But capitalism could not have flourished without two new activities that had been unnecessary so long as the future was a matter of chance or of God's will. The first was bookkeeping, a humble activity but one that encouraged the dissemination of the new techniques of numbering and counting. The other was forecasting, a much less humble and far more challenging activity that links risk-taking with direct payoffs. *Peter Bernstein, Against the Gods: The Remarkable Story of Risk*

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The Juxtaposition of Accounting and Portfolio Management

Provision of Information and Decision-Making in Uncertainty

From TDCapital Portfolio Strategies Group

Dear Clients and Friends: I have spent the adult portion of my career straddling the two disciplines of accounting and portfolio management. These two subjects have always seemed compatible to me, but not to all. A couple of years ago I set about trying to reconcile my two interests. The results of my efforts include the presentation of a rather long and involved paper to a particularly nerdy group – the paper was titled, "Accounting Can Be Fun." Following this note is the first of a few installments that we intend to share with you in bite-sized form. This first entry makes a few introductory comments, and then chronicles numbers and counting and mathematics from rudimentary forms of trying to keep track of stuff in the very early years of civilization to the advent of "friendlier" forms of numbers and mathematics.

In later writings we will look at the intersection of accounting and the mathematics of probability and begin tracing these concepts into our much more advanced world of modern portfolio concepts and theories.

We hope these thoughts are interesting and useful to you; we welcome your thoughts and discussions - related, or unrelated, to these writings.

Hope all is well. God Bless, Doug

Numbers and Counting

A discussion or consideration of accounting and investing necessarily involves numbers and counting. And it seems that the need for numbers, counting and keeping track of "stuff" are inextricably attached. Historians and archeologists suggest that numbers and counting appeared about 20,000 years ago, but came into use with the rise of cities – about 3,000 - 4,000 BC in Sumer (southern Mesopotamia). With people, livestock, crops, and artisan goods located in the same place, cities needed a way to organize and keep track of it all.

Sumerians kept a group of clay objects, or tokens, of various shapes inside sealed clay pouches. The tokens represented something tangible: say a chicken. If a man had five chickens he was given five tokens. When he traded or killed one of his chickens, one of his tokens was removed – this was a big step in counting because that step was the invention of subtraction and thus the invention of arithmetic (it appears that the need for accounting for assets generated the creation of arithmetic).

The sealing of the clay pouches suggested that there should be a way of knowing the contents without unsealing. Marks or shapes were written on the outside of the pouches. Someone soon hit upon the idea that the clay objects inside the pouches were not needed. So instead of having a pouch filled with tokens and marks made on the outside of the pouch, recordkeeping became marks, or writing. As the pouches became flatter they rather resembled tablets (accounting chauvinists suggest that we also invented writing).

The Egyptians transformed the number "one" from a unit of counting things to a unit of measuring things. The number one became a unit of measurement to measure length. When building pyramids, temples, canals and obelisks you need a standard unit of measurement. The Egyptians therefore invented the cubit – the length of a man's forearm, from elbow to

fingertips, plus the width of his palm. The Egyptians also invented symbols for numbers. They had a symbol for one, a line; ten, a rope; one hundred, a coil of rope, and so on.

The Greeks made further contributions to the world of numbers and counting, much of it under the guidance of Pythagoras who studied in Egypt and introduced mathematical concepts to Greece via establishment of a school of mathematics. Pythagoras developed the ideas of odd and even numbers and is most famous for his Pythagorean Theorem. However, his biggest contribution to mathematics may have been laying the ground work for Greek mathematicians to follow.

Certainly influenced, and perhaps of the school of Pythagoras, was Archimedes who took theoretical mathematics to higher levels. Archimedes is considered the greatest mathematician of antiquity who enjoyed doing experiments and playing games with numbers (more on numbers and games later). Archimedes' death at the hands of a Roman soldier in 212 BC literally ended the golden age of mathematics in the classical world.

The Romans weren't as interested in mathematics (they were more concerned with world domination). And, Roman numerals were so unwieldy they couldn't be used for anything more complicated than recording the results of calculations. Romans did their calculating on a counting board, which was an early version of an abacus. There are no famous Roman mathematicians.

Moving now to Asia, the Indians were interested in some very abstract concepts and needed a way to express very large numbers. They created a method - a different symbol for every number from one to nine. These symbols are known as Arabic numerals, but would be more properly called Indian numbers. The Indians have been using Arabic numerals since about 500 BC.

The next big advance in the world of numbers and mathematics came around 500 AD in India with the invention of an entirely new number: zero. With the invention of zero the Indians gained the ability to make numbers infinitely large or infinitely small – the concept of nothing had a number. This magic happened when zero was paired with other numbers (10, 100, 1000).

Fractions were invented in about 762 AD in what is now Baghdad – then Persia. Following the teachings of the Koran, possessions of the deceased had to be divided among their descendants. Unlike Christianity at the time, Islam divided belongings among women as well as men, but women got a lesser share - working all that out required fractions. Enter Arabic numerals. The most prevalent story states that one day an ambassador from India arrived in Baghdad and presented the Caliph with the greatest gift in his possession: Arabic numbers.

Using Arabic numbers, Muslim mathematicians invented entirely new methods of mathematics. Besides fractions they turned Arabic numbers into quadratic equations, and algebra, and these numeric breakthroughs enabled science, mathematics, and astronomy to reach new levels in the Middle East.

Around the year 1180 or so Leonardo Pisano Bigollo, later known as Fibonacci, was introduced to Arabic numbers in Algeria while traveling with his merchant father. Fibonacci became enthralled with this new method of counting, and its practical capabilities. He introduced Arabic numbers to Europe when he returned to Italy. In 1202 he published a book of mathematics called, *Liber Abaci*. Through that book, Europe was introduced to Arabic numbers. The Roman numeral system was deeply entrenched in Europe, but good old fashioned greed prevailed.

This new, calculation friendly, numbering system proved very timely. Prior to the Catholic Reformation, Christians weren't allowed to charge interest on loans because the Catholic Church considered it a sin. But after the Reformation charging interest was allowed and merchants adopted the new Arabic system because interest could be calculated to several decimal points. From there, use of Arabic numbers spread and satisfied the world's desire for counting, measuring and calculating. So we have "friendly" numbers, how shall we put them to use? More soon…