

The Role of Negative Numbers in the Development of Double Entry Bookkeeping

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This note examines the development of debits and credits in bookkeeping. It is argued that the terms used resulted from a need for a bookkeeping system free of negative balances. The basic balance sheet equation, $A = L + OE$, could just as easily be expressed $A - L = OE$. Why was the former equation preferred to the latter? It is our belief that the use of the traditional equation, wherein both the debit balance and credit balance accounts are positive, developed because of mathematical considerations. This belief is based on the idea that mathematicians did not accept the concept of negative numbers when bookkeeping methods were being developed.

Pacioli's Contribution

The first significant written work on double entry bookkeeping was contained in Fra Luca Pacioli's *Summa De Arithmetica Geometria Proportioni et Proportionalita* published in Venice in 1494.¹ The *Summa* was primarily devoted to mathematics. The last section, the treatise on bookkeeping, appears to be included merely for the sake of completeness. This may be because, at the time of the *Summa*, the differences between and among the sciences and professions were not as clearly defined as they are today. In any case, Pacioli is considered

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¹ There is some question about whether the correct spelling is Pacioli or Paciolo. See deRoover [1944] for a discussion of this issue.

by many to be the first person to popularize the double entry bookkeeping system.

While most accounting historians hold Pacioli in high regard, quite a different view is expressed by mathematical historians. Boyer [1968, p. 307] is typical when he refers to the *Summa* as being "more influential than it was original." From a mathematical point of view, the *Summa* was a review of the literature, describing the then-current state of mathematical technology. This function of the *Summa* is more explicitly stated by Kline [1972, p. 237]: "Pacioli served as the intermediary between what existed in the scholarly work and knowledge acquired by artists and technicians." If these views of the *Summa* are correct, we can assume that Pacioli relied upon the existing mathematical theory—theory that did not recognize negative numbers.

DEBITS AND CREDITS

In his treatise on bookkeeping, Pacioli describes the journal system employed in Venice. According to Crivelli's [1929, p. 24] translation, each entry in the journal has two expressions ". . . one called 'Per,' the other 'A' each having a different meaning." In this system, "Per" denoted a debtor, while "A" denoted a creditor. When Brown and Johnston [1963] translated Pacioli's book into contemporary English, they substituted the more common terms "debit" and "credit" for Pacioli's "Per" and "A".

Negative Numbers

According to Cajori [1919, p. 72], the earliest reference to negative numbers is found not in mathematics, but, surprisingly, in commerce. In the first century A.D., the Chinese used red rods for positive numbers and black rods for negative numbers. For commercial purposes, red rods were used to record what others owed to you and black rods recorded what you owed to others (Boyer [1968, p. 223]).

The second reference to negative numbers is also found in commerce (Kline [1972, p. 185]; Boyer [1968, p. 241]). Brahmagupta in India in A.D. 628 advocated the use of negative numbers to represent debt. Unfortunately, Omar Khayyam (A.D. 1045–1123), an influential figure in India, later rejected the existence of negative numbers (Cajori [1919, p. 107]), and their use died out. The Arabs also rejected negative numbers, in spite of knowledge of their use in India (Cajori [1919, p. 107]).

Thus, it appears that the concept of negative numbers appeared first in accounting rather than mathematics. It is interesting to observe that even after mathematicians accepted the theoretical existence of negative numbers, they continued to reject the idea of their having any useful purpose. For example, Descartes (1596–1650) accepted negative numbers in part, calling them "false roots" (Kline [1972, p. 252]). However, other notable figures such as Pascal (1623–1662)

regarded the subtraction of 4 from 0 as utter nonsense (Kline [1972, p. 252]). Thomas Harriot (1560–1621) was the earliest mathematician to accept negative numbers completely, almost a century after Pacioli's *Summa* was published (Kline [1972, p. 252]).

Pacioli, like other mathematicians of his time, did his utmost to avoid even the use of a symbol for minus, let alone a negative number. Addition was denoted by *p*, and equations were written to cause all coefficients to be positive. Although an occasional subtraction of a term appears in the *Summa*, there is no question that Pacioli rejected negative numbers. For example, he would not accept the possibility of an algebraic solution to a quadratic equation, since the solution would require negative numbers (Kline [1972, p. 237]).

Positive Account Balances

Based upon this brief historical review, we can surmise that learned men of the era in which commerce and trade developed rejected negative numbers. It would be unlikely, then, that laymen would have been able to put forth a system based on negative numbers. Thus, we would expect the development of a bookkeeping system based entirely on positive account balances. The notation Pacioli used in his treatise on bookkeeping served the same purpose as writing equations such that all terms were positive. "Per" and "A" became a rhetorical way to indicate an increase or decrease in what we now call an account whose balance must always be positive. This, then, established the balance sheet equation as $A = L + OE$.

Summary

Our objective has been to trace historical antecedents to some of the rhetoric of accounting. The terms debit and credit appear to have evolved from Pacioli's terms "Per" and "A." These terms were apparently devised in order to describe increases and decreases in positive account balances. Why debits and credits? Apparently, because there were no negatives!

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