

The evolution of bookkeeping methods in China: A Darwinist analysis of developments during the twentieth-century

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Abstract

This article reviews the historical development of bookkeeping methods in China during the twentieth century by applying the “Universal Darwinism” theory developed by Dawkins (1983) and Hodgson (2002). According to Dawkins and Hodgson, the biological principles of variation, selection and inheritance can be applied to cultural and other forms of evolution. This article applies these principles to critically evaluate the evolution of double-entry bookkeeping methods in China during the twentieth century. It concludes that bookkeeping methods are selected by their surrounding environment which is determined by the political, economic and cultural factors of that particular period. The methods selected are those that adapt best or are most suited to a change in the environment. Different methods compete for the dominant position. If a single method cannot be exclusively selected, then multiple methods may be permitted to co-exist. This conclusion can also explain why, in general, pluralism is a very prevalent phenomenon in accounting.

Keywords

Bookkeeping methods, China, evolution, Universal Darwinism

Introduction

Chinese accounting has a long history. Approximately 6,000 years ago, people in China had already developed a numeric system and understood arithmetic rules. A unique Chinese writing system was invented and is still used today. People started to record their activities, including counting activities, on bamboo or wooden slips (Aiken and Lu, 1993; Feng, 1933). During the *Western Zhou* Dynasty (1045–771 BC), Chinese accounting reached its first high point. A comprehensive governmental accounting system was established in the royal courts. A single-entry bookkeeping method with *Ru* (In) and *Chu* (Out) as recording symbols was used.

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After the *Western Zhou* Dynasty, during the long centuries of feudal society, accounting in China experienced only slow development. However, there were some advances. For example, there was the use of the *Bi-Bu* system – an auditing system developed in the *Tang* Dynasty (618–907 AD); the invention of the elaborate government accounting system of the *Song* Dynasty (960–1279 AD); and the emergence of Chinese double-entry bookkeeping in the late *Ming* Dynasty (1368–1644 AD) (Guo, 1988). These events can be regarded as significant achievements in Chinese accounting and also as great contributions by the Chinese to the world.

With its defeat in the First Opium War in 1840, the *Qing* Empire (1644–1911 AD) was forced to receive outsiders. Afterwards, China went through a series of rebellions, foreign wars and revolutions (Twitchett and Fairbank, 1978; Shou, 1926). Central governmental controls over its territories were seriously challenged by both internal and external forces. Nevertheless, China had not disintegrated or become a colony as had, say, India. Like other disciplines, Chinese indigenous bookkeeping was threatened by Western bookkeeping methods and experienced significant changes after the First Opium War. For political and ideological reasons, the study of the development of Chinese accounting in this period was neglected by many scholars (Lu et al., 2009).¹ However, it can be argued that this period was the first “Golden Age” in modern Chinese accounting history. After the First Opium War, Western thoughts and technologies, including Western accounting ideas and methods, were introduced into China. Chinese indigenous bookkeeping for the first time experienced strong challenges from the new “species” of the West. Under external pressure, the indigenous bookkeeping method evolved and was modernised (Gao, 1985; Ji, 2001). Accounting law and auditing law were promulgated for the first time in Chinese history (Guo, 1986). Chinese governments started to unify the accounting systems used by monopolised industries: post, telecommunications, shipping and railroads (Guo, 1988). The Chinese accounting profession also appeared in Shanghai and other treaty-port cities (Xu and Xu, 2003).

This article focuses on a very important development in Chinese accounting history: the evolution of bookkeeping methods from single-entry to double-entry bookkeeping and switches between the use of Western-style double-entry bookkeeping and Chinese indigenous double-entry bookkeeping. The Western-style debit-credit bookkeeping method was introduced into China in the late nineteenth century (Guo, 1986) and was only fully embraced by Chinese accounting practitioners from 1992. The objectives of this article are to analyse the evolution of bookkeeping methods in Chinese accounting history and to investigate what factors drove the fall of Chinese indigenous double-entry bookkeeping and why it has taken so long for a foreign system (debit-credit bookkeeping) to attain the dominant position in China. We do this by applying the “Universal Darwinism” theory² developed by Dawkins (1983), Hodgson (2002) and others.

Dawkins (1983) believes that a good evolution theory should be capable of explaining adaptive complexity. The concept of adaptive complexity was first used by Maynard Smith (1969: 82). He says:

The main task of any theory of evolution is to explain adaptive complexity, i.e. to explain the same set of facts which Paley used as evidence of a Creator. Thus if we look at an organism, we find that it is composed of organs which are at the same time of great complexity and of a kind which ensures the survival and/or reproduction of their possessor. Evolution theory must explain the origin of such adaptations.

Dawkins (1983: 404) argues that “adaptive complexity is probably the best diagnostic of the presence of life itself”, and that Darwinism, with its principle of natural selection, is the only evolutionary theory capable of explaining the existence of adaptive complexity.

Dawkins (1983: 420) interprets Darwin’s theory of evolution by natural selection as “the non-random selection of randomly varying replicating entities”. The replicating entities do not have to

be DNA or any organic molecules. Therefore, the selection can operate on different levels: on the level of genes and species, and also on the level of cultural transmission units. In addition, he emphasizes that complex adaptation requires many generations of cumulative selection, not one-off selection. Dawkins (1983) says that one-off selection is very common in physics, such as the sorting of pebbles by waves on a beach, but cumulative selection is the distinguishing characteristic of biology and the force underlying all adaptive complexity.

Hodgson (2002) argues that Darwinism is not only a specific theory that explains biological evolution mechanisms, but is also a broad theoretical framework which can be applied to the analysis of the evolution of all open, complex systems, including socio-economic systems.

Even though the detailed mechanisms of change in social-economic systems are quite different from those in biology, Hodgson (2002) argues that Darwinism is still applicable to socio-economic evolution in several fundamental senses. For example, he points out:

Darwinian evolution is not tied to the specifics of genes or DNA: essentially it requires some mechanism of inheritance. On planet Earth, we find that DNA has the capacity to replicate. But other 'replicators' may exist, on Earth and elsewhere. One possible and relevant example is the propensity of human beings to communicate, conform and imitate, making the replication or inheritance of customs, routines, habits and ideas a key feature of human socio-economic systems. (2002: 270) [for a brief definition of what is meant by "routines" see endnote 10]

Hodgson (2002) believes that mechanisms of variation, selection and inheritance exist in the socio-economic sphere and that Darwinism is fully relevant for economics and other social sciences. In addition, he emphasises that "Universal Darwinism" is not a version of biological reductionism where everything has to be explained in biological terms. Rather, it refers to a core set of general Darwinian principles that may be applied to a wider range of phenomena.

According to Dawkins and Hodgson, the biological principles of variation, selection and inheritance can also be applied to cultural evolution. This article is thus motivated by an attempt to demonstrate that the development of bookkeeping methods can be explained based on the principles of Darwinism. With a change of environment, bookkeeping methods compete with each other for survival. Eventually the bookkeeping methods best adapted to the changes are selected by the environment³ and are, therefore, most suited to the environment under that particular setting. The principle of "survival of the fittest" (Spencer, 1864: 444) does not necessarily mean that only one bookkeeping method can be selected. Actually, multiple bookkeeping methods can co-exist if they all meet the environmental constraints. Bookkeeping methods are selected by humans. If a single bookkeeping method is not selected exclusively from among its competitors, multiple methods may be permitted to stay. The result of such selection is the co-existence of multiple methods. This is one reason why pluralism is prevalent in accounting measurements, methods and systems, and even in accounting research paradigms.

The structure of this article is as follows. The main features of Universal Darwinism are discussed in the next section. Following this, the evolutionary process of bookkeeping methods in China is examined. The strengths and weaknesses of Chinese indigenous double-entry bookkeeping and Western debit-credit double-entry bookkeeping methods are compared. Next, the article evaluates the factors that have contributed to the rise and fall of Chinese bookkeeping methods according to the principles of Universal Darwinism. The last section concludes that the development of bookkeeping methods in Chinese accounting history can be explained by applying "Universal Darwinism", and that bookkeeping methods used in China have changed according to changes in the environment, contingent upon political, economic and cultural conditions.

Universal Darwinism and its applications

Darwinism is a term for the underlying theory proposed by Charles Darwin (1809–1882) and developed by his followers concerning the natural evolution process. Darwin's theory of evolution by natural selection is based on the following arguments:

- All species are capable of producing more than enough offspring to replace themselves; however, most offspring cannot survive because they cannot adapt to the environment.
- Offspring have to struggle for existence because of limited resources; therefore, the environment affects an individual's chances of survival.
- There are many variations among individuals. Some individuals are more likely to survive because they can better adapt to the environment due to their particular variation providing them with advantages over others.
- Therefore, the individuals who are better adapted to the environment have more chances to reproduce and pass their variations on to the next generation.

Over many generations, the proportion of well-adapted individuals in a population is likely to increase. Individuals with less adaptive variations are likely, eventually, to die out. This process is called evolution by "natural selection" (Darwin, 1859: 81). The significant contribution of Darwinism is its discovery of natural selection as the driving force for evolution. Natural selection is based on the survivability of individuals' inherited characteristics. Those individuals that are best able to access and harness environmental resources will survive to reproduce. Each generation inherits traits from its parents, but each generation has occasional random variations in these traits. These variations are necessary and will enhance the ability to survive and propagate more offspring. Through natural selection, living populations become better adapted to their environment (Waters, 2003). Hodgson (2002: 270) made the point that as long as there is a population with imperfect inheritance of its characteristics, with not all of its members having the potential to survive, then Darwinian evolution will occur.

Darwin's theory of evolution by natural selection was the greatest biological breakthrough of the nineteenth century and it has become the central principle of biology. The discovery of DNA in the 1950s explains fully variation and inheritance mechanisms and corrects some previous misconceptions in biology.⁴ It has provided immense support to, and broadened, Darwin's theory (Gould, 2002).

Over more than a century, many prominent followers of Darwinism have argued that Darwinian principles of evolution by natural selection can be applied not only in biology but also in other fields, such as cultural evolution. Campbell (1965)⁵ suggests that Darwinism may be regarded as a general evolution theory which can be applied to all complex systems, including those within the social sciences. He examined different types of evolutionary theory in the social sciences, including Darwin's theory of natural selection. He then identified three essentials in the evolutionary process. These are variation, selective systems, and retention systems. He states:

If there are representatives of these three requirements at the level of social forms and customs, then a socio-cultural "evolutionary" process or a socio-cultural "learning" process is inevitable. If analogues of these three requirements are in operation, then there will occur drift pressures toward increased organizational units, if such increases give selective advantage. (Campbell, 1965: 27)

The proponents of "Universal Darwinism" claim that Darwin's evolution theory is not dependent upon aspects of genes or DNA which actually require some mechanism of inheritance and

reproduction (Cziko, 1995). In the natural world, DNA has the capacity to reproduce, but there are also many social elements which can be replicated. Human beings' ability to communicate, imitate and follow make it possible to replicate or inherit customs, routines, habits and ideas, and this is a key aspect of human socio-economic systems (Hodgson, 2002).

Johansson and Siverbo (2009: 149) claimed that "the fundamental principles of evolutionary theory can be applied to most open and complex systems rather than only to biological systems". According to them, "Universal Darwinism (UD) means that evolution appears where variation is generated, where there are mechanisms that guarantee retention and where variation and retention are subject to a selection process" (p.149).

Evans and Selina (2001) argue that natural selection happens whenever the following three conditions are in place: (1) there is a population of things that make copies of themselves; (2) the copying process is not perfect; (3) the copying errors lead to differences in the ability of offspring to survive and make copies of themselves. They suggest that these three conditions do not just apply to animals and plants; they can apply to anything that can copy itself, such as computer viruses. Therefore, Darwinism can be generalised and extended beyond biology and applied in other disciplines if the mechanisms of variation, selection and inheritance proposed by Darwin can be formulated and applied. The success of applying Darwin's evolutionary theory in the social sciences depends on how well evolutionary theorists can explain the processes of variation, selection and inheritance in the discipline where UD is applied.

The principle of variation

The principle of variation refers to two issues. The first issue is whether species are fixed or whether there are variations within species. The second issue relates to the causes of the variations.⁶ Contrary to Creationists such as Aristotle (384–322 BC), Darwin argued that even in a single species, individuals vary and these individual differences are very important because they provide the materials for natural selection to act on (Darwin, 1859). However, Darwin did not fully understand the causes of the variations. He believed that variations were caused by changes in the external environment, and these variations were then passed on to offspring through sexual reproduction. It was not until the discovery of DNA that scientists started to fully understand that most variations are caused by the mutations of DNA. It was also realised that not all variations caused by the external environment can be inherited. Only the variations caused by mutations of DNA can be heritable, whereas variations caused by the use or disuse of an organism are non-heritable. Variations are a common phenomenon in the social sciences. We can easily see that there are different cultures in the world, and that there are differences among social groups, such as differences between firms. And even within a single social group, there are also differences between persons. Such variations provide adequate raw material for selective systems to operate on. The greater the heterogeneity among variations, the more advantageous it is for an adaptive system (Campbell, 1965).

The principle of selection

The principle of selection refers to how variations are selected and why only certain variations survive. Darwinism argues that some variations provide their bearers with an advantage in the struggle to live and reproduce. Those bearers, therefore, have more chance to survive. Over many generations, the population of more adaptive variations increases and this causes the evolution of the species. This selection process is described as "survival of the fittest". However, the selection process in UD is the most controversial issue debated by evolutionary theorists (Johansson and

Siverbo, 2009). There are three major differences between the selection processes of the social sciences and the natural sciences. The first difference is based on the fact that Darwinism excludes human intentionality. The exclusiveness of human intentionality in selection provides the strongest resistance to the application of Darwinism in social sciences. Ramstad (1994) argues that institutional evolution involves 'artificial' rather than 'natural' selection.⁷

Hodgson (2002: 267) strongly rejects this notion by saying that:

The essential characteristic of artificial selection is that humans manipulate the criteria or environment of selection ... But it would be a misunderstanding to see artificial selection as an alternative to natural selection. After all, the human who is doing the selection is also a product of natural evolution. There is nothing that privileges humans above other animals in this respect. In addition, other animals make selections too. Ants collect and keep live aphids. A tiger selects its prey. A cow first eats the tastiest grass.

Hodgson concludes that "in fact, any artificial selection depends on prior natural selection" (Hodgson, 2002: 267). There is no significant difference between artificial selection and natural selection from the point of view of an animal. Darwin (1859) argued that domesticated animals are artificially selected by humans while their wild counterparts are selected by nature. They are all selected by the external environment and humans are also a part of that external environment from the perspective of domesticated animals.

Second, the selection process in the social sciences may not be as irreversible as that in natural selection. Some variations can be unfavourable in certain periods, but, being in a recessive state, these variations can be retrieved when the external environment changes. The selection process in the social sciences is similar to that in biology and is based on "survival of the fittest". However, the selection process in the social sciences chooses the fittest at a particular point in time. There may be many variations struggling to attain the dominant position and, if one variation cannot win dominance, it can be allowed to stay along with its competitors. Therefore, pluralism is more prevalent in the social sciences.

Finally, the selection process in the social sciences can be active or passive, or ex-ante and ex-post (Dickson, 2003). A selection process can be initiated by an organisation (in our discussion, an organisation can be as small as a business unit or as large as a country) in order to accord with changes in the environment. This process can also be imposed by external forces such as market mechanisms or government sanctions.

The principle of inheritance

The principle of inheritance refers to how selected variations are inherited and passed on to offspring. According to Hodgson (2002), a key feature of human socio-economic systems is their replication or inheritance of customs, routines, habits and ideas. So what is the mechanism through which these customs, routines, habits and ideas are inherited? In biology, the processes of variation and inheritance (or retention) are carried out through the workings of biological genes or DNA.⁸ Many evolutionary theorists have struggled to find the equivalent to genes or DNA as replicators in the social sciences. Dawkins (1976: 92) invented a hypothetical unit of cultural evolution which he called the "meme". He said:

We need a name for the new replicator, a noun that conveys the idea of a unit of cultural transmission, or a unit of imitation. "Mimeme" comes from a suitable Greek root, but I want a monosyllable that sounds like "gene" I abbreviate mimeme to meme. Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches. Just as genes propagate themselves in the gene pool

by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation.

Blackmore (2001: 225) defines “meme” as “information copied from person to person by imitation”. Imitation is a process whereby an observed behaviour is copied by another individual. An individual can also obtain information through a recording instrument, for example a book or a video tape. McNamara (2011) suggests that memes can be classified as either internal memes (ideas in our brains, also called i-memes) or external memes (ideas installed in books, recipes and maps, also called e-memes). Blackmore (1999) also argues that memes can be seen in the genotype (the brain structures that instantiate ideas) and the phenotype (the behaviours these brain structures produce). Variations can also occur when memes change their forms, for example, from genotype to phenotype (Blackmore, 1999). A meme is the least unit of cultural transmission and has no given size (McNamara, 2011). A meme could consist of a single word, such as “debit” or “credit”, a phrase, such as “intangible assets” or sentence(s), such as the definition of fair value.⁹ The size of a meme also depends on the effectiveness of information transmitted by a transmitter and the capacity of a receiver to understand or copy such information (Blackmore, 1999).¹⁰

In summary, it can be argued that the mechanisms of variation, selection and inheritance exist in the social sciences, otherwise traditions, customs and ideas cannot transmit from one generation to the next generation or from one person (or a group of people) to another person (or another group of people). Hodgson (2002) argued that although there are differences between the socio-economic and natural domains, the general principle of Darwinism can be applied to both. He made the following point:

Evolution is a multi-level process, and key features of the natural and the socio-economic levels are different. Accordingly, not all mechanisms that are relevant to biology will apply to the socio-economic level as well. However, the principles of Universal Darwinism suggest that some general features of a Darwinism explanation can be common to all levels, wherever the features of variation, selection and inheritance are present. (2002: 277)

Furthermore, Hodgson (2002) mentioned that Darwinism only provides a theoretical framework rather than a detailed set of explanations for all phenomena. Consistent and complementary theories are still needed for each different discipline in the social sciences.

In this article, bookkeeping methods, viewed as adaptive complexity systems,¹¹ are carried out and implemented by accountants in their daily jobs, copied by one accountant in imitation of another accountant, and transmitted through memes. Memes are defined as ideas about and within bookkeeping methods, such as recording symbols and rules, the classification of accounts and balancing methods, and so on.

Many have successfully applied Darwinism to their field of study. One good example is the work of Nelson and Winter (1982). According to them, natural selection is used as a metaphor to model a competitive struggle that results in the survival of the fitter firms. Firms are selected in the sense that they survive competition. Another good example is the work of Wilson (1975) who related social behaviour to biological evolution. He further developed a theory of cultural co-evolution tying human culture to both biological and cultural evolution.

Steels (1999) applied Darwinism to linguistics and proposed that linguistic research should concentrate on the evolutionary nature of language. He explained that languages are like species. Similar to biological species, there is a natural variation in verbal behaviour; that is, every individual speaks differently. These variations are due to differences between the internal knowledge of individuals and their response to environmental resources. Some variations

Table 1. Chronology of bookkeeping methods in China.*

Period and Date	Major Developments
1122–771 BC Western Zhou	Single-entry bookkeeping emerged and was used in government accounting: “ <i>Ru</i> ” (input) and “ <i>Chu</i> ” (output) were used as recording symbols. Two forms of accounts were used: <i>Cao Liu</i> (a day book) and <i>Zong Qing</i> (a ledger) entries from the day book every 10 days or monthly.
1122 –771 BC Western Zhou	<i>Sanzhu Jiesuan</i> (Three Column Method) was used to check balance.
206 BC–221 AD Han Dynasty	<i>Xinshou</i> (New Receipts) – <i>Kaichu</i> (Amount Paid Out) = <i>Jianzai</i> (Balance)
618–707 AD Tang Dynasty	Single-entry bookkeeping was widely used. “ <i>Shou</i> ” (Receipt) and “ <i>Fu</i> ” (Payment) were used as the recording symbols in non-government accounting, while “ <i>Ru</i> ” (In) and “ <i>Chu</i> ” (Out) were used in government accounting.
	<i>Sizhu Jiesuan</i> (Four Column Method) appeared.
	<i>Jiuguan</i> (Old Balance) + <i>Xinshou</i> (Newly Received) – <i>Kaichu</i> (Payment) = <i>Jianzai</i> (New Balance). The major difference between the Three Column Method and Four Column Method is that, in the Four Column Method, people began to distinguish “balance from last period” from “balance of this period”. It was the foundation of Chinese double-entry development.
	Since then, accounting and reporting advanced to the form of numeral interpretation in which the four items, the old, the newly received, the payment and the balance were listed in terms of currency.
Mid-1500 AD in the Ming Dynasty (1368–1644 AD)	<i>Sanjiao Zhang</i> (Three Feet Bookkeeping) emerged. This is an intermediate framework lying between the single- and double-entry methods. It used a form of double-entry for non-cash transactions. It was mainly used in non-government accounting. “ <i>Shou</i> ” (Receipt) and “ <i>Fu</i> ” (Payment) were used.
Mid-1600 AD in the late Ming Dynasty (1368–1644 AD) and the early Qing Dynasty (1644–1911 AD)	<i>Longmen Zhang</i> (<i>Longmen</i> Bookkeeping) appeared. This was the primitive indigenous double-entry bookkeeping. It used three kinds of account books: <i>Cao Liu</i> is the same as Memoranda in Western accounting, being used as source documents. <i>Xi Liu</i> is different from the journal in Western accounting, the former is the re-writing of <i>Cao Liu</i> , the latter requires journal entries, using debit and credit double-entry. <i>Zong Qing</i> is the same as the ledger in Western accounting, in that both classify the effects of transactions on each individual account.
Mid-1800 AD in the Qing Dynasty (1644–1911 AD)	<i>Sijiao Zhang</i> (Four Feet Bookkeeping, also known as Heaven and Earth Matching Bookkeeping) method was invented. It was much more mature than the previous methods, especially in accounting reporting. It had “ <i>Cai Xiang Jie Ce</i> ” and “ <i>Cun Chu Jie Ce</i> ”. They resembled the profit and loss statement and balance sheet.
1840s after the First Opium War (1840–1842 AD)	Debit-credit bookkeeping was introduced to China. Western accounting was mainly used in customs administration and railway administration which were taken over by the colonists. However, all recording and reporting were prepared in foreign languages, and then translated into Chinese, using the Chinese Four Column report.
1905 AD Toward the end of the Qing Dynasty (1644–1911 AD)	The publication of <i>Lian Huan Zhang Bu</i> (Chan Accounting) by Xi-Yong Cai. This is the first book published in Chinese that introduced Western double-entry accounting. It started to gradually change the attitudes of Chinese towards debit-credit double-entry. There were more books published following this one, mainly by scholars who had studied in Japan.
1910s–1920s In the period of Republic of China (1911–1949)	In 1908, <i>Daqing</i> Bank, the predecessor of the Bank of China, was established. A number of Chinese who graduated from Japan joined in the establishment of the <i>Daqing</i> Bank, and advocated the use of Western accounting. By 1916, the accounting methods used in the newly renamed Bank of China were Western bookkeeping methods. From then on, all newly founded banks used Western accounting.

Table I. (continued)

Period and Date	Major Developments
1920s–1930s In the period of Republic of China (1911–1949)	A serious debate about the debit-credit method and the Chinese indigenous method emerged. The debate was led by two schools: one school advocated the complete use of Western accounting, abandoning Chinese bookkeeping, while the other suggested reforms to Chinese bookkeeping, using the Chinese recording symbols of “ <i>Shou</i> ” (Receipt) and “ <i>Fu</i> ” (Payment) with the Western multicolumn account format. The outcome of this debate is mixed. By 1949, the debit-credit method was widely used in large and medium-sized businesses while the modified Chinese method was used for small businesses.
1963 After the Great Leap Forward Movement (1957–1962)	The increase-decrease method was invented and was unveiled in a journal article. It was implemented first in state-owned commercial (retail) enterprises and then it was adopted by many other industries.
1960s During the Cultural Revolution (1966–1976 AD)	The receipt-payment methods emerged. There are three different types: (a) the cash receipt-payment method was used by banks; (b) the property receipt-payment method was used by rural villages; and (c) the fund receipt-payment method was used by government units and not-for-profit organisations.
1978-1992	Debit-credit double-entry re-emerged. All enterprises were required to use this method from 1 July 1993 after the issue of the first Chinese accounting standard.
1995	From 1995, all government departments, agencies and not-for-profit organisations were required to use the debit-credit method.

*The table was compiled by the authors, drawing upon Guo (1986, 1988) and Wei (1984).

may get carried on in a selection process. For example, shortened words are easy to remember and they will disperse throughout the population. Words that are related to new technology and linked with a visual image, such as “google” and “google search”, are more robustly recognised. These terms would not necessarily be understood by someone unfamiliar with the use of the internet.

Applying Darwin’s principles to explain the evolution of human affairs has become a new research paradigm and UD may also be used to explain many accounting phenomena. Accounting is very often called the language of business. This business language has evolved over thousands of years. Some methods and systems appeared and then took a back seat in the evolutionary process. Some of them have been inherited and selected while others still compete for dominance. Single-entry bookkeeping, for example, was replaced by double-entry bookkeeping. Fair value is competing with historical cost. Positive accounting theory has gained popularity in the accounting research arena. The purpose of this article is to apply the principles of UD to explain the evolutionary progress of double-entry bookkeeping methods in China. As bookkeeping methods can be viewed as complex adaptive systems, in the next section our analysis will refer to ideas about and within bookkeeping methods as memes.

Evolution of bookkeeping methods

Littleton (1966) listed the conditions for the development of bookkeeping: private property, capital, commerce, credit, writing, money and arithmetic. The most important factors for the invention

of Chinese double-entry bookkeeping were private property and commerce. In the late *Ming* Dynasty during the fifteenth and sixteenth centuries, with the development of a commodity economy, especially in commerce and banking, economic activities tended to become more complicated with the increase of capital and of connections between businesses (Meng, 1957). The Chinese double-entry framework known as The *Longmen Zhang* (Dragon Gate Bookkeeping) and *Sijiao Zhang* (The Four Feet Bookkeeping) emerged under these circumstances. Thus, economic factors are the main causes for the evolution from single-entry to the double-entry bookkeeping methods in China. Table 1 provides a chronology of bookkeeping methods in China.

Development of Chinese indigenous bookkeeping methods

The change from single-entry to double-entry was not a sudden switch, but a gradual process: from single-entry to an intermediate framework between single and double-entry and, finally, to double-entry. The intermediate framework was called *Sanjiao Zhang* (The Three Feet Bookkeeping). This was based on the single-entry framework, but with a form of double-entry added for non-cash transactions. It was known as *Sanjiao Zhang* because the double-entry for a non-cash transaction represented two feet, while the single-entry for a cash transaction represented one foot only. A cash diary was used to record cash increases and decreases, from which, using *Sizhu Jiesuan* (Four Column Method),¹² the cash balance on hand in the diary could be obtained and then checked with the actual cash on hand. *Sanjiao Zhang* is the basis of the Chinese double-entry framework.

The first indigenous double-entry framework in China was called the *Longmen Zhang*, which originated in the commercial sector at the end of the *Ming* Dynasty and at the beginning of the *Qing* Dynasty (Aiken and Lu, 1998; Lin, 1992). There were three kinds of account books used in the *Longmen Zhang* system, namely *Cao Liu*, *Xi Liu*, and *Zong Qing*. A set of financial reports was produced based on *Zong Qing* accounts. Compared with *Sanjiao Zhang* and single-entry bookkeeping, the features of *Longmen Zhang* were:

- Using *Shou* (Receipt) and *Fu* (Payment) as recording symbols. All transactions, including cash and non-cash transactions, are double recorded; according to the rule, *Shou* appears with the *Fu*, and the amount must be equal.
- *Shou* (Receipt) and *Fu* (Payment) are used not only as recording symbols, but also represent the actual directions of cash flows. The principle of recording is based on cash inflows equal cash outflows. *Shou* means *Laizhang Yin* (silver from, or cash coming from), *Fu* means *Quzhang Yin* (silver to, or cash going to). For each transaction, *Laizhang Yin* must be equal to *Quzhang Yin*, or “silver from” must be equal to “silver to”.
- All accounts were classified into four categories: *Jin* (Receipt), *Jiao* (Payment), *Cun* (Keeping) and *Gai* (Owing). Account balances in *Jin* (Receipt) and *Jiao* (Payment) categories were the basis for calculating profit.
- Account balances could be checked by using the equation: $Jin \text{ (Receipt)} - Jiao \text{ (Payment)} = Cun \text{ (Keeping)} - Gai \text{ (Owing)}$.

The classification of accounts used in the *Longmen Zhang* system is different from the classification of accounts used today. Today all accounts are divided into three categories: asset, liability and owner's equity. The four types of accounts in *Longmen Zhang* were not classified in terms of the nature of accounts, but in terms of the results of the business transactions. In the *Longmen Zhang* system, *Jin* (Receipt) accounts reported all the income made by a business and *Jiao* (Payment)

accounts represented all the expenses incurred by a business. *Cun* (Keeping) accounts represented increases in assets; *Gai* (Owing) accounts represented increases in liabilities.

In the *Longmen Zhang* system, *Jin* (Receipt) and *Gai* (Owing) accounts were always recorded under the “*Shou*” side, while *Cun* (Keeping) and *Jiao* (Payment) accounts were always recorded under the “*Fu*” side. Just as the Chinese writing style in ancient times was from the top to the bottom, an ancient Chinese ledger was also divided into a top part and a bottom part. “*Shou*” activities were recorded on the top part of the ledger while “*Fu*” activities were recorded on the bottom part of the ledger.

The results of activities in *Jin* (Receipt) and *Jiao* (Payment) accounts were summarised and matched in a “*Jin* (Receipt) and *Jiao* (Payment)” report and the results of activities in *Cun* (Keeping) and *Gai* (Owing) accounts were reflected in a “*Cun* (Keeping) and *Gai* (Owing)” report. The difference between *Jin* (Receipt) and *Jiao* (Payment) should be equal to the difference between *Cun* (Keeping) and *Gai* (Owing). This principle was applied to checking for any recording mistake and whether accounts balanced.

Based on *Longmen Zhang*, a new version of the Chinese indigenous method *Sijiao Zhang* was developed. It was much more mature, especially in accounting reporting. There were two types of financial reports under the *Sijiao Zhang* system: “*Cai Xiang Jie Ce*” and “*Cun Chu Jie Ce*”. “*Cai Xiang Jie Ce*” is like a form of profit and loss statement found in Western countries where all revenues (receipts) appear in the top part of the statement, and all expenses (payments) are stated in the bottom part. There was a profit if the amount in the top part exceeded that in the bottom part; if not, there was a loss.

“*Cun Chu Jie Ce*” is similar to a balance sheet. All liability items (owing) and owner’s contributions were listed in the top part of the report, and all assets (keeping) were stated in the bottom part. The ending balance in the “*Cai Xiang Jie Ce*” was transferred into “*Cun Chu Jie Ce*”. If a profit was made, it appeared in the top part, whereas a loss would appear in the bottom part. The top part of “*Cun Chu Jie Ce*” was called “*Tian Fang*” (Heaven side) and the bottom part was called “*Di Fang*” (Earth side). The process of balancing the two parts was called “*Tian Di He*” (matching Heaven with the Earth).

Developments after the introduction of Western debit-credit double-entry bookkeeping into China

Before 1840, when the first Opium war occurred in China, the government of the *Qing* Dynasty (1644–1912 AD) had advocated a “closed door” policy on the grounds that China was rich in resources and it did not need to obtain products from other countries. But, following the invasion of China by other countries during the period 1840–1842, this government dream was shattered. With the introduction of modern industrial techniques from the West, and the operation of Chinese military industries and other national production, the self-sufficient economy began to collapse. Against this background, Western bookkeeping methods were introduced passively into China (Ji, 2001).

Western-style bookkeeping, an imported new species, was initially brought in and used by foreigners working in China¹³ and was not immediately taken up by the Chinese themselves. Chinese academics learned the methods of the new style of bookkeeping first, mainly through their education in Japan. In 1905, a Chinese scholar named Xi-Yong Cai wrote the first book *Lian Huan Zhang Bu* (Chain Accounting System), introducing the new system into China. In this book, the author termed the Italian double-entry system a chain accounting system. Cai (1905: 10) explained that under this system:

When recording a transaction between two businesses, what appears on the credit side in one business must be on the debit side in the other business, and vice versa. This was called chain accounting, because it makes a check possible of the total debits and total credits before settling the accounts: If the totals are not equal, there must be some recording mistake. The accounts are settled half-yearly or yearly. The difference between the revenue and expenditure is obtained: If the result is positive there is a profit, if negative there is a loss.¹⁴

In order to help Chinese readers to understand the debit-credit double-entry system, Cai used the Chinese recording symbols “*Gai*” and “*Cun*”, in place of “Debit” and “Credit”. The book-keeping principle was “*Gai* and *Cun* must appear at the same time, and must be equal”. In his book, Cai also retained the Chinese vertical recording system with *Cun* at the top and *Gai* below. This book had a great influence on the evolution of Chinese bookkeeping methods. However, this book was based on the Italian fifteenth-century double-entry framework and made no mention of later developments in bookkeeping methods in America and Europe (Chen, 1998).

In 1907, the book *Bank Bookkeeping*, written by two Chinese authors who were studying in Japan, Lin Xie and Shen Meng (1907), was published in Tokyo. This book is a comprehensive introduction to the debit-credit double-entry framework, and one of its main contributions is the explanation of the meaning of “debit” and “credit”. It enabled Chinese accounting professionals to begin to understand the debit-credit method.

After the successful adoption of Western methods in the banking sector,¹⁵ some accounting professionals in China began to advocate the use of Western accounting and the phasing out of Chinese bookkeeping (Gao, 1985). These radical revolutionists were mainly of two kinds. Firstly, there were those whose background was in the banking sector. They believed that an accounting method as used in banks would suit other industries as well. They applied their methods to manufacturing industry, but received mixed results. Secondly, there were those whose background was in foreign business and who thought Western bookkeeping was much better than the Chinese indigenous bookkeeping methods (Chen, 1998; Liu and Wang, 1994). This group of revolutionists was led by Mr Xu-Lun Pan, a graduate from the United States. He advocated completely abandoning the Chinese indigenous bookkeeping system. His group argued that the debit-credit method was the most scientific and logical method.

On the other hand, many people still proposed that Chinese indigenous accounting should be retained and could be reformed. The first wave of debate on the strengths and weaknesses of Chinese indigenous bookkeeping and Western bookkeeping occurred in the 1920s. The reformist school was led by Yong-Zuo Xu who advocated the use of Chinese account books but with the principles of the Western double-entry bookkeeping system, thus avoiding the need for imported account books which were very expensive. One difference between Chinese and Western bookkeeping at that time was that the former used two-part (top and bottom) ledger accounts and Chinese numerals, while the latter used a multiple column form ledger and subsidiary ledger accounts and Arabic numerals. This difference made it difficult for Chinese bookkeeping methods to imitate their Western counterparts completely.

A more critical issue in the adoption of Western debit-credit double-entry bookkeeping in China is that the Chinese were confused by the actual meaning of the terms debit and credit. In Chinese, *Jie* (Debit) means borrowing money from someone, while *Dai* (credit) means lending money to someone. On many occasions, *Jie* (Debit) and *Dai* (Credit) are interchangeable. For example, supposing a Chinese has a loan from the bank, he/she may say in Chinese ‘I have a *Dai Kuan* (loan) from the bank’ or ‘I *Jie Kuan* (borrow money) from the bank’. The meaning of ‘*Dai*’ and ‘*Jie*’ in these two sentences is the same. Therefore, in 1925, Yong-Zuo Xu suggested maintaining the Chinese

indigenous bookkeeping symbols *Shou* (Receipt) and *Fu* (Payment) as double-entry symbols while allowing accountants to use whichever form of accounts and whichever numerals they liked. This suggestion was welcomed by Chinese accountants because it not only provided them with the advantages of the Western bookkeeping method, but it also suited their writing habits. After several years of research and practice, the idea of how to reform Chinese accounting was maturing.

In December 1933, a book called *An Outline of Chinese Accounting Reform* by Yong-Zuo Xu (Xu, 1933) was published, and reprinted in 1934. In essence, Chinese accounting reform was trying to apply the Western bookkeeping method to reform deficient aspects of Chinese bookkeeping methods and make them more compatible.

However, even after modifications by some accounting reformers such as Yong-Zuo Xu, Chinese indigenous double-entry bookkeeping still lost its popularity among users because of internal deficiencies inherent in Chinese indigenous bookkeeping methods. The significant differences between the Chinese indigenous and the Western-style of bookkeeping are summarised in Table 2. The inherent problems in the Chinese indigenous bookkeeping methods are:

- The Chinese indigenous double-entry system is derived from the concept of cash movement: cash inflows (silver from) should be equal to cash outflows (silver to).¹⁶ All transactions can be interpreted as cash flowing from one account to another. If cash flows out of an account (*Laizhang Yin*, cash coming from), the Chinese call it *Shou* (Receipt); simultaneously it should flow into another account (*Quzhang Yin*, cash going to), which the Chinese call *Fu* (Payment). The amount of flows out must be equal to the amount of flows in, at the same time. However, some transactions are difficult to interpret under such a concept of cash movement.
- The classification of accounts is based on the results of activities, not on the transaction contents. For example, silver (cash at bank) can be either classified as a *Cai* (owing) account or as a *Cun* (keeping) account, depending upon different circumstances.
- According to the recording principle, transactions related to the *Jin* (Receipt) and *Gai* (Owing) accounts are always recorded on the *Shou* (Receipt) side; while transactions related to *Jiao* (Payment) and *Cun* (Keeping) accounts are always recorded on the *Fu* (Payment) side. Therefore, only increases in *Jin* (Receipt), *Jiao* (Payment), *Cun* (Keeping) and *Gai* (Owing) are recorded. If there is a decrease in these accounts, for example sales returns, a decrease in *Jin* (Receipt) is treated as a purchase instead. It would be recorded as an increase in the *Cun* (Keeping) account.
- The most controversial issue in Chinese indigenous double-entry is the recording rule for cash and bank deposit accounts. When cash is received from sales, it is recorded as “*Fu* (Payment): cash (silver) on hand”. When cash is spent on a purchase, it is recorded as “*Shou* (Receipt): cash (silver) on hand”. There is sometimes confusion as to why cash is recorded on the *Fu* (Payment) side when selling products, while cash is recorded on the *Shou* (Receipt) side when purchasing inventories.¹⁷

Evolution after the establishment of the People’s Republic of China in 1949

Since the introduction of the debit-credit bookkeeping method in the early twentieth century, there has been endless debate about whether to reform Chinese indigenous bookkeeping or completely abandon it and replace it with the Western debit-credit system. In order to compete with the Western debit-credit method, Chinese indigenous bookkeeping had undergone significant changes and especially improvements made by reformists led by Yong-Zou Xu in the 1930s. However, the

Table 2. Comparison of Debit-Credit, Chinese indigenous Receipt-Payment, Increase-Decrease, Fund Receipt-Payment bookkeeping methods.

Items	Debit-Credit Method	Chinese indigenous Receipt-Payment Method	Increase-Decrease Method	Fund Receipt-Payment Method
Recording symbols	Debit, Credit	Receipt, Payment	Increase, Decrease	Receipt, Payment
Accounts classifications	Asset, Liabilities Owner's equity	Receipt (<i>Jin</i>), Payment (<i>Jiao</i>) Keeping (<i>Cun</i>), Owing (<i>Gai</i>)	Fund Sources Fund Applications	Fund Sources, Fund Applications Fund Balances
Basic equation	Assets = Liabilities + Owner's Equity	Receipt (<i>Jin</i>) – Payment (<i>Jiao</i>) = Keeping (<i>Cun</i>) – Owing (<i>Gai</i>)	Fund Sources = Fund Applications	Fund Balances = Fund Sources – Fund Applications
Recording principles	Debit and Credit must appear at the same time and the respective amounts must be equal	Receipt and Payment must appear at the same time and the respective amounts must be equal	For transactions within the same category, increase and decrease must appear at the same time and the respective amounts must be equal. For transactions crossing "Fund Sources" and "Fund Applications", one account in "Fund Sources" records an increase (or decrease) and another in "Fund Application" also records an increase (or decrease), the amount on each side being equal	For transactions within the same category, receipt and payment must appear at the same time and the respective amounts must be equal. For transactions crossing "Fund Source" accounts, "Fund Applications" and "Fund Balance" accounts, one account in "Fund Sources" records a receipt (or payment) and another in "Fund Balances (or "Fund Applications) records a receipt (or payment), the amount on each side being equal.
Trial balance formula	Total debit amount = Total credit amount	Total receipt amount = Total payment amount	Total increases in Fund Sources – Total decreases in Fund Sources = Total increase in Fund Applications – Total decrease in Fund Applications	Net receipts in Fund Sources – Net payments in Fund Applications = Net receipts in Fund Balances

Illustrative example for journal entries under the above four methods: to record purchase of inventory 100,000 yuan, and half of the inventory has not yet been paid, owing to Mr X.

- (1) Under the Debit-Credit double-entry method, the journal entries are:
Dr: Inventory 100,000
Cr: Cash at Bank 50,000
Cr: Accounts payable 50,000
- (2) Under the Chinese indigenous Receipt-Payment Method, the journal entries are:
Receipt: Cash from the Owner 50,000
Receipt: Cash from Mr X 50,000
Payment: Silver on inventory 100,000

Table 2. (continued)

Items	Debit-Credit Method	Chinese indigenous Receipt-Payment Method	Increase-Decrease Method	Fund Receipt-Payment Method
(3)	Under the Increase-Decrease double-entry method, the journal entries are:			
	Increase: Inventory 100,000			
	Increase: Accounts payable 50,000			
	Decrease: Cash at bank 50,000			
	It can be seen that the total increase is 150,000 and the total decrease is 50,000. The correctness of journal entries cannot be checked automatically by total increases equals total decreases like the formula of total debits equals total credits under the Debit-Credit double-entry system.			
(4)	Under the Fund Receipt-Payment Method, the journal entries are:			
	Payment: Inventory 100,000			
	Payment: Cash at Bank 50,000			
	Payment: Accounts payable 50,000			

debit-credit bookkeeping method has gradually assumed the dominant position since the 1940s. By 1949, before the establishment of the People’s Republic of China (PRC), the method was widely used in large and medium-sized businesses. It can be seen, from this process, that economic and cultural factors were major determinants in selecting the debit-credit bookkeeping method over Chinese indigenous bookkeeping methods. As economic transactions became more complicated and frequent, Chinese indigenous bookkeeping was unable to cope, even though culturally it was more in line with Chinese traditional thinking.

In 1949, the political system in China changed fundamentally. Under socialist ideology, China underwent significant political, economic and social reforms. In the initial period of the PRC from 1949 to 1952, private ownership was still allowed. However, during the period of restructuring of private enterprises from 1953 to 1958, most privately owned enterprises were closed or transformed into state-owned enterprises (SOEs) or collective-owned enterprises (COEs) (Adler, 1957; Berry, 1988).

Because of changes in the political, economic and social environments, debate was reignited during the Great Leap Forward Movement (1957–1962) and the Cultural Revolution (1966–1976) (Center for Chinese Study, 1968). The resurgence of debate was mainly politically motivated, but was also caused by economic or cultural changes. From the political perspective, the Chinese Communist Party (CCP) had taken control of China. Marxism, Leninism and Mao’s thoughts were the dominant ideologies. Any contradicting ideas, particularly from capitalism, feudalism and revisionism were to be criticised and eliminated. From the economic perspective, all enterprises in China were transformed into state-owned or collectively-owned organisations, and private ownership could no longer exist in China. The Chinese economy at that time was referred to as a centrally planned economy. Accounting was regarded as a tool to facilitate central planning and management. From the cultural perspective, any films, shows or publications that portrayed capitalist and feudal cultures were criticised and denounced. Bookkeeping methods could not escape the proletariat’s scrutiny. At that time, radical ideologists believed that the debit-credit method originated in Western countries and therefore was a capitalist method.¹⁸ It was argued that the concepts of “debit” and “credit” were associated with private ownership and, therefore, it was no longer appropriate to continue using the

debit-credit method in SOEs and COEs. In the debit-credit method, the structure of capital includes liabilities and owner's equity, but at that time in China, financial sources were all provided by the government. Financial sources in Chinese enterprises were not allowed to be called "capital", due to political sensitivity. They were called "funds". Therefore, the basic accounting equation of "Assets = Liabilities + Owner's Equity" was replaced with either "Fund Sources = Fund Applications" or "Fund Balances = Fund Sources – Fund Applications" (Cheng, 1971; Tang et al., 1996).

Furthermore, the debit-credit method had been adopted by the Soviet Union and for this reason was also regarded as a revisionist method (Berry, 1988) by the Chinese in the early 1960s after the Sino-Russian split. Chinese authorities argued that China was a socialist country and thus should use its own socialist bookkeeping method with Chinese characteristics. Several bookkeeping methods were then proposed and formulated based on Chinese indigenous bookkeeping methods (Liu and Wang, 1994). These methods replaced the debit-credit double-entry bookkeeping method.

Among these methods, the increase-decrease method and receipt-payment methods were the most popular and practicable (Wei, 1984). The increase-decrease method was invented in the early 1960s and implemented first in state-owned merchandising enterprises. The method was called the increase-decrease method since it used Chinese *Zeng* (Increase) and *Jian* (Decrease) as recording symbols. Increase (or decrease) represents the actual increase and decrease in transactions. It was considered easy to master, and overcame much of the confusion associated with the debit-credit method (Mao and Guo, 1993). Soon after the successful adoption of the increase-decrease method in merchandising enterprises, the Ministry of Finance (MOF) endorsed this method which spread into other industries through the promulgation of the *Uniform System of Industrial Accounting* in 1966. The method became so popular that the debit-credit method was completely abolished during the Cultural Revolution. The main features of increase-decrease bookkeeping are summarised in Table 2.

The main advantage of this method is that it used *Zeng* (Increase) and *Jian* (Decrease) as its recording symbols and it also directly reflected the movements of fund sources and fund applications. However, the increase-decrease method had some internal deficiencies:

- Transactions can be recorded in opposite directions (Increase/Decrease) and sometimes they can also be recorded in the same direction (Increase/Increase or Decrease/Decrease). Therefore, total increases do not equal total decreases. The trial balance is calculated by checking whether the difference between increases and decreases in "Fund Application" accounts equals the difference between increases and decreases in "Fund Source" accounts.
- The increase-decrease method was unable to cope with some of the more complicated business transactions and could result in total increases not being equal to total decreases.
- The recording directions for a ledger and its sub-ledger accounts can be different. This makes the internal checking mechanisms under this method weak.

At the same time, several new versions of receipt-payment methods were also proposed and used. These methods are different to, but based on, the indigenous receipt-payment methods used in the 1920s and 1930s. The cash receipt-payment method was used in the banking industry; the property receipt-payment method was used in people's communes; and the fund receipt-payment method was used by government units and not-for-profit organisations. From 1965 onwards, the fund receipt-payment method was the most widely used of the three methods. It was only replaced by the debit-credit method in 1995.

The characteristics of the fund receipt-payment bookkeeping method are summarised in Table 2. The main advantage of this method is that it maintains the Chinese *Shou* (Receipt) and *Fu* (Payment) as recording symbols. However, under the fund receipt-payment method, transactions can be recorded in the opposite directions (Receipt-Payment) as well as in the same direction (Receipt-Receipt, Payment-Payment) and it compromises the rigidity of the double-entry principle. It makes the detection of mistakes in the recording process, and preparing trial balances, more complicated (Käfer, 1966). Only the “balancing of differences” approach can be used.

Domination of the debit-credit double-entry method

Since China opened its doors in 1978, debate about whether to keep Chinese bookkeeping methods or revitalise the Western debit-credit bookkeeping method again arose. Many useful discussions led to the revival of the debit-credit bookkeeping method in China. The relaxed political atmosphere since 1978, when the CCP abandoned its hard-line class struggle and prioritised the development of the socialist economy, was a major factor in the rebirth of debit-credit bookkeeping. The debit-credit method was reintroduced initially to those enterprises with foreign trade and soon to other sectors. The Chinese government’s position in this period was unclear, and the coexistence of different bookkeeping methods was allowed. This situation has changed significantly since the issuing of the first Chinese accounting standard in 1992 (Aiken et al., 1995; MOF, 1992), whereby debit-credit bookkeeping was selected as the mandatory method to be used. For the first time, Chinese accounting authorities unified China’s bookkeeping methods (Chen, 1998). The standard declares that “All enterprises should use the debit-credit double-entry method” (MOF, 1992: 1). From 1995, all government departments, agencies, and not-for-profit organisations were required to use the debit-credit double-entry method.

Discussion

This article attempts to analyse the evolutionary process of bookkeeping methods as adaptive complexity systems in twentieth-century China. The evolutionary process from single-entry to double-entry bookkeeping in China took more than a thousand years to accomplish. However, the process was interrupted by the introduction of a new “species”, the Western double-entry bookkeeping method. Since then, the indigenous double-entry method has evolved in order to compete for survival. Several variations in Chinese double-entry bookkeeping methods, such as the increase-decrease method, and the fund receipt-payment method, have been used by Chinese accounting practitioners, supported by favourable political and economic environments. But eventually these indigenous double-entry methods have come to be replaced by the Western debit-credit method because the debit-credit method is more technically advanced and it has stronger memes, for example clearer and more rigorous recording rules and balancing methods. The evidence shows that the evolutionary process of bookkeeping in China has been influenced by political, economic and cultural factors. These factors have brought about variations in bookkeeping methods, and also changes in the selection criteria for the bookkeeping methods chosen over time. These factors have also caused changes in the inheritance mechanisms which determine how selected bookkeeping methods are disseminated, whether voluntarily adopted by firms, or mandatorily sanctioned by the authorities.

As a species, Chinese indigenous bookkeeping methods evolved over one thousand years from a single-entry method to the *Longmen Zhang*, accompanied by numerous variations, mutations and selections. The variations appeared naturally as a result of the imperfect imitation of bookkeeping

methods by accountants copying from each other. These variations could be in recording symbols, rules and styles. They are variations in memes. The selection of those variations was mainly driven by economic and cultural factors. Only those variations that met the development of the economy and changes in the cultural environment survived and accumulated. The traditional Chinese cultural favouring of agriculture over commerce is the main reason for the slow evolution of Chinese indigenous bookkeeping methods from single-entry to double-entry.

Even within this slow evolutionary process, it is clearly seen that memes in single-entry bookkeeping, such as recoding symbols, rules, accounts and balancing equations, have mutated continuously. The single-entry method was initially used in government accounting, and *Ru* (In) and *Chu* (Out) were the recording symbols. Then the symbols of *Ru* (In) and *Chu* (Out) mutated into *Shou* (Receipt) and *Fu* (Payment). *Shou* (Receipt) and *Fu* (Payment) single-entry bookkeeping was used mainly in non-government accounting as these symbols were more appropriate to reflect private transactions involving the exchange of economic benefits. *Ru* (In) and *Chu* (Out) single-entry and *Shou* (Receipt) and *Fu* (Payment) co-existed for more than a thousand years. *Ru* (In) and *Chu* (Out) was still in use in the era of the *Qing* dynasty (1644–1911). The meaning of the symbols of *Ru* (In) and *Chu* (Out) represent, to some degree, governmental coercive powers in China.¹⁹ In the early years of single-entry bookkeeping, there were only two kinds of accounts, *Cao Liu* (rough memorandums) and *Zong Qing* (ledgers). Then another account, *Xi Liu* (literally, running water accounts, daily accounts), was added in between. The balancing equation used in the single-entry bookkeeping methods was also changed from *Sanzhu Jiesuan* (Three Pillar or Column Method) to *Sizhu Jiesuan* (Four Pillar or Column Method). These were the major variations in memes in the evolutionary process of single-entry bookkeeping and, in fact, variations in memes could occur at any time, whenever accountants carried out their bookkeeping. For example, people could copy transactions in *Cao Liu* to *Xi Liu* differently, according to their own styles. The inheritance mechanism at this stage mainly operated through passing on technical knowledge orally in master–apprentice relationships.

The evolution of Chinese indigenous bookkeeping had continued from the *Ming* Dynasty (1368–1644 AD) to the First Opium War (1840 AD). During this period, Chinese indigenous double-entry bookkeeping methods, *Longmen Zhang* and the *Sijiao Zhang* (Four Feet bookkeeping) systems were incubated and developed. *Sijiao Zhang* was also called *Tian Di He Zhang* (Heaven and Earth Matching Bookkeeping) (Gardella, 1992). Until 1840 there was no single prescriptive text available to dictate bookkeeping methods. Ideas about bookkeeping methods (defined as memes in this article) were taught orally from master to apprentice. Since most tacit knowledge of bookkeeping methods was passed on through imitation (by the apprentice copying from his master), this prevented it from being introduced from one business unit to another efficiently, and this eventually slowed down the evolutionary process. Different bookkeeping methods co-existed and passed from one generation to another in different business units. However, none of them could reach a dominant position because of the lack of communication among business units and the lack of written materials explaining clearly the memes in indigenous bookkeeping methods.

The evolutionary process took a new turn at the start of China's modern era, beginning with the First Opium War. At that time, a new species, Western double-entry, was introduced into China. China's own indigenous species, *Longmen Zhang* and *Sijiao Zhang*, were challenged because, from a technical perspective, memes such as the internal recording rules, balancing mechanisms and account structures found in the Western double-entry system were much clearer and more rigid than those of the Chinese indigenous double-entry methods. If the indigenous methods did not improve, they could be replaced by the new species. In fact, there was a significant increase in variations in Chinese indigenous double-entry methods after the first Opium War. These variations were responses to the threat of the new ideas (or memes) introduced by Western-style bookkeeping. Meanwhile, the

ideas (or memes) of Western-style bookkeeping spread rapidly among accountants. Western-style bookkeeping was used initially by customs and industries controlled by foreigners, and was outside the mainstream of Chinese business organisations. It was then introduced into Chinese banking systems and other sectors where it faced resistance from the Chinese indigenous methods. Eventually, the new species of Western-style bookkeeping was selected in preference to the old species of indigenous bookkeeping. By 1949, the debit-credit method was widely used in large and medium-sized businesses. However, this did not signal the end of Chinese indigenous bookkeeping methods. Although they lost their dominant position, they were still used by small businesses. The inheritance mechanism had also advanced at this stage. Formal accounting education had become an important vehicle for the transmission of knowledge of both Western and Chinese indigenous bookkeeping methods.

The favourable political environment during the 1960s and 1970s allowed ideas (memes) in the Chinese indigenous bookkeeping methods to be retrieved. Variations in the memes within bookkeeping methods first appeared in some commercial enterprises in Beijing during the early 1960s (Wei, 1984). Those variations in memes were in the bookkeeping symbols. The symbols of “Debit” and “Credit” were changed to “Increase” (or “Receipt”) and “Decrease” (or “Payment”). Variations in memes also occurred in recoding rules and balancing methods. All accounts had been designed to have three columns (increase or receipt, decrease or payment, and balance) and did not follow the Chinese traditional two-part accounts (receipt at top and payment at bottom). These variations in memes were soon selected and supported by government authorities because they met the needs of leftist ideology in this period. There were three major bookkeeping methods in use during this period: the increase-decrease method, the cash receipt-payment method, and the fund receipt-payment method. Variations in the memes in bookkeeping methods during the 1960s and 1970s were mainly caused by political favouritism. The selection was imposed externally by governmental sanctions. Therefore, in this instance, politics was the determining factor.

However, the ideas (or memes) of the debit-credit method had never died in the minds of some Chinese accountants, even though they were suppressed by the leftists during the Cultural Revolution. After decades of the “closed door” policy, China began its economic reform in 1978. With economic development and reforms in state-owned enterprises, private and foreign ownership were once more encouraged. The debit-credit method was reintroduced in Chinese enterprises (Mao and Guo, 1993). The reason for the revival of the debit-credit method is that in order to attract foreign investment, China had to reform its accounting system (Fang, 1989; Gang, 1992) and make it more comparable and transparent to outsiders. The debit-credit bookkeeping methods first reappeared in the accounting systems of joint ventures established by Chinese enterprises and foreign investors. The debit-credit method was officially permitted to be used in those joint ventures. It was then gradually adopted by other types of enterprises and government agencies. It was argued that the reintroduction of Western debit-credit bookkeeping, the widely accepted method globally, would enable foreigners to better understand Chinese accounting systems.

Meanwhile, the demise of Chinese bookkeeping methods, such as increase-decrease and various receipt-payment bookkeeping methods, was caused mainly by a change in the political and economic environments. However, the resurgence of the debit-credit method has been associated with its more rigid memes such as its internal check and balance mechanisms. In the previous section, we highlighted the characteristics and technical deficiencies in memes inherent in Chinese indigenous double-entry bookkeeping methods. In order to compete with the Western double-entry bookkeeping method, attempts have been made to overcome the deficiencies in memes of the Chinese bookkeeping methods, and accordingly many changes have been made. However, even with improvements over many years, Chinese bookkeeping methods were still unable to overcome their inherited deficiencies in memes and were still technically more disadvantaged than the Western method.

Consequently, the technical deficiencies in memes in Chinese indigenous bookkeeping have led to its demise. In terms of the external environmental factors, culturally, Chinese bookkeeping methods are more connected with Chinese traditional thinking and linguistic habits. This is why the Chinese have tried to keep their indigenous methods. From this cultural perspective, the Western bookkeeping method is at a disadvantage. However, due to more than 160 years of promotion and education, the meaning of debit and credit (as a very important meme in the debit-credit method) has gradually come to be understood by the Chinese. The Western method seems to have already crossed the cultural barrier. As we saw before, political factors can cause drastic interruptions in the evolution process, as evidenced by the development of Chinese bookkeeping methods during the 1960s and 1970s. However, with the fading of political favouritism, the evolutionary process of bookkeeping methods in China is once again determined by economic factors. The economic factor, presently, is the main factor allowing the Western method to regain its dominant position. The Western bookkeeping method can cope with more complicated business transactions and acts as a common international business language spoken by the global business community. From the evolutionary process of Chinese bookkeeping methods, we can see that the dominance of the Western double-entry bookkeeping method occurs not by chance, but follows the processes of variation, selection and inheritance as described in "Universal Darwinism".

Conclusion

Chinese accounting underwent significant changes during the twentieth century. Many Western accounting ideas and practices have been introduced into China whereby Chinese accounting practitioners have faced unprecedented challenges from the outside. Over the years, some Western accounting methods have been widely accepted by the Chinese people while other techniques have been resisted strongly by Chinese accounting professionals and academics.

In this article, we have utilised the basic principles of "Universal Darwinism" to analyse one significant evolutionary process in Chinese accounting history: the evolutionary process of bookkeeping methods from single-entry to Chinese indigenous double-entry, and then to Western double-entry. It can be demonstrated that since the introduction of Western-style double-entry bookkeeping methods into China, Chinese indigenous double-entry methods have undergone significant changes to resist the threat of demise. Notable changes in bookkeeping methods include the accounting revisionist movement led by Young-Zou Xu in the 1930s (Guo, 1988) and the inventions of the increase-decrease method and several receipt-payment methods in the 1960s. These developments were motivated by a desire to maintain the continuity of Chinese indigenous double-entry methods which were claimed to be more in line with Chinese culture than Western methods. Those indigenous methods flourished in the particular political environments of the times. However, they were defeated in the competitive struggle when the favourable political tides turned. One can argue that changes in the external environment have caused the demise of Chinese indigenous bookkeeping methods. The internal deficiencies in memes, the imperfect "genes" inherited in the Chinese indigenous double-entry methods, also caused them to lose their popularity. However, it would be wrong to conclude that those indigenous methods have necessarily been extinguished forever. Rather, they may have just become dormant, to be retrieved when the external environment is conducive to their revival.

In conclusion, the evolutionary process of the bookkeeping methods in China can be seen to follow the principles of "Universal Darwinism". The bookkeeping methods selected are the methods most suited to the environment under that particular setting. The principle of "survival of the fittest" does not necessarily mean that only one bookkeeping method can be selected. In fact, several bookkeeping methods can co-exist if they all meet the environmental constraints.

Dominant accounting methods are selected by humans. If an accounting method cannot be selected exclusively from among its competitors, various alternative methods may be permitted to remain. It has been shown that Chinese indigenous bookkeeping methods co-existed with Western bookkeeping methods in several periods, such as the period of the late 1930s to the late 1940s, and also the period from the early 1980s to the early 1990s. In the 1960s and 1970s when China was governed by the leftists, there were still several different versions of improved Chinese indigenous bookkeeping methods in operation.

This article has significant implications for future accounting research. First, and most importantly, this article provides an alternative paradigm, “Universal Darwinism”, which can be applied to analyse many accounting issues. The evolution of accounting can be critically evaluated by using the principles of variation, selection and inheritance (retention) identified in Universal Darwinism to determine the factors which cause the rise and fall of accounting methods or the justification for their continued use. The scope of the application of Universal Darwinism in accounting is quite wide since pluralism is a very prevalent phenomenon in accounting. For example, investments can be accounted for by using the one-line or line-by-line method, some revenue can be recognised on a cash basis and other revenue on an accrual basis. Historical cost is still widely used in asset measurement, even though fair value measurement is gaining popularity with the support of accounting standards setters such as the Australian Accounting Standards Board (AASB) and the International Accounting Standards Board (IASB). There are two conditions required for an accounting “species” to survive. The first condition is contingent on the internal memes (like genes in biology). An accounting method should not have severe internal deficiencies in memes compared with the memes in its competing alternatives. Otherwise, those internal deficiencies in memes could result in methods being placed in a disadvantageous position. The second condition is contingent on external factors. A surviving species should be well adapted to the environment. When the environment changes, memes in accounting methods need to mutate in order to suit the changes in the new environment. The external environment determines which method(s) can survive according to the rule of “survival of the fittest”.

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Notes

1. In the 1960s and 1970s, Chinese scholars who attempted to evaluate accounting achievements for the period 1840–1949 were treated as counter-revolutionists and put into prison. Today, there are still many taboos in social science research in China.
2. Richard Dawkins coined the phrase “Universal Darwinism” in 1983 to describe the application of Darwinism to the social sciences.
3. Here “environment” has a much broader meaning and includes human intervention. In the social sciences, selection is always artificial because selection is made by humans.
4. In the past, it was believed that variations were caused by needs, as explained in Lamarck’s classic example of the giraffe. Lamarck argued that as conditions made trees grow further apart and taller,

the original giraffes had to stretch their necks more and more to get to the leaves. Therefore, giraffes' necks became longer and longer (Mills, 2004). The variations caused by needs are called Lamarckian variations in the literature. The modern discovery of DNA has shown that Lamarckian variations are scientifically incorrect. The variations are absolutely random in their occurrence (but not, of course, random in their likelihood of survival, which is related to consistency with the environment). Most variations are caused by a mutation of genes and not all external environmental changes cause mutations of genes. Some of them can, such as nuclear radiation and smoking, but not in the case of the exercise of its neck by a giraffe. Variations caused by mutation are inheritable, but variations caused by needs are not inheritable. If you are a muscle builder, you cannot cause your offspring to be born as muscular as you are. Therefore, the acquired characteristics are not inherited (Dennett, 1995).

5. Donald T Campbell (1916–1996) was one of the first and most influential authors to formulate a generalised Darwinian theory directly applicable to phenomena outside of biology.
6. Hodgson (2002) argued that causal explanation is a key issue in Darwinian ontology. In principle, all outcomes have to have their causes and everything must submit to a causal explanation in scientific terms.
7. According to Hodgson's argument (2002), the development of accounting can also be regarded as the result of artificial selection and not of natural selection.
8. Darwin was unaware of the existence of genes and DNA, which had not yet been discovered by science and, therefore, he was unable to explain how parental traits are inherited. He believed that changes caused by the environment would leave permanent marks on parents' gametes. In the next generation, each gamete reproduced the offspring's particular bodily component (Rosenbaum, 2011). Through this process parental traits are inherited by their offspring. This inheritance mechanism was first suggested by Lamarck as inheritance of acquired characteristics. It is called Lamarckian inheritance.
9. Fair value is defined as "the amount for which an asset could be exchanged between knowledgeable, willing parties in an arm's length transaction" (Deegan, 2010: 202).
10. McGrath (2005) argued that "meme" is an analogical and explanatory construct. There is no evidence for the existence of a "meme". Nelson and Winter (1982) suggested a more tangible replicator, which they called a "routine". They proposed that routines in organisations can be seen as replicators, like genes in biology. There are different interpretations of routines in the literature. For example, routine can be referred to as behavioural patterns or cognitive regularities such as rules, standard operating procedures, etc. For further discussion about routines, see Becker (2004). Memes and routines are all hypothetical concepts invented by neo-Darwinists in order to apply Darwinian principles to the social sciences (Dawkins, 1976; Nelson and Winter, 1982). For a comparison of memes and routines, refer to Table 2 in Hodgson (2003: 379).
11. Complex adaptive systems (CAS) are defined by Holland (2006: 1) as "systems that involve many components that adapt or learn as they interact".
12. *Sizhu Jiesuan* (Four Column Method) refers to $Jianzai$ (New balance) = $Jiuguan$ (Old balance) + $Xinshou$ (Receipt) – $Kaichu$ (Payment) or $Jianzai$ (New balance) – $Jiuguan$ (Old balance) = $Xinshou$ (Receipt) – $Kaichu$ (Payment).
13. In 1845, customs administration in China was taken over by the colonists. In 1855, HN Lay was head of the tax section of the Shanghai customs and, in 1860, he headed the tax section of the national customs department. From 1860, this office began to use Western bookkeeping, and to make financial reports regularly according to the Gregorian calendar. This was the first time that Western accounting was used in China (Wei, 1984). Next it was adopted for railway administration. The first railway was built according to English designs. It was finished in 1874 and, by the following year, the length of rail track in China reached 13,000 kms. Most of these railways were built with foreign loans. The terms of the loans included the nomination of the engineer, the chief accountant and other key personnel, hence the accounting method used was that of the country from which the loan was obtained.
14. This is a translation by the authors of this article.
15. In 1908, Daqing Bank, the predecessor of the Bank of China, was established. A number of Chinese who graduated in Japan joined in the establishment of the Daqing Bank, and advocated the use of Western accounting. Lin Xie was nominated as chief accountant, and set out to reform bank accounting. The problem he faced was that only those who trained in the Daqing Bank School or Jiangnan Advanced

Business College knew anything about Western accounting. Therefore, the government Treasury organised special lectures to train students from other banks, and the lectures were given by Lin Xie. By 1916, the bookkeeping method used in the newly renamed Bank of China was the Western bookkeeping method, and the old Chinese indigenous bookkeeping system had been abandoned (Li, 1982). With the successful transformation, Lin Xie was invited to be in charge of the reform of the Chinese Communication Bank system. The reform took only a short time because of the experience of the Bank of China. From then on, all newly founded banks recognised the necessity of using Western accounting, and all bookkeeping methods used in Chinese banks became similar.

16. The traditional Chinese Receipt-Payment method is different to the principle underpinning the Western Debit-Credit method. The foundation of the traditional Chinese Receipt-Payment method is cash movement. Cash inflows (silver from) must be equal to cash outflows (silver to). The recording principle of the Western debit-credit method is based on the property right between a debtor and a creditor. For example, in the case of a transaction using cash on hand (\$1,000) to purchase some inventory, the transaction is recorded as Dr Inventory \$1,000 and Cr Cash on hand \$1,000, in the Western debit-credit method. How can we interpret this journal entry and why should we use Debit (Dr) and Credit (Cr) as recording symbols? The answer is that assuming we can personify all accounts, this transaction can be interpreted as “a person called ‘Cash on hand’ lends \$1,000 to another person called ‘Inventory’”. Therefore, “Inventory” is a debtor, and recorded as “Dr” and “Cash on hand” is a creditor, recorded as “Cr”. The amount lent must be equal to the amount borrowed. Therefore, all transactions can be viewed as exchanges of property rights between debtors and creditors in the debit-credit method. This is also our answer to one of the critiques of Hoskin and Macve (2011).
17. People commonly believe that *Shou* (Receipt) means increase while *Fu* (Payment) means decrease or reduction. They are confused because these journal entries contradict their common understanding. They are perplexed as to why, when selling products, cash increases but is recorded as *Fu* (Payment), while, when purchasing inventories, cash decreases but is recorded as *Shou* (Receipt). This phenomenon can be explained as follows. One has to imagine that there is a cash box or bank account. When there is a sale transaction, cash (silver) is received from a customer and deposited into the cash box or bank account. This transaction is recorded as *Shou* (Receipt): silver from sale (cash is flying from a customer); and *Fu* (Payment): silver to cash on hand (cash is then flying to the cash box or bank account). When there is a purchase transaction, cash (silver) is withdrawn to purchase the inventory. This transaction is recorded as *Shou* (Receipt): cash on hand (cash is flying from the cash box or bank account); and *Fu* (Payment): Inventory (cash is then flying to the inventory). The Chinese indigenous bookkeeping method is based on cash movement, all business transactions can be viewed as cash movements from one account to another. Cash flying from is called *Shou* (Receipt) and cash flying to is called *Fu* (Payment). Cash flying from must equal cash flying to.
18. Since 1951, there has been a long debate on the nature of accounting: Does accounting bear a distinction of class, either socialist or capitalist, or is accounting mainly a discipline with a methodology of a technical nature? The first opinion dominated during the first decades following the founding of the PRC and this meant that any accounting method with capitalist characteristics should be banned.
19. The symbols of *Ru* (In) and *Chu* (Out) originate from the governmental financial system. Under this system governmental fiscal income was called *Sui Ru* (annual income) and governmental expenditure was called *Sui Chu* (annual expenditure). Annual income was raised through governmental taxes and annual expenditure was sanctioned and distributed to governmental organs and agencies at different levels.

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