Technical Considerations in the Stock Market: Fibonacci Numbers

November 1, 2009 sageinvestor 4 comments

Buckle your seat belt for this journey…

Study the graph below carefully (I suggest right-clicking the image and then open it in a new window, zooming in a bit). Notice the lines drawn. Each line has a percentage associated with it, like 38.2% or 50%. These lines measure the percentage rertracement of the distance from the March 2009 bottom relative to the October 2007 peak. Time after time, corrective or countertrend rallies do not end at indiscriminate points, but at spectacular ratios that are found everywhere in nature. Sounds weird? Well, these ratios are far from the fringe; they have fascinated the greatest of minds including Plato, Pythagoras, Bernoulli, Kepler, Da Vinci and Newton. Even the great architects of ancient Egypt took notice, enshrining these ratios in the scale of the Great Pyramids. Wait a minute! Aren't we supposed to be talking about stock price measures when we talk about the stock market? Not entirely. I believe one should first address something more fundamental, the interaction of people en masse, or their natural forces at work. To do that fully though, I have to tell you more about these ratios.

In 1202, a mathematician named Leonardo Fibonacci da Pisa published his famous book, Liber Abaci (The Book of Abacus, or The Book of Calculation), which introduced many great mathematical discoveries. Most notably, Liber Abaci was celebrated in its day for introducing Europe to the decimal system with zero as the first digit. [1] But buried in Chapter 12 of this 500-page book is a math problem that made the author's name famous,

for it explains an infinite array of numbers known as the Fibonacci sequence. My goal is to talk about Fibonacci numbers as they relate to the real world. But in order to get to where I want to go I have to tell you more about this remarkable sequence.

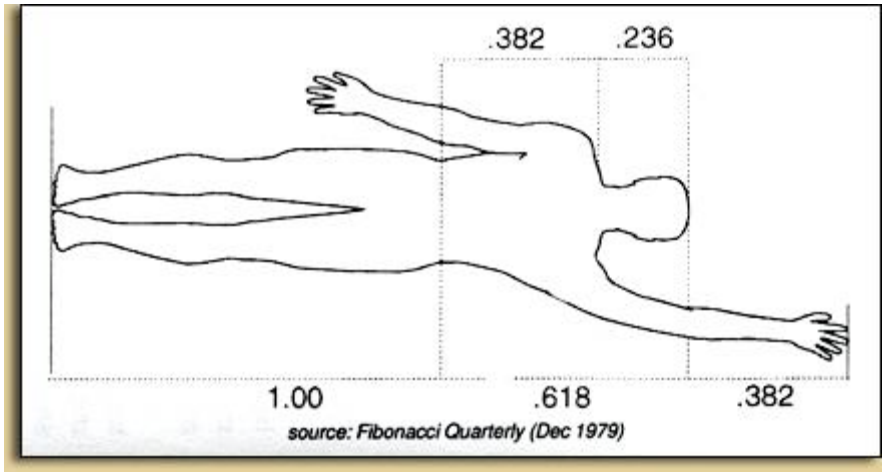
Fibonacci numbers are created by starting with the number 1. From that point, the sequence is developed by simply adding the last number in the sequence to the current number, creating the next number in the sequence. Starting with 1 and 0 (or nothing before it), we get 1. Then adding 1 and 1 we get two. 1 plus 2 equals 3, 2 plus 3 equals 5, 3 plus 5 equals 8, etc. So the beginning of the Fibonacci sequence looks like this:

1,1,2,3,5,8,13,21,34,55,89…

Looks pretty innocuous, right? But wait til you see where it goes…

There are other number sequences, but this one is unique, it's special, and it alone is the reason Fibonacci is famous. After the first several numbers in the sequence, the ratio of any number relative to the number directly to its right is approximately 0.618 and the ratio of any number relative to the number directly to its left is approximately 1.618, the reciprocal of 0.618. As the sequence expands, this ratio converges exactly on *phi*, or _, an irrational number equaling 1.6180339887… Phi is the *only* number that when added to 1 equals its inverse: 1+0.618 =1/0.618. Between alternate numbers in the sequence the ratio is 0.382. 1 minus 0.382 equals 0.618. The mathematical phenomenon of the Fibonacci sequence continues [2]. For now all we need to know are the Fibonacci numbers themselves and phi, which is also known as the Golden Ratio or Golden Mean.

Phi is all around us, and it is within us. It is the basis for the construction of Golden Rectangle [3]. It is found in the proportions of man and in nature. Look at these images below [4]:


.382
.236
1.00
.618
.382
source: Fibonacci Quarterly (Dec 1979)

Examples of Fibonacci numbers in nature: Proportions of a human being, bones in the finger, DNA double-helix segment

The Golden Rectangle is remarkable for another reason. If you divide the Golden Rectangle into smaller Golden Rectangles repeatedly you get the backbone for the development of a spiral, which emanates out of the Golden Rectangle. This is known as the Golden Spiral and it is depicted in Figure 1. [3]

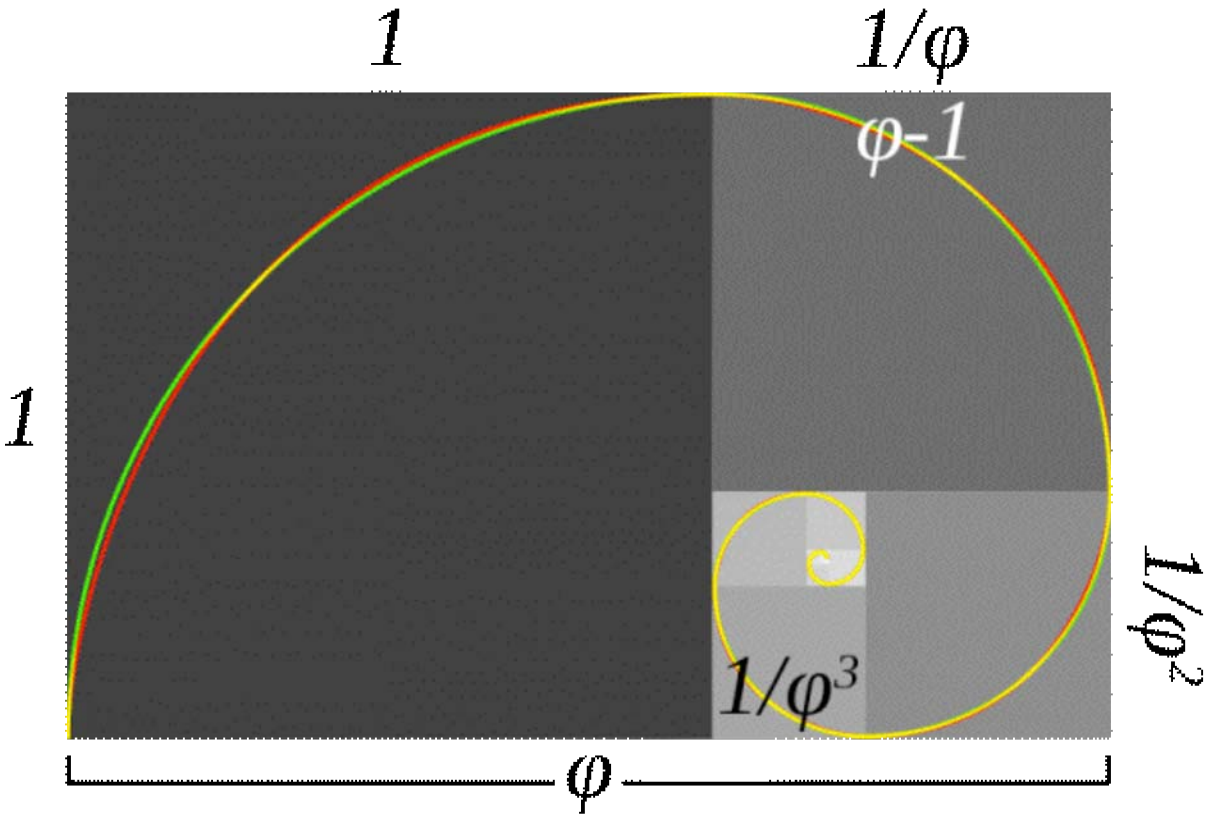
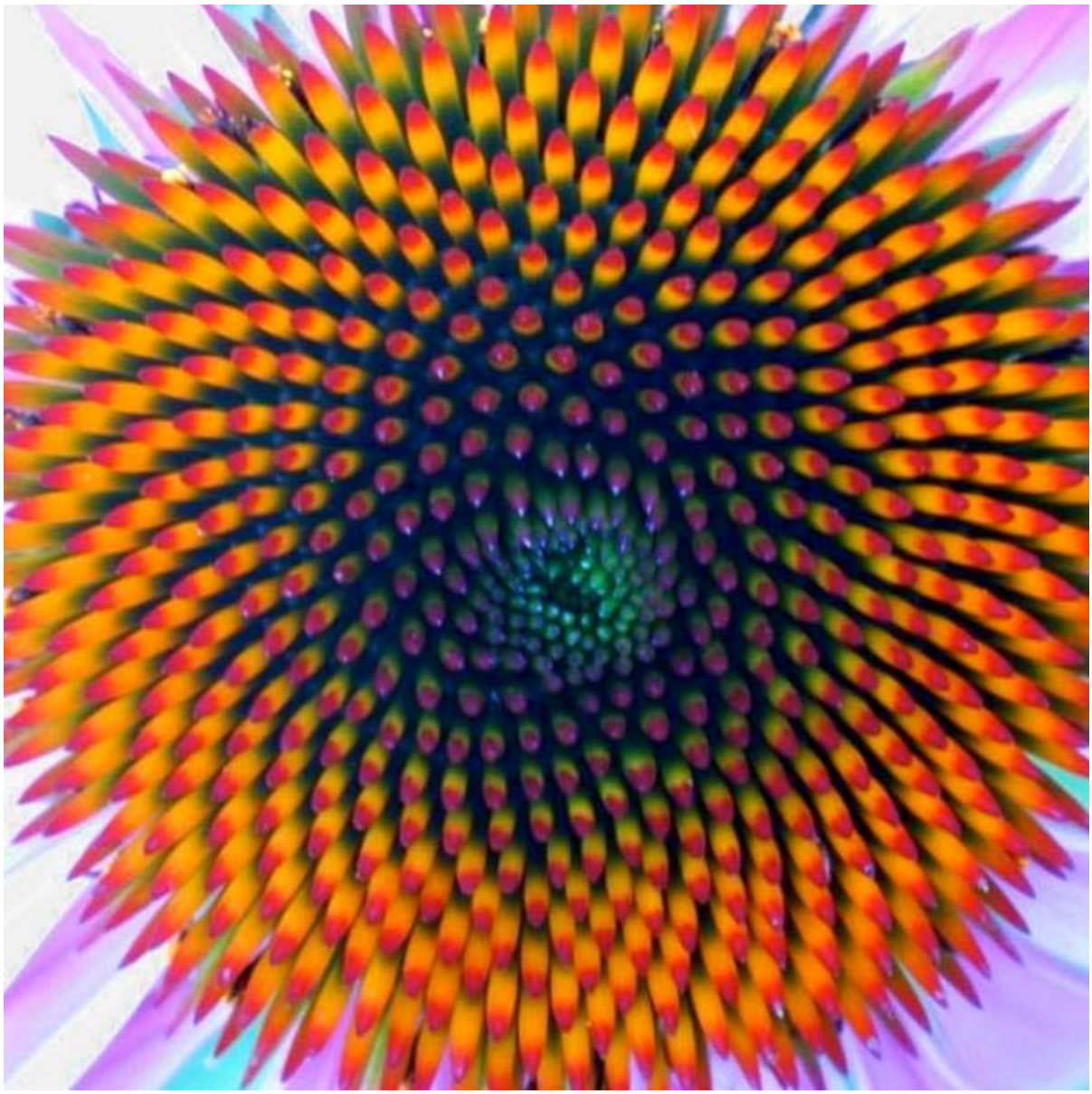


Figure 1

There are some amazing properties to the Golden Spiral too [5]. The Golden Spiral is abundantly depicted in nature, as the images below show.



Now if you got this far you must be wondering how this equates to stock prices and the like. Some theorize that stock prices are a random walk. Others, including me, believe stock prices reflect patterned behavior. For me, Fibonacci ratios play a part in seeing that behavior at work (but not solely*)*. The stock market is a creation of man, and man is natural. It is possible that the laws that shape natural things is inherent in the actions of our collective organization, like group behavior and social mood. The stock market is the best place to measure such behavior, because it produces an intricate and long series of data. If there is a general law of ordered growth in the universe, than society's broadest and most universal measure of growth, the stock market, should be subject to that law. If nothing else, there are way too many coincidences to simply dismiss this idea. There are principles everywhere, even if we are unaware of them or too blind to see a connection. One of those principles may be as simple as 'man, being a part of nature, obeys the laws of nature'. This is far from a radical idea: Einstein explains this best when he said, "God does not play dice with the universe".

So now I get back to the very first graph. Society progresses in an ebb and flow manner. Obvious examples of this are the Dark Ages followed by the Renaissance, or wartime followed by prosperity. The stock market is a reflection of this ebb and flow. We find natural resting places after periods of growth, and we also find natural resting places for periods of decline. These places often settle on Fibonacci ratios!

Notice from the bottom in March 2009 the market grew at a rapid rate, to the beginning of May, and then settled back to a line of support (line 1), a Fibonacci ratio of 23.6%. It rose and then came back to settle on that very same line. The summer rally saw the market vault further, to line 2, a Fibonacci ratio of 38.2%. After bouncing around this settling spot for a month, investors pushed prices higher. In fact, they pushed prices almost to 50%, to line 3, another Fibonacci ratio. Can we push to the next Fibonacci ratio of 61.8%? Sure. But I don't think so. Like any argument you need supporting data, and we have plenty to support this claim using this technically beautiful graph.

Overlaid on this graph of prices are a few ratios plotted of all NYSE advancing stocks to declining stocks. You may quickly notice that they displayed a Fibonacci relationship throughout the rally, albeit in a diminishing manner. From the bottom, the biggest bull market days (depicted by long bars up, in green) saw advancing stocks outnumber declining stocks by a 13:1 ratio, and then an 8:1 ratio, 5:1 ratio, 3:10 ratio, and finally a 1:1 ratio at the top. Not only is this indicative of a natural rhythm in the market, it is also a factual depiction of a tiring market. Higher index prices are being met with less broad market participation.

Markets also establish trends, depicted by trendlines. Trends push forward and trends break down. No different than fads or political forces. In the stock market though, we can literally see and measure trends, because we have the data to plot movement. When we correctly see that movement break down, i.e., prices falling below the proper trendline, we can literally *see the change happening in real time.* Last week, such a move occurred, and it is depicted in the graph above. Prices fell below the lower purple line, indicating a change in direction. Maybe more importantly, the market constrained itself by establishing a top trendline to it's growth trend, as it pushed near the upper purple line eight times. The market's decision to fall away from this trendline tells us the same

thing, the trend is changing. Put them together and the argument is strengthened considerably.

Finally, there is a white line drawn at the top. It connects the all-time top of 1576.03 in the SP500 on 10/11/07 (not shown) and the near term top of 1101.72 on 10/21/09. Notice the confluence of this trendline with the top purple trendline. They met, and the market turned. Coincidence, or natural next move? If you believe in the Efficient Market Hypothesis or Keynesian economics you can easily dismiss this theory for those theories. I prefer behavioral economics, as I believe investors act irrationally and that investors are prone to herding behavior (see previous posts). That supports trending, and that supports a natural rhythm in society and in its stock market.

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[1] Fibonacci learned the Hindu-Arabic system from the Arabs while living in North Africa. More accurately, the Arabs rediscovered it. The Babylonians developed digital values and were the first to use the value of zero. Separately, the Mayans also developed a digital system without zero many years later.

[2] To name just two more: The sum of all Fibonacci numbers in the sequence up to any point, plus 1, equals the Fibonacci number two steps ahead of the last one added. The square of a Fibonacci number minus the square of the second number below it in the sequence is always a Fibonacci number.

[3] An explanation of the construction of the Golden Rectangle and the Golden Spiral can be found by clicking here.

[4] For more on the Golden Ratio, the Golden Rectangle, Golden Spiral, and the Golden Segment click here.

[5] To learn more phi stuff, click here.

Categories: Behavioral Finance, Investments Tags: crowd behavior, Fibonacci, Golden Mean, Golden Ratio, Golden Spiral, herd behavior, Phi, social mood