

The Economic Consequences of the Invention of Writing

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Abstract:

This paper sets out the economic consequences of the invention of writing, as best we can determine them, given the absence of information in the pre-literate phase of human history. It first sets out the distinguishing features of writing as a form of communication. Then it briefly sets out the nature of writing and writers in the three early and hugely important civilisations - Mesopotamia, Ancient Egypt and China. These first writings had huge effects on record keeping, commercial law and administration in these civilisations. They also had profound system effects on the development of abstract thought and mathematics. The paper then puts forward the conjecture that the application of literacy and numeracy in literate societies to business, trading and public administration yielded a substantial increase in the total output per capita and in the standards of living in these societies. Finally, it looks at the evidence which supports this conjecture.

Key words:

literacy, orality, mathematics, abstract thought, standards of living

Introduction

The invention of writing is of fundamental importance to the subject of human history because it defines the dividing line between the period before the invention, known as Prehistory, and the period after the invention, known as History. This binary division has largely determined how historians traditionally investigate issues and events of history.

This line is, however, really a discrete period of time rather than a single time. Scholars now acknowledge that writing was developed independently¹ in a number of distinct locations; (Wikipedia, 2022a) lists Mesopotamia (between 3400 and 3100 BC), Egypt (around 3250 BC), China in the Shang Dynasty (around 1200 BC) and lowland areas of Southern Mexico and Guatemala (by 500 BC), but there are many other sites in the Indus Valley, USA, and other locations. (For a general review of the invention of writing, see Fischer, 2005). In the context of the long period of roughly 300,000 years of human history, this period of little more than 3,000 years is quite short.

Outside the study of history, writing has been acknowledged as a major step in the evolution of human technology. As one example, the Chicago historian James Breasted (1926, p. 23) stated “The invention of writing and of a convenient system of records on paper has had a greater influence in uplifting the human race than any other intellectual achievement in the career of man.” (See also the recent book, *The Greatest Invention: A History of the World in Nine Mysterious Scripts*, by Silvia Ferrara (2022).) It is necessary, however, to identify the way or

ways in which the invention advanced human technology. Commonly scholars have identified the invention of writing with the development of civilisations. The philologist Gelb stated baldly “Writing exists only in a civilisation and a civilisation cannot exist without writing” (Gelb, 1962, p. 22)² More recent research reaches a contrary view. “Civilisation is usually associated with formalised governance, law, art and monumental architecture. However, there is evidence that many, if not all, of these things had been achieved long before the invention of writing” (Bywater, 2013, p.6). Writing should be treated as a single stand-alone invention.

The literature on early writing has focused on the scripts and writing materials, the languages and the beginning of literature. Writing is said by historians to have helped the development of the civilisation by keeping records of transactions and debts, allowed the codification of laws and improved civil administration. It is also said to have promoted the culture of civilisation. For example, it has been important in recording rituals and events concerning the death of pharaohs, kings and other high-status individuals; one well-known instance is the many versions recorded in pyramids and other tombs in Ancient Egypt of the Book of the Dead. There has not, however, been any account of the ways and the extent to which the invention of writing has increased aggregate output and the standards of living and other aspects of the economies in which writing was invented.

Writing as a form of communication

Writing is a form of communication of information between one person, the writer, and another or others, the reader or readers. Communication occurs over time and space. In some cases the writer and reader are the same person; for example, in logs or records where the record-keeper or his successors will read events or measures at different times such as the Egyptian Nilometer. Mostly, however, the writer and readers are different persons when the writer wishes to pass on information or to communicate with a particular person or persons.

Written communication is an alternative to oral communication.³ With oral communication the speaker and the person(s) addressed must be in the same location, although in some cases the speaker may rely on an intermediary to communicate by word of mouth to a person or persons in another location. In effect, writing removes the need for the persons communicating to be in the same location.

This removal has major consequences. It extends the geographic range over which communication can occur. For example, in the case of civilisations which developed writing, it facilitated the distribution of laws, decrees and other information throughout the whole geographic range of the civilisation. Another consequence is that written communication improves the accuracy of communications. Written communications do not change whereas oral communication, especially over long distances or time, may be subject to change because of memory failure.

Importantly, all writing systems including numbers. As with words, the written communication of numbers improved the accuracy and reliability of the numbers of the things communicated. Moreover, numbers which were written down led to the development of numbering systems and mathematics.

In short, communication by writing is qualitatively different than oral communication in many ways.

Who are the writers

In order to understand the ways in which written communication has increased the performance of economies, we need first to understand who the writers were and the functions they performed in the economies that used their writings. I consider in a very brief and general way the features of writers in the three early and

highly important “civilizations” of Mesopotamia, Ancient Egypt and Ancient China.

Mesopotamia

The form of writing is called cuneiform and the writing material used was the clay tablet.⁴ These tablets could be stored indefinitely (as their unearthing five thousand years later testifies) and they were transportable.

Scribes were part of a complex centralized administration. They had a lengthy training in schools known as “tablet houses”. These were attached initially to temples but later secular schools became more important.

They were an elite class. The vast majority were men, sons of the elite or the wealthy in their society who could afford the costs of many years of schooling. In the Akkad period, about one thousand years after the invention of writing, there is evidence of some female scribes. These were daughters of the elite, some daughters of scribes but they had a lower status than the male scribes (Pearce, 1995, vol. IV, p. 226).

Most of the documents are accounting records and almost invariably contain numbers which relate to the business matters recorded in them; for example, records of sales, debts and inventories. Scribes were employed by businesses to record transactions and financial obligations. They were employed in the King’s court and also in temples, where they recorded offerings for the gods. The Sumerians also compiled texts which systematically described every branch of knowledge.

Numbers was an important area of scribal training and practice. The Sumerians invented the sexagesimal (base 60) system which led to the division of time – 60 seconds in the minute and 60 minutes in the hour – and the 360 degrees of location in a circle used later by the Babylonian astronomers. These measurements are still used today.

Ancient Mesopotamia was the first known site for the development of mathematics. This was algebra and geometry. The mathematics is elementary but they did make some notable achievements. These include the solution of quadratic and cubic equations, and an approximation to the square root of two - which is accurate to the 5th decimal place - and a gross approximation to pi (namely, the number 3).⁵ Mansfield and Wildberger (2017) claimed that they also developed an alternative form of trigonometry based on the ratios of sides rather than angles but this has been disputed (see Lamb (2017)). The main application of their mathematics was to astronomy.

Ancient Egypt

The Ancient Egyptians developed several different scripts (hieroglyphs, hieratic and demotic scripts). The dominant writing material used was the papyrus.⁶ This was reserved for administrative texts and literary or scholarly works. Sheets of papyrus were rolled or folded. These were storable and easily transportable over long distances.

There was a network of scribes throughout the country. These scribes kept accounts and made reports on papyri. Scribes were members of a centralized bureaucracy which regulated the operation of the system. There was a Department of Scribal Administration. Official papyri were stored in the archives of government institutions and temples. Scribes were trained in Scribe Schools which existed in every major city in Ancient Egypt.

Scribes were an elite group which was ranked highly in their society. They were men who were exempt from taxes and military conscription. There is evidence of female scribes working in medical practice and using written texts containing medical information.

In addition to their work as part of government administration, Egyptian scribes found employment in just about every sector of the economy, including agriculture, crafts, trade, mining, building and quarrying. They were also an important part of life in the temple, where hieroglyphic texts accompanied the reliefs on temple walls, and in the army, where they listed conscripts and counted the dead on battlefields.

Ancient Egyptians made considerable advances in mathematics. Notable achievements were formulae for the area of a circle, the volume of a truncated pyramid and the Pythagorean Triple and possibly the Pythagorean Theorem (see Robins, 1995). Their development of mathematics was intended to provide solutions to practical problems, including those arising in the surveying and building of pyramids.

China

China's experience in the invention of writing is very different than that of Mesopotamia and Egypt and less well documented. "The study of scribes in ancient China appears to be less developed than those in other ancient civilizations due to the scarcity of the evidence." (Tsang, 2017, p. ix).

Writing is generally believed to have developed in Ancient China during the Shang Dynasty (1600-1046 BC).⁷ The earliest forms of writing were pictographic but these

were replaced by logographic forms, in which the symbols represented concepts rather than objects. The first writing material was bone but later wood, bamboo and silk were used. Paper was made in China, for the first time anywhere in the world, from about 105 AD. All of these materials were storable and readily transportable over long distances.

Chinese writing began with the divination of the future and other ritual practices. It seems to have been limited at first to royal households and groups linked to them. Later it spread to imperial administration and to the work of professional groups. "Unfortunately the records of economic transactions are sparse and a thorough study based on recent archaeological finds has yet to be done." (Cook, 2015, n. 10.) At some time writing must have been adopted in business transactions.

Scribes were initially a group of highly educated intellectuals whose positions were hereditary. All were men though later female scribes wrote literary and other texts.

Mathematics developed in China by the 11th century BC, independently of other civilisations. They had a decimal number system. They made numerous contributions to number theory, algebra, geometry and trigonometry.⁸ As in Mesopotamia and Ancient Egypt, the development of mathematics was motivated primarily by the need to solve practical problems in surveying, engineering and business. The abacus was invented by at least the 2nd century BC.

In summary, writing in the Mesopotamia and Ancient Egypt cultures began as a more accurate form of record keeping or accounting. "Complete writing's crucible was accountancy." (Fischer, 2005, p. 22) (See also Nissen, Damerow and Englund (1973)). Acting as accountants, scribes worked in both the public and private sectors in the modern terminology to record economic transactions in many sectors of the economies including international trade, and debt. In Ancient China, by contrast, writing began as a form of divination and imperial administration. Writing was, in these three civilisations, extended progressively in temples, courts and other locations to a variety of applications. In all three cases, written words were easily transportable throughout the civilization.

Economic consequences of the invention of writing

The high social status and relative income level of scribes in ancient civilisations is a testament to their important contribution to the aggregate annual output of

their economies. However, the contribution of writing to the economic development of the economies in which they operated was much greater than their immediate output. They had wide-reaching system effects on the literate economies.⁹

The first system effect was to record keeping. As noted above, this made government administration, business and trading more efficient.

Another system effect is the development of what we would now call commercial law. The best known of these is the Code of Hammurabi, set down by the King of Babylon circa 1750 BC. It covered laws relating to family, property, land, commerce and other areas. It established standards for commercial transactions including loans and debt, trade and fraud. Fines and punishments for violation of the Code were set out. This law must have facilitated commerce throughout the Mesopotamia and trade with other economies.

Havelock (1963) developed another effect of writing. He compared thought in pre-literate oral works of the Greek civilization with thought in the later literate period. This is possible in the case of the Greek civilization because, in the early years of the development of writing and literature in Ancient Greece, Homer wrote down the oral epics of *The Iliad* and *The Odyssey*. Comparing the metrics and vocabulary and grammar of the two periods, he found that thought in this oral period was profoundly different in nature to that in the literate period. The advent of writing led to more abstract thinking, as exemplified in the philosophical writings of Plato and Aristotle and other Greek philosophers.

Walter Ong (especially Ong, 2013) formalized this line of argument and extended it to all literate societies.¹⁰ He considered that thought in literate societies was more objective, abstract, analytical and less traditionalist than that in pre-literate societies. In his words, “writing restructures consciousness”. His most relevant work, *Orality and Literacy*, is subtitled “The Technologizing of the World”. This line of argument has far-reaching implications for the development of human thought. While it became very popular among language specialists, neither the premises (as stated in the nine characteristics of primary oral cultures which he laid down in Ong, 2013, chapter 3) nor their predictions have been subject to testing for the period of human history when writing systems were invented: that is, in the period when societies transitioned from the period of pre-literacy – prehistory - to the period of literacy

- history. Empirical testing is essential to verifying the line of argument.

A related system effect is the development of measurements and the beginning of mathematics from early number systems. Mathematics is abstract and analytical. This new knowledge of mathematics was used by the Egyptians, Romans and Greeks and other civilisations in the construction of pyramids, roads, bridges, the reticulation of water for both irrigation and household use, and other infrastructure.

The beginning of mathematics in turn led to the development of science. This had a profound influence on the development of new technologies for industries, especially in the Renaissance period and since that time. Indeed, these technologies would not have been possible without writing.

Writing and the development of mathematics were incorporated in the curricula of schools as formal education spread first in Western Europe and then in other parts of the world. Galor (2022, especially chapter 4) traces the contribution of education to the formation of human capital and technological developments during the Renaissance and the Industrial Revolution.

Conjecture

The application of literacy and numeracy in literate societies to business and trading and to public administration can be expected to have had a substantial effect on the efficiency of these economic activities.

Proposition

The application in literate societies of literacy and numeracy to business and trading and to public administration yielded a substantial increase in the total output per capita and in the standards of living of the economies of these societies.

In early civilisations, little capital and other non-labour inputs was used. In these economies, factor productivity therefore reduces to labour productivity; that is, the aggregate production of goods and services divided by a measure of the aggregate labour input. As all physically fit persons of all ages in these societies worked to the best of their abilities, one can assume the ratio of aggregate labour inputs to total population is fixed. Output per capita, therefore, moves in step with labour productivity.

This proposition can be stated as an hypothesis. Regrettably the hypothesis cannot be tested because of the absence of quantitative information. A test of the hypothesis requires annual statistics of aggregate output and labour input for early civilisations and other variables that might be expected to explain the changes in labour productivity, for the periods before and during the civilization. There are no such statistics. We do not even know the time when writing was invented in these societies or the time when it became widely used.

There are two sources which add credibility to this hypothesis.

The first source is the wonderful dataset compiled by Angus Maddison (2007, chapter 1) for Ancient Rome. Building on the pioneering work of Goldsmith (1984) and others, he estimates the aggregate output/income and income per capita of the Empire and its individual provinces and other series for the years 300 BC and 14 AD; the first date is in the period of the Roman Republic and the second is in the period of the Roman Empire. This is the first estimation of income and allied series ever done on a civilization basis, as distinct from the standard estimates on a nation state basis. He found that Romanization in the provinces outside Rome lifted income levels, especially in the provinces in Europe and north Africa:

“These areas began to savour the benefits of urban life, absorbed the technology of ancient civilizations in West Asia and benefited from new opportunities to trade and specialize. The Pax Romana created security. The legal system protected property and rights. Roads, bridges and harbours reduced transport costs. The elimination, creation of a common currency, and the spread of a common language greatly enlarged market size.”
(Maddison, 2007, p. 2)

Literacy is of course not the only civilisational characteristic that boosted income levels but it is essential to several of those mentioned by Maddison (the legal system, the construction of infrastructure and a common currency) and it contributed indirectly to the others.

The second source is the study by Jeremiah Dittmar (2011) of the effect of the introduction of the printing press in Europe on the rate of growth in European cities.

The economic consequences of the invention of the printing press

The invention of printing was the second innovation, after the invention of writing itself, that extended the way in which written ideas and information available to the writer could be communicated to others and stored for future use. Movable type printing was developed in China after 1,000 AD but it was the invention of the printing press that led to the widespread availability of printed materials. Johannes Gutenberg established the first movable type printing press in Mainz, Germany, around 1450. Printing presses were established in many other European cities in the second half of the 15th century. Books, pamphlets and other materials that they printed by presses were much cheaper than the hand-printed materials that preceded them. Moreover, like the invention of writing, the invention of the printing press had huge effects on the societies and the economies in which it happened. In 1997 Time-Life magazine picked the Guttenberg press as the most important invention of the second millennium (from 1,000 AD to 1999 AD) (Wikipedia, 2022b)

Dittmar constructs data series for the rate of growth for European cities after the invention and for various potential explanatory variables. There is no series, at the city level, for output or incomes. He uses the growth of city population as a proxy, arguing that cities that grew more rapidly as a result of the establishment of printing presses became richer. Population growth is measured over the interval from 1500 to 1600 during which printed material became widely available.

Dittmar found that cities in which printing presses were established in the late 1400s grew 60 per cent faster than other cities, and that the difference in growth rates was not due to other locational factors. He also found that printing delivered special growth benefits to port cities beyond the advantages associated with the printing itself.

To explain this difference in growth rates, Dittmar stresses the effects of print media on the development of economically useful skills and knowledge. “The printing press fostered knowledge and skills that were valuable in commerce. Print media played a key role in the development of numeracy, the emergence of business education, and the adoption of innovations in bookkeeping and accounting.” (Dittmar, 2011, p. 1134.) One type of book which was common and particularly important to business were the manuals devoted to “commercial arithmetic.” This account is remarkably similar to the account in Section 3 of the ways

in which the first invention of writing in Mesopotamia and Egypt was used in business and trade.

Conclusion

There is considerable evidence of the changes in the way of doing business and trade, and in the technologies used in newly-literate societies that followed the invention of writing. This is based on the activities in which scribes engaged and surviving printed material.

Measuring the economic effects of the invention of writing on the economies of newly-literate societies, however, is not generally possible because of the absence of quantitative records in pre-literate societies. In one instance it has been possible to construct data or proxies for economic variables in the newly-literate period. This is the case cited above of the estimation of incomes and incomes per capita in the provinces of Ancient Rome. Aside from this case, the comments on the economic effects of the invention of writing remain mostly conjecture.

One can safely say that the advent of literacy, and its companion numeracy, had a substantial positive effect of the productivity of the economies of literate societies, thereby raising per capita incomes and standards of living. These economic benefits are additional to the effects of the invention of writing on the subject of history and on literature, religion and culture which have been well-recognised by historians. They strengthen the importance of the divide between the periods of Prehistory and History.

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Endnotes

1 By “independence”, previous writers appear to mean that each script was developed separately. There were, however, many instances of borrowing some aspect of a writing system from earlier scripts: for example, the Roman script was adopted from the prior Etruscan script, and the alphabet, having been invented in Ancient Egypt around 1800 BC was adopted subsequently by many writing systems including the Phoenician, Greek and Roman and others (Fischer, 2005, chapter 4). The concept of writing itself may have been borrowed in some “independent” scripts from earlier scripts.

Several hundred different scripts have been invented. Moreover, many scripts, were changed during their sometimes long period of use, extending in cases such as Ancient Egypt, Mesopotamia and China for multiple millenia.

2 The term “civilization” is a loose and elusive description of a society with a more advanced technology and governance. There is not a one-to-one correspondence between the presence of writing and the existence of civilisations. Some recognized civilisations did not have writing; for example, the Incas though they had a complex system of knot records called quipu. Yet, they were able to administer an empire that extended over more than 2,500 miles of territory. Conversely, many societies which invented their own form of writing have not been recognized as “civilisations”.

The term is, however, still useful as a general descriptor of the cities and empires with these attributes.

3 Another form of communication is visual communication; for example, smoke signals or semaphore.

There are also aural forms of communication other than speaking; for example, whistling. (For further examples, see Fischer, 2005, chapter 1 and Gelb, 1952, chapter 1).

In the great majority of situations, the forms of oral and written communication are the only two practical alternatives.

4 Stone and metal were used for Royal communications, and ivory and wood were also used.

5 A truly remarkable example is the claim that the Sumerians knew Pythagoras' Theorem. This claim is based on the Climpton 322 clay tablet, which was first published in 1945 and is believed to date from around 1800 BC. See Mansfield and Wildberger (2017) and references therein. This claim has been disputed by Lamb (2017). Wikipedia (2020c) has an account of the history of the theorem in several civilisations.

6 Clay tablets and ostraca (pieces of polished pottery or limestone) were also used.

7 Markings on pottery dated to 7,000 BC – and therefore predating any writing in Mesopotamia and Ancient Egypt - are regarded by some archaeologists as primitive pictographic writing. Others, however, dispute this interpretation.

8 This included the discovery of the ubiquitous Pythagorean Theorem in the Zhou dynasty (Swetz and Kao (1977)). If accepted, this puts the date of the Chinese discovery before Pythagoras but after the Mesopotamians.

9 With respect to non-economic behaviour, writing was used in some civilisations to record past battles and other events, to set out religious beliefs and practices, to record myths and epic stories and poems, and to promulgate the law of the society or empire.

10 Ong was a member of a group of scholars at the University of Toronto, including Marshall McLuhan, who compared orality and literacy.

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