Charting the "Rise of the West"

Manuscripts and Printed Books in Europe, A long-term perspective from the sixth through eighteenth centuries

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We wish to thank Bas van Bavel, Tine de Moor, the participants in seminars at the Economics Department of Groningen University and the Economic History Group at LSE, and two anonymous referees for their comments on earlier drafts of this paper, as well as Peter Koudijs and Maarten Bosker for their help with the econometrics

Charting the “Rise of the West”: Manuscripts and Printed Books in Europe, A long-term perspective from the sixth to the eighteenth centuries

This paper presents estimates of the development of manuscripts and printed books in Western Europe in the course of thirteen centuries. These estimates show that medieval and early modern book production was a dynamic economic sector, with an average annual growth rate of around one percent. Growth after the middle of the fifteenth century was probably a result of the decline in book prices and the growth of literacy. To explain the more complex dynamics of medieval book production we provide estimates of urbanization ratios and numbers for universities and monasteries. Monasteries seem to have been most important in the early period, while universities and laypeople dominated the later medieval demand for books.

1. Introduction: why study book production

The quantitative reconstruction of book production can help shed new light on the long-term development of the European economy in the centuries before the Industrial Revolution. It can be argued that books were very strategic commodities. They were a crucial part of the information infrastructure of the societies under study, in a way, they were the "hardware" in which all ideas were stored. The production and accumulation of books can therefore be used as a proxy for the production and accumulation of ideas – an important variable in endogenous growth theory.[1] Also, the demand for books will to a large extent be determined by the level of literacy in a given society, although other variables such as income per capita and the relative price of books also played a role (as well as cultural influences such as religion). In short, the production of books is linked to a number of variables used in new growth theory, such as human capital and knowledge production.

Second, books and manuscripts are luxury products whose demand increases with income. Economic prosperity will therefore generally lead to the flowering of this industry; depression (and warfare, invasions, and civil unrest) will result in declining demand and production. Of course, this relationship is more complex, and we will show that cultural and political variables also influence the level of book production, without fundamentally changing the correlation between income and book production.[2] Finally, we deal with real artifacts from the period itself, many of which have been preserved in libraries and private collections, and which therefore can be counted and analyzed. There exists a large literature about the production of books in this period, which helps to date and catalogue them; for manuscripts and printed books, information about where

[1] Kremer, "Population Growth and Technological Change: One Million B.C. to 1990."
[2] On the basis of recent (ca. 1995) data, it is possible to establish that the correlation between book production and GDP per capita is very strong, r being .90 or higher; data on the production of book titles from http://www.ipa-uie.org/statistics/annual_book_prod.html; GDP per capita from Maddison, *The World Economy*.

and when they were transcribed or published is often available, making it possible to create datasets containing this information. As will be explained shortly, these datasets form the basis of estimates of the total number of manuscripts and printed books produced in the period from 500 to 1800.

These arguments suggest that the number of manuscripts and printed books produced in a given society are complex measures of economic performance and societal capabilities, and are therefore a valuable guide to the study of long-term economic change. This was probably already true for the Carolingian period, as is, for example, argued by Rosamond McKitterick:[3]

> Such an investment in wealth cannot be ignored. Book ownership as much as land ownership was a mark of social status and means. As part of the trade in luxury items (which many would have regarded as necessities), the book trade deserves to be recognized as a crucial indication of what men and women were prepared to spend their money on. Furthermore, the books surviving from the Carolingian period are a clear and rarely fully appreciated index of Carolingian prosperity. No historian can afford to ignore the evidence of the book produced and owned when assessing the level and the range of economic activity under the Carolingian rulers. It was an economy in which the cultivation of literacy and learning played a fundamental part.

If this is true for this early period, which, as we will show, had a relatively low level of "investment" in books, it must be equally true for later periods, when an increased portion of income was spend on this luxury product. Therefore, a

[3] McKitterick, *The Carolingians and the Written Word*, p. 163.

quantification of book production makes it possible to address some of the larger debates in the economic history of Europe. These relate to the timing of growth: when, for example, was the European economy at its lowest point after the collapse of the Roman Empire? Was it during the sixth and seventh centuries, or did recovery only start in the tenth century? How dynamic was this industry (and the economy at large) during the High Middle Ages, and how did book production react to the famous "crisis" of the late medieval period? Or was the period after the Black Death, by contrast, a period of economic prosperity? What effects did the invention of the printing press have on book production?

Equally important are issues related to the pattern of the European economy in different countries: when did the change in trade occur from the Mediterranean to the North Sea routes? Was it a single shift, or can we discern a number of shifts in economic gravity in the Latin West? When do the Scandinavian countries appear on the scene – and how does central Europe (Poland, for example) enter in this context? An important question in this respect concerns patterns of convergence and divergence that can be discerned in European history: in which periods were there differences in levels of book production in the various countries that reflect income and point to growing economic homogeneity, and when did the gaps between the core regions of development and the "periphery" increase?

Further, there is a series of questions related to the reasons why book production increased so dramatically over the very long term. How did income growth and urbanization affect this growth? Was there a link to the rise of universities (during the Middle Ages) and the growth of Protestantism (from the sixteenth century on)? How to explain the fact that we find continuous strong growth of book production and consumption (per capita), whereas other indicators of human welfare do not show long-

term progress (as the evidence collected by Nikola Koepke and Joerg Baten on the heights of Europeans suggest[4])? Studying book production does not provide any final answers to these questions, of course, but the estimates presented here do shed a new light on these issues.

We will first present the datasets and estimates that form the basis for our series of book production (Section 2) and then turn to a chronological and area analysis of the patterns found (Section 3), answering the questions about when and where. Next, we try to analyze the determinants of the growth in book production during the Middle Ages (Section 4) and the early modern period (in Section 5). Finally, we turn to the world outside the West, and discuss the "uniqueness" of the level of book production established for Europe in the centuries before the Industrial Revolution (Section 6).

2. Datasets and estimates

The aim of this section is to present our estimates of the output of manuscripts and printed books from 500 to 1800. The dataset consists of two parts: estimates of manuscripts written per century from 500 to 1500, and of books printed from 1454 to 1800. The unit of analysis of the first part is the individual manuscript, the unit of analysis of the second part is the (new) title or edition; we made additional estimates of average print runs from 1454 to 1800, resulting in estimates of total book production for that period as well. The region studied is Western Europe; we use the current boundaries for the following countries: British Isles (for printed books a distinction is made between Ireland and Great Britain), the Netherlands, Belgium, Germany,

[4] Koepke and Baten., "The biological standard of living during the last two millennia."

Switzerland, Italy, France, the Iberian Peninsula (for printed books only Spain), Austria, Bohemia (Czech Republic), and Central Europe (CentrE, comprising Hungary, Slovakia, Poland, and the Scandinavian countries). For printed books Poland, Sweden, and (very tentatively) Russia have been analyzed separately, but the Russian figures are not included in the estimates for Western Europe.

In separate appendices we present the method for estimating the output of manuscripts and printed books in greater detail.[5] Appendix I presents details of the estimates for the production of manuscripts from the sixth to the fifteenth centuries. First, on the basis of literature references, we constructed a database of 17,352 manuscripts written in eleven regions of Western Europe from 501 to 1500. The representativeness of the database was tested by comparing its results with detailed studies of, among other things, Latin Gospel Books from the fifth to eighth centuries, ninth-century monastic catalogues, Latin bestiaries from the eleventh to fifteenth centuries, and the entire European corpus of *manuscrits datés* (*CMD*).

Then we performed a number of mathematical operations to correct for the inevitable geographical and selection biases in the data, and estimated the more absolute numbers of surviving manuscripts by comparing the relative results of the database with the number of absolute pegs describing numbers of surviving manuscripts. For the period prior to the ninth century, there is a collection of (fragments) of manuscripts, which is covered extensively by Lowe in his series *Codices Latini Antiquiores*, leading to the absolute numbers of surviving manuscripts for this period. For the ninth century the estimate of the numbers of surviving manuscripts is mainly based on work done by Bernard Bischoff. The third peg may be found in the remaining Latin bestiaries from

[5] The appendices are available on the "global historical bibliometrics" Website at http://www.iisg.nl/bibliometrics/.

England, mainly from the thirteenth century, on which Ron Baxter reports.[6] After adjustment, the more absolute information was combined with the distribution over time of surviving manuscripts and printed books from medieval libraries of Great Britain presented by Neil Ker.[7]

The above steps resulted in estimates of the number of surviving manuscripts per century and area. These absolute numbers of surviving manuscripts have to be corrected for the losses that occurred in the period between the original copying of the manuscript and the present in order to get the numbers produced in medieval times. The data presented by Ker is also pivotal for the quantification of the losses of medieval manuscripts.[8] Ker's data allow us to calculate the loss rates in percent per century of medieval books from libraries in Great Britain for the twelfth to sixteenth centuries, which leads to an estimate of medieval production of manuscript books.

The estimates of the output of printed books are based on the number of titles or editions that appeared in Western Europe from 1454 to 1800, multiplied by estimates of the average size of print runs. The definition of title and edition (and re-edition) are derived from the OECD, which collects this kind of data for the present.[9] A title is "a printed publication which forms a separate whole, whether issued in one or several volumes. Different language versions of the same title published in a particular country should be considered as individual titles"; this includes first editions and re-editions, the latter being a "publication distinguished from previous editions by changes made in the

[6] Baxter, *Bestiaries and their Uses in the Middle Ages*.
[7] Ker, *Medieval Libraries of Great Britain, A list of surviving books*.
[8] Ibid.
[9] OECD definitions: the OECD collects information on: Number of titles of non-periodic printed publications (books and pamphlets) published in a particular country and made available to the public. Unless otherwise stated, statistics on titles refer to both first editions and re-editions of books and pamphlets; Title: Term used to designate a printed publication which forms a separate whole, whether issued in one or several volumes. Different language versions of the same title published in a particular country should be considered as individual titles; First edition: First publication of an original or translated manuscript. Re-edition: Publication distinguished from previous editions by changes made in the contents (revised edition) or layout (new edition) and which requires a new ISBN; see http://www.uis.unesco.org/ev.php?ID=5058_201&ID2=DO_TOPIC

contents (revised edition) or layout (new edition) and which requires a new ISBN." Titles may be books (which have by definition more than 49 pages) or pamphlets (for example, smaller publications). The first printing of Gutenberg's Bible is one title, new editions of the Bible will again be counted, but a reprint of exactly the same manuscript would not be included.

The most important sources for counting new titles are meta-catalogues (or short title catalogues) that are based on the books in library catalogues and present inventories of editions published in different countries and/or languages. Such meta-catalogues are available for incunabula (all books printed in Western Europe before 1500), for books printed in the Netherlands and Belgium, for books in English (covering not only Great Britain but also Ireland, the United States, Canada, etc.), and – but this catalogue is sometimes incomplete – for books published in Western Europe from 1454 to 1830 (the so-called *Hand-Press Book File*). For a few countries – in particular Sweden and Switzerland – the latter catalogue appears to be complete. For other countries the degree to which this source underestimates new titles can be estimated by comparing it with the much more complete *Incunabula Short Title Catalogue*. For the period 1454-1500, this results in an estimate of the extent to which the former dataset underestimates book production, a ratio that varies from 27.5 percent (France) to 48.4 percent (Italy). To estimate total book output per country, the number of books according to the *Hand-Press Book File* has been corrected by this ratio, which gives a systematic series of book production from 1455 to 1800. The problem with this procedure is that it assumes that the extent of underestimation of the *Hand Press Book File* is constant over time, which may not be the case (for example, there appears to be a discontinuity in the number of Spanish titles included in the file, as the number suddenly drops from 742 in 1700 to 175 in 1701 and 133 in 1702). So we checked the results of this procedure on a country-

by-country basis, using the available literature on book production in those countries (see Appendix II for the details).

The same method for estimating new titles can be applied to Germany and Poland (and Russia), but the resulting estimates are much lower than the number of new titles mentioned in the catalogues of the Leipzig and Frankfurt *Buchmesse* from the same years (a series that begins in 1565); so the *Hand Press Book File* and the additional corrections made seriously underestimate the output of new titles in these cases. For these countries we have therefore relied on the figures from the book fairs, although these are also low estimates (not all books were presented there).[10]

For a number of reasons our figures should be interpreted as low estimates: we do not correct where all trace of a book has been lost, nor for the fact that at the book fairs only part of the production was presented. Serial publications are not included either. The estimates of print runs are also conservative: we follow the literature, which suggests that average sizes of editions from the 1450s to 1500 probably increased from 100 to 700; there is ample evidence that this increase continued after 1500, but at a slower pace. We tentatively estimate that it went up to 1,000 in 1800; again, this is a conservative estimate; Michael Harris,[11] for example, assumed that this level had already been reached during the sixteenth century, but that is probably an overestimate.[12] For relatively small markets such as those of Poland and Russia, these estimates of print runs are rather high, but this somewhat compensates for the fact that the figures of new titles for these countries are probably too low.

[10] Finally, for six countries – Norway, Denmark, Portugal, Hungary, Austria, and the Czech Republic, we were unable to estimate book production directly, as the numbers in the *Hand Press Book File* and the catalogues of the book fairs were very small; to get total estimates for Western Europe that are comparable with those for manuscript production before 1500, we estimated, on the basis of the share of these six countries in the *Hand Press Book File*, the total volume of the printing industry – but this share was extremely small (it increased from 0.18% in 1454-1500 to 1.54% during the eighteenth century).
[11] Harris, *History of Libraries in the Western World.*
[12] For a discussion of print runs, see Febvre et al., *The Coming of the Book*, p. 216-22; St Clair, *The Reading Nation in the Romantic Period*, p. 458 ff. p. 466; Harris, *History of Libraries in the Western World*, p. 121.

One way to test the accuracy of our results is to look at what they tell us about the production of manuscripts and printed books in the second half of the fifteenth century, when both techniques coexisted. As can be seen from a comparison of tables 1 and 2, there is also a strong correlation between the structure of manuscript production during the fifteenth century and the output of incunabula from 1454-1500.[13] Margins of error for our estimates are relatively large, especially for the earlier periods. The incunabula of the second half of the fifteenth century are perhaps the most intensely studied kind of books, and the data for these are particularly good. This period can therefore be seen as an anchor for the two sets of estimates of printed books and manuscripts. However, because the total numbers of manuscripts in the millennium from 500 to 1800 increase nearly 50,000-fold, there may still be considerable errors in our estimates, up to a factor of two or three in the early centuries, which are dwarfed by the overall developments, but valid comparisons can be made even with our uncertain early production estimates.

3. Long-term patterns

European book production increased enormously in the period under study, from somewhat more than 12,000 manuscripts per century (or 120 per year) from 500 to 700, to more than one billion books published during the eighteenth century (the peak year is 1790, when more than 20 million copies were printed). Because such a long period is covered here, the average rate of growth does not seem excessive: slightly more than 1 percent per year for Western Europe as a whole. Tables 1 and 2 also show the ups and

[13] For 18 libraries we can also establish the ratio between the total numbers of manuscripts (calculated from the manuscript database) and the number of incunabula there, which is 4.95. The total number of surviving manuscripts has been estimated at 2.9 million, thereby implying an estimate of 590,000 incunabula that currently still exist globally. Neddermeyer, *Von der Handschrift zum gedruckten Buch* , p. 77, estimates the average survival of incunabula to be 4.2%, which leads to an average estimated production of 13.9 million incunabula. This estimate accords well with the estimates acquired from counting the editions, multiplied by the average print runs, which is 12.6 million for the same period. Thus, for the incunabula both approaches yield very similar results.

downs of book production. First there is a decline from the sixth and seventh centuries; the latter is the lowest point in the series, consistent with recent interpretations of the long-term development of the West European economy following the disintegration of the (west) Roman Empire (see Michael McCormick and A. Verhulst for recent overviews of the debate[14]). This is followed by the Carolingian Renaissance of the eighth and ninth centuries, which is one of the periods with the most rapid growth of book production, albeit starting from a very low level (see Rosamond McKitterick 1989 for the flowering of book production in this period[15]). Then follows another dip in the tenth century, most apparent in France and Austria, presumably as a result of the disintegration of the Carolingian Empire and invasions from the north and east (by Vikings and Magyars).[16] The eleventh century shows a recovery (to the level of the ninth century), which is sustained and extends to the strong expansion of the medieval economy in the next 250 years, especially impressive are the leaps from the eleventh to thirteenth centuries.

The Black Death of 1348 and the resulting decline in population levels had a complex effect on book production. In the short term, output probably declined significantly, as is shown in figure 1, which contains more detailed (decade by decade) estimates of dated manuscripts from German-speaking countries from 1300 to 1500 (derived from Uwe Neddermeyer[17]). The rapid growth that occurred in the first half of

[14] McCormick, *Origins of the European Economy*; Verhulst, "The origins of Towns," and "The Carolingian Economy."
[15] McKitterick, *The Carolingians.*
[16] This is suggested by the fact that production decline was most dramatic in France, where during the tenth century a power vacuum emerged as a result of the disintegration of the Empire; this led to the Peace of God movement trying to restore law and order there; see, for example, Cowdrey, "The Peace and the Truce of God in the eleventh century"; other parts of Western Europe were less affected, as is clear from the relative favorable performance of Germany, where the Holy Roman Empire witnessed an 'Ottonian Renaissance' in the late tenth century, and by the continued growth of book production in England and Ireland, where both political developments (a certain centralization of power) and the flowering of monastic life led to a further increase of book production.
[17] Neddermeyer, "Möglichkeiten und Grenzen einer Quantitativen Bestimmung der Buchproduktion im Spätmittelalter."

the fourteenth century suddenly stopped, and the creation of new manuscripts from 1340/49 to 1360/69 declined by some 50 percent (but population also fell probably by about a third in the same period). However, after this temporary decline, production rebounded significantly, and an even sharper increase in output began, resulting in an almost tenfold increase in the next hundred years (average rate of growth was 2.2 percent over the 1360/69-1460/69 period, whereas it had been 1.8 percent during the first half of the fourteenth century).[18] The strong decline in manuscript production after 1470 (shown in figure 1) is an effect of the invention of printing (and can be found everywhere in Europe). But it is clear that production of textual output per capita continued to grow during the century and a half following the Black Death, a period sometimes referred to as the "crisis of the late medieval period"[19]; it probably accelerated after 1370, and again after 1470 as a result of the invention of the printing press. The number of incunabula (printed books produced during the second half of the fifteenth century) was already 150 percent higher than manuscript production during the entire fifteenth century, which was in turn almost twice the manuscript production of the fourteenth century (see table 2).

The acceleration in the growth of books that occurred after 1454 continued until the end of the sixteenth century; in 1550, for example, our annual estimates show that the total output of the Western European printing industry was more than 3 million books, or more than the total production of manuscripts during the fourteenth century. During the rest of the early modern period growth continued, but at a slightly slower pace (somewhat under 1 percent per year).

[18] See also Bozzolo et al., "La production du Livre en quelques pays d'Europe occidentale aux XIVe et XVe siècles," 1984, who present similar time series of manuscript production in Italy, Germany, and France, showing a strong increase in output during the second half of the fourteenth and fifteenth centuries.

[19] Epstein, "Cities, Regions and the Late Medieval Crisis", and Hatcher and Bailey, " Modelling the Middle Ages" for different approaches to this "crisis".

We will now take a closer look at the patterns that can be observed in the different countries. Two indices are used to study this: the regions that produce the bulk of book output (which is dominated by the big countries), and those with the highest output per capita (here the small countries shine) (see tables 3 and 4).[20] One of the problems with this approach is the unequal size of the countries; if we had more detailed data on, for example, northern Italy or the north of France (including Paris), these regions would do much better in the second measure.

During the first two centuries (sixth and seventh), levels of book production largely reflect the extent to which the information infrastructure of the Ancient economy had remained intact during the mass migrations that followed the disintegration of the Roman Empire. Italy in the sixth century was (still) the most important center of book production, both in absolute terms (it produced about two-thirds of total output) and output per capita. This was arguably the last flowering of the Roman Empire, or in fact the Ostrogothic "client" state of Byzantium headed by Theodoric in the north, with Ravenna as its capital city.[21] During the seventh century book production in Italy went down substantially, a decline that was only partially compensated by growth elsewhere, in particular in France, Spain, and on the British Isles. In per capita terms Ireland probably became the leading producer in the eighth and ninth centuries, since it produced, according to our database, 36 percent (seventh century) to 28 percent (ninth century) of the total manuscripts of this area, whereas it had a population of perhaps no more than 20 percent of that of the British Isles as a whole.

[20] Population figures from McEvedy et al., *Atlas of World Population*..
[21] Bertelli, "The production and distribution of books in late Antiquity", p. 55, demonstrates that "No other western centre witnessed such an intense activity of book production and in the book market as Ravenna at the time of the Ostrogothic kings."

The new structure of book production that emerged during the Carolingian period consisted of the core region of the empire of Charlemagne – northern France, Belgium, and western Germany – producing the bulk of the manuscripts, with additional important production taking place in Switzerland, Austria, and Spain. The latter country was temporarily the European "leader" in the tenth century, reflecting the flowering of the (Islamic part of the) Spanish economy in this period.[22] Again, in the twelfth and thirteenth centuries, France and Germany were the most important production centers, and neighboring Belgium had the highest output per capita. So the period from 800 to 1300 – with the exception of the crisis of the tenth century – shows a remarkable degree of continuity in which the core area of the (former) Carolingian Empire dominated the industry.

During the Renaissance Italy emerged (again) as the most important center of book production, whereas production in Germany and France stagnated in the fourteenth century, and even declined in the British Isles and Belgium, although the latter country remained the leader in per capita production. The same pattern is clear from the production of incunabula (from 1454 to 1500): in spite of the fact that Gutenberg made his innovations in southern Germany, Italy (Venice in particular) soon became the most important producer. Italy was also the only large country that, from 1454 to 1500, could compete with small countries such as Switzerland and the Netherlands in per capita production. Thus, the growth spurt of (northern) Italy leads to a new pattern in which the core area of Carolingian Europe (Belgium, the western and southern parts of Germany, and eastern and northern France) was linked to northern Italy. We witness the emergence of the urban belt of Western Europe, stretching from

[22] Glick, *Islamic and Christian Spain in the Early Middle Ages*.

northern Italy, via southern Germany to the Low Countries as the new core area of Western Europe.[23]

During the sixteenth century Switzerland has the highest per capita output of books, which is largely due to the flowering of reformation printing in cities such as Basel and Geneva.[24] During the seventeenth century the northern Netherlands first emerges as a new center within this urban belt. Later on this belt was extended to include England, which became the most important producing area from 1650 to 1750 (although the difference in production from France and Germany was not very large). In the second half of the eighteenth century, France regained this position (perhaps as a reflection of the Enlightenment). Per capita, the Dutch had no rivals during the period from 1600 to 1800; Britain was often a close second, but in the second half of the eighteenth century it was overtaken in this respect by a "newcomer," Sweden, where the policy of increasing the literacy of the population led to a growing demand for books and an "explosion" in the printing industry.

To round off this brief presentation of long-term trends, we add a few words about two regions that failed to continue their once strong performance: Ireland and Spain. The definite Irish lead during the seventh and eighth centuries and the almost complete "disappearance" of this island from the book-making scene in the next millennium are some of the most striking developments shown by our data. During the early medieval period, Irish monasteries were focal points in the religious infrastructure of Western Europe and storehouses of knowledge and literacy. But, for reasons not fully understood, it does not seem to have participated in the great expansionary boom that characterized the economies and societies of Western Europe from 1000 to 1300, and its

[23] De Vries, *European Urbanization 1500-1800*.
[24] Gilmont, *The Reformation and the Book*.

relative contribution to European book production clearly declined in the centuries after 1000 (it was a latecomer in the production of printed books, compare table 2).[25]

The relative decline of Spain was almost equally dramatic; its share in European production declined from roughly a third in the tenth century to 2 to 2.5 percent from 1600 to 1800. Spain did participate in the boom from 1000 to 1300 and maintained a level of book production not far below the Western European average. Relative decline set in during the fifteenth and sixteenth centuries, when per capita book production declined to less than a quarter the European average, after which it more or less stabilized at this level. Thus, the relative decline of Spain coincided with the period that is often seen as the "Golden Age" of Spanish economy and society.

Against these two examples of decline, there are comparable examples of progress: in per capita production, Switzerland, the Netherlands (very marginal before the fourteenth century), Great Britain, and, perhaps most surprisingly, Sweden (again very marginal until the seventeenth century) become important centers of book production; it is probably not a coincidence that these were also the countries where the Protestant reformation of the sixteenth century was most successful (see Section 5).

These comparisons also show that the shift in the cultural and economic center of gravity from south to north was not really a single process. Instead, there were several complex, shifts during this thirteen-century period . The most decisive perhaps was the shift from Italy, the political and commercial core area before and during the sixth century, to the Carolingian core area of northern France, southern Germany, and Belgium, which already occurred from 700 to 800. This new core succeeded in generally maintaining its position from 800 to 1300, although Ireland, Britain, and Spain were also important centers during part of this period. During the Renaissance the

[25] Compare Crónín, *Early Medieval Ireland*, pp 196-232, for the flowering and (relative) decline of Irish culture; the chapter on the tenth century and after is appropriately titled "the waning star" (p. 229).

center of gravity returned to the south, and northern Italy became relatively important again. The final shift to the north occurred only after 1600, when Italy lost its leading position in the book industry to the Netherlands, France, and England. The strong performance of Sweden in the eighteenth century further added to this shift in the center of gravity of the European economy.

Finally, looking at patterns of convergence and divergence reflected in the coefficients of variation in tables 3 and 4, two long-term processes can be discerned. From 600 to 900 there is a distinct reduction in inequality among the various countries, partly due to the emergence of new centers of book production in formerly peripheral parts of Western Europe such as the British Isles, Germany, Switzerland, and Austria, which were followed in the next wave of Christianization by the central and north European countries. In tables 3 and 4 we see that the zeros have disappeared, and book production spreads from the south to the most distant corners of the Latin West. It reflects the process of "Europeanization" that occurred during the Middle Ages, as a result of which Western Europe acquired a certain homogeneity in cultural attitudes, institutions, and (apparently) levels of economic development, although important differences continued to exist.[26]

The early modern period saw, by contrast, an increase in inequality among the various countries, although differences within Europe remained rather limited (including Russia in the calculations would, of course, significantly affect the coefficient). This was caused by the gradual divergence of the northwestern part of Europe, in particular the Netherlands and Great Britain. These trends can also be found in estimates of real wages,[27] and of GDP per capita.[28]

[26] The best survey is Bartlett, *The Making of Europe.*.
[27] Allen,"The great divergence."
[28] Van Zanden, "Early modern economic growth."

4. Convergence in levels of book production, 500-1500

One way to look at the spectacular growth of book production in the centuries before 1500 is to think of the book as a new innovation that matured in the centuries from 300 to 800. From the second to fourth centuries the codex, the bound book, was "invented" and gradually replaced the "unwieldy scroll."[29] Around 600 Irish monks developed a system of writing that separated individual words, which greatly facilitated reading. Finally, around 800, modern punctuation, uniform script, and division into paragraphs were introduced, all also greatly helping the reader to understand the text quickly.[30] In sum, a new information technology was created, which, as Ulrich Blum and Leonard Dudley argued, helped launch the European economy in the period that followed. The growth of book production shown in tables 1 and 3 is generally consistent with such a view: initially growth rates are spectacular, especially during the eighth and ninth centuries, a growth that is accompanied by the spread of book production from a small core region in Italy to Western Europe as a whole. Moreover, thanks to additional innovations in the High Middle Ages (in particular, substituting paper for parchment, but also the spread of more efficient ways of hand copying manuscripts, such as the pecia system[31]) and during the fifteenth century (the printing press), the price of books was greatly reduced, providing additional impulse to the growth process. What is striking in figure 2, which shows the long-term trends in per capita book production in three different regions and in Western Europe as a whole, is how synchronized the long-term changes in these different parts were, at least from the seventh century on. The

[29] Brown, *The Rise of Western Christendom,* p. 23.
[30] See Blum and Dudley, "Standardised Latin and medieval economic growth," who argued that these innovations – and in their view in particular the standardization of Latin in 800 – launched not only the book but a new, uniform, and more efficient form of writing, helping to promote European economy in the centuries after ca. 950.
[31] Rouse and Rouse, *Manuscripts and their makers*.

spectacular growth of book production occurred in all regions (with only one or two exceptions, such as Ireland after 1000) at approximately the same pace, testifying to the unity of the Western European experience.

The story is more complex, however. Supply and demand changed fundamentally in the millennium from 500 to 1500. During a large part of the Middle Ages, a close link existed between the monastic movement and book production: monasteries were not only the most important sources of supply, but also for the demand for books. Performing their religious duties and studying the word of God were the core business of these "powerhouses of prayer." Because, from early Christian times, even minor deviations from official formulae were believed to render a religious service ineffective, (written instructions on) the correct wording were essential, and hence the permanent monastic and ecclesiastical emphasis on written texts. In the Early Middle Ages, when markets were scarce, books had to be made in-house from the monastic surplus of agricultural products. These links are illustrated by Michael Gorman, whose writing on the production of manuscripts in Monte Amiata, one of the most important monasteries in eleventh-century Tuscany, Italy, describes the close interconnection between the financial position of a monastery and its library:

> It is worthwhile to highlight the abbey's economic history because manuscript production coincides with favorable economic factors. An active scriptorium depends upon a great library, full of exemplars, and both require significant financial resources. Many peasants must work hard to raise the sheep, make the parchment and produce the wealth to be consumed by the monks toiling away in the abbey's library and scriptorium.[32]

[32] Gorman, "Manuscript Books at Monte Amiata in the Eleventh Century," pp 229.

We may therefore hypothesize that during the Early Middle Ages book production was to a large extent driven by the number and size of monasteries, which was in turn determined by the share of the agricultural surplus that regions and countries directed to this part of the economy.

To test this hypothesis, we derived estimates of the numbers of monasteries in the different regions and centuries from several sources (table 5), which can be plotted against book production in the same time and place (see figure 3).[33] The correlation between the two variables is fairly consistent, stressing the important role monasteries played in this period.

The development of monasteries in the Middle Ages shows a pattern of continuous growth during the first half of the period, when more than a thousand were added to the stock each century, followed by a boom in the tenth to twelfth centuries. The boom is partially explained by the reform movement begun by Cluny in the early tenth century, which gradually spread to other parts of the Latin West. Apparently, these reforms enhanced trust in monasteries and the services they supplied (such as prayers for the souls of the deceased), resulting in increased investment in this form of religious overhead. Additionally, after the collapse of the Carolingian Empire, parts of Western Europe went through a political crisis characterized by a collapse of states and the absence of law and order; to some extent the Church and its institutions (such as the monasteries) became an alternative center of power, which tried to pacify the countryside.[34] This may also have enhanced the status of monasteries and drawn funds to their activities. Moreover, changes in the countryside that increased the powers of

[33] Zero values for either the number of monasteries or book production have not been included in figure 2.
[34] Van Zanden, "Economic growth in a period of political fragmentation 950-1300," for a number of hypotheses about these links between the religious revival of the tenth to twelfth centuries and institutional and economic change.

local lords (such as monasteries) vis-à-vis the rural population and made possible an increase in their share of the agricultural surplus may also have played a role. The tenth and eleventh centuries witnessed the rise of the "seigneurie," local lords who were increasingly able to control the countryside around their castle, and used their power to impose new taxes and duties or to reimpose old ones.[35] The combination of these changes caused a dramatic growth in the monastic movement from 900 to 1300, which greatly increased the production of books. After about 1300 this rapid growth came to a halt, and from 1300 to 1500 the number of monasteries in the Latin West stabilized at some 21,000.[36]

The literature suggests that during the height of the Middle Ages other sources of demand – the cities, universities, and more generally, the growth of literacy among the lay population – were becoming increasingly important .[37] To test the ideas that book production before the eleventh to twelfth centuries was driven by the monastic movement and that afterwards urban factors took over, we have tried to perform a regression for book production on the following variables: the number of monasteries as shown in table 5, and then we estimated urbanization ratios from Paul Bairoch (table 6).[38] We are aware that these estimates are not as definitive as they might be, especially for Spain. We estimated two sets of urbanization: for the Christian part of Spain and for the country as a whole. Our dataset does not really cover manuscript production in the Muslim part of the country, which was more urbanized and developed; for that reason we also included a dummy variable for Spain in the regressions, which also helps to

[35] Fossier, "Rural Economy," pp. 50-53; see also the discussion on the feudal revolution in this period: Bisson, "The Feudal Revolution"; Wickham, "Debate. The 'Feudal Revolution.'"
[36] Only the Netherlands was an exception to this trend, as its numbers continue to grow (the rapid expansion of relatively small and mainly urban monasteries during the fifteenth century is probably related to the Modern Devotion of that period, which was concentrated in the northern Netherlands).
[37] Rouse and Rouse, *Manuscripts and their makers*
[38] Bairoch et al., *La population des villes Européennes de 800 á 1850*, estimates show many gaps, which were intrapolated by us; when no estimates were available at all, we assumed that the city was below the 10,000 inhabitant threshold; all estimates for the period before 1000 are extremely tentative.

neutralize possible biases in the estimates of urbanization ratio. Finally, the number of universities could easily be established (table 7).

One of the problems with these regressions is that some observations are zero, making it difficult to use logs. On the other hand, the growth of book production is so spectacular that it would normally be preferable to specify the model in log terms so that observations about the later period do not dominate the regressions. Three different sets of regressions were carried out: panel data regressions using only the non-zero observations, and two procedures that make it possible to integrate the zeros. These were Tobit regressions and a Heckman two-step procedure using time dummies as extra determinants in the first stage. Moreover, two different versions of the hypothesis were tested: the first model estimated all coefficients for the period 500-1500 as a whole, the second tested for changes in the coefficients of monasteries and the urbanization ratio before and after 1000 (table 8).[39] Alternative regressions using time dummies (fixed effects) not shown here, provide almost identical results.[40]

Table 8 shows the results of these regressions, which explain the log of per capita book production in country x in period y by the log of the number of monasteries (per capita), the number of universities (again per capita), the urbanization ratio calculated from Bairoch,[41] and the dummy for Spain. If we take the Middle Ages as a whole, the three factors we have data for – universities, monasteries, and urbanization – together explain almost 60 percent of the variation in per capita book production (first two columns). All coefficients show the expected signs, and do not change significantly among the various tests (most striking in this respect is the increase of the coefficient for monasteries when applying the Tobit estimation procedure). Dividing the period in

[39] Because there were no universities before 1000, the coefficient of that variable could not be tested for the first period.
[40] The most significant change is that including time dummies leads to a decline in the coefficient of universities, which tends to pick up some of the time trend.
[41] Bairoch et al., *La population des villes Européennes de 800 á 1850.*

two shows the changes in the determinants for book production: the link to monasteries is very strong in the first half of the period but much less so during the Late Middle Ages. In both periods the coefficient of the urbanization index is positive; it is somewhat surprising that this coefficient is larger for the early period than for the second half of the Middle Ages (but levels of urbanization are much lower in the first half of the period). The regressions confirm the hypotheses found in the literature about the importance of monasteries during the early Middle Ages and of universities and cities from 1000 to 1500, but they also show that even before 1000 urbanization mattered for book production.

5. Book production and income growth: from 1450 to 1800

How to explain the significant increase in book production and consumption in the centuries following the invention of moveable type printing in the 1450s? The effect of the new technology (and important technological changes in the production of paper) was that from the 1470s on book prices declined very rapidly. This had a number of effects: consumption per literate individual increased, but it also became more desirable and less costly to become literate. Moreover, economies of scale in the printing industry and increased demand led to a reduction in prices over the long term, thus further contributing to the cumulative growth of book production. Given these interactions between supply and demand, it is difficult to separate the different factors involved.

One way to partially circumvent the problem is by first focusing on the growth of literacy. For a few countries the literature shows estimates on the long-term evolution of the portion of the population able to read and/or write. On this basis Bob Allen made a number of informed guesses about the evolution of literacy in the period between 1500

and 1800, which can be checked against the estimates of book production and consumption produced here.[42] Our estimates of book consumption per capita were transformed into estimates of literacy via: 1) estimates of the development of relative book prices (taken from Jan Luiten van Zanden and Gregory Clark[43]) and 2) an estimate of the elasticity of demand for books taken from contemporary literature (of 1.4).[44] The long-term trends also identified by Allen – a rise of literacy from about 10 percent in 1500 to one-third three centuries later – is well reflected in these estimates, and the differences among countries at about 1500 are generally consistent with the Allen figures. The comparison suggests that Allen may have overestimated literacy in Spain and Poland, and probably underestimated it in the Low Countries and Italy.[45] Other long-term trends known from the literature, such as the significant rise of literacy in Great Britain during the sixteenth and seventeenth centuries, followed by stagnation during the eighteenth century, are also clearly reflected in the estimates in table 9.[46] The overall pattern shows a strong increase in the North Sea area (including Sweden), stagnation on the southern periphery (Spain), and slow increases in Italy and Poland.[47] The conclusion that can be derived from this is that the 30-fold increase in European per

[42] Allen, "Progress and Poverty in Early Modern Europe."
[43] Van Zanden, "Common workmen, philosophers and the birth of the European knowledge economy," and Clark, "Lifestyles of the Rich and Famous: Living Costs of the Rich versus the Poor in England, 1209-1869."
[44] We applied a demand function $b/p = \alpha * \beta * p^{-1,4}$, where b/p is book consumption per capita (from table 4), α is a constant derived for the Netherlands in the eighteenth century (where we have independent estimates of the level of literacy), β is the estimated rate of literacy, and p is the real price of books from Van Zanden, "Common workmen," and Clark, "Lifestyles"; the elasticity of demand is from Ringstad, "The demand for books," which has a discussion of the different estimates for the price elasticity of demand; the value of – 1.4 was suggested by a number of studies cited, and produces estimates of the development of literacy consistent with the Allen 2003 estimates of literacy.
[45] In fact, the estimates published here are probably still too low for the Low Countries; see Van Zanden, "Common workmen."
[46] Stephens, "Literacy in England, Scotland, and Wales, 1500-1900."
[47] This approach probably provides better estimates for large countries than for small ones, such as Belgium or Ireland (or the Netherlands in the sixteenth century), which were partially dependent on imports of books whose magnitude is difficult to estimate. Applying the same procedure to the period before 1450, and using the estimates of book prices that can be derived from Bozzolo et al., *Pour une histoire du livre manuscript au moyen âge*, and assuming that before 1200 real book prices remained constant, yields the following estimates of the level of literacy in Europe (per century): eleventh: 1.3%, twelfth: 3.4%, thirteenth: 5.7%; fourteenth : 6.8%, first half of the fifteenth: 8.6%.

capita production from 1450/1500 to 1700/1800 can be decomposed in two elements: a tenfold increase caused by falling book prices and a (slightly less than) threefold increase in literacy.

Falling book prices dominated the growth of book production, but the pattern of increased divergence within Western Europe cannot be explained by this. To understand these patterns, we tried to analyze what caused the increase in literacy: was it driven by urbanization and income growth, or did Protestantism, often mentioned in the literature on the subject, play a major role? Did state formation have an impact? Did decentralized states such as the Netherlands, Germany, or Italy experience a more favorable development of literacy than did centralized states that were able to suppress the free press (following J. De Long and Andrei Shleifer[48])? To test these ideas, a panel regression was carried out on the estimates of literacy in the period from 1450 to 1800. The following independent variables were used:

- income measure: GDP per capita,[49] or real wages[50]
- urbanization ratio (portion of the population living in cities with more than 10,000 inhabitants), from De Vries[51];[52]
- dummies for Protestantism (after 1550: 1 for Britain, Sweden, the Netherlands; Germany, being half Protestant and half Catholic, is given a .5)
- dummies for a centralized state/monarchy versus decentralized state or republic (taken from De Long and Shleifer[53])
- number of universities per capita (from Encyclopedia Britannica[54]) (see table 7).[55]

[48] De Long et al., "Princes and Merchants: City Growth Before the Industrial Revolution."
[49] Van Zanden, "Early modern economic growth."
[50] Allen, "The Great Divergence in European Wages and Prices."
[51] De Vries, *European Urbanization 1500-1800*.
[52] Experiments of urbanization ratios as estimated by Bairoch et al., *La population des villes Européennes de 800 á 1850*, gives similar but overall somewhat less satisfactory results.
[53] De Long et al., "Princes and Merchants: City Growth Before the Industrial Revolution."
[54] *Encyclopedia Britannica*, 1898, vol. 23, p. 858.
[55] One problem here is that the Netherlands did not have a university before 1575, and that the zero observation cannot be converted in logs; we therefore assumed that the northern Netherlands shared Leuven University with the southern part of the Low Countries and had 0.5 university before 1575.

Switzerland and Ireland are not included in the regressions because there are no estimates of real wages or of GDP per capita.

Table 10 presents the results of the explanation of the development of literacy in nine countries. The Protestantism dummy dominates the regressions – conversion to Protestantism appears to result in an increase in literacy by 16 to 24 percentage points. The effects of other variables are much more limited: GDP per capita and urbanization also show the expected signs and are often significant, but real wages do not have the hypothesized effect (the negative coefficient is probably caused by the long-term decline of real wages in large parts of Europe, whereas literacy shows a rising trend).[56] Universities and state formation do not seem to have any effect.

6. Book production outside Europe

So far we have seen that a number of processes led to a very rapid growth in book production in Western Europe: first there was the flowering of the monastic movement, second, the growth of urban demand and related institutions (such as the universities) during the twelfth to fifteenth centuries, and third, the invention of the printing press (which can be seen as a response to the growth of demand after 1350), leading to a dramatic decline in book prices that further stimulated the growth of the market. Were these changes – and the corresponding levels of book production and consumption – unique for Europe, or do we find a similar expansion of the printing industry elsewhere?[57]

During the Middle Ages the level of literacy and book production in the Middle East may easily have equaled and possibly surpassed that in Western Europe, but the region did not make the transition to mass production of books using the printing press

[56] Therefore, no further regressions with real wages are shown.
[57] We do not include the Western offshoots in Northern America in our comparison, but it is clear that book production as well as literacy and universities flourished there in the eighteenth century.

– nor did India, another highly developed and literate society. Toby Huff, in his comparative study of "the rise of early modern science," analyzed resistance to the printing press in Islamic countries, which was ultimately based on a "distrust in the common man" and "to prevent his gaining access to printed materials."[58] The sultan of the Ottoman Empire, for example, banned the possession of printed material after he discovered what the invention of the printing press meant for Western Europe.[59] The fact that the new technology could so easily be suppressed probably also suggests that the demand for books was rather limited in the Ottoman Empire.[60]

The two candidates for a level of book production similar to Western Europe are China and Japan, both of which developed a commercial printing industry during the centuries before 1800. Recently, the literature on the Chinese printing industry has been growing rapidly, which makes detailed comparisons with Western Europe possible. What emerges from this literature is that during the late Ming and the Qing, book production in China expanded rapidly; it was during the sixteenth century in particular, that printed books largely replaced manuscripts; the growth of the commercial printing industry in the Yangtze delta played an important role in this transformation.[61] The best evidence collected recently about the volume of output of the Chinese book industry is for the second half of the Ming (1522-1644), which was probably the most dynamic period. The two main centers of production, Jianyang (in Fujian) and Nanjing (in Jiangsu) produced about 1,000 and 700 editions, respectively.[62] The estimates for the other cities and provinces are much lower; according to Zhang's estimates not more than 1600 titles were published in the rest of China, of which about half was also

[58] Huff, *Rise of Early Modern Science. Islam, China and the West*, p. 232.
[59] Pedersen, *The Arabic Book*, p. 133.
[60] Already in the early sixteenth century, Italian printers tried to get access to the Ottoman market by printing specialized books for it, but these ventures were not very successful from a commercial point of view, which also points to a limited demand for (printed) books (Pedersen, *The Arabic Book*, p. 134).
[61] Chow, *Publishing, Culture, and Power in Early Modern China*, p. 22; and McDermott, "The Ascendancy of the Imprint in China."
[62] Chia, "Mashaben: Commercial Publishing in Jianyang from the Song to the Ming," p. 128.

concentrated in the Yangtze delta. Combining these figures yields a total of about 3,300 new titles, or 27 titles annually.[63] Other recent estimates by Lucille Chia for the whole of China during the 1505-1644 period indicate a level that is almost double this estimate, i.e., 47 titles annually.[64] As with our European estimates, these figures are based on books still available in libraries, and therefore underestimate real output. But even if we multiply these figures by a factor of 10, they are low compared to the estimates for Western Europe (which had a similar population size); the average annual book production in Western Europe from 1522 to 1644 can be estimated at about 3750 titles, or about 40 times higher than the highest estimates for China in the same period.

For Qing China much less recent work has been done; the only estimate available is that a total of about 126,000 new editions were published from 1644 to 1911, which means that the average annual output was 474.[65] Again, this was much lower than output in Europe (which produced close to 6000 titles in 1644 alone), even lower than the output for a small country like the Netherlands during much of the seventeenth and eighteenth centuries. This is the more striking as the printing industry in China was probably quite efficient, producing books with relatively low prices (although perhaps not as low as in Europe); it may indicate that the demand for books was much more limited than in Western Europe.[66]

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[63] During the Wanli period (1573-1610), when book production in Nanjing and Jianyang peaked, the average per year may have been double this figure, 50 to 60 per year (based on Chia, "Mashaben: Commercial Publishing in Jianyang from the Song to the Ming," p. 128); Chow, *Publishing, Culture, and Power in Early Modern China,* p. 22, gives much lower estimates: 19.1 on average per year for the 1573-1644 period.

[64] Chia, "Mashaben: Commercial Publishing in Jianyang from the Song to the Ming," gives a total of 7,325 editions for the Ming (707 before 1505, and therefore 6,618 from 1505 to 1644; the latter would imply an average of 47 per year, almost double the figure that could be derived from the estimates by Zhang); this shows how large the extent of errors are, but the gap with Europe remains formidable no matter which estimates are used.

[65] Tsien Tsuen-Hsiun, *Paper and Printing*, p. 190, note f; in view of the significant growth in book publishing in the nineteenth century (see Reed, *Gutenberg in Shanghai*), the average for the period before 1800 must have been even lower than 474.

[66] For a discussion of Chinese book prices compared to those in Western Europe, see Rawski, *Education*, p. 119; Chow, *Publishing*, p. 40ff, and Van Zanden, "Common workmen"; the different technologies used by European and Chinese printers – movable type and woodblock printing – points in the same direction:

For Japan we have only found one estimate of book production in "the three cities of Edo, Osaka, and Kyoto" of about 400 new titles between 1727-1731 and almost 600 between 1750-1754.[67] Again, these estimates are low by European standards; France, which had a slightly smaller population, produced more than 1,500 books annually from 1727 to 1731 and 2,350 per year from 1750 to 1754. Assuming that these three cities produced at least 50 percent of the total Japanese output, Japanese levels of book production were still considerably below those of France and most other European countries, but higher than in China or anywhere else in the world. Nevertheless, it is significant that the only major centers of large-scale book production outside Western Europe (and North America) were in China and Japan, a region that according to other studies was characterized by relatively high levels of human capital formation.[68]

7. Conclusion

The estimates of book production presented in this paper show a remarkable and consistent rate of growth during the long period studied here. The Middle Ages are characterized by a very significant increase in book output; rates of expansion during the Carolingian Renaissance of the eighth and ninth centuries, in the height of the Middle Ages (eleventh to thirteenth centuries), and during the "Crisis of the late Medieval period" (1350-1500) are quite high. After 1454 the invention of movable type led to a further acceleration in output growth. Whereas during the sixth and seventh

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movable type printing is characterized by large economies of scale, and is therefore efficient when the market is large; the scale economies of woodblock printing were limited, and therefore this technology suited the more limited Chinese (and Japanese) market better; this also suggests that the low number of new titles produced in China was not compensated for by larger print runs; in fact, print runs in China were probably smaller than in Western Europe.

[67] Hayami et al., "Demography and Living Standards," p. 241.

[68] A related paper, Baten and Van Zanden, "Book Production and the Onset of Modern Economic Growth," found that book consumption in the eighteenth century was a good predictor of economic performance during the nineteenth century; China was exceptional, however, as its performance was much poorer than predicted on the basis of book consumption.

centuries on average only about 120 books were produced annually in Western Europe, in the peak year of 1790 total production was more than 20 million books.

This spectacular growth was concentrated in certain regions. Initially, during the sixth century, Italy was still the dominant producer of manuscripts, but already during the Carolingian Renaissance the center of production shifted to the region of northern France, western Germany, and Belgium, which remained the core until the fourteenth century. But at times other countries – Ireland, Britain, and Spain – also substantially contributed to the flowering of medieval manuscript production. During the Renaissance of the fourteenth and fifteenth centuries, the core again shifted to the south, to northern Italy, and it was only during the seventeenth century that the "decisive" shift to the North Sea region, to the Low Countries, and England occurred (although even during the fifteenth and sixteenth centuries, the Low Countries had a very high per capita production of books and manuscripts). During the seventeenth and eighteenth centuries, the Dutch Republic dominated per capita production, Great Britain became the largest producer of books, and Sweden also emerged as a country with high levels of book production and consumption.

The production of books and manuscripts was a form of "luxury," which arose from a surplus after the first essentials of life were fulfilled; it also indicates a certain level of education existed that was necessary to write, and then to read the texts. The way this surplus was mobilized fundamentally changed in the centuries from 500 to 1800. In the earliest period Christianization was an important element in the spread and growth of manuscript production. Areas in central and Western Europe where the church was not yet present in the sixth and seventh centuries had virtually no output, as opposed to those areas where the Roman Catholic Church was established as the state religion. Missionaries and monasteries were instrumental in spreading the Christian

religion in the rest of the Latin West in this early period. During this period the monasteries dominated manuscript production in large parts of Europe – only in Spain and perhaps in Italy did urbanization play a role. In the second half of the first millennium, manuscript production was not yet a market. Carolingian production was based on the orders of ecclesiastical and worldly dignitaries and had a primarily spiritual function. Acceleration of growth after 1000 reflected the growth of the monastic movement in this period.

From the eleventh to twelfth centuries on, however, the market took over the role of the monasteries. Urban demand and the demand linked to the universities drove the continuous growth of the book industry in the late Medieval and Early Modern periods. The universities are indicators of a complex interplay of factors. On the one hand they provide an indication of literacy and schooling, and on the other hand they also show the emergence of education not directly controlled by the authorities, as universities were often relatively free from state or ecclesiastical interference. The growing literacy of the (urban) population, the long-term increase in their incomes (which accelerated after 1348), and, in particular after 1454, rapid technological change in the production of books, dominated the process in the Early Modern Period. The regional variation in these patterns seems to be linked to regional differences in income levels and the level of urbanization, but they were to a large extent also dominated by the rise of Protestantism, which appears to have had a strong positive impact on literacy.

The long-term increase in book consumption was mainly due to the very significant decline in book prices in the centuries after 1454. Already during the twelfth and thirteenth centuries, the use of paper (transferred to the Latin West from Muslim countries via Italy and Spain) led to lower production costs and increased production. In addition, scriptural developments also led to lowering the cost of manuscripts (smaller

letters, abbreviations, double columns). The universities introduced the academic *pecia* system of manuscript production, making it possible for students and scribes to copy certain manuscripts at lower cost. But the most radical change occurred during the fifteenth century, when Gutenberg's inventions revolutionized the industry. It is striking how fast the new technology spread across Europe; within one generation printing presses appeared in the most distant corners of Western Europe, and the cost of books had been cut by two-thirds or more. Demand reacted strongly – our estimates are consistent with a price elasticity of demand of 1.4 - indicating that a decline in book prices had a powerful impact on output. More subtle and indirect was the long-term change in the level of literacy of the population, which also seems to have responded to these changes. The net effect was the growth of a mass market for books, especially in Protestant countries like Switzerland, the Netherlands, Great Britain, and Sweden.

One final question is: why did book consumption increase so spectacularly despite the fact that at its height the standard of living of the majority of the population did not increase or at all?[69] During most of this period, books were luxury products consumed by the elite – the religious elite at first, but after 1100 increasingly the urban and academic elites. They were, apparently, able to mobilize a growing portion of their income to spend on these (and similar) items of luxury consumption. Urbanization probably led to a significant increase in income inequality,[70] favoring the class of merchants and professionals who became the main consumers of the product. Increased income inequality may therefore be part of the explanation. The strong decline in the price of books also played a role in explaining this paradox; in the early modern period books came within the reach of the lower middle classes (and perhaps even the poor). This development already started with the rise of "mass" literacy in the late fourteenth

[69] Koepke and Baten, "The biological standard of living during the last two millennia."
[70] Van Zanden, 'Tracing the beginning of the Kuznets curve."

and fifteenth centuries, when new religious movements (such as the Modern Devotion) began to encourage all believers to read the Bible. European citizens in 1800 may not have been better fed than in 600, but their access to books and their capabilities for reading them had definitely fundamentally changed.

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Table 1. Manuscript production in absolute numbers per century (sixth to fifteenth centuries)

	6th	*7th*	*8th*	*9th*	*10th*	*11th*	*12th*	*13th*	*14th*	*15th*
CentrE	0	0	0	0	0	3,983	27,530	120,987	301,833	376,650
Boh	0	0	0	0	0	657	1,136	5,377	42,066	45,363
Brit	81	1,026	5,474	7,926	9,793	20,360	81,044	200,654	155,513	208,729
Fran	1,682	2,441	15,920	74,190	12,752	45,061	197,831	510,828	564,624	1,195,783
Belg	0	127	1,111	3,029	1,555	8,529	43,219	119,588	106,148	572,124
Neth	0	26	60	82	58	354	1,731	2,066	13,179	171,974
Germ	0	0	7,503	59,771	45,703	49,548	166,876	270,392	293,814	515,116
Switz	0	30	594	5,330	1,799	1,090	2,355	3,821	6,349	10,652
Austr	0	0	2,735	9,414	0	2,808	37,370	37,408	39,777	88,623
Italy	10,194	4,478	6,536	20,307	15,215	38,768	95,207	253,013	879,364	1,423,668
Iberia	1,594	2,512	3,770	21,693	48,763	40,871	114,422	237,818	344,284	390,478
Western Europe	13,552	10,639	43,702	201,742	135,637	212,030	768,721	1,761,951	2,746,951	4,999,161
Increase per Century (%)		-21	311	362	-33	56	263	129	56	82

Sources: see Appendix I.

Table 2. Production of printed books per half century, 1454-1800 (in thousands of books)

	1454-1500	1501-1550	1551-1600	1601-1650	1651-1700	1701-1750	1751-1800
G.Britain	208	2,807	7,999	32,912	89,306	89,259	138,355
Ireland	0	0	4	268	1,341	8,586	17,598
Fran	2,861	34,736	39,084	61,257	85,163	73,631	157,153
Belg	394	1,963	5,720	4,334	7,203	3,016	4,817
Neth	473	1,045	2,842	15,009	30,149	40,950	53,063
Germ	3,227	15,603	32,112	40,553	57,708	78,205	116,814
Switz	400	3,312	5,786	1,988	1,656	1,277	4,615
Italy	4,532	16,719	41,641	35,067	43,293	37,930	75,500
Spain	463	2,205	2,306	4,631	7,088	9,124	16,304
Sweden	6	34	49	2,080	3,756	6,654	21,305
Poland	1	63	146	1,807	2,062	3,468	9,208
Rest[a]	22	530	718	1,000	2,310	2,974	14,067
Russia	0	0	0	123	165	1,275	12,367
Total[b]	12,589	79,017	138,427	200,906	331,035	355,073	628,801

[a] Austria, Hungary, Portugal, Czech Republic, rest Scandinavia

[b] without Russia

Sources: see Appendix II.

Table 3. Per capita consumption of manuscript books annually (per million inhabitants), sixth to fifteenth centuries

	6th	*7th*	*8th*	*9th*	*10th*	*11th*	*12th*	*13th*	*14th*	*15th*
CentrE	0.0	0.0	0.0	0.0	0.0	10.8	72.4	186.1	443.9	509.0
Boh	0.0	0.0	0.0	0.0	0.0	8.2	10.3	35.8	247.4	283.5
Brit	0.9	11.4	54.7	61.0	54.4	88.5	270.1	466.6	370.3	485.4
Fran	3.5	5.1	32.5	142.7	22.0	62.6	217.4	384.1	418.2	919.8
Belg	0.0	4.2	37.0	101.0	38.9	170.6	540.2	1087.2	1061.5	5721.2
Neth	0.0	1.3	3.0	4.1	1.9	8.9	34.6	29.5	188.3	2149.7
Germ	0.0	0.0	23.4	181.1	134.4	130.4	333.8	360.5	376.7	660.4
Switz	0.0	1.0	19.8	177.7	60.0	27.3	47.1	54.6	90.7	152.2
Austr	0.0	0.0	54.7	156.9	0.0	35.1	339.7	233.8	248.6	553.9
Italy	25.5	12.4	17.2	47.2	31.7	71.8	146.5	294.2	1034.5	1674.9
Iberia	3.7	6.4	9.7	51.7	110.8	83.4	193.9	312.9	453.0	550.0
Western Europe	6.5	5.3	20.9	88.1	52.6	70.2	206.1	330.0	507.8	929.2
Coefficient of variation	2.37	1.56	0.83	0.81	1.06	0.80	0.77	0.90	0.67	1.23

Source: Table 1 divided by population data from McEvedy and Jones (1978)

Table 4. Per capita consumption of printed books annually, 1454/1500-1751/1800 (per 1,000 inhabitants)

	1454-1500	1501-1550	1551-1600	1601-1650	1651-1700	1701-1750	1751-1800
G.Britain	2.0	14.6	27.3	80.0	191.8	168.3	192.0
Ireland	0	0	0.1	3.8	14.2	61.7	77.7
Fran	3.2	29.9	33.7	52.2	70.1	58.7	117.9
Belg	4.7	17.7	48.2	33.2	73.6	30.7	44.5
Neth	7.9	14.2	33.5	139.0	259.4	391.3	488.3
Germ	4.1	21.2	43.4	54.0	78.7	99.7	122.4
Switz	9.3	48.1	78.5	9.3	14.6	14.2	32.3
Italy	6.8	21.3	51.0	42.1	56.3	48.4	86.5
Spain	0.9	4.2	4.3	8.8	14.3	18.5	28.3
Sweden	0.2	0.8	1.1	39.7	58.5	83.8	208.9
Poland	0.0	0.2	0.5	5.7	6.2	9.9	22.5
Rest[a]	0.0	1.1	1.5	2.0	4.5	4.8	17.5
Russia	0	0	0	0.0	0.1	0.8	5.8
Western Europe[b]	3.1	17.5	29.1	40.6	66.7	66.7	122.4
Coefficient of variation[b]	1.06	1.05	1.00	1.06	1.16	1.33	1.13

[a]Austria, Hungary, Portugal, Czech Republic, rest Scandinavia

[b]without Russia

Source: Table 2 divided by population data from McEvedy and Jones (1978)

Table 5. Estimated numbers of monasteries in Western Europe (sixth to fifteenth centuries).

	6	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
CentrE	0	0	0	0	16	79	458	718	695	690
Boh	0	0	0	0	17	32	113	119	107	113
Brit	236	460	463	437	437	526	1,325	1,530	1,447	1,333
Fran	586	988	1,240	1,636	2,091	5,051	8,104	8,564	8,189	7,554
Belg	0	53	68	70	88	175	313	364	361	335
Neth	0	2	4	7	13	20	68	189	336	679
Germ	0	138	622	824	1,129	1,652	2,873	3,110	2,967	2,752
Switz	10	19	37	71	104	144	247	321	337	333
Austr	12	11	70	99	113	186	344	406	413	372
Italy	291	306	495	704	995	2,072	2,990	3,405	3,416	3,333
Iberia	58	117	170	537	1,340	2,549	3,290	3,223	3,003	2,876
Western Europe	1,193	2,094	3,168	4,385	6,343	12,485	20,125	21,948	21,270	20,369
New foundations	(1,193)	1,021	1,284	1,533	2,397	6,776	8,888	3,836	1,516	1,226
Increase in %		86	58	44	48	91	63	17	6	4

(Sources: for the Netherlands Schoengen (1941[a,b], 1942), for the Iberian Peninsula adapted from Vaquero *et al*., (1973), and for the other areas based on Cottineau (1939), though adapted for Germany, Austria, Switzerland, Bohemia, and central Europe; all countries with a decay rate of 10% per century; for more information, see Buringh 2008).

Table 6. Estimates of urbanization ratio (portion of the population living in cities with more than 10,000 inhabitants), sixth to fifteenth centuries

Century	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Centr Eur				0.0	0.0	0.0	0.1	0.2	0.6	1.6
Boh				0.0	0.0	0.6	0.9	2.0	4.3	5.9
Brit				0.4	2.4	3.1	2.2	2.2	2.5	2.1
Fran		0.5[a]	2.1[a]	2.9	3.6	4.9	5.7	5.5	6.1	6.7
Belg				0.0	3.0	9.9	12.5	15.0	26.2	29.6
Neth				0.0	0.0	1.0	2.2	4.1	4.7	10.4
Germ		0.9[a]	2.5[a]	3.5	4.8	5.8	5.3	4.7	5.0	5.0
Switz				0.0	0.0	0.0	0.0	0.0	0.7	2.4
Austr				0.0	0.0	0.0	0.5	1.0	1.3	1.3
Italy	3[a]	1.8[a]	3.0[a]	4.3	9.9	14.3	13.0	13.2	13.6	13.1
Iberia[b]			0.0/3.0[a]	0.1/8.2	0.2/12.5	3.7/10.6	4.8/7.9	5.6/8.5	7.8	9.8
European average[c]		0.6[a]	1.4/2.0[a]	2.0/3.5	3.6/5.6	5.9/6.8	6.0/6.4	5.9/6.2	6.7	7.2

Source: Calculated from Bairoch et al. (1988)

[a] Own estimate extrapolated from Bairoch et al. (1988); for Spain before 1200: Glick (1979).

[b] First figure for Iberia is based on urbanization in Christian part of Spain only; during *reconquista* urbanization rapidly rises as Muslim cities are included.

[c] First figure European average based on urbanization in Christian part of Spain only; second figure is European average including Muslim Spain.

Table 7. Cumulative distribution of foundation dates of Universities in Western Europe, twelfth to eighteenth centuries

Area	*<12th*	*12th*	*13th*	*14th*	*15th(i)*	*15th(ii)*	*16th(i)*	*16th(ii)*	*17th(i)*	*17th(ii)*	*18th(i)*	*18th(ii)*
Centr Eur	0	0	0	3	3	5	6	6	8	9	10	11
Boh	0	0	0	1	1	1	1	2	2	2	2	2
Brit	0	1	2	2	3	5	5	7	7	7	7	7
Fran	0	1	4	10	13	15	15	15	16	16	16	16
Belg	0	0	0	0	1	1	1	1	1	1	1	1
Neth	0	0	0	0	0	0	0	3	5	5	5	5
Germ	0	0	0	3	6	11	14	17	20	22	24	24
Switz	0	0	0	0	0	1	1	1	1	1	1	1
Austr	0	0	0	1	1	1	1	2	3	4	4	4
Italy	1[a]	4	10	17	17	17	17	17	17	17	17	17
Iberia	0	0	4	7	7	9	9	9	9	9	9	9
Latin West	1	6	20	44	52	66	70	80	89	93	96	97

[a] The University in Italy prior to the twelfth century is Salerno (medicine), presumed date of foundation in ninth century.

Source: Encyclopedia Britannica, 1898, vol. 23: 858.

Table 8. Panel data regression on per capita production of manuscript books

Method	Only non-zeros		Tobit		Heckman 2-step	
	(1)	(2)	(1)	(2)	(1)	(2)
Lmonasteries	0.77***	-	1.78***	-	0.61**	-
Lmonasteries<1000	-	1.00***	-	2.37***	-	0.77**
Lmonasteries>1000	-	0.51**	-	0.51	-	0.51*
Universities	1.21**	0.93**	1.21**	0.93*	1.19**	0.93**
Urbanization[a]	0.11**	-	0.13***	-	0.11**	-
Urbanization<1000	-	0.15*	-	0.34**	-	0.12
Urbanization>1000	-	0.09***	-	0.09**	-	0.09***
Iberia	0.07	-	0.89	-	-0.09	-
Iberia<1000	-	1.01*	-	3.73***	-	0.53
Iberia>1000	-	-0.14	-	-0.14	-	-0.14
R^2	0.56	0.63	0.14	0.22	-	-
N	92	92	99	99	99	99

* = Significant at 5 percent level

** = Significant at 1 percent level

*** = Significant at 0.1 percent level

Table 9. Estimates of the development of the rate of literacy compared with those of Allen, 1451/1500 – 1751/1800

	Allen 1500	1451-1500	1501-1600	1601-1700	1701-1800	**Allen 1800**
Great Britain	6	5	16	53	54	53
Ireland	-	0	0	3	21	-
France	7	6	19	29	29	37
Belgium	10	10	17	25	13	49
Netherlands	10	17	12	53	85	68
Germany	6	9	16	31	38	35
Italy	9	15	18	23	23	22
Spain	9	3	4	5	8	20
Sweden	-	1	1	23	48	-
Poland	6	0	0	3	5	21
Western Europe	-	12	18	25	31	-

Sources: Table 4, and note 21

Table 10. Panel data estimates of the explanation for the development of literacy from 1451/1500 to 1751/1800

Independent Variable	Literacy	Literacy (time dummies)	Literacy (country dummies)	Literacy
Constant	-7.54	-12.37	-15.14	10.17
Lreal wages	-	-	-	-.35
LGDP p.c.	.36*	.36*	.28	-
Urbanization ratio	.46*	.22	2.31**	0.92*
DProtestantism	24.36***	20.34**	16.34**	28.14***
Universities p.c.	-1.82	0.64	-4.34	-1.83
Dcentralstate	-1.80	-3.99	1.50	-3.32
R^2	0.61	0.73	0.75	0.59
N	62	62	62	60

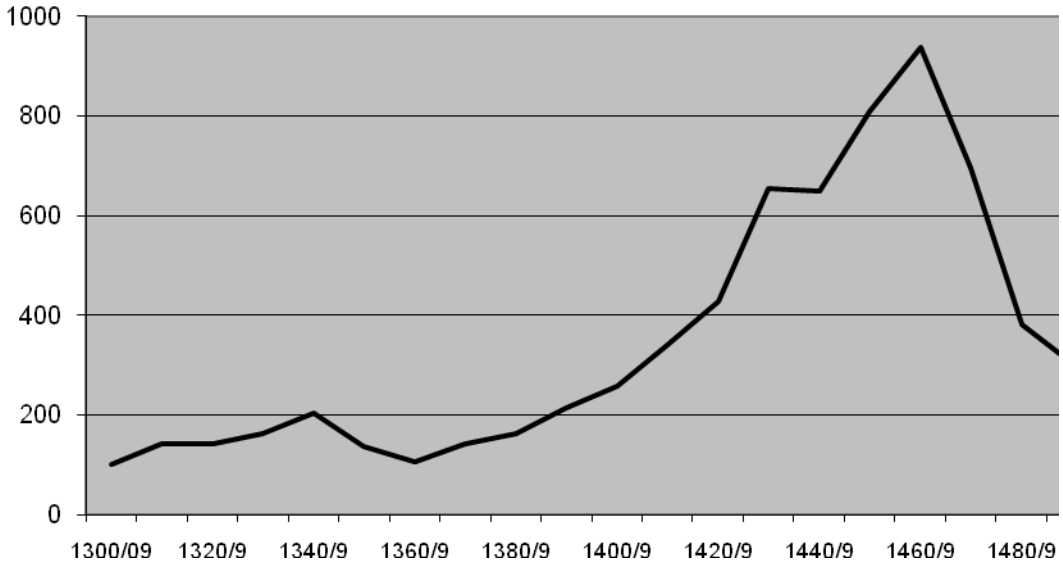
* = Significant at 5 percent level

** = Significant at 1 percent level

*** = Significant at 0.1 percent level

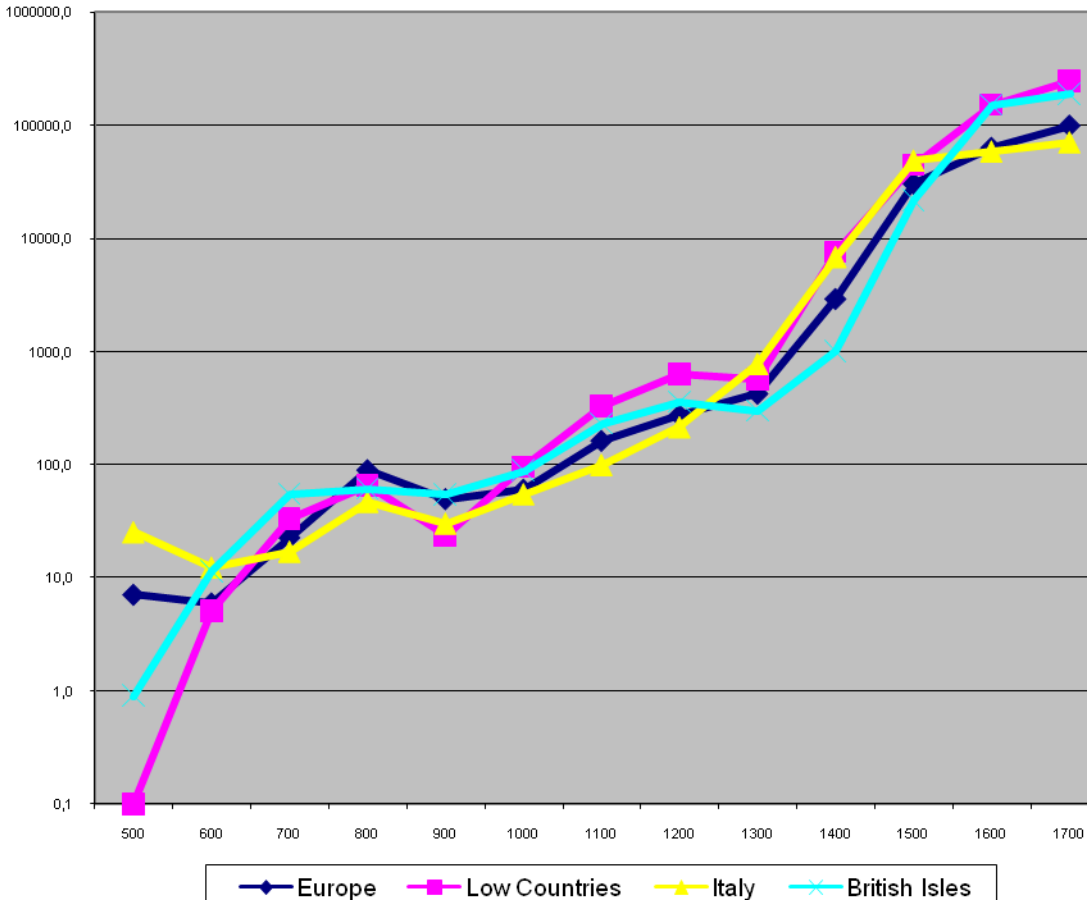
Source see text: according to style sheet JEH be explicit about the sources of the tables

Figure 1 Estimates of the development of manuscript production in Central Europe, 1300/09-1490/99 (1300/09=100)



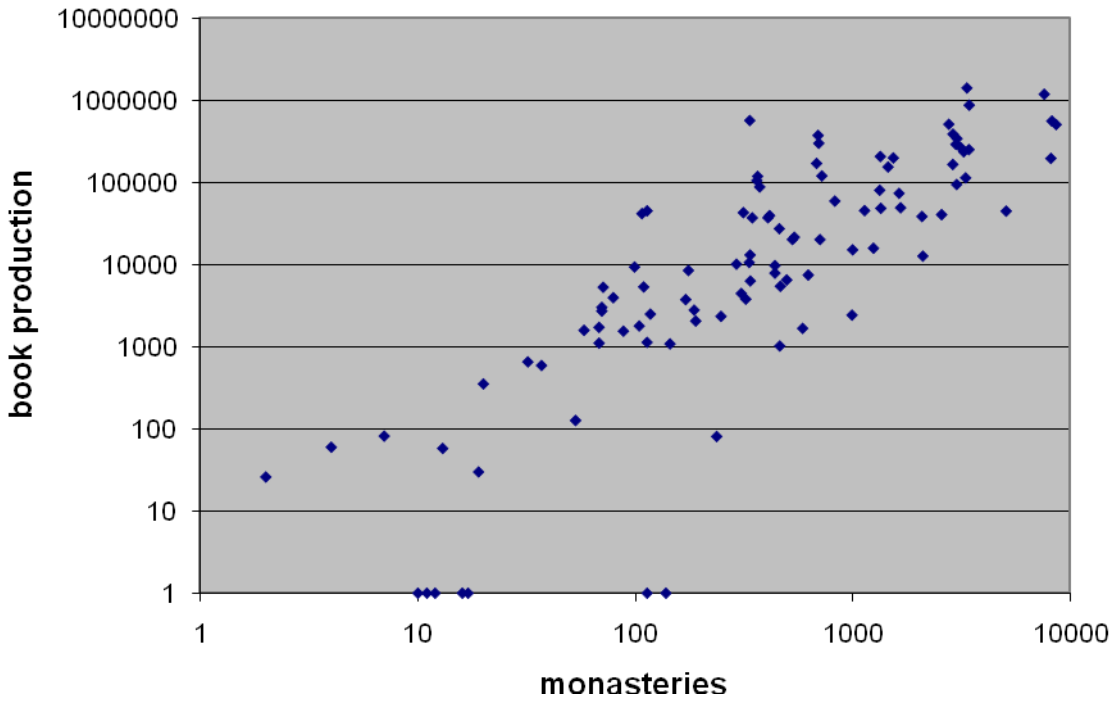
Source: Neddermeyer 1996.

Figure 2 Book production per million inhabitants in Western Europe, 501/600-1701/1800



Sources: Tables 3 and 4.

Figure 3 Book production and the number of monasteries 6th-15th centuries (log-scale)



Sources: Tables 1 and 5.