.02	0.04	0.13	0.07	0.07	0.14	0.36	0.28	0.05
8	0.04	0.06	0.04	0.08	0.10	0.04	0.11	0.23	0.44	0.05
9	0.11	0.02	0.03	0.07	0.00	0.06	0.04	0.04	0.07	0.58

Tab. 16. **Cross-tabulation of variable kldb1 (proportion per column), transformation phase (1730-1789), colour highlighting of great stability, father at the top, son on the left**

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0.13	0.00	0.03	0.00	0.00	0.01	0.01	0.02	0.02	0.02
1	0.03	0.28	0.01	0.01	0.08	0.02	0.03	0.01	0.01	0.01
2	0.40	0.25	0.61	0.26	0.25	0.36	0.18	0.15	0.19	0.30
3	0.13	0.06	0.06	0.46	0.13	0.09	0.04	0.04	0.04	0.03
4	0.00	0.00	0.01	0.01	0.33	0.00	0.01	0.01	0.01	0.00
5	0.06	0.07	0.03	0.03	0.00	0.18	0.02	0.01	0.02	0.00
6	0.11	0.23	0.15	0.13	0.04	0.17	0.52	0.32	0.19	0.14
7	0.04	0.01	0.03	0.03	0.08	0.09	0.10	0.27	0.10	0.02
8	0.08	0.05	0.04	0.01	0.08	0.04	0.05	0.15	0.38	0.07
9	0.03	0.05	0.04	0.06	0.00	0.05	0.04	0.03	0.05	0.40

Tab. 17. **Cross-tabulation of the variable kldb1 (proportion per column), mobile phase (1790-1849), colour highlighting of great stability, father at the top, son on the left**

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0.07	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.00
1	0.02	0.11	0.01	0.01	0.04	0.02	0.03	0.02	0.01	0.01
2	0.44	0.36	0.56	0.40	0.19	0.38	0.30	0.19	0.20	0.34
3	0.14	0.05	0.06	0.30	0.08	0.09	0.05	0.03	0.03	0.05
4	0.00	0.00	0.00	0.00	0.15	0.01	0.00	0.01	0.00	0.00
5	0.08	0.08	0.05	0.05	0.01	0.14	0.05	0.06	0.05	0.05
6	0.12	0.22	0.18	0.13	0.32	0.21	0.42	0.30	0.25	0.21
7	0.04	0.04	0.04	0.03	0.07	0.06	0.07	0.20	0.12	0.05
8	0.03	0.05	0.03	0.03	0.05	0.03	0.03	0.11	0.25	0.08
9	0.06	0.06	0.05	0.05	0.07	0.06	0.04	0.05	0.08	0.20

For further interpretation, it is therefore particularly relevant to examine what changed for those born in Leipzig during the transformation phase (1730-1789). At this point, it is questionable whether a preceding shock like the Seven Years' War (1756-1763) could trigger such a process of transformation. As already indicated, the city suffered greatly during the Seven Years' War (hard years, population loss, disruption of the trade fair).[32] However, after the war, there was a resurgence of the trading hub. Additionally, a significant increase in employment in the printing industry during this time period was also demonstrated. Nevertheless, these changes did not occur abruptly during or immediately after the war; instead, a gradual institutional transformation spanning about two generations (60 years) is evident. Consequently, it can be inferred that from the mid-18th century onwards, there must have been increasing opportunities in Leipzig for individuals to deviate from their fathers' occupations. Particularly, the significant increase in mobility on the HISCAM scale implies this.

The Seven Years' War could indeed have acted as a demographic shock by significantly reducing the population, thereby laying the groundwork for the positive developments afterward (cf. Epstein 2000, 69). Epstein identifies demographic shocks (triggered by events such as diseases like the plague) as essential drivers of economic growth. His line of thought is based on Schumpeter's concept of creative destruction (cf. Schumpeter 2020, 106). According to this idea, the shortage of labor resulting from demographic shocks leads to institutional changes. For example, apprenticeship admissions in guilds may become easier, and labor-saving innovations may find greater acceptance (cf. Pamuk 2007, 309f.). Consequently, while not all

[32] Additionally, Denzel attributes a cyclical downturn in trade fair commerce, currency instability in Saxony, and high contribution payments as contributing factors to the situation (cf. 2016, 213).

remaining individuals change their occupations, institutional changes occur, slowly and gradually leading to transformation.

Moreover, when fathers pass away and their positions are not immediately filled by their descendants, increased professional rematching occurs. Children, due to the resulting decision-making flexibility, can choose occupations that better align with their abilities, skills, and interests. This reallocation of labor leads to a more efficient use of resources and positive economic implications. Furthermore, occupational mobility is a necessary condition for changing the occupational structure (and thus for economic change). The more mobile individuals are, the faster the economy can adapt to market changes.

The long-term effects of such demographic shocks are evident, as demonstrated by the example of the Plague of 1627-1629. Alfani, Gierok, and Schaff illustrate that this event led to a structural break in the inequality development of Germany. After the population reduction, society became more egalitarian until the 18th century (cf. 2022, 92, 107 u. 118).

Years' War could indeed have initiated institutional change. In fact, a population decline can be identified during the affected period: while about 32,000 people were residing in the city in 1753, ten years later, there were approximately 4,000 fewer individuals. The famines of the 1770s further reduced the population by about 2,000 people (cf. Höpel 2016, 97). This represents a noticeable reduction of about 20 percent, which on an individual level, could have provided opportunities for occupational change.

If predominantly men had died, this could also provide an explanation for the increased mobility. For instance, Abramitzky, Delevande, and Vasconcelos demonstrate, using the example of France after World War I, that an excess of women promotes mobility – men are more likely to marry women of higher status (cf. 2011, 144). However, the Leipzig population suffered more directly from the effects of war, rather than because Leipzig sons fell on the battlefield. While across all KLF data, 57 percent of individuals with a date of death are male, during the years 1756-1763, it is only 52 percent. From this perspective, it seems unlikely that the war led to a significant surplus of women.[33]

Höpel attributes the rapid resurgence of the city to bourgeois educational and occupational aspirations, as well as to the Saxon state reforms after the Seven Years' War (cf. 2016, 97). However, Leipzig's post-war resurgence is not unique: The so-called Saxon Rétablissement leads to the reconstruction and reform of all of Saxony, later transforming it into one of Germany's leading industrial regions (cf. Kroll 2014, 72-74 u. 96). For instance, in 1764, the Leipzig Economic Society was founded with the purpose of promoting the efficiency of production through scientific knowledge. This led, for example, to the promotion of the manufacturing industry, with 26 manufactories established in Leipzig alone (cf. Höpel 2016, 100f.). It is evident that the reforms implemented after the war also had the potential to foster occupational mobility. When classifying the reasons for occupational changes into the categories defined by Kammerer and Altmann (as introduced earlier), it becomes clear that in

[33] Allerdings sind die Todesdaten in die KLF wie gezeigt nur sehr unvollständig übertragen worden.

Leipzig, especially during the Rétablissement, technological changes, changes in societal conditions, and changes in demand were prominent factors. Technological changes were primarily driven by the promotion of the manufactory system, which introduced production-related innovations. Moreover, the general endeavor to integrate scientific knowledge into production processes may have had a beneficial impact on production efficiency.

Höpel identifies a change in the societal value system as the second area concerning societal conditions - promotion of trade and education, as well as frugality, replaced an opulent court and resource-consuming military apparatus (cf. Höpel 2016, 102). Further elaborating on Höpel's observations, which describe the emergence of a bourgeois culture and sociability, one gets the impression of an enlightened urban culture where even the urban elites incorporate emerging groups (cf. 2016, 106-10). Beachy also notes that with the Rétablissement, bourgeois influence profoundly changed traditionally corporatist institutions (cf. 2005, 97). Specifically, examples include the establishment of the Academy of Drawing, Painting, and Architecture or the creation of a professorship in economics in Leipzig (cf. Höpel 2016, 101).

Another aspect that may have promoted opportunities for professional mobility in this context was the rise of Leipzig as a trading center.[34] Due to its proximity to the marketplace, engaging in commercial activities became an obvious choice. However, the mechanism of action could also occur in the opposite direction: the transformation of Leipzig may have made it necessary to pursue commercial occupations. Ultimately, this changes the demand for labor. Those born during the Transformation phase, roughly between 1750 and 1810, would be in their career exploration phase. This period, as previously discussed, witnessed a significant transformation of Leipzig into a trade center of European significance. The increased trading activity indeed appears to be a significant factor contributing to intergenerational mobility, as evidenced by the results of the cross-tabulations presented earlier: a substantial portion of the change occurs in category 6 (Trade). However, not all sons persist in this occupational choice in the subsequent generation; roughly half of them leave this occupational category. Mobility cannot solely be attributed to the trade aspect. The cross-tabulations also show growing fluctuations in the production sector (2). While this cannot be explained by industrialization in Leipzig during the Transformation phase, the establishment of 26 manufactories in the last third of the 18th century provides a potential explanation. Moreover, a significant portion of mobility occurs between production and trade occupations: the sons of craftsmen become traders, while many traders' sons become craftsmen again. This demonstrates a close relationship between the production and distribution of goods.

In summary, it can be said that a significant portion of occupational mobility is influenced by newcomers. Intergenerational change also plays an important role, especially during the mobile phase from around 1790 onward. Between

[34] According to Höpel, the resurgence of trade fairs, as well as the introduction of manufactories after 1763, can be attributed to the effects of the Rétablissement and developments in the book industry (cf. Höpel 2016, 104).

approximately 1730 and 1790, a shift from a predominantly non-mobile society to one with high mobility can be observed. Those born during this period are highly affected by the repercussions of the Rétablissements after the Seven Years' War. The institutionally driven reforms, deemed economically fruitful, trigger an institutional shift that leads to higher occupational mobility on various levels. The relevance of these individual levels (population decline, technological change, demand change, societal change) for this societal transformation cannot be precisely determined here - only their combined effect. In this sense, the Seven Years' War can be evaluated as an act of creative destruction, wherein the labor market becomes more permeable, allowing greater room for innovations. Even if the subsequent reallocation of the workforce does not solely determine positive economic development, it plays at least a supportive role. Thus, the extreme growth in the 19th century is not solely attributed to the industrialization of the city and its surroundings (cf. Walther 2012, 201f.) - rather, the findings of this research suggest that development is also a result of the Rétablissements and the associated change in occupational mobility. Occupational mobility acts as a catalyst for economic development, while intragenerational mobility-related changes in occupational structure are considered less relevant.

Indeed, the stabilization of the change in professional mobility towards the end of the 18th century raises questions. The trends shown in Graph 10 suggest a regressive pattern, indicating a decrease in the speed of the mobilization trend by the end of the 18th century. This implies that such a high level of professional mobility has been reached, which is simply not surpassed under the prevailing societal conditions. Another possibility is that the Napoleonic Wars at the beginning of the 19th century may influence this development and interrupt this trend.

4.3 Special features for testators

The KLF is divided into the testating individuals (n=870) and non-testating individuals (n=65,512), each with occupational information. The underlying assumption is that the testating individuals are wealthier. However, the average HISCAM score of the testators is 62.3, only 0.5 scale points higher than the score of those who have never made a will. This difference is minimal. Furthermore, the Mann-Whitney U-test yields a p-value of 24%, indicating that this difference is not statistically significant. Additionally, upon examining the occupations of the testators, there is no evidence to suggest that only individuals with particularly prestigious occupations have made wills. Instead, the occupations of the testators represent an average cross-section of the population in terms of prestige on the HISCAM scale. Therefore, the group of testators cannot be used as originally planned to study differential behavior as an example of an elite class. Consequently, this step is omitted from the analysis.

5. Conclusion

The hypothesis underlying this study, that abrupt or trend-breaking changes of various kinds are also reflected in the occupational structure of a city, cannot be clearly confirmed in the case of the city under investigation - Leipzig - during the period from 1550 to 1849. Instead, a differentiated view is required: Despite significant changes, the occupational structure remains very stable over a long period. Even the Thirty Years' War (1618-1648) does not lead to a permanent change in the occupational structure. This enduring stability is particularly surprising for Leipzig, a city that is presumed to be more sensitive to shocks as an important trading center. Only with the transition to the 19th century does a gradual change in the occupational structure begin to emerge. This change is preceded by the Schumpeterian creative destruction of the Saxon state in the Seven Years' War (1756-1763), followed by a period of reform known as the Rétablissement. In this phase of reforms, key reasons for changes in Leipzig's occupational structure are recognized: changes in production technology, demand, and societal conditions - coupled with institutional changes. Despite these significant upheavals, however, the change occurs slowly, partly due to migration but mainly through intergenerational mobility.[35]

Not only does the occupational structure change, but also the occupational mobility increases significantly during this period. The likelihood that a child born after 1790 will take up the same profession as their father is only about half as high as it was for children born before 1730. This reallocation of labor implies that people can better utilize their skills, abilities, and interests in the economy, making them more effective. This, in turn, suggests that the increase in occupational mobility contributes positively to Leipzig's economic prosperity - and consequently to the significance the city holds several decades later.[36]

The significance of the Rétablissement for the history of Leipzig - and beyond, for the entire history of Saxony - is primarily associated with reforms and the founding of institutions that individually promote the economy of Saxony significantly. What has so far gone unnoticed is the indirect impact through occupational mobility. This study highlights this undiscovered element for the rise of Leipzig. The results suggest a mechanism whereby positive economic effects can be achieved through increasing mobility. This, in turn, may also provide reason to evaluate and shape current economic development measures in terms of their effects on promoting occupational mobility.

Leipzig differs significantly from other cities examined in this regard. While Leipzig shared some common urban trends, its reliance on trade and intellectual exchange, rather than industry alone, makes it a distinct case within the broader European context. Additionally, unlike Florence, analyzed by Barone and Mocetti, Leipzig does not consistently exhibit low mobility. Here, we observe a shift towards

[35] The chosen method does not allow for a more detailed quantitative weighting of these factors.

[36] By the end of the observation period, Leipzig had just over 60,000 inhabitants, as stated by Gränitz (cf. Gränitz 2013, 86). The population boom to over 700,000 inhabitants occurred thereafter, up to the first half of the 20th century. It's worth noting the relative growth compared to the beginning of the 19th century, which often gets overshadowed by the later boom.

a much more mobile society earlier than in Florence. On the other hand, Favre, Floris, and Woitek observe a declining mobility in Zurich, which is also undergoing significant structural changes socioeconomically. This suggests that the change does not affect socioeconomically disadvantaged social strata there, unlike in Leipzig. For future research, it is desirable to examine and compare the occupational mobility and economic development of different cities. Not only Leipzig undergoes a phase of great prosperity; other cities also experienced strong growth phases in the 19th century - without being affected by the Rétablissement, for example.

The present dataset is also characterized by the restriction that occupational information is only linked with the birth date, leading to temporal inaccuracies. With a different type of dataset that provides more detailed information on occupational status at the time of the event under investigation, the effects of shocks could potentially be better examined. Additionally, it has been shown that using the current dataset, a Chow test alone, due to the ambiguity of occupations as a unit of measurement and the determination of turning points for long-term disruptions in a one-year interval, does not yield meaningful results. However, the methods used to analyze the effects of migration, as well as intragenerational and intergenerational mobility on the city's occupational structure, are convincing. The method for determining the migration effect appears to be hypothesis-generating. Furthermore, it would be relevant to develop a method that incorporates the different weighting of these three factors.

BIBLIOGRAPHY

Abramitzky, Ran, Adeline Delevande, and Luis Vasconcelos. 2011. "Marrying up: the role of sex ratio in assortative matching." *American economic journal: applied economics* 3: 124-57. https://doi.org/10.1257/app.3.3.124.

Alfani, Guido, Victoria Gierok, and Felix Schaff. 2022. "Economic inequality in preindustrial Germany, ca. 1300-1850." *The Journal of Economic History* 82, 1: 87-125. https://doi.org/10.1017/S0022050721000607.

Altmann, Norbert, and Guido Kammerer. 1970. *Wandel Der Berufsstruktur*. München: Carl Hanser.

Barone, Guglielmo, and Sauro Mocetti. 2020. "Intergenerational mobility in the very long run: Florence 1427-2011." *The Review of Economic Studies* 88, 4: 1863-91. https://doi.org/10.1093/restud/rdaa075.

Beachy, Robert. 2005. *The soul of commerce. Credit, property, and politics in Leipzig, 1750-1840*. Leiden-Boston: Brill.

Blaschke, Karlheinz. 1967. *Bevölkerungsgeschichte von Sachsen Bis Zur Industriellen Revolution*. Weimar: Böhlau.

Brea-Martínez, Gabriel, and Joana-Maria Pujadas-Mora. 2018. "Transformación y desigualdad económica en la industrialización en el área de Barcelona, 1715-1860." *Revista de Historia Economica - Journal of Iberian and Latin American Economic History* 36, 2: 241-73. https://doi.org/10.1017/S0212610917000234.

Chow, Gregory C. 1960. "Tests of equality between sets of coefficients in two linear regressions." *Econometrica* 28, 3: 591-605. https://doi.org/10.2307/1910133.

Clark, Colin. 1951. *The conditions of economic progress*. London: Macmillan.

Clark, Gregory, Neil Cummins, Yu Hao, and Dan Diaz Vidal. 2015. "Surnames: a new source for the history of social mobility." *Explorations in Economic History* 55: 3-24. https://doi.org/10.1016/j.eeh.2014.12.002.

Denzel, Markus A. 2012. "Messestadt Leipzig: Marktplatz Europas in Der Frühen Neuzeit." In *Leipzigs Wirtschaft in Vergangenheit Und Gegenwart. Akteure, Handlungsspielräume, Wirkungen (1400-2011)*, ed. Susanne Schötz, 3: 95-106. Leipzig: Leipziger Universitätsverlag.

Denzel, Markus A. 2016. "Die Leipziger Messen Vom 16. Bis Zum Frühen 19. Jahrhundert." In *Geschichte Der Stadt Leipzig. Von Den Anfängen Bis Zur Gegenwart. Von Der Reformation Bis Zum Wiener Kongress*, ed. Detlef Döring, 2, 199-230. Leipzig: Leipziger Universitätsverlag.

Döring, Detlef. 2016. "Vom Ende Der Schwedischen Besatzung (1650) Bis Zum Ende Des Siebenjährigen Krieges (1763)." In *Geschichte Der Stadt Leipzig. Von Der Reformation Bis Zum Wiener Kongress*, ed. by Detlef Döring, 2, 70-97. Leipzig: Leipziger Universitätsverlag.

Elvery, Joel. 2019. "Changes in the occupational structure of the United States: 1860 to 2015." *Economic Commentary*, no. 2019-09 (June). https://doi.org/10.26509/frbc-ec-201909.

Epstein, Stephan R. 2000. *Freedom and growth: the rise of states and markets in Europe, 1300-1750*. London: Routledge.

Favre, Giacomin, Jool Floris, and Ulrich Woitek. 2018. "Intergenerational mobility in the 19th century: Micro-level evidence from the city of Zurich." *University of Zurich, Department of Economics, Workings Paper Series*. https://doi.org/10.2139/ssrn.3102280.

Fuchs, Thomas. 2016. "Buchhandel Und Verlagswesen." In *Geschichte Der Stadt Leipzig. Von Der Reformation Bis Zum Wiener Kongress*, ed. Detlef Döring, 2, 234-71. Leipzig: Leipziger Universitätsverlag.

Füssler, Heinz. 1955. "Leipzig Im Zeitalter Des Barocks Und Rokokos." In *Leipziger Bautradition*, 103-24. Leipzig: VEB Bibliographisches Institut.

Goldberg, Jan Michael, and Katrin Moeller. 2022. "Automatisierte Identifikation Und Lemmatisierung Historischer Berufsbezeichnungen in Deutschsprachigen Datenbeständen." *Zeitschrift Für Digitale Geisteswissenschaften* Heft 7. https://doi.org/10.17175/2022_002.

Gränitz, Frauke. 2013. *Daten Und Fakten Zur Leipziger Stadtgeschichte*. 5. Leipzig: Leipziger Universitätsverlag.

Gretschel, Carl Christian Carus. 1982. *Leipzig Und Seine Umgebungen*. Frankfurt am Main: Weidlich.

Hällsten, Martin, and Martin Kolk. 2021. "The shadow of peasant past: seven generations of inequality persistence in Northern Sweden (Working Paper)." https://doi.org/10.31235/osf.io/yjksz.

Häner, Melanie, and Christoph A. Schaltegger. 2022. "The name says it all. multigenerational social mobility in Basel (Switzerland), 1550-2019." *Journal of Human Resources*, January. https://doi.org/10.3368/jhr.0621-11749R2.

Hasse, Ernst. 1876. *Statistische Wanderung Durch Leipzig. Vortrag Gehalten Am 8. März 1876 in Dem Verein von Freunden Der Erdkunde*. Leipzig: Engelmann.

Hasse, Ernst. 1878. *Die Stadt Leipzig und ihre Umgebung. Verwaltungsbericht der Stadt Leipzig für die Jahre 1866 - 1877*. Leipzig: Duncker & Humblot.

Hein, Markus. 2017. "Evangelische Kirche." In *Geschichte Der Stadt Leipzig. Vom Wiener Kongress Bis Zum Ersten Weltkrieg*, ed. Susanne Schötz, 3, 75-78. Leipzig: Leipziger Universitätsverlag.

Heßler, Martina. 2016. "Zur Persistenz Der Argumente Im Automatisierungsdiskurs." *Aus Politik Und Zeitgeschichte*, no. 18-19/2016: 17-24.

Homburg, Heidrun. 2000. "Der Ortsansässige Handel in Der Stadt Leipzig 1771-1835. Umfang Und Innere Gliederung Des Tertiären Sektors Im Spiegel Sozialstatistischer Quellen." In *Leipziger Kalender*, 161-82. Leipzig: Leipziger Universitätsverlag.

Höpel, Thomas. 2016. "Vom Rétabilissement Bis Zum Wiener Kongress." In *Geschichte Der Stadt Leipzig. Von Den Anfängen Zur Gegenwart. Von Der Reformation Bis Zum Wiener Kongress*, ed. Detlef Döring, 2, 97-124. Leipzig: Leipziger Universitätsverlag.

Keiderling, Thomas. 2012. "Innovation Im Leipziger Buchhandel Und Buchgewerbe 1800-1914." In *Leipzigs Wirtschaft in Vergangenheit Und Gegenwart. Akteure, Handlungsspielräume, Wirkungen (1400-2011)*, ed. Susanne Schötz, 221-42. Leipzig: Leipziger Universitätsverlag.

Kessler, Gerhard. 1932. "Genealogie und Wirtschaftsgeschichte." *Archiv für Kulturgeschichte* 22 (December: 199-236. https://doi.org/10.7788/akg-1932-jg11.

Khadke, Parag, Raju Kharat, and Kalpana Kamble. 2019. "Changing Occupational Structure in Auragnabad City." *International Journal of Research in Engineering, IT and Social Sciences* 9, 3: 25-32.

Knapp, Georg Friedrich. 1872. *Aeltere Nachrichten Über Leipzigs Bevölkerung 1595-1849 Und Über Den Bevölkerungswechsel in Den Jahren 1868-1871*. Mittheilungen Des Statistischen Bureaus Der Stadt Leipzig 6. Leipzig: Duncker & Humblot.

Koizumi, Ryo, and Yoshiki Wakabayashi. 2015. "Changes in the spatial patterns of occupational structure in the Tokyo metropolitan area after the bubble economy." In *Urban development challenges, risks and resilience in Asian mega cities*, ed. R.B. Singh, 351-66. Tokyo: Springer Japan.

Korge, Marcel. 2012. "Zunfthandwerk Und Kollektive Sicherung Bei Krankheit Und Tod Vor 1800." In *Leipzigs Wirtschaft in Vergangenheit Und Gegenwart. Akteure, Handlungsspielräume, Wirkungen (1400-2011)*, ed. Susanne Schötz, 107-28. Leipzig: Leipziger Universitätsverlag.

Kroll, Franz-Lothar. 2014. *Geschichte Sachsens*, ed. Martin Reuther. München: C. H. Beck.

Kuznets, Simon Smith. 1966. *Modern economic growth: rate, structure, and spread.* Yale: Yale University Press.

Lambert, Paul S., Richard L. Zijdeman, Marco H.D. Van Leeuwen, Ineke Maas, and Kenneth Prandy. 2013. "The construction of HISCAM: a stratification scale based on social interactions for historical comparative research." *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 46, 2: 77-89. https://doi.org/10.1080/01615440.2012.715569.

van Leeuwen, Marco H.D., Paul S. Lambert, Ken Prandy, Ineke Maas, and Richard Zijdeman. 2013. "HISCAM: estimating social interaction and stratification scales for the 19th and 20th century." CAMSIS. 2013. https://www.camsis.stir.ac.uk/hiscam/.

Löffler, Katrin. 2017. "Juden in Leipzig." In *Geschichte Der Stadt Leipzig. Vom Wiener Kongress Bis Zum Ersten Weltkrieg*, ed. Susanne Schötz, 3, 80-81. Leipzig: Leipziger Universitätsverlag.

Ludwig, Jörg. 2017. "Bevölkerung, Wirtschaft Und Soziales." In *Geschichte Der Stadt Leipzig. Band 3. Vom Wiener Kongress Bis Zum Ersten Weltkrieg*, ed. Susanne Schötz, 29-39. Leipzig: Leipziger Universitätsverlag.

Mitzscherlich, Birgit. 2017. "Römisch-Katholische Kirche." In *Geschichte Der Stadt Leipzig. Vom Wiener Kongress Bis Zum Ersten Weltkrieg*, ed. Susanne Schötz, 3, 78-80. Leipzig: Leipziger Universitätsverlag.

Müller, Moritz. 2022. "Time Machine Leipzig: Digitale Bürgerwissenschaft als Beitrag zur urbanen Sozialgeschichte." In *Genealogien. Zwischen populären Praktiken und akademischer Forschung*, ed. Georg Fertig and Sandro Guzzi-Heeb, 18, 269-73. Innsbruck: Studienverlag.

Oesch, Daniel. 2016. "Wandel der Berufsstruktur in Westeuropa seit 1990: Polarisierung oder Aufwertung?" In *Essays on inequality and integration*, ed. Axel Franzen, Christian Joppke, and Eric D. Widmer, 184-210. Zürich: Seismo.

Pamuk, Şevket. 2007. "The Black Death and the origins of the "Great Divergence" across Europe, 1300-1600." *European Review of Economic History* 11, 3: 289-317. https://doi.org/10.1017/S1361491607002031.

Schäfer, Michael. 2012. "Handelsmetropole in Der Industrieregion: Leipzig Und Die Industrielle Revolution in Sachsen." In *Leipzigs Wirtschaft in Vergangenheit Und Gegenwart. Akteure, Handlungsspielräume, Wirkungen (1400-2011)*, ed. Susanne Schötz, 185-98. Leipzig: Leipziger Universitätsverlag.

Schlenkrich, Elke. 2017. "Sanitäts- Und Armenwesen." In *Geschichte Der Stadt Leipzig. Band 3. Vom Wiener Kongress Bis Zum Ersten Weltkrieg*, ed. Susanne Schötz, 94-98. Leipzig: Leipziger Universitätsverlag.

Schönfelder, Günther, and Michael Börngen. 2015. "Naturräumliche Grundlagen. Landschaft Und Klima." In *Geschichte Der Stadt Leipzig. Von Den Anfängen Bis Zur Reformation*, ed. Enno Bünz, 1, 33-47. Leipzig: Leipziger Universitätsverlag.

Schötz, Susanne. 2017. "Leipzig Im Eisenbahnfieber." In *Geschichte Der Stadt Leipzig. Band 3. Vom Wiener Kongress Bis Zum Ersten Weltkrieg*, ed. Susanne Schötz, 253-56. Leipzig: Leipziger Universitätsverlag.

Schumpeter, Joseph A. 2020. *Kapitalismus, Sozialismus und Demokratie*. Tübingen: Narr Francke Attempto Verlag.

Seidel, Egbert Johannes, and Martina Wermes. 2017. "Kartei Leipziger Familien (Moritz-Kartei). Konzeptkartei "Italiener"." *Familie Und Geschichte* 103 6: 289-316.

Shaw-Taylor, Leigh, and Edward A. Wrigley. 2014. "Occupational structure and population change." In *The Cambridge economic history of Modern Britain, Volume 1, 1700-1870*, ed. Roderick Floud, Jane Humphries, and Paul Johnson, 53-88. Cambridge: Cambridge University Press.

Solon, Gary. 2018. "What do we know so far about multigenerational mobility?" *The economic journal* 128, 612: 340-52. https://doi.org/10.1111/ecoj.12495.

Sonnenkalb, Hugo. 1864. *Statistische Tabelle Der in Der Stadt Leipzig von Anno 1595 an Getrauten, Getauften Und Gestorbenen, Sowie Der Einwohner*. Leipzig: Rocca.

Sorokin, Pitirim A. 1998. *Social Mobility*. London: Routledge Thoemmes Press.

Süßmilch, Johann Peter. 1742. *Die Göttliche Ordnung in Denen Veränderungen Des Menschlichen Geschlechts*. Berlin: Daniel August Gohl.

Time Machine Leipzig. 2022. "The Leipzig Time Machine." Time Machine. 2022. https://www.timemachine.eu/the-time-machine-leipzig/.

Walther, Alexander. 2012. "Zum Bevölkerungswachstum in Leipzig Im 19. Und Frühen 20. Jahrhundert." In *Leipzigs Wirtschaft in Vergangenheit Und Gegenwart. Akteure, Handlungsspielräume, Wirkungen (1400-2011)*, ed. Susanne Schötz, 197-220. Leipzig: Leipziger Universitätsverlag.

Watson, Audrey. 2005. "Occupational structure and urban growth." In *Occupational employment and wages*, 10-20. OEWS Bulletins/U.S. Department of Labor, Bureau of Labor Statistics. https://www.bls.gov/oes/bulletin_2004.pdf.

Weiss, Volkmar. 1993. *Bevölkerung Und Soziale Mobilität, Sachsen 1550-1880*. Berlin: Akademie-Verlag.

Wittmann, Reinhard. 2019. *Geschichte des Deutschen Buchhandels*. München: C.H. Beck.

Wooldridge, Jeffrey M. 2009. *Introductory econometrics. A Modern approach*. Mason: South-Western.

Wrigley, Edward A. 2016. "Changing occupational structure and consumer demand." In *The path to sustained growth: England"s transition from an organic economy to an industrial revolution*, ed. E.A. Wrigley, 67-100. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781316488256.006.

Zwahr, Hartmut. 1996. "Leipzig Im Übergang Zur Bürgerlichen Gesellschaft (1763-1871)." In *Revolutionen in Sachsen. Beiträge Zur Sozial- Und Kulturgeschichte*, ed. Ulrich von Hehl, Wieland Held, Günther Heydemann, and Hartmut Zwahr, 138-70. Weimar, Köln, Wien: Böhlau.