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Golden Ratio and Financial Trading

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Introduction to Golden Ratio 0.618 for financial trading

When I look back, even during my math class in the university, the golden ratio or Fibonacci number was not so popular topics. However, I still remember that a particular technique called a "Golden Section Search" was taught along with Newton's method. Well, just like many of the students, I forgot about this technique after passing the exam. Many years later, the term "Golden ratio" keep coming back more and more during my research with financial market data (If you are not sure what the Golden ratio is, please check the appendix at the end of this article.) I realized that the importance of Golden ratio might be far more significant than what the financial trader think. Firstly, many geometry or shape found in nature including trees, leaves, flowers, etc, are often built upon the golden ratio and the derived ratios (i.e. Fibonacci ratios). Even there were some interesting research showing the relationship between the golden ratio and beauty. Now you can tell that the frequent occurrence of the golden ratio is natural phenomenon. What do you think about the financial market? As you know, financial market is made by man. Would the golden ratio play an important role in the financial market? If so, it would be quite surprising. The truth is yes. The Golden ratio 0.618 and other derived ratios (i.e. Fibonacci ratios) like 0.382 and 0.500 are considered as important. In fact, the belief about the Golden ratio was there for more than 85 years. I am referring to the work by Ralph Nelson Elliott in 1938. The use of golden ratio for the financial market can go back even more. Whether you are user of the golden ratio and the Fibonacci ratio for your financial trading (see appendix), you will be kept surprising reading this article until the end. We have built a scientific tool to reveal the precise structure of the financial market. The scientific tool can not only extract the useful information for your financial trading but also it can be used to make some interesting inference about the financial market. Now to start with, let us understand how to use the golden ratio and Fibonacci ratio for the financial trading first.

How to use the Golden Ratio and Fibonacci Ratio for financial trading

The most common way to apply the golden ratio and Fibonacci ratio is to use two price swing points in your chart. To identify the two swing points, you can simply use the peak trough analysis provided on our website. It is free of charge for use and for sharing (http://algotrading-investment.com). You can have a multiple options to identify the swing point in your chart. However, there are automated tools (the peak trough analysis) for the task, we will not discuss too much on how to detect the swings points manually.
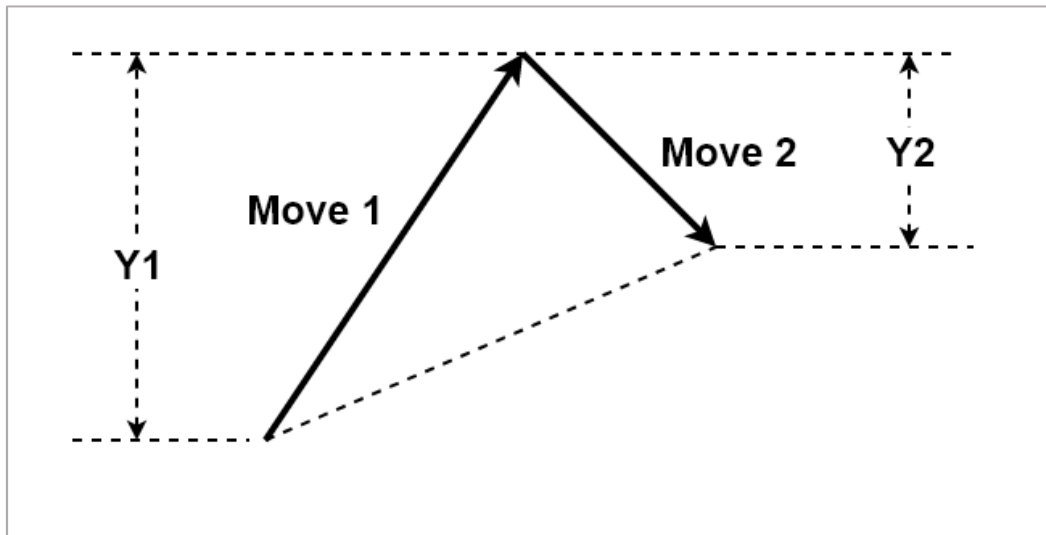

Figure 1: Basics of Fibonacci ratio measurement (or Shape ratio measurement).
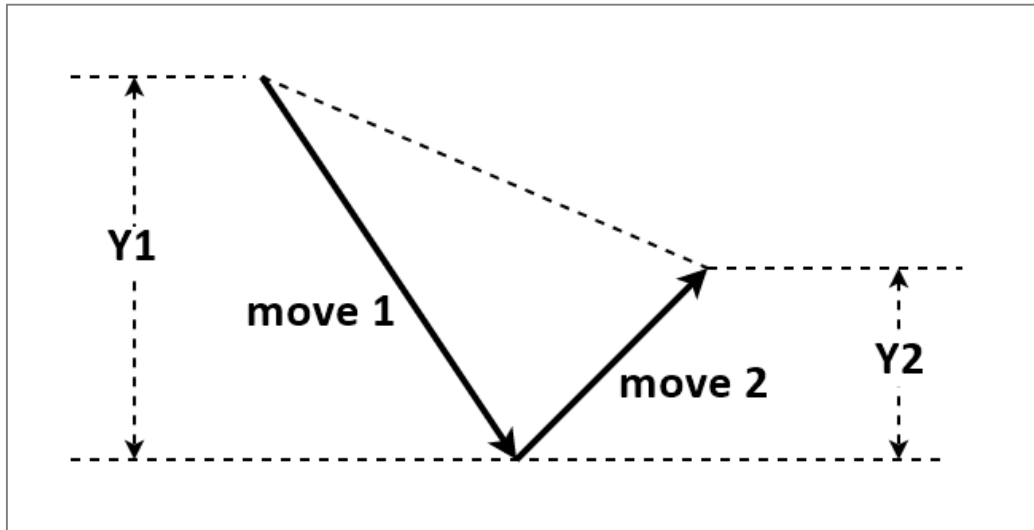
Figure 2: Basics of Fibonacci ratio measurement (or Shape ratio measurement).

Anyway, after you have identified the swing points, you can measure the ratio of two price swing points as shown in Figure 1 and 2. The ratio of price height of two swing points often expected to be close to the golden ratio or the Fibonacci ratio. We use this knowledge for our trading as shown in Figure 3 and Figure 4. In Figure 3 and Figure 4, we expect that the price will reverse at 38.2% (0.382) Fibonacci ratio. This analysis is called Fibonacci retracement analysis. This analysis is useful to check the corrective phase of the market. In the chart, we can easily spot where it reverse. Based on this idea, we can make our trading plan. This is the typical strategy used by millions of forex and stock market traders.

Figure 3: Fibonacci Retracement drawn over daily EURUSD candlestick chart for bearish setup.
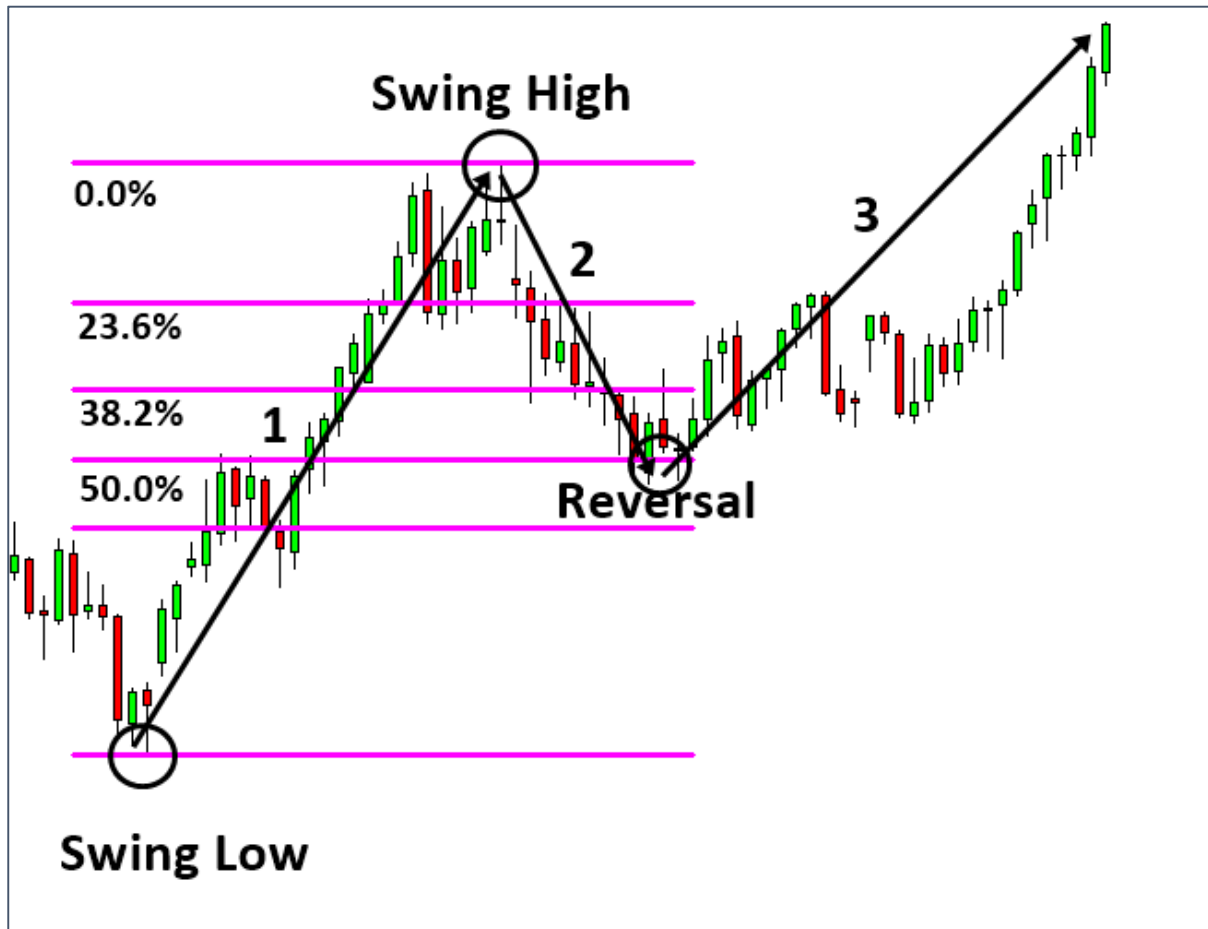
Figure 4: Fibonacci Retracement drawn over daily EURUSD candlestick chart for bullish setup.

Trading with Fibonacci retracement and expansion is relatively simple. Now there are advanced trading strategies using the Golden ratio and Fibonacci ratio too. We can introduce the two trading strategies in brief. One of them are Harmonic pattern trading. The other one is Elliott wave trading. In harmonic Pattern trading, we identify three or four successive swing points to identify the reversal trading opportunities. Just like Fibonacci retracement and expansion, the ratios measured between three or four successive swing points are expected to be the Golden ratio or Fibonacci ratio. In Elliott wave trading, we use around three to five swing points to identify the trading opportunities. The ratios of these swing points are the Golden ratio and Fibonacci ratios. In Elliott wave trading, the Golden ratio 0.618 and 1.618 are highly emphasized whereas in harmonic pattern trading, the other Fibonacci ratios are equally used to construct the harmonic patterns.

Figure 5: Butterfly pattern formed in EURUSD H4 timeframe.

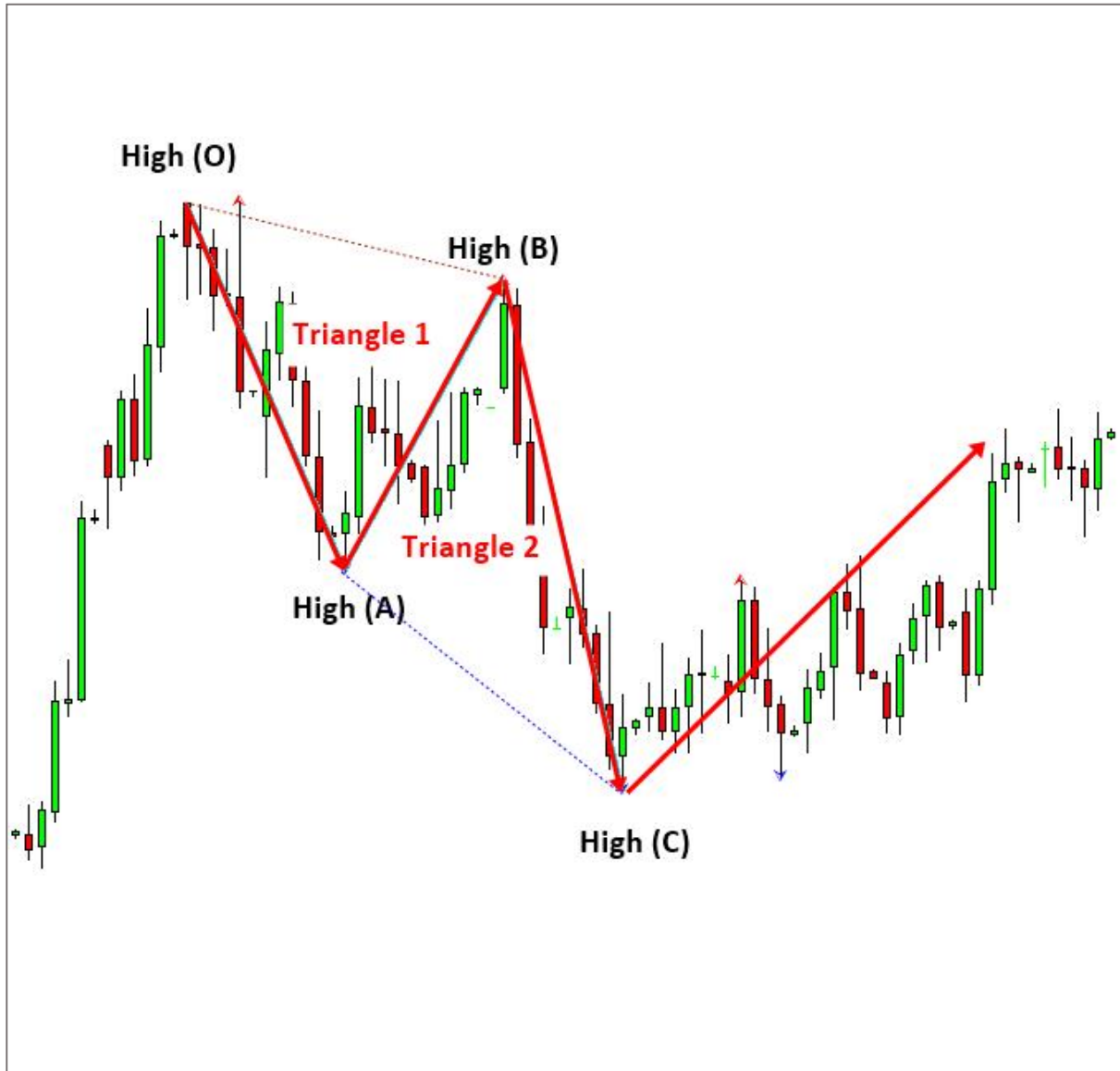Figure 6: Impulse Wave 12345 pattern formed in EURUSD D1 timeframe.

Figure 7: Corrective Wave ABC pattern formed in EURUSD D1 timeframe.

Revealing the Financial Market Structure using Equilibrium Fractal Wave Index

So far, we have introduced three trading strategies based on the Golden ratio and the Fibonacci ratios. These trading strategies are based on the assumption that there will be the frequent occurrence of the Golden ratio and Fibonacci ratios in the financial market. However, not necessarily we have much scientific evidence to support this assumption. I think these trading strategies can become more popular if there is more scientific evidence to support the trading logic and rational behind the Golden ratio and the Fibonacci ratios. To reveal the

financial market structure precisely, we have made a scientific framework called Equilibrium fractal wave. To reveal the market structure, we need to understand what ratios the market is made up including both Fibonacci ratios and non-Fibonacci ratio. Using the framework of the Fibonacci ratio analysis can limit our understanding since we can only study Fibonacci ratios. Therefore, we use the generic term called "Equilibrium Fractal Wave" to describe the price geometry made up from the two price swing points (or three points) in your chart as shown in Figure 1 and Figure 2.

By definition, an equilibrium fractal wave is a simple triangle made up from two price swing points. It is precisely identical to the triangle introduced in Figure 1 and Figure 2. We refer to the ratio (Y2/Y1) as the shape ratio in equilibrium fractal wave. The shape ratio represents the shape of each equilibrium fractal wave and it is an identifier used to reveal the market structure. The shape ratio can include any ratios including Fibonacci ratios and non-Fibonacci ratios in our study.
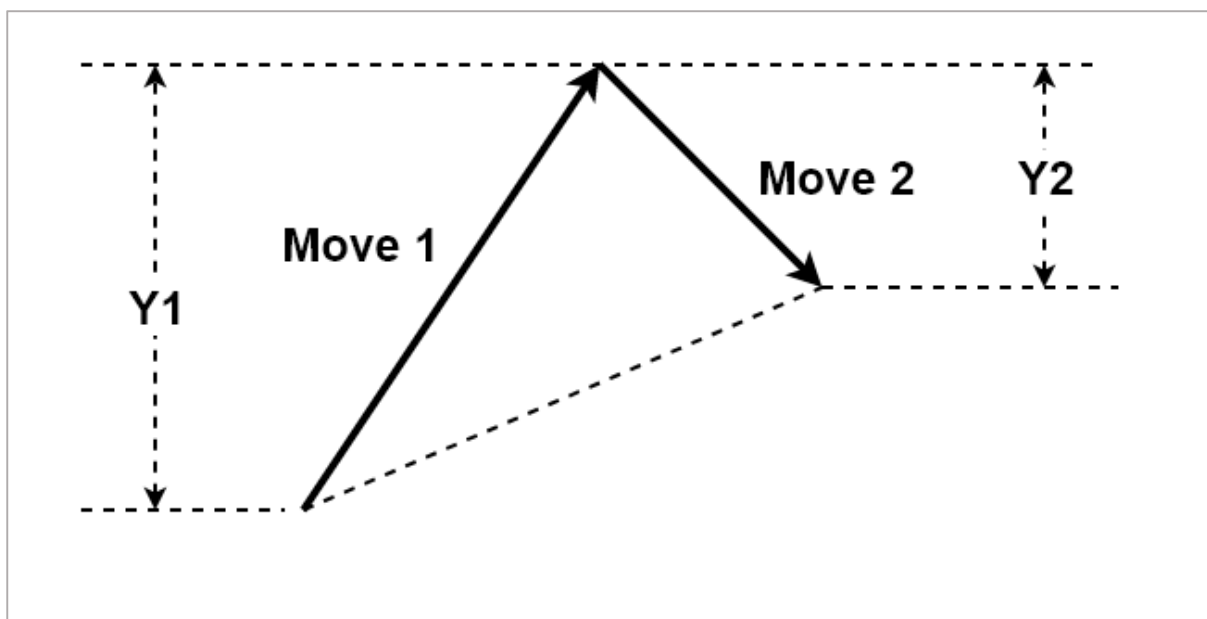

Figure 8: One unit (or one cycle) of equilibrium fractal wave.

To reveal the market structure, we use the quantity called Equilibrium fractal wave (EFW) index. The equation of the EFW index is shown below:

Equilibrium Fractal Wave (EFW) Index = number of the particular shape of equilibrium fractal wave (the shape ratio = Y2/Y1) / number of peaks and troughs in the price series.

The equation is straightforward to calculate in any charting package. The EFW index is a quantity describing how frequently we can detect the particular shape ratio (Y2/Y1) in the financial market. For example, if the Golden ratio 0.618 is really dominating in the financial market, we should have a highest EFW index among all ratios. Otherwise, our belief on the Golden ratio can be wrong or less optimal. It is the same for other Fibonacci ratios. If you were using the Fibonacci ratios 0.382 (38.2%), you should expect the EFW index of 0.382 to be higher. Otherwise, you were trading less optimal strategy for your investment. To reveal the market structure, we can create a distribution of EFW index from the ratio 0.1 to the ratio 3.0. We list the distribution of EFW index for EURUSD, GBPUSD and USDJPY in Figure 9, 10 and 11.
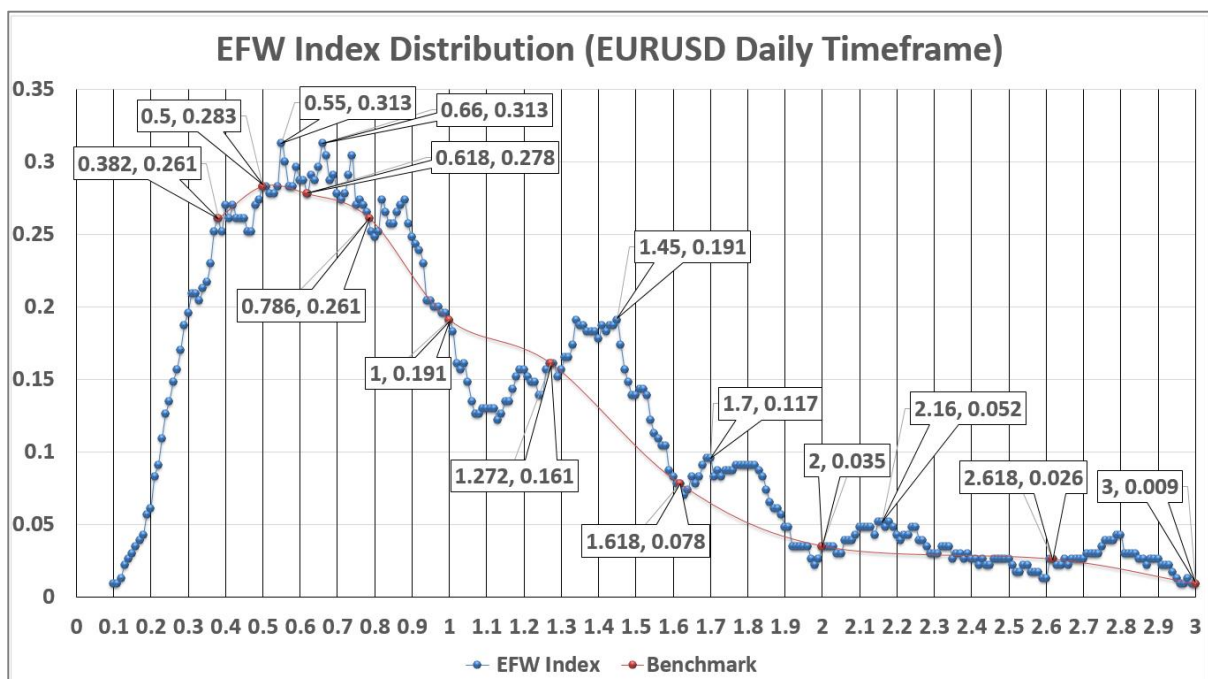

Figure 9: EFW Index Distribution for EURUSD Daily Timeframe from 2009 09 02 to 2018 02 20 (Label inside callout box, left: Ratio, right: EFW Index, vertical axis: EFW index, horizontal axis: ratio from 0.1 to 3.0).
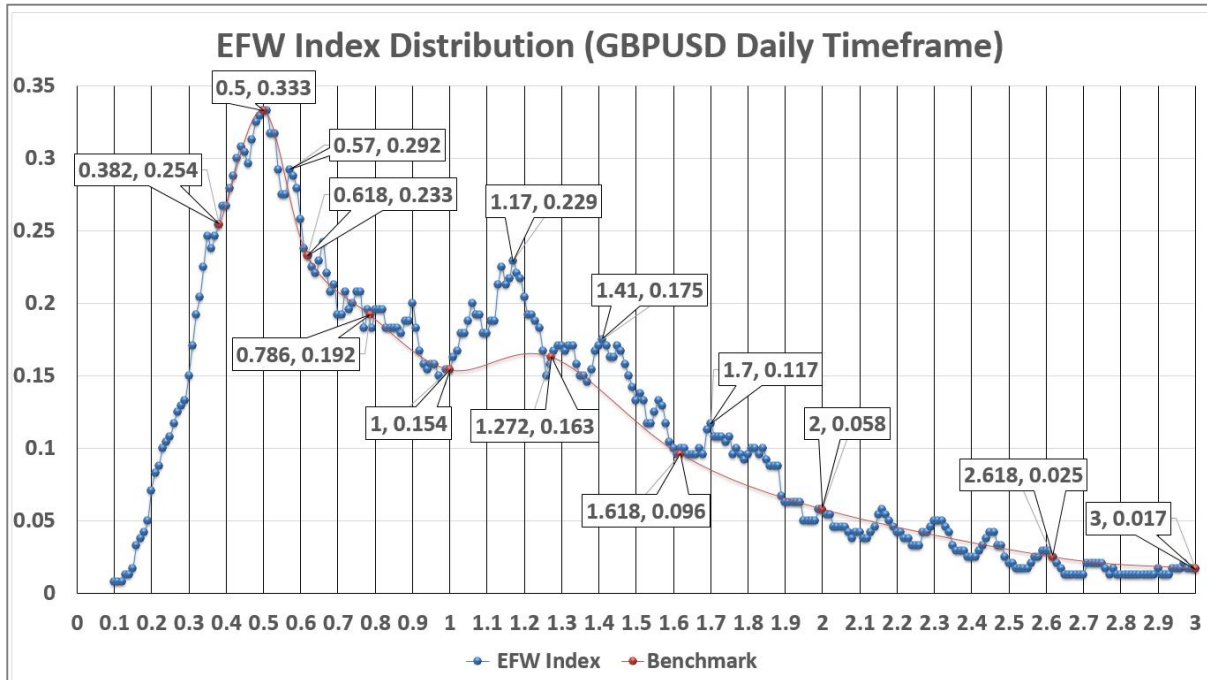
Figure 10: EFW Index Distribution for GBPUSD Daily Timeframe from 2009 09 02 to 2018 02 20 (Label inside callout box, left: Ratio, right: EFW Index, vertical axis: EFW index, horizontal axis: ratio from 0.1 to 3.0).

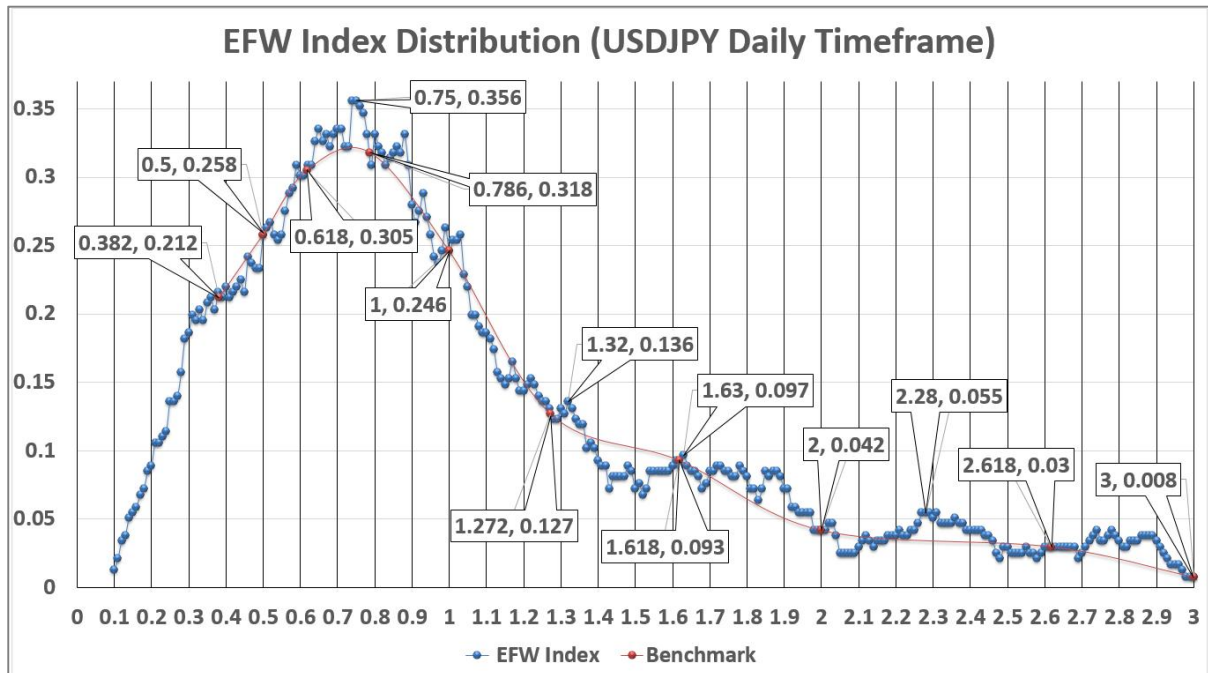**EFW Index Distribution (USDJPY Daily Timeframe)**

Figure 11: EFW Index Distribution for USDJPY Daily Timeframe from 2010 05 30 to 2018 02 20 (Label inside callout box, left: Ratio, right: EFW Index, vertical axis: EFW index, horizontal axis: ratio from 0.1 to 3.0).

You can immediately recognize several important factors in this analysis. Firstly, each financial market has the different footprint of the EFW index distribution. This justifies their own unique behaviour of each financial instrument. Secondly, our belief on the Golden ratio and the Fibonacci ratios are less optimal rather than wrong. We can tell that the Golden ratio and the Fibonacci ratios stay in the top of the league table for three currency pairs. However, still some other ratios are ranked highest in the table. For example, the ratio 0.66, 0.50 and 0.75 stayed in the top of the table. It should be noted that for each financial instrument, there is a preferred ratio for your trading. If you were trading using the ratio 0.618 for GBPUSD, then it was far less optimal. You should have used the ratio 0.500 instead. In Figure 12, we have calculated the EFW index over the rolling window for GBPUSD daily timeframe. The rank of each ratio does not change often. We can tell that the market structure is stable over the time. Therefore, the revealed market structure in Figure 9, 10 and 11 might be at least semi-permanent characteristics of each financial instrument.
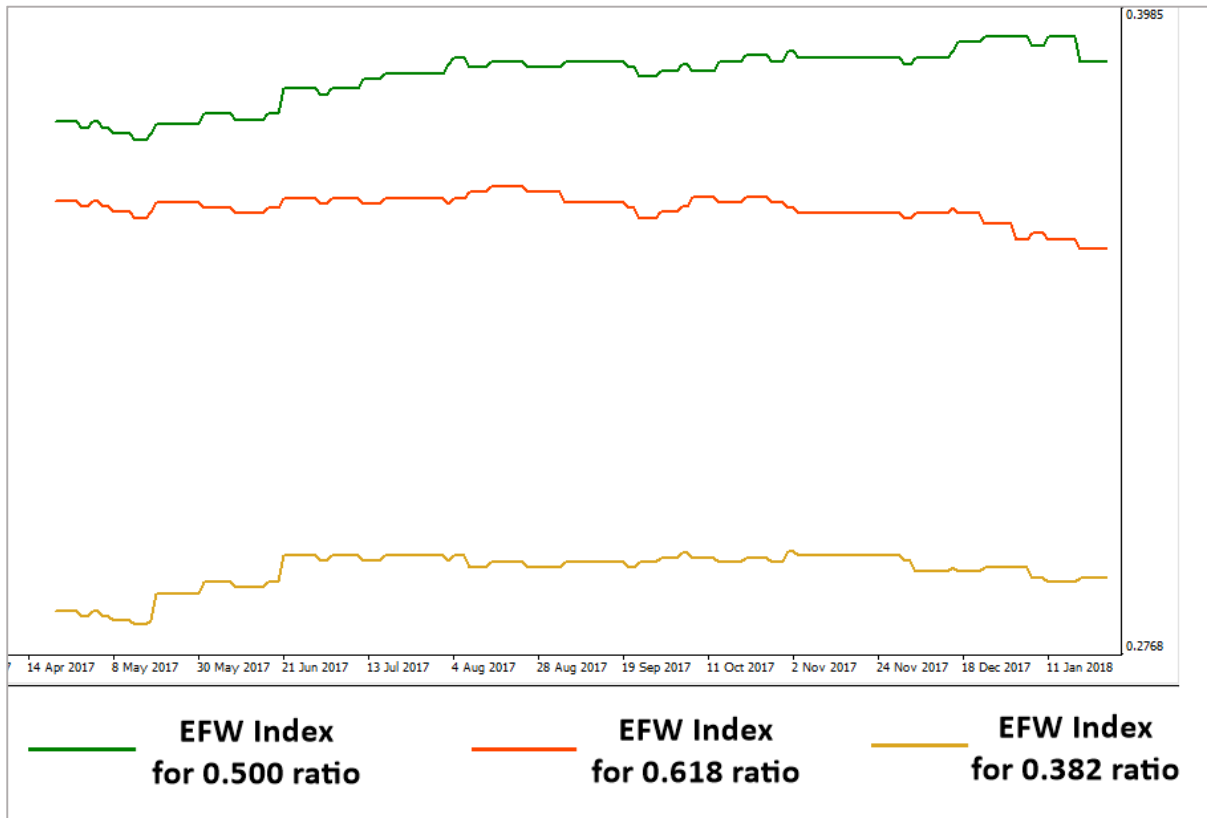
Figure 12: EFW index for GBPUSD D1 timeframe from 2007 01 04 to 2018 01 20.

What is your belief now and how you are going to trade?

This article revealed some important information for your trading, that no one have revealed before. We were trying to answer the question on the Golden ratio and the Fibonacci ratio, which were not answered last 100 years. In our analysis, we have revealed the market structure of the financial market using the scientific tool called the EFW index. If you were trading using the Golden ratio and the Fibonacci ratio, you might be shocked a bit. Now you know what to do to improve your trading. It is only the scientific analysis can help you to win in the financial market. Many traders including myself might be curious why the Golden ratio is less optimal or not optimal for some financial instruments. Well, honestly I do not have the right answer for it. I think that no one has the right answer but we can only guess. In nature, the golden ratio or other Fibonacci ratios are repeating in much higher precision than the financial market. The less precise nature in the financial market might be due to the higher

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noise in the financial market because of too many diverse players. Another possible explanation might be that the profitability of the Golden ratio and some Fibonacci ratios might be exhausted because too many of us were using them every day. Therefore, the EFW index distribution in Figure 9, 10 and 11 might be showing the distorted image of the financial market. Please feel free to write me on FinancialEngineerPro21@gmail.com if you have a better explanation about why the Golden ratio is less or not optimal for the financial market.

Appendix (Golden ratios and Fibonacci ratios)

The Fibonacci Ratio is used by millions of forex and stock market traders every day. It is a mega popular tool in the trading world. If you do not know what the Fibonacci ratio is, here is the simple explanation. Fibonacci ratio is the ratio between two adjacent Fibonacci numbers. To have a feel about the Fibonacci ratios, here is the 21 Fibonacci numbers derived from the relationship: $Fn = Fn-1 + Fn-2$.

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89,144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, …………………

Once the Fibonacci numbers are reasonably large, you can just pick up any two adjacent Fibonacci numbers above to derive the ratio. For example, we will find that 4181/6765 = 0.618 and 1597/2584 = 0.618. Here 0.618 is called as the golden ratio. The golden ratio is one of the most important Fibonacci ratios. The rest of Fibonacci ratios are derived by using simple mathematical relationship like inverse or square root or etc. Table below shows the list of Fibonacci ratios you can derive from the Golden ratio 0.618.

Type	Ratio	Calculation
Primary	0.618	Fn-1/Fn of Fibonacci numbers
Primary	1.618	Fn/Fn-1 of Fibonacci numbers
Primary	0.786	$0.786 = \sqrt{0.618}$
Primary	1.272	$1.272 = \sqrt{1.618}$
Secondary	0.382	0.382=0.618*0.618
Secondary	2.618	2.618=1.618*1.618
Secondary	4.236	4.236=1.618*1.618*1.618
Secondary	6.854	6.854=1.618*1.618*1.618*1.618
Secondary	11.089	11.089=1.618*1.618*1.618*1.618*1.618
Secondary	0.500	0.500=1.000/2.000
Secondary	1.000	Unity
Secondary	2.000	Fibonacci Prime Number

Secondary	3.000	Fibonacci Prime Number
Secondary	5.000	Fibonacci Prime Number
Secondary	13.000	Fibonacci Prime Number
Secondary	1.414	$1.414 = \sqrt{2.000}$
Secondary	1.732	$1.732 = \sqrt{3.000}$
Secondary	2.236	$2.236 = \sqrt{5.000}$
Secondary	3.610	$3.610 = \sqrt{13.000}$
Secondary	3.142	3.142 = Pi = circumference /diameter of the circle

Table 1: Fibonacci ratios and corresponding calculations to derive each ratio.