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Glossary of Methodological Approaches

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Ways to Deal with the Sources: A Glossary of Approaches and Methods

This glossary provides a concise overview of all the methods and approaches employed in the reviewed sample studies (see Chaps. 6, 7 and 8). We use the term method in a very broad sense: It comprises all the possible ways of dealing with the sources. The glossary thus gives an impression of how a tool kit for doing premodern economic history could look like. If you want to apply any of the methods yourself, we recommend consulting the literature cited in the respective section. You cannot learn how to apply a method by reading this glossary, but we will give you an impression of how the method works, which should help you decide whether this approach may help you deal with your sources and answer the questions that you are studying. Every section summarises the basic idea underlying this approach. It sketches how the method is applied and which sources and data you need if you want to get meaningful results. The choice of a method for doing a study in premodern economic history depends heavily on the sources that have survived and are available. Every section thus points out the scope and the limitations of the respective method.

The glossary and the reviewed sample studies are closely interlinked: The glossary describes those methods and approaches which are employed in the reviewed sample studies. This way you are always able to check how this particular approach is implemented in practice. As you will notice, if you compare the methods described here with the methodological approaches employed in the reviewed sample studies, the entries in this glossary often describe the approaches in more detail and greater complexity than they appear if you see them implemented in practice. The entries here often list a number of steps that have to be performed when working with the approach described. Most of the reviewed sample studies, however, do not talk explicitly about all the different steps. Some use them without explicitly pointing them out, while others do not use all of the possible steps. For instance, institutional analysis is depicted here as a neatly structured analysis. In Chaps. 6, 7 and 8, in contrast, we tagged all reviewed sample studies with the keyword 'institutional analysis' that discuss the effects of a certain institutional setting on the shape and performance of a certain part of the economy. The same is true for source interpretation: The section on source interpretation in this chapter outlines a number of steps that a researcher working with this method has to perform. Hardly any reviewed sample study employing source interpretation as its methodological approach discusses these steps explicitly.

The approaches stem from historical research as well as from economics; some can be described as quantitative and others as qualitative methods; some approaches can be regarded as traditional and well tested, while others are innovative and riskier to apply. As Chaps. 6, 7 and 8 show, nearly all the reviewed sample studies employ more than one methodological approach. Most reviewed sample studies use descriptive statistics or source interpretation (or both) to get a first impression of the content of the sources. They then go on to work with other methods to add layers of interpretation. For instance, Bruch combines a source interpretation of monastery accounts with a comparison of six different Cistercian monasteries (see reviewed sample study 1). Gelderblom et al. first use descriptive statistics of credit transactions registered by aldermen and notaries to gauge the credit market, and then employ a regression analysis to find out why registration was shifted from aldermen to notaries (see reviewed sample study 51). In some of the studies presented here, descriptive statistics and source interpretation are combined to render a thorough analysis of the sources. Rippmann, for example, uses source interpretation and descriptive statistics to analyse accounts and tax lists to get a nuanced picture of women's work in the Upper Rhine region (see reviewed sample study 13). A number of studies use more than two methodological approaches to explore a phenomenon from different perspectives. For example, Börner and Quint classify different types of brokerage rules, analyse their institutional set-up, build a model of their effects on welfare and run a regression analysis to determine why a particular rule was employed in a certain city (see reviewed sample study 43).

Taken together, the different methodological approaches show the rich diversity of methods and approaches that can help us to get a grasp on premodern economic phenomena and transformations. You may read the glossary as a whole if you want to get an impression of the approaches currently applied in economic research on the Holy Roman Empire, or you can look up single entries to learn more about a method used in a specific reviewed sample study.

Analytical Bibliography (Karina de la Garza-Gil)

Analytical bibliography, a 'branch' of bibliography, is a method traditionally used by researchers of the production of incunabula (books printed before the sixteenth century) who are especially interested in finding out how the books were produced. However, it can also be applied to the study of the production of manuscripts or later printed material.

Analytical bibliography studies books (incunabula) as material objects. This means that the researcher concentrates on finding out as much information as possible regarding their production. She analyses the different materials and plausible practices that could have been involved in their making. This typically comprises a study of the paper (watermarks, establishing format, establishing conjugacy or the presence of cancels, etc.), the analysis of all the marks left on it by the process of printing (first- and second-form impressions, ink smears, blind impressions, point holes etc.), the analysis of metal type (printer classification, broken type, raised type, fallen type etc.) and the analysis of composition (i.e. setting the text for printing).

The scarce survival of contemporary sources of information relevant to questions pertaining to the production of incunabula is one of the reasons why the books are considered as material objects of study. There are no extant sources which describe the way the first presses were used (practices and methods of printing), and only a small number of sources attest to the organisation of early printing houses (ledgers, manuals, correspondence, exemplars). Even fewer sources testify the skills the master printers possessed. For this reason, the books themselves become an essential source of information.

However, analytical bibliography does not exclude the use of any surviving archival or historical material, nor the analysis of text or language which could be of relevance for the objective of any given study (see entries on source interpretation and discourse analysis). This means that any source of information, other than the information which can be obtained by the material analysis of the books as explained above, can (and should) be included in the final evaluation of data. For further reading see Harris (2004) and Hellinga (1989).

See reviewed sample studies 6, 32.

Archaeological Methods (Ulrich Müller)

In addition to preparation methods for excavations, archaeological structures are revealed by layer and stratigraphic excavations and then documented both graphically and in writing (Fehring [3]2007; Scholkmann et al. 2016). With plana excavation, excavations are conducted according to predetermined uniform sizes. With stratigraphic excavation, the floor of the excavation area corresponds to the real former horizon. The former identifies contiguous structures (e.g. a large market surface with footprints), while the latter requires sophisticated excavation techniques in order to detect differences (e.g. in market surfaces). In further evaluation steps, the features are consolidated to simultaneous phases and then classified in an absolute chronological order. For this purpose, not only scientific data (e.g. dendro data), coins and artefacts but also written sources are consulted.

Features found at markets include—in addition to foundations, post traces, pits, graves, technical equipment and pipelines—the historical surfaces. This encompasses traces of movements (people, animals, chariots), waste disposal and/or cleaning activities. Such market surfaces are highly dynamic. The surfaces are continually modelled by constant walking and driving activities and are altered by weather conditions, which can affect entire market areas or only selective areas. Negative features may suggest the cleaning of surfaces, while layers of dirt indicate neglect. In many places, the traces of wagons are detected. They are not only interpreted as signs of transport and evidence of traffic directions but could also serve as indications of the location of vehicles and thus wheel-rut. Constructions (benches, stands) are often only detectable via the traces of posts. Purposeful surface structuring can already be detected in the Early Middle Ages (Cologne, Heumarkt), but it becomes standard from the thirteenth century onwards, which certainly coincides with changes in waste disposal. Besides simple levelling, paving (pebbles, stone slabs) can be observed, which enabled easier movement and cleaning. Compaction was also achieved through admixtures with animal bones, ceramics or other materials.

Findings do not exclusively reflect trade activities (Garraty and Stark 2010; Hahn and Schmitz 2018). Find material often indicates craft activities, logistics (packaging, transport), waste disposal or everyday use. Cloth seals, scales and weights or coins serve as direct or indirect evidence. Mass finds or special objects also enable inferences to regional and supra-regional networks. Indications towards the infrastructure, particularly transport (horseshoes), consumption or craft activities, can be found more often than direct evidence of trade.

At first glance, distribution maps of findings (e.g. ceramics) span the gap between local and super-regional trade. However, they reflect much more complex interaction paths and forms, which are decisively contoured by spatial-statistical methods (see section on digital mapping) or network analyses (see section on network analysis) as a kind of hypothesis-generating or explorative technique (Wehner 2017). For the analysis of the distribution of findings on a marketplace, density maps are often used in addition to traditional point maps in order to outline activity areas across spaces (Reitz and Zierden 2005). Questions concerning the origins of artefacts, animals and plants can be complemented by an archaeometric analysis as well as geochemical, archaeozoological or archaeobotanical investigations (Coronel et al. 2014). They require a representative data basis in order to, for example, isolate fishing grounds for cod via the implementation of isotope analyses. Such find analyses can be supplemented by scientific cultural study approaches, which, for example, make inquiries about strategies of appropriation on the basis of object-biographical and consumer theory concepts (Heath et al. 2017).

However, excavations often do not include entire objects (e.g. an entire marketplace) and are dependent on a variety of formation processes (conservation, selection, incidence) of former and current societies. Since findings are destroyed by excavations, an exact assessment of what should and what should not be documented is necessary. In this respect, one problem is the degree of exactness. Moreover, recognising structures on the basis of features (e.g. post-construction) is always a reflective but irreversible process. For an overall understanding, it is important to establish whether data are interpreted from a procedural or post-procedural perspective. The former developed in the late 1970s and 1980s. It strongly emphasises the subjectivity of archaeological interpretations, recognises the multidimensionality of the social practices of social actors and stresses a phenomenological, hermeneutic approach. The latter perspective derives from the New Archaeology of the 1960s and gives priority to deductive explanations. It assumes that historical interpretations can be developed on the basis of theories, which are based on an objective perception of the collected data. It underlines human-environmental interactions, is interested in spatially and temporally wide-ranging cultural processes and accentuates quantifying and modelling methods. Although today, in light of theoretical pragmatism (Harris 2017; Müller 2018), these strict dividing lines appear to be less stringent, these basic assumptions continue to influence excavation methods and interpretations. For further reading see Fehring ([3]2007) and Scholkmann et al. (2016).

See reviewed sample studies 20, 37, 39, 41.

Basket of Goods (Kathrin Pindl)

A basket of goods as a model *and* a method in economic history and economics consists of a set of representative products and services for a certain market or region. Baskets of goods are used in the context of the assessment and measurement of living standards, for example, by computing a consumer price index (CPI). Therefore, it aims at reflecting the average household expenditure on foodstuff, housing, energy and other everyday necessities. Which items are put into such a basket in what quantities is of course decided by the researcher, and this choice depends first on the economic issue of interest, that is, the measurement of inflation, purchasing power of wages or nutritional status. However, since for the computation of a CPI not only wage data, but also data on prices and quantities of commodities are needed, in historical analyses at least the selection of items is also directed by the availability of such data. Most of the necessary long series of price data for computing historical baskets of goods stem from institutions, that is, cities, hospitals, monasteries and so on.

To calculate a consumer price index (CPI) on the basis of a premodern basket of goods, the data on quantities, prices and wages are commonly displayed in a spreadsheet and operationalised via basic statistics software such as Excel or Calc. This is done in the following way: The researcher creates a spreadsheet with the prices for each good for every year of observation. She then weighs the expenditure, that is, she determines the ratio of how much the premodern consumer spends on average per year or month for each group of goods (e.g. living, food, clothing, security and luxury). Finally, the basket of goods is fixed in order to statistically observe its monetary value over time, mostly on an annual or monthly basis (see section on descriptive statistics), and thus to track certain economic effects like inflation or deflation. There are also several mathematical ways of how to compute a CPI; the most common being the fixed-weight Laspeyres Index. However, there are many other possible formulae for calculating a consumer price index, for example, the Paasche Index or the Geometric Index, to name just two. They all aggregate the data in a different way. The choice depends on the preferences of the researcher and the data quality.

For historical as well as for modern baskets of goods, numerous methodological challenges arise, for example, changes in consumer habits, the availability and density of historical price series, the conversion of historical units of measurement and payment, or the actual consumption by premodern people (anthropometrical questions of calorical needs). It is important to acknowledge that a CPI based on a historical basket of goods will always be a statistical approximation instead of a 1:1 reflection of historical reality. However, it still expands our empirical knowledge on standards of living (Table 9.1).

Table 9.1 An exemplary basket of goods, here: a premodern basket of goods for the Southern German town of Mühldorf am Inn which belonged to Salzburg and was surrounded by Bavarian territory for the years 1550–1700, with the base year of 1550, source: author's calculation on the basis of Stadtkammerrechnungen Mühldorf am Inn R1/67 to R1/244

Basket of goods	Year	1550					
	Quantity per person per year	Unit	Price in gram fine silver per year	Pr.	% of total expenses	Calories per kg/l/piece	Calories per day
Bread	91.25	kg	0.636	58.1	19.4%	2450	613
Buns	36.50	kg	0.955	34.8	11.6%	2450	245
Beer	365.00	l	0.030	11.0	3.7%	426	426
Candles	3.65	kg	5.345	19.5	6.5%		
Meat	25.55	kg	0.472	12.1	4.0%	2500	175
Grain	73.00	kg	0.372	27.2	9.1%	2400	480
Subtotal				**162.7**	**54.2%**		**1939**
Rent				30.0	10.0%		
Firewood	1022.3	kg	0.022	22.7	7.6%		
Cabbage/ vegetables	54.8	kg	0.320	17.5	5.8%	800	120
Soap	2.6	kg	2.880	7.5	2.5%		
Spices	0.3	kg	15.000	4.5	1.5%		
Textiles	5.0	m	4.369	21.8	7.3%		
Cheese	5.2	kg	2.843	14.8	4.9%	3750	53
Butter	5.2	kg	3.470	18.0	6.0%	7286	104
Eggs	52.0	Stück	0.010	0.5	0.2%	79	11
Subtotal				**137.4**	**45.8%**		**288**
Total				**300.0**	**100.0%**		**2227**

For further reading see Allen (2001).
See reviewed sample study 21.

Classification/Types (Ulla Kypta)

The basic idea of classification is to group your empirical findings into more abstract classes or categories or types. This helps you grasp the essential, basic features of the phenomena you want to study, though of course you lose all the specific details of each single entity. Classification consists of creating types. Max Weber famously named them 'ideal types' (Weber 1904): They are ideal in the sense that they show not the real, but the ideal form of a phenomenon. Classification in this regard resembles modelling (see section on modelling): You create something—a model or a type—which does not exist in this form in reality. But it nonetheless helps you to better understand one aspect of reality by focusing on its essential features.

Creating an ideal type means generalising: An ideal type (or a class or type) systematically summarises historically specific cases. To a certain degree, every historian has to generalise: Without generalisation, you can only study single cases. As soon as you claim to learn something from this single case which can also be applied to other cases, you are generalising. However, claiming to have found some general feature of certain historical phenomena does not mean that you claim that they are universal, that is, that this feature characterises all comparable historical phenomena. If you find out that some medieval towns in Europe were ruled by merchants and you create the ideal type of the merchant city, you do not claim that all medieval towns (or even all towns in general in the world) were ruled by merchants. But you claim that a number of medieval cities were ruled by merchants, and that grouping them together into the category 'merchant city' helps us to see something which we would not be able to see if we studied them separately. In order to distinguish between generality and universality, you always have to make clear for which time, region and other circumstances your generalisations hold true.

Classification can be done in an either inductive or deductive way. You work inductively if you start with scrutinising the sources and then group your empirical findings into types or categories. The categories you create depend on what you are interested in: You can categorise different types of persons, groups or objects, professions or estates, different political systems, economic regimes or different types of economic change. Creating types from empirical material is important not only for historians, but also for sociologists. They call this approach 'grounded theory', since a theory is being built up while reading the sources (Charmaz 2006).

If you work deductively, on the other hand, you start, not with the empirical material, but with the abstract types. This is how Max Weber described working with ideal types: Start with choosing ideal types which consist of the most essential characteristics of your object of investigation. This means, of course, that you must know what your object of investigation is and what its most essential characteristics are. So, whether you proceed inductively or deductively, you have to have some general idea about your object of investigation and its general characteristics. If you work inductively, you start by reading your sources thoroughly and in a second step create ideal types, whereas in a deductive approach, you start with creating ideal types and then go on to read the sources thoroughly. In a deductive approach, you normally choose the ideal types suitable for your study from the existing literature. Then you have to check your sources and group the empirical cases according to the ideal types that you have chosen. The ideal types help you analyse your sources more systematically, and they sharpen your view for similarities and differences. Besides, the empirical study serves as a test for the ideal types you have chosen: Do the ideal types really cover the essential characteristics of your empirical data? The empirical study can thus lead to a refinement of the ideal types, which can be fruitful for other researchers who can now work with the refined, better ideal types that you have created.

If you want to group your material into types, you need a number of cases. If you study only one town, you cannot build a classification of towns; you can only classify the town you are studying according to an already existing classification. Creating types helps you to focus on the essential characteristics of a phenomenon. Thus, its main challenge lies in recognising what these essential characteristics are. It is necessary to keep questioning and refining the ideal types in order to make sure that they comprise the important features of the phenomenon you want to study.

Classification helps you grasp the essential features of a phenomenon, which is only possible because all the specific details of one historical case are regarded as not important. Classification thus always simplifies historical reality. The essential characteristics of ideal types are often summarised in a table. Building your own classification frequently serves as a first step for a comparison (see section on comparison). For further reading see Lengwiler (2011) and Charmaz (2006).

See reviewed sample studies 4, 7, 8, 10, 11, 12, 14, 19, 24, 26, 41, 42, 55, 57, 58, 60, 61, 65, 67.

Coin Hoard Analysis (Sebastian Steinbach)

One of the most important methods of money history and numismatics is the analysis of coin hoards. Coin hoards can be studied in terms of time structure (time of accumulation), geographical structure (region of accumulation) and value structure (value of the coins contained). It is possible to define the circulation and volume of coins travelling within a certain geographical (economic) region during a specified time period. There has been much debate on the representativeness of coin hoards as an intentional collection reflecting the money in circulation, since within the large hoards usually only the more valuable coins were accumulated. Single finds are more representative of the money used in everyday circulation (small change), but small coins also have a greater chance of getting lost. In consequence, coin hoards have to be adjusted with the help of written sources in order to get a more reliable statement on the money which circulated 'in reality'.

The youngest coin in a hoard allows the determination of a time of burial (*terminus post quem*) for the whole complex. Considering this, hoards and single finds are also a valuable source for archaeologists to date other finds within their excavations. The number and value of coins contained in a hoard makes it possible to draw conclusions about the economic situation of its former owner, his social position, trade relations/routes and the possible reasons for the concealment of the hoard. For further reading see Grierson (1965, I–XIII), (1966, I–XXI), Klüßendorf (2009, 25–34) and McDonald (1903).

See reviewed sample study 54.

Comparison (Ulla Kypta)

One of the basic methods in every scientific discipline is to compare phenomena. It can be regarded as an almost intuitive idea: If you want to find out something about a phenomenon, you compare it with others and notice similarities and differences. This helps your understanding of the phenomenon. If you take things one step further, you do not only describe similarities and differences, but you try to explain them as well. The first step is a descriptive approach and the second step is an analytical comparative approach. One of the most prominent proponents of comparative approaches in historical research was Marc Bloch (1928), the famous French historian who founded the Annales school in the first half of the twentieth century.

If you want to use a comparative approach, you need to study phenomena that can be compared. This sounds self-evident, but it means that you must see something similar in all the phenomena you are studying. If you think that every historical case is completely unique, you will not be able to compare it with any others. In practice, every comparative study has to start with this question: What do you see as the element to which the phenomena can be compared? In other words, what do you regard as the feature that all your cases have in common, so that you can compare them? For example, if you want to study the economic policy of city councils, you have to assume that all of them employed an economic policy. This feature you want to compare is called *tertium comparationis*. It is often an ideal type (see section on classification).

The first step of a comparative study consists in deciding what you are interested in: What do you want to compare? You can compare economic policies of a city council, but also towns in general, regions or kingdoms, professions or genders. Furthermore, you have to decide whether you compare the economic policy of different cities during the same time frame or compare the economic policy of one city during the fifteenth century with the same city's policy during the sixteenth century. 'Economic policy' is an abstract concept, so you need to think about the variables that you can use to grasp 'economic policy'; for example, did the city council regulate prices? If you compare regions, you also have to decide about the variables you want to include, for example, population or urban ratio. Once you establish the *tertium comparationis* and its variables, you have to choose the cases you want to compare. Which cities or professions or centuries do you want to contrast with each other? How many cases do you need in order to get meaningful results?

A descriptive comparison can be done by individualising or by universalising (Tilly 1984). In the first case, you compare phenomena to highlight their differences; in the second case, you underline the similarities. In practice, of course, most studies combine individualising and universalising elements. The 'encompassing comparison' delineates the similarities of the better part of the case studies, but then contrasts them with the other cases. The 'variation-finding comparison' first establishes groups of reviewed case studies which are all similar with regard to a certain feature and then describes the internal differences between the group members (Tilly 1984, 82f.).

The analytical comparison not only wants to describe similarities and differences, but wants to explain them as well. The similarity or difference that should be explained can be regarded as the dependent variable. The task is then to find the independent variable which causally influences the dependent variable. This can be done with a range of different approaches. For a small number of case studies, it can be done by hermeneutics (see section on source interpretation/hermeneutics); for larger numbers, regression analysis can be employed (see section on regression analysis). Historians sometimes (if mostly implicitly) use two methods that are famous in comparative political science and were described by John Stuart Mill in his *System of Logic* (1843). The 'method of difference' assembles cases in which the dependent variables vary widely, while the independent variables (i.e. the context) are similar. In other words, you try to explain why a certain phenomenon sometimes appears and sometimes does not. For example, you might like to find out why certain Hanse cities allowed craftsmen to be part of the city council and others not. You compare the independent variables (i.e. the context) of all the cities that allowed craftsmen to be on the council with all the cities that did not allow it. Then you can rule out any of the independent variables that can be found in craftsmen and non-craftsmen towns alike: They cannot explain the difference.

The method of agreement, in contrast, analyses cases in which the dependent variables are similar, but the independent variables (or the context) differ. In other words, you will try to find out why a certain phenomenon can be found in very diverse circumstances. For instance, you might like to find out why people in almost all German cities bought annuities. All the independent variables (or circumstances) that can be found in one city of annuity-buyers but not in the other can be excluded from the possible causes for annuity-buying.

To get meaningful results from a comparison, it is necessary to compare a number of cases. If your main aim is to describe similarities and differences, just two cases might be enough. But if you want to explain the differences and similarities, a larger number of cases is necessary. If you compare only two Hanse cities, one that allowed craftsmen into the city council and one that did not, it is difficult to assess the reason. All the differences between the two towns are possible explanations, and you need more cases in order to rule out some of the possibilities. It is vital to include all the possible variables into your analysis. Otherwise, it could happen that none of the variables you included are the cause of the phenomenon, and your search is either in vain or, even worse, you might be inclined to judge the wrong variable as the most important influence on the phenomenon you aim to explain.

But of course, historical phenomena seldom have only one cause, and one cause can have quite different effects in different circumstances. Thus, comparative studies should not be regarded as an easy and watertight way of establishing causal relationship. But they can give an impression of possible causes and clusters of causes, which can then be examined in more depth.

The results of comparative studies are often displayed as tables that give an overview of similarities and differences between the cases. To explain the differences and similarities, however, continuous text is more helpful. For further reading see Haupt and Kocka (1996), Kaelble (1999) and Puhle (1979).

See reviewed sample studies 1, 4, 5, 7, 8, 10, 14, 15, 16, 18, 21, 26, 27, 33, 34, 42, 43, 46, 48, 54, 56, 57, 59, 60, 61, 62, 64.

Descriptive Statistics (Ulla Kypta)

Whenever you extract numerical data from your sources, it can be helpful to calculate some descriptive statistics to get a grasp of it. Descriptive statistics aim at summarising—variable by variable—the statistical properties of your data. In contrast, more complex methods are employed to explore the relationship between different variables (see section on regression analysis). Furthermore, descriptive statistics are distinguished from inductive or inferential statistics: Descriptive statistics summarise existing data, whereas inferential statistics offer tools to determine unobservable values either inside the range of the observed data (interpolation) or outside this range (extrapolation) (see section on time series analysis).

To summarise existing data, one very convenient tool is the mean. There are different means which are calculated differently and tell you different things about your data. The arithmetic mean is the most prominent one. If you read in an article that a number is 'the mean' without further qualifications, it normally means the arithmetic mean. It is calculated by adding up all the numbers in the data set and then dividing this aggregate number by the number of observations. The arithmetic mean is very sensitive to extreme values. Therefore, it is helpful in cases when you want to summarise data sets in which all the values are close to each other. One very high or very low value shifts the arithmetic mean to a quite high or rather low number, and in such a situation, the arithmetic mean gives a false impression of the data set: It does not tell you that most values are lower or higher than the arithmetic mean. For these kinds of data sets, the median is a more appropriate mean. It is the value that lies in the middle of the data set: Half the values are larger, and half the values are lower. A third mean is the mode, which is the value that is taken most frequently in the data set.

Another instructive way of summarising the data is to say how widely dispersed the data is. The range gives the difference between the largest and the smallest value. A more complex statistic is the standard deviation. It tells you whether the values in your data set are widely dispersed or close to each other. To calculate the standard deviation, in a first step one takes the differences between the arithmetic mean and each number in the data set, squares these differences and then finds the mean of these squared differences. This results in a number which is called the variance. In a second step, one takes the square root of the variance and gets the standard deviation. If the standard deviation is small, the values are not widely dispersed. The ratio of the standard deviation to the mean, furthermore, is called the coefficient of variation. The coefficient of variation helps to compare the standard deviations of different value sets. They cannot be compared directly, since they often are measured in different units and thus have a differently scaled mean. Calculating the respective coefficient of variation, however, gives numbers that can be meaningfully compared: The value set with the higher coefficient of variation exhibits more variation around its mean than the other value set. Values like the mean or the standard deviation are called 'a statistic', since they summarise the data set.

To employ descriptive statistics, you need to have a data set that is not too small. It is not very instructive and can even be misleading to calculate a mean from only five values. Furthermore, all the values that are summarised in a statistic have to be values of the same variable. In historical research, it is sometimes challenging to make sure that, for example, the values of certain duties for a number of decades can be regarded as values of the same variable: The mode of collecting duties could have changed, more groups of people could be exempted from the dues and so on. Last but not least, you need continuous data to employ statistical methods, and these are seldom easy to get, especially for premodern times.

The advantages and disadvantages of using statistical tools are widely discussed in the humanities, but also in society at large. Some people argue that statistics can take away the ambiguity that makes human life and history interesting. For example, it reduces the information contained in the data set: Instead of a number of different values, you end up with one arithmetic mean. Defenders of statistical methods say that by taking away ambiguity, they bring clarity and allow you to come to terms with data sets which are too large to be handled without mathematical methods. As Hand (2008) describes it in his popular introduction into statistics (Hand 2008, 24): "Many people are resistant to the notion that numerical data can convey the beauty of the real world. They feel that somehow converting things to numbers strips away the magic. In fact, they could not be more wrong. Numbers have the potential to allow us to perceive that beauty, that magic, more clearly and more deeply, and to appreciate it more fully." This is especially true if charts and graphs are employed to present complex relationships.

Hand's book is an introduction for the general public. It presupposes neither mathematical nor statistical knowledge and gives an overview of the main ideas and concepts of statistics. There are heaps of introductory books into statistical methods and the software programs to use them, and most economic, sociology and other departments offer introductory courses as well. Some books are written especially for historians (e.g. Feinstein and Thomas 2002, chapter 2; Floud 1973; Thome 1989). These are mainly concerned with historical research that covers the modern period, since it is only for the last two centuries that enough data can be mined to employ the more complex statistical methods. The more difficult question of how to use statistics for premodern economic history is seldom addressed in detail. For further reading see Feinstein and Thomas (2002), Floud (1973) and Thome (1989).

See reviewed sample studies 2, 5, 12, 13, 17, 18, 21, 23, 27, 28, 35, 36, 37, 51, 57, 64, 68.

Die Analysis (Sebastian Steinbach)

If one wants to get information about the volume of coin emissions, but there are no written sources to consult, the analysis of minting dies (*Stempelkritik*) brings indications to light: Based on the fact that as a rule two dies were used for the striking of the obverse and reverse of one coin type, the combination of these two—which were not combined strictly as a pair, but changed when necessary—allows us to distinguish several connections of dies and to determine a chronology of the several types by drawing a 'pedigree of dies'. It is also possible to calculate the volume of the circulating coins of one type (emission) by mathematical methods based on the estimated number of coins that could be struck by one die (normally between 1000 and 10,000 coins in ancient and medieval times).

However, one can only do that if the numismatic material of one type (in other words every single known coin of one type) is recorded almost completely. Furthermore, one has to differentiate between more experienced mints and smaller ones, which struck coins only sporadically. One also has to keep in mind that the obverse die—which has been handled freely by the person who struck the coin—had a shorter period of usage than the reverse die—which had been fixed in a wooden or stone block. The mathematical formula to calculate the number of dies used for an emission of coins is: $D = (n \times d) : (n - d^1)$. Meaning D = original number of dies used, n = number of coins examined, d = number of dies found by examining the coins and d^1 = number of dies verified by only one of the examined coins.

In early modern times, the striking of coins with machines such as a rolling mill allowed to produce larger quantities of coins within a shorter period of time and with a smaller error rate. From the Late Middle Ages, written sources give us further information about the volume of minting of a certain coin type. Considering this, the use of the analysis of minting dies for coins is a useful approach to assess the quantities of coins only up to the sixteenth century. For further reading see Kluge (1989).

See reviewed sample study 54.

Digital Mapping (GIS) (Niels Petersen)

The use of maps has played quite a small role in historical research, although their benefit has been widely acknowledged, especially following the so-called spatial turn in historical research. Usually maps are mostly used to illustrate certain geographical relations, rather than to add another layer of analysis or to support an argument. Very seldom will one find maps depicting complex temporal features. The production of maps in general needs expertise that is not always available; furthermore, the printing process limits the information that can be presented in a map. Hence, the relation between time and space in historical events and processes is usually described in the form of text.

The most common maps that depict temporal dynamics deal with the development of settlements and cities in space during a certain time period. The urban expansion over time is normally shown as monodirectional. When structures or whole quarters disappear—or maybe even reappear at a later point in time—the printed map reaches its limits. Trade fairs and markets take place at certain times of the year, which means they appear and reappear over time. The system of the Champaign fairs is a famous example that could hardly be understood without the knowledge of their spatiotemporal distribution. A third aspect is movement through space during time. Be it movement of goods or of people or the distribution of information about an event, the identified locations would usually be connected with a date or timestamp. Common examples are maps of the itineraries of German emperors during their reigns: The respective data can be derived from the charters they issued while they stayed at a certain location.

Digital mapping solves a lot of problems with the presentation of spatiotemporal information, as not every information has to be organised on just one map. While it is often necessary to print a series of maps in order to show temporal dynamics, digital mapping is able to store all information at once, but present just the parts necessary to get certain information. The tool that is commonly used for digital mapping is a Geographical Information System (GIS) that allows a map to be drawn and certain information assigned to every element. This information is stored in a so-called geodatabase. It includes geographical data that can be enhanced by temporal data, textual description, even photos or graphics and statistical data, such as toll rates or population. It is possible to create a map that draws only on those parts of the database needed to tackle a certain research question, or to show just the information needed in this case. This interactive element is based on the idea of map layers. On a base map that contains topographical features, thematic layers will be projected. These can show either points (settlements, toll stations, harbours, grain storages etc.) or lines (roads, borders, itineraries etc.) or geometries (areas of historic landcover or land use etc.).

Finally, one can analyse the data underlying the map using other methodological approaches: the data can be analysed either statistically (how much money is being allocated to a certain place by a trade company etc.) or in terms of time and space (how long does it take to get from one place to another etc.). While GIS is part of the toolbox of the geosciences, it has great potential to be the future database to store and analyse historical data that has either a temporal or spatial aspect or both (a so-called HGIS). For further reading see Gregory and Geddes (2014), Volkmann (2017) and Bodenhamer (2010).

See reviewed sample studies 18 (mapping) 39, 41 (mapping), 55.

Discourse Analysis (Martin Kypta)

The terms 'discourse analysis' or 'discourse theory' denote a wide range of theoretical and methodological approaches, from Habermas's normative notion of the 'force of the better argument' to critical discourse analysis in linguistics. The German tradition of conceptual history (*Begriffsgeschichte*) highlights the effects of language on society and culture over the centuries. Roughly since the year 2000, an interdisciplinary approach of discourse analysis has become en vogue for historians. This strand of discourse analysis is well fitted to grasp social and political phenomena, since it aims at disclosing power mechanisms, which have determined actions. People, in this view, do not have power; rather, power lies in relations between 'partners', between the elements of discourse. Simply put, discourse itself inherits power by enabling or inhibiting statements, practices and positions. Discourse analysts scrutinise their sources by finding, highlighting and ordering recurring statements and practices, and by focusing on changes of those standard themes. Discourse analysis is positivistic in the sense that it is not hermeneutic. There is no search for an underlying meaning.

Discourse analysis rests on the assumption that there is no meaning before discourse. Only through discourse do things get meaning. Discourse is a practice rather than just a copy of an underlying reality. To many, the founding father of discourse theory is Michel Foucault. "We shall call discourse a group of statements in so far as they belong to the same discursive formation" (Foucault 1972, 117), which means they share a common regularity (an order, correlations, positions and functionings, transformations). To Foucault, it is important how knowledge comes into being, what can or cannot be said. In the narrow sense of the term, discourse theory "is a set of methodological rules for the analysis of text"

(Laclau in Bhaskar 2002, 79). It is important to note that discourse theory is still a work in progress. Theory and method consist of an ongoing openness and variety. Thus, almost every work of discourse analysis is itself in part an extrapolation of discourse theory. Still, there are basic steps any discourse analysis has to take. In the following, those steps are condensed to three (Füssel and Neu 2014).

The first step is to choose a set of texts that comprise a corpus. This task is obviously guided by a main theme or research question and, thus, is subject to changes during the course of the work. Since the chosen sources determine the outcome of the analysis, this step has to be made as transparent as possible.

The second step is to analyse how statements in the chosen corpus come about and how they are used: Are there recurring themes? Do certain statements appear only in a specific set of texts, for example at a certain time? Are there important changes over time or between certain groups of text? This step is already guided by theoretical considerations that might help to structure the findings. There are different ways to perform this step including more quantitative methods, such as counting the frequency of occurrence of selected words. There is a number of specially designed software programs to do so, such as MAXQDA.

The third step draws from the findings and brings in the aspect of power. The corpus is put into context, and the findings are put on a more general level. Could history have happened otherwise? Did the discursive formation favour a certain reality, a social or political position? How did those formations come about? What made the changes or differences possible or impossible?

Written text comprises the main source of discourse analysis. However, there are theoretical approaches (e.g. Laclau and Mouffe 2001) and a growing variety of empirical studies that focus on a broader notion of text. The analysis of pictures, symbols, gestures, layout and so on are also supported by discourse analysis.

Discourse analysis is a text-based business. However, analysing the formation of text could also be made visual by graphics or the like (see e.g. Nonhoff 2019).

Individuals are, theoretically, less of a focal point in discourse analysis than they are in other approaches. Rather, individuals occupy so-called subject positions. They are part of discourse like any other element of it. However, they often serve as nodal points where several elements of discourse come together.

Due to its focus on disclosing power relations, discourse theory is often deemed a necessarily critical business. This judgement implies that transparency and a better understanding of how things work always is of a corrosive nature. Historians therefore sometimes opt to perform only the first two of the three steps outlined above and refrain from the question how discourse shaped power relations. For further reading see Angermüller et al. (2014) and Landwehr (2008).

See reviewed sample studies 14, 31, 33, 67.

Game Theory (Ulf Christian Ewert)

Game theory is about behavioural choices people make under the conditions of cooperation and conflict. In particular, this mathematical concept goes back to the research on strategic decision-making by John von Neumann, Oskar Morgenstern and John F. Nash in the 1940s. In economics, an early field of application, the asymmetric but stable division of a market by two firms (a so-called dyopol) was treated extensively with game-theoretical models. Since the 1980s at the latest, game-theoretical reasoning has become a standard methodology in the analysis of many theoretical problems in economics. Yet, in premodern economic and social history, we find only a small number of applications (e.g. Greif 1993, 2000, 2002; Greif et al. 1994; Volckart 2004; Lehmann 2004; Ewert 2007, 2008, 2009; Hirschbiegel and Ewert 2013; Ewert and Selzer 2016).

Game theory—like other economic-theoretical approaches—rests on the assumption that rational agents seek to maximise their own utility. However, rationality can be bounded to some extent, since agents may have only limited information at their disposal. And in contrast to economic models of pure utility maximisation, agents in game-theoretical models behave strategically. They take into account that actions they expect of other agents might have an impact on their own decision-making. Thus, in game theory, the classic *homo economicus* is also a *homo sociologicus*, at least in some respect.

The objective of game-theoretical modelling is first to detect and then to analyse equilibria of action. These insights are used to explain dilemmata of action that may arise. In the process, a real-world (historical) problem is transformed into a suitable game, and subsequently the mechanism of this game is carefully examined. Examination includes a derivation of the 'optimal' choices for each agent involved in the game. Such prediction serves as a measure for the evaluation of the (historically) observed choices and actions of agents. Within game theory, different approaches and types of games are distinguished: descriptive vs. predictive approaches; cooperative vs. non-cooperative games; static vs. dynamic games; one-period games vs. repeated games; simultaneous games vs. sequential games.

Matrix games are game-theoretical models in which possible strategy combinations of all players and utility levels associated to them are displayed in matrix form. This matrix is called pay-off matrix. Games depicted in this way are so-called one-shot games—in other words, such games are basically played for one round only. It is assumed that all players make their strategy choices simultaneously. Although not strictly necessary, the number of players and number of strategy choices is very often limited to two. This is primarily because fundamental problems of cooperation are to be made clear, and a reduced model seems to be able to perform better than a complex one. Basically, such two-player games can always be generalised to *n* players and to a larger choice of strategies.

Presumably the most popular and best-known matrix game is the so-called prisoners dilemma' game (Kreps 1990). In using its n-player variant, it can be proved that economic cartels are notoriously instable and constantly prone to disband. All players have to choose simultaneously whether they would like to cooperate or whether they want to defect. In a one-shot game and under common behavioural assumptions—that is, utility maximisation and risk avoidance of players—and without any third-party enforcement, rational players will always choose 'defection', despite the fact that for each of them the individual net-benefit of cooperation is greater than zero and also the aggregate return of all players would be greater if all of them cooperated. To defect is nonetheless rational, because players are eager to avoid the risk of bearing the costs of cooperation alone, whereas all others could free-ride on this particular investment in cooperation and would thus gain the full possible return without bearing any share of cooperation costs. As a result, the likelihood of a cartel being formed is zero.

However, a more realistic approach to model cooperation is to use a repeated-game approach. In an infinite 'prisoners' dilemma' game, players would have the opportunity to acquire a reputation and to build up mutual trust over time. Reputation and trust both are instrumental to the stability of cooperation, inasmuch as in the long run, the cooperation strategy can be successful, even if it might cause short-term loss of utility (Axelrod 1984). A decisive factor here is the number of players. In a game with numerous players, it is not only harder to build up mutual trust, but each player might also think that his personal contribution to the cartel is more or less dispensable—the cartel will work effectively even without his participation—and might decide to defect.

Historical research often deals with specific actions of historical individuals or organisations. And it is often about deciding whether an action was appropriate or inappropriate, reasonable or less useful. Game theory can be quite helpful in the evaluation of the behaviour of individuals in the past, because it is able to explain why rational agents, under certain circumstances, are not willing to commit themselves to cooperation and are opting for conflict instead. Game-theoretical analysis is also able to identify those institutions which would be necessary to guarantee fruitful cooperation of rational agents. In this respect, it contributes a lot to the understanding of the manifold problems related to collective goods. This is particularly useful for the analysis of medieval long-distance trade or the provision, maintenance and management of public goods and common-pool resources in medieval agriculture as well as in the medieval town. For further reading see Axelrod (1984), Kreps (1990) and Bates et al. (1998).

See reviewed sample studies 4, 19.

Hypothesis Testing (Ulf Christian Ewert)

A hypothesis can stand at the beginning or at the end of a historical study. Historians either analyse their data (the sources) and then build a hypothesis (inductive reasoning), or they propose a hypothesis, based on theory or coming from the literature, and then go on to check if the empirical data confirms or rejects the hypothesis (deductive reasoning). The latter case can be called hypothesis testing in a very broad sense. Such an approach first states the hypothesis (or a number of hypotheses) and then outlines why this hypothesis seems plausible, either from a theoretical perspective or because recent research suggests as much. Secondly, criteria for rejection of the hypothesis are determined. Thirdly, the empirical data (the sources) is checked: Does the hypothesis fail in the light of the available data? If yes, it has to be rejected. If not, the hypothesis can momentarily be accepted, but would have to be refined in order to be tested once again. Thus, a 'new' hypothesis can be proposed which can be checked by analysing more or different data.

The term 'hypothesis testing', however, often has a narrower meaning and refers to a very standardised procedure: Statistical hypothesis testing. A wide range of the statistical properties of empirical data is expressed in various descriptive statistics like sample mean, variance, coefficient of variation (ratio of standard deviation to mean) or range (difference between maximum and minimum). To check the precision and reliability of such measures, statistical hypothesis testing is necessary. Under the assumption that the values observed are realisations of identically and independently distributed random variables, statistical tests can reveal—with a certain probability of error—whether the obtained estimates of descriptive statistics are random or not.

A typical strategy is to test an alternative hypothesis (H1) against the so-called null hypothesis (H0). Commonly, it is tested (a) if a sample mean differs from zero, (b) if sample means of several subsamples deviate from each other, (c) if estimated regression coefficients differ from zero or (d) if they are greater or smaller than a given value derived from theory. Relevant information for the decision to either reject or to accept the null hypothesis is given by the test statistic—this is the estimate itself, but normalised by its variance—and by the probability of error α. The probability of error indicates how likely it is to reject the null hypothesis as false, even though it is true (type I error). The null hypothesis should be rejected whenever α is small. By convention, this is the case for $\alpha < 0.1$, $\alpha < 0.05$ or $\alpha < 0.01$. Critical values of the test statistic can be obtained from statistical tables. However, this sort of conventional approach which uses printed tables is no longer necessary nowadays, because various test procedures are implemented in the available statistics and econometrics software, and the respective computer program automatically calculates the critical probability of error for which the null hypothesis would have to be rejected with the given empirical data.

A serious problem that may arise within the testing procedure is the fact that most statistical tests are constructed in such a way that the type I error will be at a minimum. However, it can be shown that minimisation of the type I error often also implies an increase in the concomitant type II error. A type II error occurs when the null hypothesis H0 is false but cannot be rejected as such. As a consequence, the true alternative hypothesis H1 will not be accepted. One also has to keep in mind that reliable information from statistical tests can only be obtained if the empirical data are a result of sampling. Therefore, assuming that observed values are realisations of identically and independently distributed random variables may cause a methodological problem when applied to historical data, because for most historiographical applications where statistical methods are used, the random character of observations can be doubted. For further reading see Johnston ([3]1984) and Feinstein and Thomas (2002).

See reviewed sample studies 24, 30, 35, 36, 43.

Institutional Analysis (Ulf Christian Ewert)

A lot of different notions and definitions of the word 'institution' exist, and as a consequence, in different approaches to institutional analysis the focus is set differently. What is common to all definitions of institutions is the element of structure or mechanism within a society which creates social order and governs interactions. The widest and most flexible, and probably nowadays most influential, definition evolved from the analysis of Europe's premodern economic development and growth. According to Douglass C. North (1920–2015), who was an American economist and Nobel Laureate (in economics) of 1993, "Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction" (North 1990, 3). With regard to their contribution to society, he continues: "In consequence they structure incentives in human exchange, whether political, social, or economic." Such a definition allows for including formal rules such as constitutions, laws and property rights as well as informal rules such as sanctions, customs, traditions or taboos.

Institutional analysis then tries to reveal in a systematic manner the behavioural incentives created by a single rule or a set of rules, a so-called institutional arrangement. Furthermore, institutional analysis aims at understanding whether a given rule or an institutional arrangement is able to either enhance or inhibit a certain behaviour of individuals, for example to engage in exchange or to cooperate with each other. This methodological concept is extremely important for historical research because (in the words of North) "Institutional change shapes the way societies evolve through time and hence is the key to understanding historical change" (North 1990, 3).

In this sense, institutional analysis is closely related to *New Institutional Economics* (NIE), a now widespread approach in economics which became popular in the 1970s. In particular, NIE questions a number of assumptions traditionally made in neoclassical economic theory about individual behaviour and economic exchange, for example that market entry is priceless for users, that market participants are fully informed about market developments and intentions of potential trade partners, and that property rights are well defined. Under these neoclassical assumptions, exchange can be handled without costs.

However, in the light of empirical research, the neoclassical model of economic exchange turned out to be unrealistic and even misleading for understanding economic transactions. Markets are usually imperfect; property rights are often only incompletely specified, and individuals only possess limited information on what is going on at the market.

Therefore, NIE sees the market itself as an institution, which can be designed in different ways, and points to the fact that property rights may have an impact on both decision-making and economic action of individuals. Moreover, transaction costs—these are all costs necessary for operating economic exchange including costs of information, transportation and contracting—are extremely important. If transaction costs are (too) high, it is fully rational for individuals to refrain from using the markets. Finally, the incomplete information of market participants and the information asymmetry between them both cause bounded rationality, which means that in principle individuals take rational decisions, but only within the boundaries of their actual and usually incomplete knowledge. Thus, a standard scheme in institutional analysis is to identify property rights and boundaries of information, and to assess whether under these conditions a given rule (or a set of rules) is able to lower transaction costs significantly.

North's seminal argument regarding the determination of Europe's unprecedented economic take-off since the Middle Ages points precisely to these steps in institutional analysis. For North this tremendous take-off was mainly due to the development of efficient institutions, at least in the long run. He states that Europeans were successful especially because they created or adopted institutions with well-defined and often exclusive property rights. Thus, information asymmetries and transaction costs were reduced, which enhanced entrepreneurial aspirations and facilitated market exchange.

However, assessing the capacity of institutions to reduce transaction costs is only one aspect of institutional analysis. One can also investigate the reasons why institutions often keep being used although they have become inefficient and obsolete. This phenomenon is called lock-in. It shows a path dependence of institutional development and underlines that institutional development is always bound to specific historical contingencies, which often cannot be made inoperative by the decision-making of later generations (Arthur 1989; David 1994). A third aspect of interest lies in the enforcement of institutions: In general, third-party enforcement and self-enforcing institutions are distinguished. A 'third party' (e.g. a court) can guarantee that a given rule will be observed, but institutions can also be designed so that a third-party enforcement is not necessary. Self-enforcing institutions usually create strong incentives for individuals to deliberately negotiate a fair solution. So even in a kind of social worst-case scenario with purely selfish people, cooperation would nonetheless be in the best interest of all the parties involved.

Since studies that assess self-enforcing institutions mainly focus on the specific conditions that bring supposedly conflicting strategies of individuals into coordination, we often find game-theoretical approaches in this strand of institutional analysis (Greif 2000) (see section on game theory). Interestingly, the huge impact that different enforcement schemes may have on exchange, development and growth has been demonstrated in economics since the early 1990s by using a medieval case, the so-called Commercial Revolution of the Middle Ages, when long-distance trade in Europe was re-established (Greif 1992). North's argument regarding the significant reduction in transaction costs through a clever institutional design as being the main driving force of Europe's economic take-off was modified to say that especially self-enforcing institutions contributed to the enormous economic growth of premodern Europe: Contracting was facilitated by doing it without the costly means of public third-party enforcement but relying instead on the cheaper private means of reputation, credibility and trust (Greif 2006). However, this statement has recently been challenged by pointing to the fact that medieval trade—and impersonal exchange by that time in general—grew immensely as a result of the wide development of law-based (i.e. third-party) institutions, as can be seen for example in the common law protection of medieval fairs (Munro 2001; Edwards and Ogilvie 2011, 2012). For further reading see David (1994), Edwards and Ogilvie (2012) and North (1991).

See reviewed sample studies 4, 9, 11, 19, 23, 24, 27, 30, 34, 35, 49.

Metal Analysis (Sebastian Steinbach)

The physical and chemical analysis of coins can be used to specify the precious metal content of one object as well as the alloy (mixture of metals) or even the deposit of the ore by analysing the trace elements. This analysis is useful to get information about where the metal used for minting came from. Common methods can be divided in destructive and non-destructive groups: Destructive ones are, for example, the touchstone (assaying tool) or wet chemical methods (melt down). Non-destructive methods are, for example, the determination of the specific weight or the X-ray fluorescence analysis (XRF).

Using metal analysis, differences between the real metal content of one coin and the fine weight specified in mint master contracts or minting ordinances can be detected to get information about the possible discrepancy between 'virtual coins' as described in the written sources and 'real coins' in circulation. To get a more reliable database, a larger amount of coins of one type has to be analysed with (in the best case) different methods and compared to each other. The more elaborate the method, the more detailed are the results: A touchstone can only give an approximation of the precious metal content while the X-ray fluorescence analysis provides detailed quantities of all metals contained within one alloy. For further reading see Metcalf and Oddy (1980–1988) and Metcalf and Hall (1972).

See reviewed sample study 54.

Micro-exemplary Method (Ulla Kypta)

The micro-exemplary method is a two-step procedure: First, you thoroughly study a comprehensive data set of a small community. Second, you check the reliability and the representativeness of the findings by comparing your own results with the results of studies that have analysed a similar phenomenon at a different time or place. The micro-exemplary method thus combines a qualitative study as the first step with a quantitative check as the second step. It rests on the assumption that past societies can only be understood in full if one uses quantitative as well as qualitative approaches: Only the first one can help us to comprehend the processes and interactions in a community, and only the second one can enable us to see whether these processes and interactions were part of larger processes that cannot only be found in this smaller community. The two steps together thus pave the way for broader issues such as the origin of certain processes or their long-term consequences.

The first step is a historical analysis (see section on source interpret ation/hermeneutics). Reading as many sources as possible, the historian paints a picture of a certain aspect of a small community. The more sources she reads, the better she understands what was happening in this society. To describe these processes, the historian does not use abstract concepts from today's scientific language, but constructs categories that are as close to the sources as possible. In this way ideally, a complete, hermeneutic, qualitative picture of the society in question emerges. In the second step, the historian tests this picture against quantitative data derived from other, similar studies. The quantitative check tests the representativeness and robustness of the findings. It can but does not necessarily have to be done by using descriptive statistics or regression analysis (see entries on descriptive statistics and regression analysis). In contrast to purely quantitative approaches, the micro-exemplary method does not regard the quantitative results as superseding the qualitative result. If both do not fit together, both have to be checked. This two-step procedure aims at creating a system of empirically sound concepts, a proto-theory. It is, however, an open-ended process that does normally not come to one final conclusion.

To employ the micro-exemplary method, you first need a comprehensive data set from a smaller community, which should encompass not more than roughly 5,000 members, since it is difficult to employ a thorough analysis of the connections between more than 5,000 members. For the second step, you need robust and reliable results of other studies to compare her own findings with. The results are normally presented as a narration, but connections between members of a community can also be expressed as a graph. For further reading see Carus and Ogilvie (2009).

See reviewed sample studies 9, 10, 31, 38, 48, 60, 61.

Microhistory (Tanja Skambraks)

Microhistory denotes not a complex methodology, but rather an approach which historians choose when they want to study a certain, well-defined entity, namely one individual case, for instance, a certain place, a certain community or person, or a specific time slot. Opting for this approach can result from two motivations: It can be the result of a pragmatic decision: Due to the limited availability of source material and/or time, one compiles a locally, temporary and thematically limited case study. This case study has to be representative, at least to a certain degree, regarding a total phenomenon (see section on source interpretation/hermeneutics).

One advantage of this approach is the simplification of the research process by reducing the often vast amount of source material—by picking out single cases. Many historical studies are micro-studies without explicitly saying so. The problem remains the possibility of generalising the results. Again, comparison with other findings and studies is necessary.

The second motivation to do microhistory is that some historians—namely from the French Annales and their followers—deliberately used and developed this approach (micro histoire) to create a specific new way of historical research which follows a different strand of narration interested in the everyday life of the lower classes, the individual, village culture and most important: mentalities. Thereby new themes have evolved and entered the sphere of social and cultural history. These approaches might also contribute widely to a new perspective on economic history. For further reading see Walter (2008), Le Roy Ladurie (1991) and Ginzburg (1980).

See reviewed sample studies 1, 5, 6, 13, 25, 29, 32, 37, 43, 50, 56, 58, 63, 65, 68.

Modelling (Ulla Kypta)

In a scientific context, a model shows one small aspect of reality. By concentrating on this particular aspect, we are able to come to terms with. As Morgan puts it, "each [model] depicts, renders, denotes, or in some way provides, some kind of representation of ideas about some aspects of the economy" (Morgan 2012, 13). If we work with a model, we better understand the aspect of the world represented in the model, and this enables us to better understand the world of which this aspect is a part.

The basic assumption at the heart of modelling, hence, is that you can get a better grasp of a phenomenon by taking it out of its context and putting it into an abstract model. Without abstraction, Hatcher and Bailey claim, you are sure to get lost in the ocean of facts: "The sheer size and complexity of the major processes of economic and social change mean that historians cannot hope to describe, analyse, and explain them by the gathering and narrating of factual information alone" (Hatcher and Bailey 2001, 4). Historians thus need to systematise the empirical data they are dealing with, be it price lists or narrative accounts of famines. They need to search for patterns, for common themes, for repeated events. If they describe such a pattern, common theme or repeated event on an abstract level, they are building a model.

Modelling can be seen as a two-stage process: First, you build a model, and second, you work with it or test it. The first step consists of choosing the one aspect you want to study in detail, and then phrase it in abstract terms. This can be done using mathematical language, but this is not necessary. Morgan lists four ways of how economists build a model. All four ways also work in economic history (Morgan 2012, 21–23):

1. Recipe-making—You put together ingredients such as "different ideas, intuitions and bits of knowledge of how the economy works", and hope that something new will come out of it, for example, a better understanding of how all the parts work together.
2. Visualising—You find a powerful image to describe how some aspects of the economy work.
3. Idealising—You pick out the relation that interests you, isolate it from the disturbances of the real world and study it in an ideal form (see section on classification/types).
4. Choosing analogies—You recognise similarities in the "form, structure, content or properties between two fields and investigate these similarities in a systematic way".

Once the model is built, there follows the second step of modelling: working with the model, that is, seeing how the ingredients of the model work together, how different inputs produce different outputs, determining how relevant the different factors are for producing a certain outcome and so on. By working with the model, you thus explore, test and refine your ideas about the workings of the economy. You can, of course, also work with or test a model that you have not built yourself. The most prominent examples in economic history are the model of population and resources by Thomas Malthus and David Ricardo, the model of class power and property relations by Karl Marx, and the model of commercialisation and markets by Adam Smith (Hatcher and Bailey 2001).

To construct some abstract ideas about the workings of the economy, you need to have enough examples so that you can find patterns and similarities. It is difficult to judge whether a similar pattern occurs in different cases if your research is based on only two test cases (see section on classification). Nevertheless, regardless of how many cases you investigate, a model never gives you an accurate picture of the world. The whole point of a model is to abstract from real-life disturbances and focus on one or few aspects. Thus, the main problem of modelling is to gauge whether what the model tells you about the aspect you are investigating does tell you anything about the real world, too. Models can be put into mathematical equations, graphical expressions, or simply be described in words. For further reading see Morgan (2012).

See reviewed sample studies 15, 24, 43, 45, 51.

Network Analysis: Social Network Analysis (SNA) and its Derivative, Historical Network Research (HNR) (Benjamin Hitz)

Since the 1990s and under the impression of Milgram's 'small world' experiment in the 1960s, the world has seen a boom of the term *network*. This leads Straus to see it as a possible paradigm of the twenty-first century (Straus 2010, 11). The first historian to refer to methods of social network analysis was Wolfgang Reinhard, who proposed the concept of entanglement (*Verflechtung*) as a translation of the term *network* (Reinhard 1979). This first introduction had little immediate effect, but network analysis has become popular in the last two decades (Lemercier 2012; Düring and Stark 2011; Düring et al. 2016).

SNA has its origins in quantitative methods and in graph theory (for an introduction to SNA Borgatti et al. 2013; Prell 2012; Jansen 2012).

Graphs are (mostly visual) representations of complex structures. In SNA, graphs are formed with actors (generally people, but not necessarily) as *nodes* and their relationships as *edges*. On the basis of such coding, SNA quantitatively analyses the totality of social relationships of a group of people delimited by some criteria. To constitute a sample of network data for analysis, one has to establish a dataset of sufficient density and completeness. In principle, SNA can be applied to all kinds of sources that meet these conditions. Typical sources are correspondence, court records (see section on court records), urban annuities (see section on annuities in Chap. 10) or prosopographic data (see section on prosopographic analysis). The material is then encoded and subsequently analysed using specific SNA software.

Despite the difficulties due to incomplete source material, SNA has been used in medieval history (see, e.g. Jullien 2013; Burkhardt 2009; van Doosselaere 2009; Selzer and Ewert 2010; as well as Chilosi et al. 2016). As distance encourages writing, some of the examples focus on geographically widespread commercial networks and public debts.

Depending on the research approach, SNA can examine various aspects: It can focus on the position of individuals in the network structure and thus try to find central, that is, important people. Or it can try to understand the underlying structure of the network by finding clusters and patterns or by identifying people in similar structural positions. SNA either examines entire networks, trying to analyse flow of information, network constellations or positions of people, or so-called ego networks (based on the relations of one person called ego), looking for explanations for certain behaviours or attitudes (Hennig and Stegbauer 2012, 8).

The kind of resource circulating within a network (e.g. money, information, 'friendship') determines the interpretation of individual network positions. In network theory, a difference is made between positively and negatively joined networks (Jansen 2012, 178). With regard to credit, for example, a network can be a resource (thus positively joined) when trying to find credit. But as credit relations can create dependency, it can also be useful to consider such a network as negatively joined: Having powerful partners in the network would then be seen as a disadvantage. On the other hand, Granovetter has shown that so-called weak ties (i.e. single ties to people outside one's usual social environment) can prove very important in certain situations (Granovetter 1973). Networks are not only interesting with regard to the flow of resources: Hennig and Kohl (2012), for example, established a connection between network theory and the concepts of habitus and capital by Bourdieu, showing how the network position can be used to analyse an actor's habits and opinions.

Network data can, but need not, be represented as a network chart, that is, a graphical representation of the network structures. Such representations can be very telling, but in case of large networks they cause confusion. Since formal network analysis is based on statistical methods of hypothesis testing (see section on hypothesis testing), network charts are not the only possible output: Tabular data or plain text is also within the range of possibilities.

While a growing number of historical studies are referring to SNA as a method, by far not all of them contain formal (i.e. quantitative) network analysis. But such metaphoric usage of network terminology can be fruitful too (see Bixler 2015, 54). Although SNA has certainly proved productive for understanding the social dimension in various contexts, some authors are critical of its applicability and usefulness for historical research (Burkhardt 2014 as well as Hitzbleck and Hübner 2014). Jahnke (2010, 189) laments the 'inflationary use' of network terminology, claiming that not all 'simple connections' between people can be called a network. For further reading see Borgatti et al. (2013), Burkhardt (2014) and van Doosselaere (2009).

See reviewed sample studies 16, 25, 31, 46, 55, 63.

New Economic History (Ulf Christian Ewert)

New Economic History (NEH) is the name of a specific approach to economic history that is, broadly speaking, characterised by its explicit use of economic theory and quantitative methods. Because of the latter, it is often also referred to as cliometrics. This approach was in fact 'new' around 1960 when the first seminal study in this methodological direction, the article of Conrad and Meyer (1958) on slavery in the antebellum South (of the United States), had just been published. With their analysis of the economic performance of the system of slavery in the

Southern states of the United States in the first half of the nineteenth century, Conrad and Meyer challenged an older view in American historiography on the Civil War (1861–1865). The older view was that this painful and bloody war would not have been necessary at all in order to at last abandon slavery, simply because slavery had, in economic terms, already become extremely inefficient on the eve of the war. Collecting data on cotton production and slave raising and testing the efficiency of the system of slavery in the context of an economic model, Conrad and Meyer came up with a different conclusion. They demonstrated that the antebellum South had developed into a geographically highly specialised system of production, in which the slaves were raised in the older and in agricultural terms less productive Southeastern states and cotton was grown in the newer Southwestern states, where the more productive soils were. Their analysis must not be understood as a justification of either the morally doubtful slave-holding society of the South or of the beginning of the war by the North, but Conrad and Meyer were able to show that, from an economic perspective, slavery was still a viable institution around 1860, showing no sign of dissolution whatsoever. Since then, the concept of NEH has been extremely influential in economic history, mainly in the English-speaking world. One of the main figures of NEH, Robert W. Fogel, who published a lot on the contribution of railways to nineteenth-century American economic growth and who initiated the anthropometric approach to the measurement of historical living standards, was elected as one of the Nobel laureates (in economics) of 1993. With the construction of so-called counterfactuals, Fogel also added a further component to the methodological tool box of NEH. For the quantitative assessment of the contribution of railways to economic growth in the United States during the nineteenth century, he compared the observed economic growth until the 1890s with aggregated growth rates he had obtained from a model assuming that overland transportation was operated not by railways, but with an alternative traffic infrastructure, namely with a system of canals. His results—railways were not the leading sector of American industrialisation and overall growth of the US economy turned out to be only a little higher than it had been without railways—challenged the American myth of the indispensability of the railway for the United States' becoming the largest and most dynamic economy of the world at the turn of the twentieth century. Fogel thus constructed an alternative (and in a way fictional) historical development of the US economy (a counterfactual), which he needed as a point of reference for the assessment of the historically observable economic growth (Fogel 1964). His approach of explicitly constructing counterfactuals can be fruitfully applied to every kind of economic history problem, since historians are always using counterfactuals for interpretation, even though usually they are not making their assumptions explicit. For further reading see Conrad and Meyer (1958), and Fogel (1964).

See entries on descriptive statistics, game theory, hypothesis testing, regression analysis, time series analysis and the reviewed sample studies listed there.

Prosopographic Analysis (Julia Bruch)

A prosopographic analysis focuses on a specific group of people. In a first step, all the information on the individual people in this group is gathered: One collects person-relevant data on the genealogy and biography of the individuals and classifies the data in terms of constitutional history and social history. Prosopography is thus closely related to genealogy and biographical analyses. The second step is to generate findings about general structures from the large amount of information. For example, von Heusinger 2009 prosopographically records the guild members in the city of Strasbourg in the thirteenth and fourteenth centuries as a group of persons. This leads her to make general statements about the functioning of premodern guilds and their activities in the cities. Both steps can be assisted by computer-based programs and databases.

In some cases, a researcher is not interested in the history of individuals, or it is not possible to find out detailed information on individual persons. The researcher can then employ a prosopographic analysis not of individuals, but of groups of people, and then analyse them in terms of kinship, neighbourhood, class, status or social rank. It is thus possible to analyse the environment, the social context and the significance of the group of people within society. Furthermore, prosopographic research analyses the development of a cohort in terms of time and place in the sense of analytical social history: Historians working prosopographically often research specific strata, classes, social ranks, groups of entrepreneurs or types of merchants. The question of whether a certain person (e.g. Jakob Fugger) was typical of his time is also often asked. In order to answer this question, the group of people to which the person belongs (e.g. merchants) must be examined.

A prosopographic analysis is often combined with a network analysis (see section on network analysis) to study the interconnections between the persons (Goetz 2014, 284f.; 355; Walter 2008, 43f.). This adds the connections between persons or groups as a further layer of analysis. For further reading see Bulst and Genêt (1986) and Eck (1993).

See reviewed sample studies 2, 7, 16, 25, 62.

Regression Analysis (Ulf Christian Ewert)

Regression analysis is the most important statistical technique used by empirical economists and more broadly by social scientists who are working with statistical methods. The use of regression analysis greatly increased amongst economic historians after the 1970s, in the wake of the 'cliometric revolution'. Arguably it has by now become part of the essential toolkit of the economic historian. It is rather demanding in terms of sample size: many observations are needed for its meaningful application. Unavoidably, this means that in medieval economic history the scope for its application is smaller than in modern economic history. Yet there have been several applications also in medieval economic history, for studying issues like market integration, standards of living, inequality, agricultural production, population growth, monetary policy and the cost of public borrowing, or courtly gift-giving.

Technically speaking, regression analysis is the appropriate method with which to model the (assumed) causal relationship between a dependent variable y and one or more independent (explanatory) variables x_i. The variable whose variation is focused on in the analysis is called the dependent variable. Regression analysis estimates how the dependent variable responds to changes in the value of each of the explanatory variables, keeping the values of the other explanatory variables included in the analysis constant. A regression analysis thus gives marginal effects of the explanatory variables. Focusing on just two variables at a time and neglecting the impact of other important variables may lead to incorrect inference. For example, the demand for grain in a late medieval town was of course determined by the grain price. Additional variables like prices of other foodstuffs and of manufactured goods, disposal of income, or the intensity of market regulation presumably affected the demand for grain as well. However, the marginal effect of a change in grain price on the quantity of demanded grain can only be estimated, if all other potential determinants of the demand variable are held constant (*ceteris paribus*).

The easiest and most common way of performing a regression analysis is to assume a linear model $y = \alpha + \beta_1 x_1 + \ldots + \beta_k x_k + \varepsilon$, where α is a constant, the β-coefficients represent the marginal effects of $i = 1, \ldots, k$ explanatory variables x_i on y, respectively, and ε is a random error term with zero mean and a constant variance σ^2. Data can either be cross-sectional data or be time series data (see section on time series analysis). By assumption, in such a linear multiple regression model, the variation of the dependent variable y is explained by the variation of the explanatory variables x_i. A model with only one explanatory variable is called single regression. If more than one regression equation is estimated, that is, two or more independent variables exist, one speaks of a multivariate regression or a linear regression system. For example, the grain price was affected by grain supplies to the market (the amount of grain available), and the harvest itself depended on the quality of soil (in the long run) and on seasonal weather conditions (in the short term). So one might also think about formulating a second regression model for grain supplies and a third regression model for quantities of harvested grain, both of which, together with the first one for demand of grain, would create a three-equation linear regression system.

To obtain estimates of the parameters α, β_1, …, β_k and σ^2 from the empirical data at hand, application of the *Ordinary Least Squares* (OLS) approach is the most popular. In this procedure, parameter estimates are chosen so that the sum of squared differences between the observed values of y and the estimated values of y will be minimised. According to statistical theory, this yields the best linear and unbiased parameter estimates. The coefficient of determination R^2 measures the share of variance explained by the independent variables x_i and allows for the evaluation of the relative fit of different specifications of the regression model. Whether a single explanatory variable x_i, or all of them together, have an impact on the dependent variable y can be tested using the standard procedures of statistical hypothesis testing. Usually, one would test whether a certain estimate of β_i is zero (H0) or deviates systematically from zero (H1). For the example of demand for grain in late medieval towns, regression analysis allows the testing of several hypotheses concerning the economic characteristics of grain. According to microeconomic theory, grain usually is a normal good. One would expect the demand for grain to be reduced if the price of grain rises and vice versa, to be increased with the falling price. However, under certain circumstances (e.g. in times of scarcity and dearth) grain becomes a so-called Giffen good, and as a consequence, people will increase their demand for grain, even though the price is rising.

Statistical problems that may arise in regression analysis can be multicollinearity (bivariate correlations between independent variables x_i are too big), heteroskedasticity (the variance σ^2 is not constant for all i and varies systematically instead) and autocorrelation (in a time series, the error term ε systematically depends on the error term in preceding periods). If not taken into account, such problems cause biased and unreliable parameter estimates, but there exist a wide range of statistical tests to check the appropriateness of the data, and usually such statistical problems can be solved by mathematical transformations of inappropriate data. However, as economic historians are increasingly emphasising, regression analysis only permits robust causal claims under a set of rather restrictive conditions. Two conditions that are particularly hard to meet are the exclusion restriction (there is no omitted variable that is associated with one or more of the explanatory variables that influence the dependent variable) and the absence of reverse causality (changes in the dependent variable must have no effect on any of the explanatory variables). Another serious problem in the latter respect is the underlying assumption of causality between variables y and x_i. This assumption cannot be proven with the regression procedure. Parameter estimates and statistical tests for the regression coefficients β_i can only reveal whether some causal effect of x_i on y could exist or not. To make causal relationships plausible, theoretical reasoning is needed. In consequence, in recent years much effort has been dedicated to developing ingenious research designs that explicitly take these limitations into account, using approaches like instrumental variables, difference-in-differences and regression discontinuity analysis. For further reading see Johnston ([3]1984) and Feinstein and Thomas (2002).

See reviewed sample studies 24, 30, 38, 45, 46, 51.

Source Interpretation/Hermeneutics (Tanja Skambraks)

> Erst durch intensive Quellenlektüre wird der Forscher mit den zu untersuchenden Verhältnissen näher vertraut, entwickelt dabei ein besseres Gespür für die Klassifikation von überlieferten Daten und Informationen, vertieft sein Vorverständnis für das historische Geschehen und erleichtert sich die Konzeptualisierung von Problemen. (Boelcke 1987, 93)

> It is only through intensive reading of the sources that the researcher becomes more familiar with the circumstances to be investigated, develops a better sense for the classification of traditional data and information, deepens his prior understanding of historical events and facilitates the conceptualisation of problems. (own translation)

The basis of all source interpretation especially relevant for historians is hermeneutics. For this reason, this article will first explain the concept of hermeneutics and then describe the steps of source interpretation as a method of historical research on texts.

Hermeneutics (from the Greek word *hermeneus,* meaning 'translator') is both an epistemology and a method, and a closely connected source interpretation. Its aim is to understand the deeper, hidden meaning of a text, a work of art or literature, resting on the assumption that a finding resulting from the analysis of a single source or a single case can be generalised to a certain extent. Many historical studies on individual findings or a single source generalise in such a way, often without the authors explicitly reflecting their method, which often leads to critique from 'exact' scientists. Hermeneutics consider history as the totality of human actions in the past, that does not possess—similar to a literary text—*one* clear meaning and thus has to be translated and interpreted. Hence, the methods of historians (aiming at understanding the meaning of something) must differ from the methods of the positivist or exact sciences (aiming to explain a certain regularity of something) (Lorenz 1997, 91). Therefore, historians become translators of the remains of past cultures, given that they can bridge the gap between the past and the present by deciphering these leftovers. Dealing with these basic assumptions in connection with the rise of the natural sciences since the nineteenth century has led to a long tradition of self-reflection among historians trying to offer a concrete methodology based on hermeneutics. Here only three important examples of this development will be presented, simultaneously sketching phases in the dynamic discourse on hermeneutics from the nineteenth century until the 1970s. The German historian J.G. Droysen in his *Grundriss der Historik* (1868) first presented four methodological steps still very influential in German historiography: The first is called pragmatic interpretation, meaning the collection and external critique of the sources. The second (interpretation of conditions) seeks to recognise geographical, technical, material and mental features of a time influential on human activity. This is followed by the third step of psychological interpretation looking for peoples' motives and ideas. In the last step, called interpretation of ideas, historians analyse the Zeitgeist and its relation to humans. In contrast to the determinism of exact sciences (an event consecutively results from certain rule), human activities are *not* determined and are often influenced by contingency and individuality. Of course, that doesn't mean that history is all arbitrary, but it means that historians must strive for plausibility, not for truth. Furthermore, two models of explaining history emerge in hermeneutics: the intentional model explains human activity by looking at the intentions of the actors, and the second model—the narration—is in itself a way to make the meaning explicit. (The latter approach is a frequent feature of the reviewed sample studies presented in this book.) According to R. Collingwood (cit. Lorenz 1997, 97–99), the prerequisite for this level of understanding lies in the closeness or similarity between the objects studied (human beings) and the subjects studying (human beings), enabling the latter to comprehend and put themselves in the other persons' place. Of course, intersubjectivity cannot be achieved in this approach. The knowledge of an intention in the past can never be complete, neither can it be proven. There can be unintended side-effects of an action. Structuralists of the 1960s and 1970s, like Fernand Braudel, criticised the assumption of the role of the subject and its intentions in history. Instead, they view a network of people connected to each other in symbolic and social relations, in which people carry meaning determined by social structures and mentalities. This approach is still very influential in social and economic history.

In a further approach on hermeneutics, the philosopher Gadamer (1960) denied the possibility of understanding the original meaning of a text/the past at all. (Lorenz 1997, 147–150) Due to the insurmountable time lag, the original text (reality) is lost, and every interpretation is just a result of a heap of former interpretations. Gadamer calls this *Wirkungsgeschichte* ('history of reception'). Interpretation is in this view no epistemological category, but rather an ontological one—a form of being, which is always present. Consequently, any interpretation is based on an anticipation of meaning (Gadamer calls this prejudice, horizon stemming from tradition), leading to a synthesis of the horizon of the text and the interpreters' horizons. The projection of meaning onto an object by the interpreters also traps them in the hermeneutic circle or spiral. This means that seeking to achieve a better understanding of a text or object leading to the development of a new question, which then again needs to be solved by digging deeper, bringing about new questions and so it is in principle an endless process. At the end of this view lies the hypothesis that there is no progress brought by an interpretation. All interpretations are just different views connected to their own time.

The element of objectivity—in comparison to natural science—is of course hard to define in this context, since we cannot prove whether our interpretation is right or not. But it is important to keep in mind that all historical interpretation is a preliminary and variant reading. Nevertheless, to what extent an interpretation is solid or convincing also relies on the density and quality of the data historians have collected to achieve their results. Working with parallel source material and making comparisons are valuable ways of enhancement. For further reading see Lorenz (1997) and Walter (2008).

Based on hermeneutics as a theoretical frame is the interpretation of a source aiming at the understanding of a certain historical phenomenon. To do this, there are two main steps: The first is called the critique of the sources, divided into outer and inner critique. These two first preliminary steps are followed by the actual interpretation. The formal or outer exploration of a source means identifying the type of source (e.g. charter, chronicle and account book) and its features. For analysing these outer features or materiality of the source, historians need to apply elementary or auxiliary disciplines like palaeography, diplomatics and heraldics. The important question is of course whether the source itself is authentic, allowing for further judgment on its credibility or trustworthiness.

The second step is the inner critique dealing with the informative value of the text. Historians have to apply the following questions: *when* and *where* the source was produced, *who* might be identified as the author/maker, the *main topic* of the source and the *reason* and *techniques* and *style* of its production. These questions aim at finding out more about the circumstances of its production, the intention of its creators/authors and their social, political and educative background. Therefore, reading a lot of secondary literature is indispensable. Inner critique of a text means to identify the keywords and main points in the text, trying to find out whether they are reliable, contradictory, wrong or incomplete. Next, one has to classify the type and style of content, that is, does the author report certain facts or events, does she utter an opinion, does she make judgements? Are there stylistic features typical of a certain genre or time, like certain topoi, tropes or rhetoric figures? Analysing these factors might help understand the values and perspectives of the author, to draw conclusions concerning his motives and intentions. By these preparatory steps, the researcher should be enabled to better interpret the text. The third step is the core of source interpretation consisting in a short summary of the content, that is, what is being told in the text. This analysis critically regards 'facts' as well as verdicts or tendencies in the authors' statements. Then follows the contextualisation, that is, whether and how a text fits in a historical context and the final conclusion regarding the research question(s). Obviously, the number of hermeneutically analysed sources is decisive for the depth of understanding of a certain historical problem or for answering a certain question. Thus, a comparison with other sources concerning the same topic might be fruitful and is recommended (see section on comparison). This leads to an overall interpretation of the source in its historical context and to a judgement concerning its usefulness to answer questions about the past. The method of source interpretation closely resembles some newer methodological approaches in studies of literature, namely close text reading or reading against the grain: All aim at unearthing the different layers of meaning of a text by closely scrutinising different aspects of the text as well as its context. For further reading see Rohr (2015), Pandel (2000) and Rössner (2017).

See reviewed sample studies 1, 2, 3, 7, 8, 10, 12, 13, 14, 15, 17, 22, 23, 26, 33, 34, 38, 40, 42, 44, 47, 49, 50, 52, 53, 58, 59, 62, 63, 65, 66, 67, 68.

Source Presentation/Edition (Julia Bruch)

A large part of a historian's work consists in unearthing sources. Editing and presenting the sources makes them accessible for other researchers and provides them with new evidence and data. In the reviewed sample studies, in many cases, there is no edition in the classical sense to be found, but the presentation of particularly relevant or difficult-to-access sources. In German historiography in the nineteenth century, Karl Lachmann developed some distinctive rules for compiling a historical–critical edition (*kritische Edition*). The aim was to identify or (re-)construct the original text from the existing manuscripts. For this type of edition, all steps the editor undertakes should be comprehensible; for example, all the manuscripts which were used to compile the edition should be cited, and the reader should be able to recognise which part of the edited version stems from which manuscript (see further Goetz 2014). Not all editors stick to these strict rules, but the so-called historical-critical presentation of sources still counts as the gold standard of editions in Germany (Sahle 2008). The most important collection of editions that set this standard is the *Monumenta Germaniae Historica* (MGH). An edition or presentation of a source usually gives some basic information about the context in which the source was written and preserved. Thus, a source presentation provides a first and basic step of understanding and interpreting a source (see further von Seggern 2016).

At the same time, some economic–historical source presentations have been created in the style of excerpts; this form of presentation, also developed in the nineteenth century and popular for a long time, is at the same time an evaluation of the sources (see, e.g. Weiß 2003, 3–6). Important information for newer questions can be missing and in a historical–critical edition texts sometimes are constructed in a way in which they did not originally exist. Researchers with economic–historical questions cannot always work with this kind of edition. When using or creating a source presentation, it must be clear that this influences the evaluation. The edition guidelines should be considered and incorporated into the questions. For further reading, see Gall and Schieffer (1999).

Digital presentations are genuinely neither better nor worse than printed editions, but they have advantages in the design of the layout as well as in the provision of the originals. The text is more fluid and thus corresponds more closely to medieval bookkeeping than, for example, a printed edition, which can only ever document a status quo. For example, the digital edition of the account books of the city of Basel makes it possible to switch between a digitalised version of the handwritten page, a transcript and a basic evaluation using descriptive statistics (see section on descriptive statistics). For further reading on digital source presentation, see Sahle (2017).

See reviewed sample studies 1, 28, 29, 44, 52, 56, 66.

Time Series Analysis (Ulf Christian Ewert)

Whenever a set of observations of a variable is naturally ordered along the time axis, one speaks of a time series or time series data. Usually, observations are recorded at successive equally spaced points in time (e.g. days, months, years, decennials, centuries) which gives a sequence of discrete-time data. Time series analysis provides us with a bundle of methods to describe the statistical properties of a given series and to forecast its future development.

Within the classic approach of time series analysis, the basic assumption is made that any given series can be decomposed into a systematic and an irregular part. The systematic part consists of a mean (the long-run level of the series), a time trend (representing the growth rate) and one or more cyclical components (representing seasonal effects). The irregular component is a stochastic term which produces erratic (non-systematic) short-term volatility of the data. Smoothing of the series is a commonly used method to identify the components of its systematic part. For example, calculating a moving average filters the short-term volatility out of the series and highlights any existing medium-term or long-term development and/or cyclical movement of the series. If a time series does not exhibit a systematic behaviour and consists only of non-systematic short-term fluctuations, the series follows a so-called random walk. Furthermore, the series must be stationary, otherwise it is not possible to identify and to extract the components of its systemic part. A time series is called stationary if both its mean and variance are constant in the long run, and long-run growth is only due to a time trend that may exist. In contrast, non-stationarity of the series would imply a constant and irreversible growth of its mean over time. Whether a time series can be classified as stationary or non-stationary is usually tested by applying unit-root-tests to the data such as the *Augmented-Dickey-Fuller-Test* (ADF-Test). If a time series turns out to be non-stationary, stationarity of the series can usually be yielded by taking its first or second differences. Forecasting is used to estimate potential future values of a time series. A common assumption within forecasting is that a model which sufficiently fits the data of the past will also produce a good forecast of the future. In this respect, however, autocorrelation of the series can be an important issue. A series is autocorrelated if later observations systematically depend on former observations. Thus, autocorrelation typically guarantees very precise forecasts. Finally, time series analysis is not restricted to the analysis of a single series. Even more sophisticated statistical methods deal with the correlation of two or more time series or with the estimation of parameters in complex causal systems.

Time series analysis certainly is a powerful technique for economic and social historians to apply to time series data whenever these data are available. Identifying systematic and irregular parts of historical development or distinguishing level, trend and cyclical movement is obviously what historians should aim at. Forecasting can be performed with historical time series data *ex post* in order to evaluate the fit of such a time series model. However, some of the assumptions underlying the statistical technique might be in conflict with what is a common understanding of the nature of historical analysis and historical explanation. Autocorrelation is a good example: On the one hand, it shows the historical emergence of a series and thus can explain its development over time 'historically' (out of its own development in the past). On the other hand, nothing can be said about reasons for or determinants of this development, even though autocorrelation produces at any point in time precise estimates for the future. Therefore, to find out something about historical causation, analysis of historical time series data cannot be restricted to a single time series only. Another example would be the stochastic property of time series to be stationary, which for statistical reasons is a necessary precondition of such an analysis. Nonetheless, stationary in principle contradicts the idea of historical change and development, and this definitely makes clear that, from a historical perspective, structural breaks in a time series presumably are much more common than any irregular movement around a permanently constant mean. For further reading, see Pindyck and Rubinfeld ([4]1998) and Feinstein and Thomas (2002).

See reviewed sample studies 45, 46.

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