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*Bookkeeping as a 'key technology' of pre-modern commerce.
Its relevance for the economic development in Europe**

1. Introduction

Since the classic studies of Werner Sombart (1863-1941), Max Weber (1864-1920) and Joseph Schumpeter (1883-1950), the significance of the emergence of double-entry bookkeeping for the economic development of Europe has been discussed (e.g. Melis 1991, 281-85; Miller, Hopper and Laughlin 1991; Bryer 1993; 2000; Todeschini 2006), not least at the 22nd Settimana di Studi in Prato in 1990 (Cavaciocchi 1991). According to Sombart (1902), the emergence of double-entry bookkeeping ultimately reflected the high rationality of the Upper Italian-Tuscan merchant bankers. For Weber, bookkeeping expressed calculability and was part of what he called the «spirit of capitalism» (Weber 1921/22, 49-50). In recent decades, authoritative representatives of historical accounting research, above all Basil S. Yamey since the late 1940s, have opposed such an exaltation, even glorification of accounting. Yamey (1949, 110) interprets accounting as a contribution to the «'methodising' of business life» and in particular concludes that knowledge of total returns is not mandatory or useful for decision-making within an enterprise (Yamey 1964, 119). Only in the peculiar situation of stable prices and costs did information from double-entry bookkeeping actually provide a viable basis for a corresponding, improved basis for decision-making (Yamey 1964, 128-29). Yamey (1964, 133) sees the benefit and merit of double-entry bookkeeping «in its comprehensiveness and its possibilities for the orderly arrangement of data», then in the possibility of finding and correcting arithmetical errors in the account books (Yamey 1949, 110; 1964, 135). For other representatives of current relevant research, the reporting of profit or loss is not the original and especially not the most important intention of (double-entry) bookkeeping (e.g. Sangster 2016, 301-02; Carruthers and Espeland 1991, 54; Napier 2009; Chapman, Cooper and Miller 2009; Lang 2020, 27-43). As most merchants were so deeply informed about their transactions a profit-and-loss account in the modern sense did not seem necessary. Therefore, there was no accurate and regular, but at best a periodic review of capital and income (Yamey 1949, 110-11; 1964, 119; 124; 135). As a result, one can agree with Richard A. Goldthwaite, who also rejects the thesis of a «spirit of capitalism» or a rational striving for unlimited profit, when he concludes with a remarkable qualification: «double entry, at least in its early but highly

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sophisticated manifestation, was not inherently an instrument of capitalism as we understand it today» (Goldthwaite 2015, 637).

In recent years, however, cultural-historical interpretations of double-entry bookkeeping have increasingly been promoted, underlining its function as a social and institutional practice (e.g. Miller 1994; Carnegie and Napier 1996). Three such approaches are mentioned by way of example: to begin with, according to Aho (2005), double-entry bookkeeping was a ‘rhetorical’ artifice used by the church and merchants to justify their common business practices and notably their profit-making in the fifteenth century, which would otherwise have been considered immoral or usurious. Next, a quantifying and technological interpretation of account books, originating in the Annales school, emphasises the possibility of communication on several levels through double-entry bookkeeping, whereby bookkeeping is understood as an independent agent and as a meso level between the microeconomic of businesses and the macroeconomic of, for example, markets or crown finances, linking the two. The products of accounting – the accounts books – appear as «products of data processing», even as “achievements of cognitive artefacts”, whereas their actual economic intention seems to recede into the background (Norman 2013; Llewellyn and Milne 2007; Lemarchand and McWatters 2013; Lemarchand, McWatters and Pineau-Defois 2014). Finally, a more intellectual, even art-historical interpretation points out that the Venetian accounting system is defined by symmetry, proportion, mathematical balance, order and harmony, which characterises Renaissance art as a whole (Dean, Clarke and Capalbo 2016, 10; Bryer 2016).

Against the backdrop of these current discussions, however, the question of possible economic backgrounds to the emergence of double-entry bookkeeping remains unanswered or must be asked anew. Provocatively put: did double-entry bookkeeping serve primarily or even solely to formalise, abstract and simplify the accounts, for example to avoid the appearance of usury? Was it really only – or at least essentially – rational, organisational criteria and ideas of order that induced merchants to take on the immense effort in terms of working time and costs that the preparation of double-entry bookkeeping requires (cf. Carruthers and Espeland 1991, 36; 57; 60)? What meaning and sense can the use of double-entry bookkeeping practice have if this bookkeeping – except for the presentation of extracts to the court in the case of litigation – was confidential and secret within the business?¹ The above-mentioned explanations for the emergence of double-entry bookkeeping techniques remain unsatisfactory in the end, unless at least decidedly economic intentions are also considered.

In contrast to the rather cultural-historical research approach that is recently domineering the discussion, the economic relevance of double-entry bookkeeping is highlighted again more strongly in the following. It is the aim of this contribution to carve out the importance of (double-entry) bookkeeping – interpreted as ‘useful knowledge’ for merchants – for the economic development in Europe and its possi-

¹ In the Medici Bank, for example, secrecy was taken so far that even when the contract was terminated or ended, all business documents – including the accounts – had to be returned to the ownership of the bank so that no one from outside could have a look at the accounts (Schneider 2016, 80).

ble indirect influence on economic growth by analysing examples of ledgers as 'mirrors' of their business's activities. As a result it should become clear that the useful knowledge of the technique of double-entry bookkeeping was one of the preconditions of the commercial and, later on, the industrial expansion of the Europeans, which made a significant difference to other merchant cultures in the world. Therefore, three central questions should be answered:

(1) How did bookkeeping contribute to reducing entrepreneurial risks in commerce and industry (cf. Orlandi 2018)?

(2) Did the expansion of knowledge about bookkeeping promote the expansion of commerce – or was it the opposite way around?

(3) What was the contribution of (double-entry) bookkeeping to the economic development in Europe? Did it influence economic growth? Can double-entry bookkeeping be seen as a precondition of industrialisation?

Before these questions are answered in a systematic way, a few key steps in the development of bookkeeping in pre-modern Europe are presented to lay the foundation for further argumentation. Thereby, one aspect is very important: «[A]lthough there was no standardisation of procedures, practices were common to accountants of different firms», whereby «not all firms or accountants adopted the new techniques learnt through oral or written exchanges» (Orlandi 2021, 536), and this applied equally for commercial entrepreneurs in Tuscany in the thirteenth century as well as in Upper Germany in the sixteenth or in England in the eighteenth century.

1. Steps in the development of bookkeeping in pre-modern Europe

1.1 The development of Bookkeeping in Italy during the Commercial Revolution

The main features of bookkeeping and accounting in use today can be traced back to developments that began in the cities of Upper Italy and Tuscany during the Commercial Revolution of the twelfth to fourteenth centuries. These Italian innovations in the field of bookkeeping were based on forms inherited from antiquity and handed down into the high middle ages: since the ancient oriental empires of Mesopotamia (since the Uruk Period, c.3100 B.C.; Pollock 1999, 5), the simple notation of individual business transactions served, on the one hand, as a personal reminder for the merchant, especially when he was involved in money and credit transactions as well as in long-distance trade. On the other hand, this compilation of business transactions, usually referred to in research as 'single-entry bookkeeping' and composed according to individual criteria, as was customary until the high middle ages, was also intended, if necessary, to prove the legality of his activity before the court, for example when he granted a (trade) credit to a foreign business partner from one year to the next (Arlinghaus 2006, 53; 56). The fact that this memorial function of bookkeeping and its testimonial power in court was accorded great importance, not least by the officials, is evidenced by the explicit reference to it in the *Corpus Iuris Civilis* compiled under Emperor Justinian I (527-565) between 528 and 534. This single-entry bookkeeping was sufficient for both the merchant of antiquity and the long-distance merchant of the early and high middle ages; the latter also accompanied his

goods himself over long distances and required only a small written record of his activities, if any at all.

This situation changed with the expansion of trade of the Italian maritime cities since the ninth and tenth century and with that of the other Christian Western Mediterranean in the wake of the Crusades, which promoted especially the Levant and Orient trade, the maritime traffic required for this and the resulting payments. The protection of maritime transport through the novel type of premium-based marine insurance and the efficient processing of payments and credit by the cashless bill of exchange required, in return, a much more elaborate system of bookkeeping than which had previously been usual. At the same time, the once travelling long-distance merchants became resident merchants who progressively based their business activities outside their city on agents or factors and established partnerships or (trading) companies. They were therefore very reliant upon a system of bookkeeping and accounting that is increasingly exact as they were not allowed to lose control over their external transactions, which their factors carried abroad (Lane 1977; Arlinghaus 2002, 245) since they were answerable about profits and losses to their partners, i.e. investors (Carruthers and Espeland 1991, 43-46).² The fact that such simple account ledgers, as well as business correspondence, transformed into instruments of information and thus also of knowledge management are regarded crucial features in the background of the spreading of bookkeeping, along with the emergence of Italian merchant bankers operating throughout Europe, the increasing acceptance of credit, money economy becoming widespread in concert with a growing monetary stability since the thirteenth century and, quite practically, with the expanding availability of good paper as a cheap writing material since the second half of the thirteenth century (Sangster 2012, 98).

These early ledgers of individual business transactions were often not easy to understand due to their mostly low-level internal order and also displayed considerable regional peculiarities and differences (Antinori 2004). Since the turn of the thirteenth century³, such ledgers were no longer sufficient for some resident merchants in Upper Italy and Tuscany, the internal order of such ledgers was gradually refined and thus adapted to the expanding business activity. The evolution of the debtors and creditors book began in the early thirteenth century (Orlandi 2021, 538-39), partly with entries in or from separate books, whereby credits appeared to be the most important and most critical and were therefore often specifically listed (profits,

² It should be noted, however, that this early phase of improved commercial arithmetic was still based solely on calculation with Roman numerals and the thoroughly efficient use of the abacus (Hess 1977; Portet 2006, 55-7), even though knowledge of Indo-Arabic numerals became increasingly widespread from the turn of the twelfth to the thirteenth century, at least in the university-academic sphere, i.e. for mathematical, astronomical, and calendrical calculations (Durham 1992, 27-32). «The system caught on slowly, but it had enormous advantages for accounting, measuring, and calculating, and it was doubtless instrumental in the development of double-entry bookkeeping» (Mokyr 1990, 74).

³ According to Mills (1994, 86), the business of merchants was already so extensive around 1200 that there was «a critical mass» and thus the need for double-entry bookkeeping, not least because of the ever more extensive transactions at the international fairs in Champagne. However, there is no empirical evidence for such an early beginning of the development of double-entry bookkeeping.

in contrast, were not) (Mills 1994, 84): «Credit dealings almost certainly were responsible for systematic accounting» (Yamey 1949, 103). The division into debit on the left page (*deve dare* – shall give) and credit on the right one (*ànne dato* – has given us, later: *deve avere* – shall have) as a tool for data processing did not have to take place on every page, but for practical reasons was often also carried out within an entire book (front – back, whereby the book was then turned upside down) (Arlinghaus 2006, 55; cf. Orlandi 2021, 539). Whereas formerly all items had been written down only once, the next step was to establish the habit that «all external transactions as well as all internal stock changes ... are recorded in two different accounts of a general ledger, one on the debit side (left) and one on the credit side (right). Both entries register the same amount but show it with different algebraic signs (debit and credit). Consequently, the total of all debit entries must equal the total of all credit entries» (Yamey 1995, 89-90).⁴ Since the late thirteenth century, this system could be amended by additional account books, such as the cash book, the merchandise book, and the moveably property book (Orlandi 2021, 539-41).

In current Anglo-Saxon research, such rudimentary twofold accounting is called «dual-entry bookkeeping» and regarded an essential (intermediate) step towards actual double-entry bookkeeping, which can empirically proven to have happened for the first time in Florence at the turn of the fourteenth century. Double-entry bookkeeping in the full sense of the term first came to pass when ledgers and journals yielded information on where exactly the offsetting entry was to be found (Sangster 2016, 300; 302; 310; cf. Lee 1977). Different, separate accounts for specific goods or fields of business appear as yet another significant characteristic of double-entry bookkeeping, which has to be seen as fully developed by the end of the fifteenth century (Yamey 2000, 1; cf. Goldthwaite 2015, 626). And – not to forget – according to Federigo Melis (1950; 1972; Orlandi 2021, 541) the introduction of the surplus and deficit account could be seen as the decisive constitutive element of the double-entry bookkeeping. As the accountants at the Farolfi company used the surplus and deficit account as well as the capital account in 1299/1300, Orlandi (2021, 544) argues that «the double-entry method had already come into being by the end of the thirteenth century. ... In the following decades, this accounting method spread among companies and merchant banking houses, with gradual improvements in its efficiency leading to the milestone of the introduction of the double-entry journal».

But when were the accounts balanced? In the vast majority of commercial enterprises, this was not a regular action, but rather done on demand, such as when the company was terminated pursuant to contract or in case of inheritance. Yet balances only were compulsory if a ledger was full and a new one had to be opened: then the balances of each account could be transferred to the new general ledger,⁵ which was both laborious and time-consuming. Instead, only the most relevant balances were copied in the new ledger, while the introduction of a profit-and-loss account at the

⁴ This passage refers to Giovanni Domenico Peri's work *Il negoziante* (Venezia 1649), who defined double-entry bookkeeping in exactly this way.

⁵ Such a *libro grande* «represented the definitive simplification of the procedure. It emerged from the old debtors and creditors book, which contained the merchandise book and, over time, basic accounts, and elementary or derivative accounts» (Orlandi 2021, 453).

time of balancing the individual accounts made it possible to close all those accounts that were no longer needed in the new general ledger (Yamey 1949, 107-09; 1991, 183). Above all, balances were made in preparation of a *bilancio del libro*, which, according to first evidences in the late fourteenth century, was a kind of prototype of an actual balance sheet, a 'trial balance', so to speak. The «techniques used for balance sheets were often crude» (Gervais 2016, 33), as can be seen several times in the *compagnia* of Francesco di Marco Datini and Toro di Berto, which existed from 1367 and 1373 (Arlinghaus 2000; 2002, 246): «Taking a trial balance as a test of equilibrium remains basic to double-entry bookkeeping» (DeRidder 2005, 14). Once this was achieved, it was only a small step to the general balance sheets, which were prepared comparatively rare since they were labour- and cost-intensive.

Yet, at least upon contractual termination of a trading company, such balancing through a profit-and-loss account was mandatory (Yamey 1991, 183) so as to determine each participating partner's profit or loss. As late as in early-seventeenth century England, according to Richard Dafforne's *The Merchant's Mirrour* (1636, 48), a general balance was prepared only if the ledgers were full, the merchant died or went out of business (cf. Lane 1945, 165-8) as it had been the case in Italy in the fourteenth and fifteenth centuries.

The fact that the development towards a double-entry bookkeeping took place exactly in the Upper-Italian-Tuscan area has been ascribed rightly to the innovative economic power of the Venice-Genoa-Florence-triangle. In Florence, the centre of wool and silk manufacture of that time, a habit had evolved to work with two types of ledgers, one for production and the other for trade (Mills 1994, 83-4). Here, where there were already at least six schools for bookkeeping in 1338, no manuals on the matter were written or published – unlike in Venice for instance – simply because there might have been no need to do so due to profound and widespread expertise in this field (Goldthwaite 2015, 623; Carruthers and Espeland 1991, 49; cf. Grendler 1989, 306-22). Genoa was among the nuclei of cashless payment and marine insurance, the intensive use of which required precise documentation of business transactions and therefore suggested the establishment of double-entry bookkeeping techniques.

The Massari account ledgers of the city of Genoa, surviving since 1340, are the oldest evidence of municipal double-entry bookkeeping (Chatfield 1977, 35). Venice, which, along with textile production and banking, maintained the largest trade network of the late middle ages that necessitated elaborate bookkeeping techniques, became the most important centre of book printing with moveable type in the second half of the fifteenth century together with Upper Germany ahead of Genoa and Florence, and thus also the most relevant distribution centre of information in this field for whole Europe (Mills 1994, 83-84; 88-92).

It is therefore significant that it was in Venice in 1494 where the classic treatise on accounting that set the standards for decades was published in printed form, namely in the *Summa de Arithmetica, Geometria, Proportioni et Proportionalità* (Venecia 1494) by the Franciscan Luca Pacioli (1445-1509).⁶ Pacioli's work was not written for

⁶ Here: First part, second section, tractatus XI: *Particularis de computis et scripturis*. – The fact that Pacioli was a Franciscan or Angelo Pietra (1550-1587) with his highly systematic book *Indirizzzo degli*

his own use, but for the spreading of knowledge (Sangster 2012, 104) – which is aptly to be understood in the sense of ‘useful knowledge’ – and also achieved a very high degree of dissemination for the time (Sangster 2007, 143). Pacioli thus presented the first printed and relatively complete overview of the Venetian bookkeeping system of the late fifteenth century, which thus became the leading system in the whole of Western Europe (Yamey 1995, 90).

In this way, Pacioli’s writings inspired ever new treatises on the art of bookkeeping in Italian, English, German, Flemish resp. French language from the 1540s onwards (Yamey 2004, 146-7; cf. Houtman-de Smedt 1991, 226). This work, purposefully ‘advertised’ by Pacioli himself, helped to install the Venetian form of double-entry bookkeeping as standardized and, in the long run, as the only guiding and common one, against which the Genoese or Tuscan forms stood back. According to the current state of research, the much older first German treatise on double-entry bookkeeping, written by Benedetto Cotrugli Raueo (from Ragusa, 1416-1469) in Naples after 1451 in the thirteenth chapter of his work *Della Mercatura et del Mercante perfetto*, which was printed only after 1573 in Venice (Hernández Esteve 1992; Tucci 1990), did not achieve anything like a comparable circulation or status.⁷

1.2 The Diffusion of Italian bookkeeping techniques: Upper Germany as a case study⁸

Through the medium of moveable type printing, the ‘new’ technique was able to spread much faster than ever before from the turn of the sixteenth century. This, however, should cover up the fact that double-entry bookkeeping techniques had already found their way beyond Italy in earlier centuries as well. Ventures such as that of Francesco di Marco Datini, who were engaged on both sides of the Tyrrhenian Sea, quickly made Italian innovations known in Catalonia. In Castile, double-entry bookkeeping is first documented in 1465 among merchants of Burgos; from the 1520s it was a common practice throughout the country (Grommes 2008, 86). In Upper Germany, which is henceforth the focus of interest, the occasional merchant Ulrich Starck from Nuremberg could have been the first (or at least one of the first)

economi (Mantoua 1586) was a Benedictine is a circumstance that should not be overlooked. For the role and experience of monasteries and religious orders in the development of bookkeeping since the High Middle Ages – due to their ever-multiplying wealth and, above all, their diverse assets and types of revenues – has been of outstanding importance according to recent research on Italian, Spanish, and English case studies (Dobie 2008; Montrone and Chirieleison 2009; Maté Sadornil, Prieto Moreno and Santidrián Arroyo 2017), although still too little researched in detail.

⁷ According to Sangster (2015b, 29), the section on bookkeeping in Cotrugli’s book was only written posthumously – in 1475 – by Marinus de Raphaeli in Naples.

⁸ The fact that Upper Germany is chosen as an example is due to the author’s current research, but also to the fact that in the sixteenth century the most surviving treatises on bookkeeping after Italian cities were written here (and in the Netherlands), in the first half of the century almost as many as in Italy and three times as many as in the Netherlands (Jeannin 1991, 259). This speaks for an outstanding interest in bookkeeping issues in the Upper German trading companies of the time. – Another very appropriate case study could be the development in Spain, for which Esteban Hernández Esteve made important contributions (Hernández Esteve 1996; 2009; 2011).

to practice the juxtaposition of services performed (commercial activity) and remuneration (payment) in his journal or manual respectively (1426-1435) (Penndorf 1913, 27), a technique that is also described in Marquart Mendel's *Buch der Hantierung* (1425-1438) (von Stromer 1965). However, a regular comparison of debit and credit can be found in a German merchant's journal as early as around 1390 and thus at the same time as Datini: the Nuremberg merchant Hilpolt Kress († 1406) practised it in his *Lange Puch*, which he kept in Venice and thus clearly under Italian influence (von Stromer 1967, 785-86).

In the German area, double-entry bookkeeping was originally not understood to denote keeping debit and credit entries, but rather keeping of two ledgers and copying entries from the journal to the general ledger (Kellenbenz 1971, 222). Thus since late fourteenth century, Nuremberg merchants at times kept several books in parallel, probably following the Italian model. A prime example of this early form of bookkeeping is that of Ulrich Meltinger, a Basel merchant active at the end of the fifteenth century, who kept account ledger entries in chronological order in principle, who kept his account book chronologically in principle, but summarised all business transactions with a business partner within the chronology, separating the journal, general ledger and debt ledger (Steinbrink 2007, 56). The debt ledger of the Basel merchant Ludwig Kilchmann (†1518), for example, was kept in such dual form (Signori 2014). The development of bookkeeping of the Great Ravensburg Trading Company, the paramount Upper German company of the time with intensive trade relations with most countries in Western and Southern Europe, was even more advanced: the few ledgers, which have survived since the 1470s, testify to a simultaneous use of various books, inventories carried out every three years and regular balancing of accounts in order to determine profit-and-loss, albeit without the indication of general and administrative costs. This finding applies equally to the Ravensburg headquarters and to the several branches (*Gelieger*). The systematic accounting already allowed for a plausible use of the invested capital (Schulte 1925, I 105; 109-10).

This brief and by no means complete finding demonstrates that – contrary to older research opinions⁹ – at least dual bookkeeping techniques entered the bookkeeping practices of Upper German merchants rather early on, although they often were adapted and modified to the merchants' specific needs. In consequence, merchants from Italy and Germany produced books that were wholly or partly incomparable, so that scholars often faced the problem of having to compare different types of sources, which lead to the dictum of a certain backwardness of Upper Germans compared to the Italians. In case the books allow to draw a meaningful comparison, however, only some minor differences can be detected (Weissen 2005, 172).

Prior to the publication of Pacioli's 'epochal' work in German in 1537, the transfer of such 'useful knowledge' to Germany took place primarily in two ways: firstly, through the *Pratiche di Mercatura*, which were the only possible books in the fourteenth and well into the fifteenth century, which were, however, usually written for personal use only; and secondly, through the exchange of knowledge in the wake of direct

⁹ In particular de Roover (1948, 60): «The business methods of the German merchants were much more primitive than those of the Italians». This view was repeated so often that Braunstein (1964, 234) wrote: «Le retard allemande en la matière est bien connu».

business contacts and personal meetings, especially when prospective merchants from Upper Germany spent part of their apprenticeship in Italy and compiled a *Pratica di Mercatura* for themselves (Weissen 2005, 173-8; Denzel 2002; Häberlein 2014, 91).

Actually, the merchants of the late middle ages and early modern period – and this can duly be generalised – focused on learning through experience, observation, and imitation of their colleagues: «They learned through practice, not solely or even necessarily by studying, but by doing» (Safley 2020, 193). Training, commercial networks and the accumulation of experiential knowledge were thus largely responsible for the transfer of 'useful knowledge' in the trade sector: «The fact that bookkeeping and the development of financial instruments nonetheless indicate a level difference cannot be attributed to a refusal to progress, withdrawal, or even isolation. Rather, the Germans adopted and adapted very little from Italy, since their self-developed business practices were quite sufficient; they were also able to conduct their business with great success using simple banking means» (Weissen 2005, 178).

When the German translation of Pacioli's work appeared, it was particularly the textbook by the Venetian merchant Wolfgang Schweicker *Zwifach Buchhalten sampt seinen Giornal* (1549) that was closely based on Pacioli (Volmer 1929, 303), 'mediated' as it were by Domenico Manzoni's *Quaderno doppio col suo giornale* (Venezia 1540), which, without referring to him, essentially adopted Pacioli's remarks and which then became Schweicker's source (Kellenbenz 1975, 38).

The transition from German double-entry bookkeeping with journal, debt ledger, and general ledger or *kapus* to the Italian variant with journal and debt ledger can be exemplified by the bookkeeping of the Welser companies and their branches (*Faktoreien*): when the Welser-Vöhlín company was founded in 1496, it is highly probable that the *kapus* was still common practice in all branches. The *kapus* is documented in the debt ledgers of the Nuremberg and Memmingen branches as late as the 1520s, while the books in Antwerp were already kept in the Italian style by 1525. It can therefore be assumed that with the end of the Welser-Vöhlín company and the reorganisation by Bartholomäus V. Welser since around 1518, the Italian version could have been adopted at the major trading centres in Western Europe. The background to this could have been, on the one side, the incipient shift in emphasis from trade in goods to financial transactions, which made it advisable to use Italian-style double-entry bookkeeping. On the other, the increasing employment of foreign *Handeldsdieners* (commercial clerks), who only knew the Italian system, could have led to this system being established in a growing number of branches. Experiences with trade organisation in Spain and a «general effort to simplify bookkeeping» could also have been important (Geffcken and Häberlein 2014, XXXI-XXXII). In any case, from the 1520s onwards, a «development process» can be observed, «which obviously first took hold in the branches at international trading centres such as Antwerp, then in those in the Holy Roman Empire and finally, from 1554 onwards, also at the company headquarters» (Geffcken and Häberlein 2014, XXXI).

Despite simple bookkeeping was still satisfactory for many companies in the sixteenth and seventeenth centuries (Weissen 2005, 172-73) and the possibilities of dual or double-entry bookkeeping were often not or only partially exploited (Carruthers and Espeland 1991, pp. 39-40; 87), double-entry bookkeeping in the Italian style is

documented in all enterprises (examined in this article) of Upper German high finance in the sixteenth century, although with clearly differentiated and exact implementation.

The ‘pinnacle’ of bookkeeping in Upper Germany, as in Italy, was the periodic balancing or general accounts (*Generalrechnungen*). They summarised the business results of a particular period and – not always, but ideally – drew up a profit-and-loss account, i.e. the company’s results were shown in the balance sheet. The periods for such general accounts varied greatly from company to company they were usually drawn up when a company contract expired – often after two to six years – in order to be able to allocate profit or loss to each investor. However, the death or withdrawal of a significant shareholder, the addition of a possible successor or other drastic events could also call for a general account. However, the balance sheet could also be reviewed again, as had been the case with the Fuggers since 1546: after the balance sheet had been closed, a *proba*, a kind of control statement, was prepared, which had an essential and, above all, a completely new role in the entire bookkeeping business. Such a *proba* was intended to enable a capital comparison, a review and, if necessary, profit-and-loss adjustment, as well as control and cross-checking, and most likely also the planning of future business activities (Isenmann 2019, 153; 157-62).¹⁰

1.3 Some developments in bookkeeping in the run-up to the Industrial Revolution

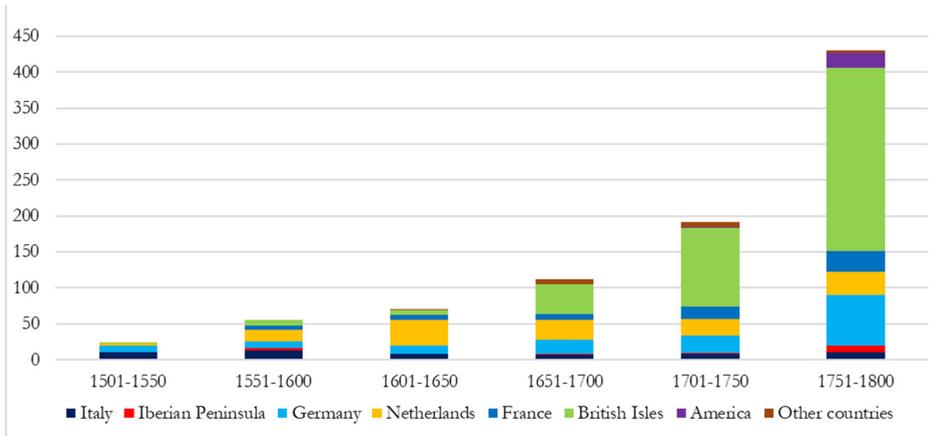
Whereas the theoretical reception of Italian accounting techniques north of the Alps had begun in the 1540s (see above), the publication of treatises on accounting from the seventeenth century onwards was progressively concentrated in Northwestern Europe and then, in the eighteenth century, specifically and foremostly in England, with a dramatic increase in the number of these writings (Graph 1) (Jeannin 1991, 259).

The background to this development is, on the one side, the process of commercialisation that began in Northwestern Europe in the late sixteenth century and culminated in the Second Commercial Revolution at the turn of the eighteenth century, on the other side, the quest for knowledge and theoretical penetration in the course of the «Industrial Enlightenment» (Mokyr 2016, 189, 339) and the Knowledge Revolution, and lastly – directly related to this – the beginning of the industrialisation process in eighteenth century England. The theoretical preoccupation with (double-entry) bookkeeping and therefore the production of ‘useful knowledge’ in this area was concentrated – as it had been in the late middle ages – in the economically leading regions of Europe, i.e. in the first half of the seventeenth century in the Netherlands, then and notably in the eighteenth century in industrialising England, whereas in the Holy Roman Empire the number of publications only began to rise in the 1780s – with the first steps towards industrialisation. In contrast, only comparatively few relevant works appeared in the Mediterranean countries after the sixteenth century.

¹⁰ An analysis of all available Fugger balances and the corresponding *probae* is currently being carried out by Mechthild Isenmann and the author. The publication of the results is expected for 2024.

Even though single-entry and double-entry bookkeeping were still used by businesses well into the industrial era (e.g. Houtman-de Smedt 1991, 225), it is still worth asking which remarkable new developments compared to the state of accounting techniques in the sixteenth century can be found in these Northwest European treatises of the seventeenth and eighteenth centuries.

Graph 1. **Bookkeeping treatises published, 1500-1800, per country**



In his *Vorstellicke bouckhouding* (Leyden 1607), the Flemish mathematician, physicist and engineer Simon Stevin (1548/49-1620) was probably the first to indicate that the separation of individual accounts in double-entry bookkeeping had two advantages: on the one hand, it was possible to see at any time how much of a particular commodity was in stock; on the other hand, it was possible to calculate the profit or loss resulting exactly from transactions with this commodity. The resulting usefulness is evident. At the same time, important information could be derived that the merchant could use for the calculation of commissions or the distribution of income to the investors, which Yamey (2000, 4-5) also explicitly points out. From the end of the seventeenth century at the latest, evidence began to accumulate according to which bookkeeping was not only understood as a justification and legitimisation of transactions, but also as a way of improving the quality of decisions made by commercial entrepreneurs (Carruthers and Espeland 1991, 58). However, this research finding should not obscure the fact that already in the sixteenth century and earlier at least some commercial entrepreneurs used their accounting to improve their business planning and strategies – for example in the sense of minimising risk. From Upper Germany, for example, Anton Fugger can be described as such an innovative merchant banker (even if the research on this has not yet been fully completed), who used the detailed and elaborate bookkeeping of his trading company in this sense around the middle of the sixteenth century. This ‘use’ of double-entry bookkeeping undoubtedly also contributed to its increasingly widespread use.

Another decisive factor for the increased use of double-entry accounting techniques, including periodic, soon to be annual balancing, was the need to pay dividends and the interest of investors in profit or loss. Both encouraged the rapid spread of double-entry accounting techniques and, in consequence, the booming theoretical study of the subject (DeRidder 2005, 15-16). The joint-stock companies that emerged in the Northwest European countries from the seventeenth century onwards can be seen as pioneers of this development.

Furthermore, the information content of the books kept grew by both increasing their numbers and thus differentiating them more thematically. In the eighteenth century, for example, special bill (of exchange) books were virtually a matter of course, in many companies there were also forwarding or freight books, and, on top of that, in Central Europe there were journals in a smaller, handy 'pocket book' format for visiting trade fairs ('trade fair books') and many other special features. All these specialised books did not provide aggregated data, but were directly related to the individual transaction, comparable to extensive general ledgers, but were not intermixed (by adherence to a chronological order) as in a journal. They therefore provided very specific information on a particular business area (which, incidentally, makes them exceptionally informative for historians). However, the accounts in the general ledgers tended to be more and more differentiated in order to make the information content of the individual entries more precise. One example may suffice: in his treatise *La science des négocians et teneurs de livres* (Paris 1704), the French mathematician Mathieu de la Porte (†1722) distinguished three categories of accounts in general ledgers. The principal's accounts comprised all capital flows and profits, including all banking and insurance transactions. The effets effectifs listed cash and cash transactions, the turnover of goods, stocks, bonds and bills of exchange transactions, as well as real estate and inventory. Finally, the compte des correspondants were personal accounts related to the business partners (Houtman-de Smedt 1991, 234-35).

Of course, the increasingly relevant asset valuations and calculations of an enterprise's profit were not standardised (Yamey 1991, 182). «Before the [industrial] evolution, fixed assets were insignificant but, with the growth of industry, became an important cost of production and distribution» (DeRidder 2005, 17). Independent costing is thus often only associated with the industrial production mode, as it now became important – in contrast to the trade of the previous centuries – how high the costs for a piece of produced goods actually were. The distinction between factory bookkeeping or costing, which became more critical in the eighteenth century as a result of the industrialisation process, and traditional commercial or financial accounting is not, however, fundamentally new. Approaches to this can already be found in fourteenth century Italy – for instance, among the cloth producers of Florence and Tuscany – which, however, were always limited to partial areas of business activity. Yet even in England in the late sixteenth and early seventeenth centuries, detailed cost accounts can be found, for example for the copper and silver production of Daniel Höchstetter at Keswick (Hemmerley 1988, esp. 117-18; cf. Donald 1955, 221-30). And in the case of English textile producers in the early eighteenth century, there were not only more or less regular balance sheets – in at least one case even weekly ('weekly profit') – but also numerous direct costing calculations by the

middle of the century at the latest (Edwards and Newell 1991, 43). The fact that costing calculations can be traced to a much lesser extent and usually much later than other accounting techniques seems to be due not least to the fact that «costing records ... were kept separate from other account books, and were often written-up as loose-leaf memoranda» (Edwards and Newell 1991, 38), as which they were quickly lost or deliberately destroyed.

These few examples highlight one thing clearly: even if the further development of accounting and its theory into the modern era was decisively driven by the economic and institutional challenges of the Industrial Revolution, the development of the railway system and then finally of business taxation, and was accompanied by the increasing importance of fixed capital (DeRidder 2005, 16-17), the elementary foundations had not only been developed in the pre-industrial era, but had also already been practised, albeit not always with the same stringency as should be required under the conditions of industrial economic activity.

2. Bookkeeping: a 'key technology' of pre-modern commerce?

After the three main questions presented at the beginning of this article, the second step is to analyse whether and, if so, how and to what extent bookkeeping can be used

- (1) as a factor of the expansion of commerce,
- (2) as a medium of the reduction of entrepreneurial risks, and
- (3) as an instrument of vitalisation of economic growth.

(1) As exhibited in the first part of this article, the developmental process of bookkeeping in Italy during the Commercial Revolution was closely intertwined with the expansion of trade, payments, maritime transport and insurance over the centuries. The emergence of ever more elaborate bookkeeping techniques appears not least as a reaction of merchants to the ever greater financial-technical challenges of their trading activities, which were to be documented with ever greater (arithmetical) precision and differentiation in order to be available – first of all – as a medium of information and memory within the company, especially when the principal had no direct insight into the business conduct of, for example, a branch abroad due to geographical distance (Yamey 1991, 183). However, the action mechanism also worked in the opposite direction: the ever more refined bookkeeping also made possible a further expansion of trade in all its facets, both in its scope and in its geographical dimensions, since the inherent control mechanisms offered protection against distant employees or business partners, for example, and significantly reduced the risks of far-reaching long-distance trade without the personal travel activity of the merchant or head of a commercial enterprise.

As an example, let us once again look at the interplay between trade and bookkeeping in Upper Germany: as already mentioned, the expansion of international trade since the fourteenth century was accompanied by the adoption of Italian bookkeeping techniques. This learning process took place in the wake of the training of northern Alpine merchants in commercial arithmetic and accounting in Upper Italian and Tuscan trading and financial centres (Mokyr 1990, 189). Even if the Upper

German merchant bankers initially developed their own form of so-called German double-entry bookkeeping (see above), which was tailored to their commercial requirements, the temporal connection and the business-specific differentiation of the various techniques with the expansion of their international trade relations in the fifteenth century tends to be unmistakable, as the example of the Great Ravensburg Trading Company shows. At the beginning of the sixteenth century, when the process of commercialisation intensified considerably, such bookkeeping no longer seems to have been sufficient to coordinate international business activities on a large scale, which is the reason why the Upper German trading companies gradually switched to dual and then double-entry bookkeeping, in the case of the Welsers, as displayed, in the 1520s (see above). The greater the challenges in trade and finance became, the more this double-entry bookkeeping was then refined or rounded off by drawing up balance sheets, the accuracy of which was finally even checked by a proba in the case of the Fugger at the height of the restructuring of their business. Even in later times of declining trading activity, the Upper German trading companies and sole proprietorships did not fall behind this 'standard' of double-entry bookkeeping practice.

However, commercial activity and its expansion also promoted two monetary aspects: on the one hand, the use of a certain money of account or later bank money as a unit of account in the books was a good way to (largely) exclude inflationary tendencies to which the exchange currencies were subjected (Sangster 2016, 309-10). The fact that Upper German merchant houses in the sixteenth century regularly kept their books in the accounting money florins Rhenish, and Italian and Spanish ones in the accounting moneys used there, is clear evidence of this practice, which was often practised to safeguard their own trading activities. In many cases, however, it was also usual to keep accounts in two different currencies – as was the case with Simon Ruiz from Medina del Campo – in order to reveal the amount and direction of the debt between two business partners or between the headquarters and a branch. In this way, the amount of profit or loss for the principal was also clearly visible when converting between the different currencies (Yamey 2011, 127; 141).

On the other hand – and this seems even more important from a long-term, macroeconomic perspective – the dual system of bookkeeping *all'italiana* already enabled the creation of book money and thus the expansion of the money supply in a continent poor in precious metals. By means of book transfers between personal accounts (Lee 1973, 137-9; Yamey 2012), payments could be settled, funds transferred or bills of exchange cleared without the flow of cash (Arlinghaus 2006, 51), thus expanding the quantity of book money by a merchant banker providing a business partner with credit on his 'transaction account' (in modern terms). In the long run, book-entry or book money gained a much higher share of the total money in circulation for payment purposes than cash. The use of book money also reduced the risk of fluctuations in value, as with coins, transport costs and the danger of robbery (LeGoff 2011, 157-8), not to mention the risk of insolvency of the 'bank'. As the authorities were unable to provide sufficient cash, i.e. coinage, for expanding trade due to the low availability of precious metals, which was reflected in the bullion famine of the fifteenth century and consequently in an economic recession in wide parts of Western Europe (Day 1978; Kindleberger 1984, 17-26; Spufford 1993;

Campbell 2016, 334; 367-9), the economically potent merchant bankers resorted to the creation of book money to compensate for this bullion famine.

The fact that in the late fourteenth and especially in the fifteenth century, when the bullion famine became more noticeable in trade and deflationary tendencies threatened to limit commercial activity, the techniques of dual or double-entry bookkeeping became more widespread and can be traced in more and more trade businesses – also outside Italy – is a significant sign of the increasing importance of book money in the commercial economy and the growing awareness of merchant bankers that they could make use of this easy-to-create means of payment. This technique of money creation by means of bookkeeping had been provided since the late sixteenth and especially in the seventeenth century by public banks in Venice (*Banco Giro*), Amsterdam (*Wisselbank*), Hamburg and Nuremberg (*Banco Publico*) as a public infrastructure for international cashless payments by means of book money in their own currencies. In doing so, they were supposed to increase the efficiency of their cities' trade and ensure monetary stability (North 1997, 39; 2003, 223; Denzel 2012, 54-5, 97). These giro banks thus already fulfilled essential functions of modern central banks (Denzel 2018).

(2) It can thus be stated: bookkeeping contributed to reducing entrepreneurial risks. This statement refers to four factors that were of essential importance within a commercial enterprise or for a merchant: first, his own memory of business transactions; second, the arithmetic correctness of the accounting of individual business transactions; third, the predictability of strategic decisions; and fourth, the profitability of the enterprise. These factors were able to significantly mitigate the entrepreneurial risk or – in the case of profitability – even overcome it.

Even simple bookkeeping could not exclude the high risks of maritime trade or credit transactions, but it at least protected the merchant from the danger of being forgotten and possibly from unjustified condemnation in court and could thus grant the enterprise a minimum of security. This finding of the memorial function is, of course, not limited to the period up to the thirteenth century, but is also valid without restriction for later centuries up to the time of industrialisation and its weighty significance has been proven (Lemarchand, McWatters and Pinau-Defois 2014)

With the *revolution du commerce* (Henri Pirenne), the importance of arithmetic, i.e. the arithmetic correctness of the accounting of individual business transactions, was added as a further relevant factor for reducing commercial risk. The more arithmetically accurate the bookkeeping was, the lower the risk of disputes among the partners and the more stringent the control mechanisms could be towards trade agents. Yamey (1991, 185) is right when he states: «A merchant's own account books, in whatever form or on whatever system these were kept, could not enable him to prevent a distant agent from being dishonest, extravagant or inefficient»; but if the principal also had information on prices, exchange rates, costs, etc., controls of the agent's accounts were certainly possible and were carried out, as exemplified by the Fuggers' action against their factor in Spain, Andreas Hyrus, who had falsified invoices, embezzled funds and carried out forbidden transactions on his own account (Haberer 1995, 147-54). It is not without reason that Mandrou (1969/1997, 193)

noted for the Fugger bookkeeping that it «testifies to the solid economic management of upper middle-class merchants who have long since recognised that an exact overview is the best prerequisite for a successful course of business».

Thus, the development of commercial records towards double-entry bookkeeping can also be interpreted as a process of ever further risk reduction: because on the one side, the possibility of balancing made it possible to check the accounting accuracy and correct it if necessary; on the other side, the differentiation of the various personal or general ledger accounts offered the opportunity to check the individual branches of business for their earnings. Such random checks, which are quite common in Italian ledgers (Goldthwaite 2015, 628), could not least be seen as a first basis for being able to plan future business activities more stringently than before, when, for example, business branches or partners were no longer taken into account due to insufficient earnings and others with positive earnings were expanded.

Yamey (1949, 109) had already emphasised that «the profit-and-loss account therefore contained a hotch-potch of entries besides those of business gains and losses». This measure of introducing a profit-and-loss account, which was actually initially a technical accounting measure, had the positive effect that the merchant could now learn how his business – or at least the respective part of the business – was doing financially, whether he had made a loss or a profit. Whether “profit calculations were not as useful for traders in the early modern era as they would be now” (Gervais 2016, 34) cannot perhaps be conclusively clarified, but it is undeniable that periodic profit calculations had already been made in commercial enterprises since the first half of the fourteenth century, for example by the Alberti of Florence (de Roover 1958, 34). The (early) Fugger inventories can also be interpreted in this sense (Yamey 1964, 120). Why should merchant bankers have made profit calculations with the help of a profit-and-loss account if they did not want to use it or did not know how to use it? The extensive work behind such calculations, some of it over 100 pages long, becomes clear and comprehensible in detail from the ledgers of the Fugger accounts. In this way, precise and detailed accounting and a balanced assessment of the individual bookkeeping items made clear decisions possible for the further strategic approach of a business’s management. This included in particular the differentiation between «good», «doubtful» and «bad», i.e. ultimately «lost debts», as can be seen for example in the bookkeeping of the Constance Grimmel (Nutz 1996).

Of comparable, if not even greater, relevance was the possibility of assessing the value of the individual balance sheet items: Anton Fugger regularly made such assessments in marginal amounts, very critically and rather to his disadvantage, so as not to make his company look good (Isenmann 2019). His Augsburg competitor Ambrosius Höchstetter, in contrast, seems to have acted in the opposite way and rather ‘doctored’ his accounts in his favour (Safley 2020, 101-29). Anton Fugger had been practising this valuation or control (revision) of the individual items since his apprenticeship in Italy, especially since the individual branches often overstated the value of their inventories. However, he also used this method to make the presentation of the individual entries ever more concise (Isenmann 2019, 157-8). In the development of Fugger bookkeeping, this striving for ever greater clarity was perfected by a growing scarcity and summary of information, at the latest since the general

account of 1546. Even if these are only individual examples for the time being,¹¹ an essential purpose of double-entry bookkeeping can be seen in the improvement of decision-making, in the calculation of profit-and-loss, of claims and liabilities of the individual capital investor as well as in the greater control of internal and external transactions (cf. Derks 2008), admittedly without wanting to absolutize these crucial functions in a Weberian or Sombartian sense or to interpret them in terms of an imaginary connection to capitalism and rationality. However, a reduction of entrepreneurial risks was in any case associated with the aforementioned possibilities for using bookkeeping.

(3) But did the advantages of double-entry bookkeeping that were pointed out and asserted also provide a stimulus for the economy as a whole and its growth? Even if bookkeeping alone did not guarantee entrepreneurial success, it was able to give commercial and later also industrial enterprises a certain inner stability that could certainly promote entrepreneurial success in the long term. Particularly in internal and external crisis situations, accounting could represent the decisive information and planning basis for short-term crisis and long-term resilience management (cf. Denzel 2020), as it can be regarded as a decisive instrument of entrepreneurial resiliencing anyway, according to recent research on Upper German case studies from the sixteenth and early seventeenth centuries (Denzel 2022). And this also applies in the reverse perspective: it is not without reason that inadequate (double-entry) bookkeeping and above all a lack of regular accounting was at least one of the main causes of the failure of several Upper German trading companies that went bankrupt in the course of the sixteenth century, and this was already recognised by expert contemporaries (Denzel 2022). Despite all the uncertainties and imponderables inherent in the accounts, they were, according to Houtman-de Smedt (1991, 241), «instrumental pour la constatation en bon temps de symptômes de maladies dans une entreprise. ... Une diagnose opportune offrirait l'avantage de pouvoir prendre des mesures de correction de trajectoire et de par là sauver éventuellement l'entreprise de la banqueroute».

Resilient enterprises – be it in trade or in manufacturing – which were able to overcome crises and perhaps even emerged strengthened from them, could in turn form a remarkable support for positive overall economic development, because, understood in this way, the term ‘resilience’ indicates ‘recovery capacity’ and ‘development on a new basis’ in the field of economy. From such a perspective, the practice of double-entry bookkeeping with all its possibilities of providing and evaluating information can at least be said to have made a positive indirect contribution to positive macroeconomic development – in the broadest sense: growth – in the pre-industrial as well as in the industrial era. Especially in the industrial sector, the question of production costs and thus costing has played a decisive role since the eighteenth century. The contribution of double-entry bookkeeping to macroeconomic growth trends can, of course, neither be measured nor calculated, but rather appears as a soft

¹¹ The extent to which this finding is also valid for other Upper German trading companies of the fifteenth to seventeenth centuries must (still) be left open here, as a comparably comprehensive source material of this special kind has not survived (or been known until now) for any other enterprise. Future research by Mechthild Isenmann and the author will address this problem.

factor, which, however, should by no means be neglected, notably when it comes to the relevance of the commercial sector for the onset of the industrialisation process. Even if double-entry bookkeeping is not necessarily to be seen as a precondition of industrialisation, it at least secured this process from the business's internal perspective, provided a stable framework for corporate information management and enabled scope for shaping and developing industrial production through costing.

Conclusion

The aim of this article was to re-emphasise the economic significance of the development of double-entry bookkeeping much more strongly than is currently the case in the mainstream of research, which underscores organisational and cultural aspects while paying little attention to economic components (e.g. Gervais 2016). Without wanting to derogate these new research results, it should be reiterated that the gradual formation of double-entry bookkeeping techniques in Italy during the Commercial Revolution and their spread across large parts of Europe and the European-dominated world in the following century were also accompanied by economic factors and consequences, the scope of which should not (any longer) be interpreted in the Weberian or Sombartian sense of a foundation of capitalism, but should also not be forgotten or suppressed. And another important aspect has to be pointed out: Contrary to what Yamey (1949, 127-28) argued some decades ago, the development of bookkeeping in Tuscany and Northern Italy «did not produce a clear distinction between new and old accounting methods», but «was characterised by gradual and contradictory changes that spread the double-entry method among accountants and managers» (Orlandi 2021, 544).

Double-entry bookkeeping has a far greater significance than being «a system of organising business information» and «a link between medieval and modern business practice» (Yamey 1991, 187; 163). It is an innovative 'key technology' in commercial practice (not only pre-modern!) and undoubtedly a useful knowledge for the commercial as well as the industrial entrepreneur. The following advantages of double-entry bookkeeping compared to single-entry bookkeeping techniques are to be noted:

Beyond the pure information management, which could be seen as a (not the!) «main purpose of accounting» (cf. DeRidder 2005, 15), double-entry bookkeeping

- made the exact arithmetical control of business operations possible (cf. Orlandi 2021, 544), although these were kept in various currencies, bank or accounting moneys;
- offered a (largely) secure framework for internal account clearing between business partners and thus for the creation of book money (thus forming one of the foundations of an extensive private and public banking sector);
- enabled the production of profit-and-loss accounts and finally of balance sheets, which made it possible to control the use of the capital invested in a company and the profitability of the enterprise or of one of its parts;
- let the entrepreneur establish and balance single successes; the balance sheet, based on extensive inventory, made it possible to produce precise statements

about the employment of corporate capital (assets) as well as the source of funds (liabilities) – the claims of entrepreneurs and debtors; and, last, but not least,

- provided the basics of an accurate costing in industrial production.

These mechanisms offered the commercial and later the industrial entrepreneur the chance to check the profitability of his actions, to mitigate his manifold risks and to make his enterprise organisationally resilient – whether he actually made use of these opportunities is, of course, often not known. The fact that inadequate bookkeeping and incorrect or missing balancing were regarded as important reasons for bankruptcy can be proven at least by various Upper German case studies. The Upper German merchants who explicitly expressed such assessments – for example in court or in bankruptcy proceedings – were therefore considered to have at least practical knowledge and application of double-entry bookkeeping and balancing as useful knowledge for the successful practice of their profession.

When double-entry bookkeeping is described here as a 'key technology' of pre-modern commerce, it is almost self-evident that it had a different effect than 'classical' technical inventions or processes such as mechanical wire drawing, the printing press, the Spinning Jenny, the steam engine or the puddling process. The innovative accounting techniques had more of an indirect and hedging effect on the expansion of trade in Europe and beyond by helping to reduce entrepreneurial risk, at least in part. This is a considerable structural and qualitative difference from, for example, the much-documented peddling or caravan trade in the Indo-Asian region (Steensgaard 1973), which did not have such accounting mechanisms. Even if it is by no means to be claimed here that the development of double-entry bookkeeping techniques was a prerequisite or basis for European expansion, it was nonetheless an instrument that supported, controlled, and safeguarded the developing intercontinental trade, which made it possible to manage correct and reliable accounts, for example in cashless payment transactions, quickly and without great effort, even over the longest distances. In the seventeenth and eighteenth centuries, this was evidenced by the manifold monetary and exchange transactions between Asia and Europe that were conducted within the European East India companies, as well as the transatlantic business activities of Western European trading houses.

This finding, which can be noted for European and intercontinental trade, applies equally to the expansion of commercial production in the eighteenth century and later, which was also supported by bookkeeping and included costing. As it were, forming a reliable arithmetical and planning framework in the background of commercial and later industrial development, it ultimately also made an indirect, albeit unquantifiable, contribution to economic growth in Europe – entirely in the sense of the contribution of useful knowledge to economic growth that can be stated in principle (cf. Mokyr 2016, 339-41).

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