some strong technical language.

Table of Contents

1. Introduction to Technical Analysis

Designing a successful strategy is an intellectually challenging process. It requires extensive research and testing. The research in trading is always followed by the immediate real world outcome. The trading strategy based on the bad system or methodology will be falsified extremely fast in the real world trading. Naturally, a trader with the scientific mind set can learn the great deal of knowledge about this world from testing various trading methodology with the financial market. Science or scientific methodology plays an important role in trading and investment.

Technical and fundamental analyses are the two main schools of thoughts for financial trading and investment. Technical analysis assumes that price discounts for everything. For example, technical analyst believe that at a given time a stock's price reflects everything that could affect the company including company's fundamental factors, economic factors and market psychological factors. Technical analyst also believes that history tends to repeat itself. Therefore, they can predict the future. Technical analysis only leaves the price as the main subject to study. For fundamental analysis, traders study the intrinsic value of the company. For example, they make their trading decision based on growth potential of the security. They are more concerned with basis like sales, earnings and management of the company. In general, fundamental traders are considered as the long term investors whereas the technical traders are considered as the short term investors. However, there are short-term fundamental traders too. For example, some news traders do not hold their position too long. On the other hands, there are technical traders basing their trading decision on monthly timeframe. Those technical traders can hold their position for several months to few years too.

The origin of technical analysis could be traced back to the trading of Japanese rice in Osaka in late 1600. This is the period when the Japanese candlestick technique was developed. With the development of high capacity computers and internet, the development of technical analysis has been accelerated even fast. In this book, we are only interested in the technical analysis in terms of the methodological point of view. Do not confuse the technical analysis with technical indicators. Technical analysis is the comprehensive methodology that covers broad scientific and mathematical methods. Technical indicator is the mathematical transformation of the price series to extract smoothed price trajectory or oscillating motion of the price like Simple Moving average or Relative Strength Index. Of course, technical indicator is a part of technical analysis but it is much smaller concept comparing to technical analysis. To give you some ideas about technical analysis, we will present five important categories for technical analysis. The five categories include charting, pattern analysis, technical indicator, mathematical method and artificial intelligence. We list some of the sub elements of the five categories in Table 1-1.

Charting Techniques	**Pattern Analysis**
• Line chart • OHLC Bar chart • Candlestick chart • Renko chart • Median Renko chart • Tick chart • Point & Figure chart • Heiken Ashi • Area • Kagi • Line break • Histogram • Scatter plot	• Japanese candlestick patterns • Support & resistance • Pivot point analysis • Volume Spread Analysis • Elliott Wave Theory • Harmonic Pattern • Fibonacci Retracement, Fibonacci Fan, Fibonacci Arc, • Gann Line, Gann Fan, Gann Arc, Gann Square • Tradable Patterns (Rising Wedge, Falling Wedge, Double top, double bottom, head & shoulder pattern) • Supply & Demand Zone (Rally Base Drop and Drop Base Rally patterns) • Andrew’s pitch fork • Market Profile

Technical indicators	Mathematical Methods
• Simple Moving Average • Exponential Moving Average • Triple Exponential Smoothing Average • Relative Strength Indicator • Fractals • MACD • Commodity Channel Index • Rate of Change • Williams's Percent (%) • Stochastic Oscillator • Parabolic SAR	• Principal Component Analysis • Wavelet Transformation • Multiple Regression • Logistic Regression • Exponential smoothing method • Autoregressive Integrated Moving Average method • Vector Autoregressive method • Error correction model • Co-Integration Test • Dynamic Stochastic programming • Monte Carlos Simulation

Artificial Intelligence
• Multilayer Perceptron • Support Vector Machine • Self-Organizing Map • Deep Machine Learning • Genetic Algorithm

Table 1-1: Five main categories of Technical Analysis.

Charting techniques are the first requirement for trading. Simply speaking traders cannot trade without any chart. The value for good visualization technique is a prime importance for traders. Important attributes in the modern charting technique is that they must allow the instant recognition of important patterns and trend from the price series. In addition, market volatility should be also easily gleaned from the chart too. Some commonly used charting techniques are line chart, OHLC bar char and candlestick chart. In modern trading software, these three types of charts are essentially provided in their basic package. Some more sophisticated software offers Renko chart, Point & Figure chart and Tick chart for advanced users. Traders tend to have their preferences for the choice of the charts. For traders using Japanese candlestick patterns, they will stick with candlestick chart over OHLC bar chart. If traders are looking for breakout patterns, then they will prefer Renko chart or Point & Figure chart.

Figure 1-1: Candlestick chart of EURUSD Daily series with tick volume.

The objective of the technical indicator is to measure the strength of trend, volatility and momentum of the price series. Technical indicators are mostly derived from the price series. Sometime technical indicator uses open, high, low and close price. Sometimes the technical indicator only uses close price for computation. The advantage of technical indicators is ease of use. For example, most of technical indicators can be displayed simultaneously together with the original price series in a convenient way. Therefore, traders can easily incorporate alerting system for his trading. The disadvantage is that most of time technical indicators are lagging behind the actual price series. In modern trading platform, technical indicators and charting facilities are the basic requirements for trading. Many of the software vendors provide over 100 technical indicators with their trading platform. There are some of the vendors claiming that they are offering over 3000 different technical indicators unofficially. Most common mistake for traders is that they tend to apply the same technical indicator across every market. The different market can have different market dynamics. Therefore, before blindly applying any technical indicators, you should ask the question like “Is this technical indicator right one for this market?”. For example, for the stock exhibiting strong growth patterns, it is not good idea to look for the trend reversal opportunities using the relative strength indicator.

Figure 1-2: Candlestick chart of EURUSD Daily series (top) with Relative Strength Indicator (middle) and Average Directional Movement Index (bottom).

Besides technical indicators, pattern analysis is another important tool for traders. Pattern analysis concerns about the price levels and the geometry of the price series. Support & resistance, Japanese candlestick pattern and Fibonacci retracement are the popular pattern recognition techniques for traders. Support and Resistance represents key price levels where the force of supply and demand meets (Figure 1-3). Normally support and resistance levels are detected by connecting frequently tested level from your chart. Support is the price level at which demand is strong to prevent the price from declining further. Resistance is the price level at which selling is strong to prevent the price from rising further. Some textbook might teach you the support and resistance level as the reversal level but this may be not true. Practically speaking, support and resistance level can act as the breakout level too. For example, when the price penetrates through resistance level, more buying momentum can build up for strong bullish movement. Likewise, when the price penetrates the supply level, more selling momentum can build up for strong bearish movement. However, what is always true is that there are strong volatility around the support and resistance area. Price will either penetrate hard or bounce back hard at support and resistance level. When the resistance level is penetrated, then the resistance level becomes support level. Likewise, when the support level is penetrated, the support level becomes resistance level. Traders should get habit of making note for the important levels always for their trading.

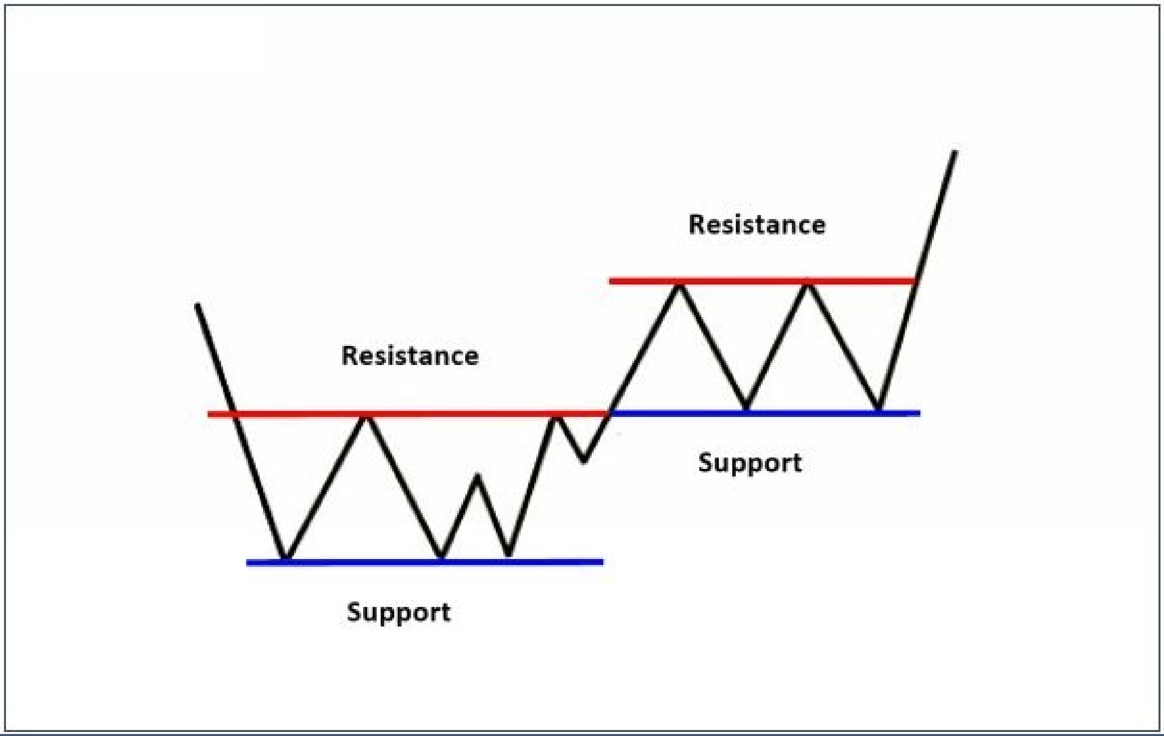

Figure 1-3: Schematic diagram of Support and Resistance for financial trading.

Fibonacci retracements are ratios used to identify potential reversal levels. Since these ratios are derived from the Fibonacci sequence, they are called Fibonacci retracement. 23.6, 38.2, 50.0 and 61.8% are the popular ratios used for Fibonacci retracement. Chartists often use these Fibonacci ratios to define retracement levels and forecast the extent of a correction or pullback. For example, Figure 1-4 show the typical sequence for bearish trend – correction – continuing bearish trend pattern. As you can see, the correction was made about 38.2% of the retracement from the initial bearish trend move. When you want to apply Fibonacci retracement, you need to identify one swing high and swing low from your chart. If swing high comes before swing low, then you will predict the bearish trend reversal point. If swing low comes before swing high, then you will predict the bullish trend reversal point. Like support and resistance levels, the accuracy of the Fibonacci retracement varies for different market condition too. Fibonacci retracement is simple but powerful concept. It can be combined with other techniques to form overall strategy. Fibonacci retracement is normally very good supportive tool to cover the weakness of the technical indicator.

Figure 1-4: Fibonacci Retracement drawn over daily EURUSD candlestick chart for bearish setup.

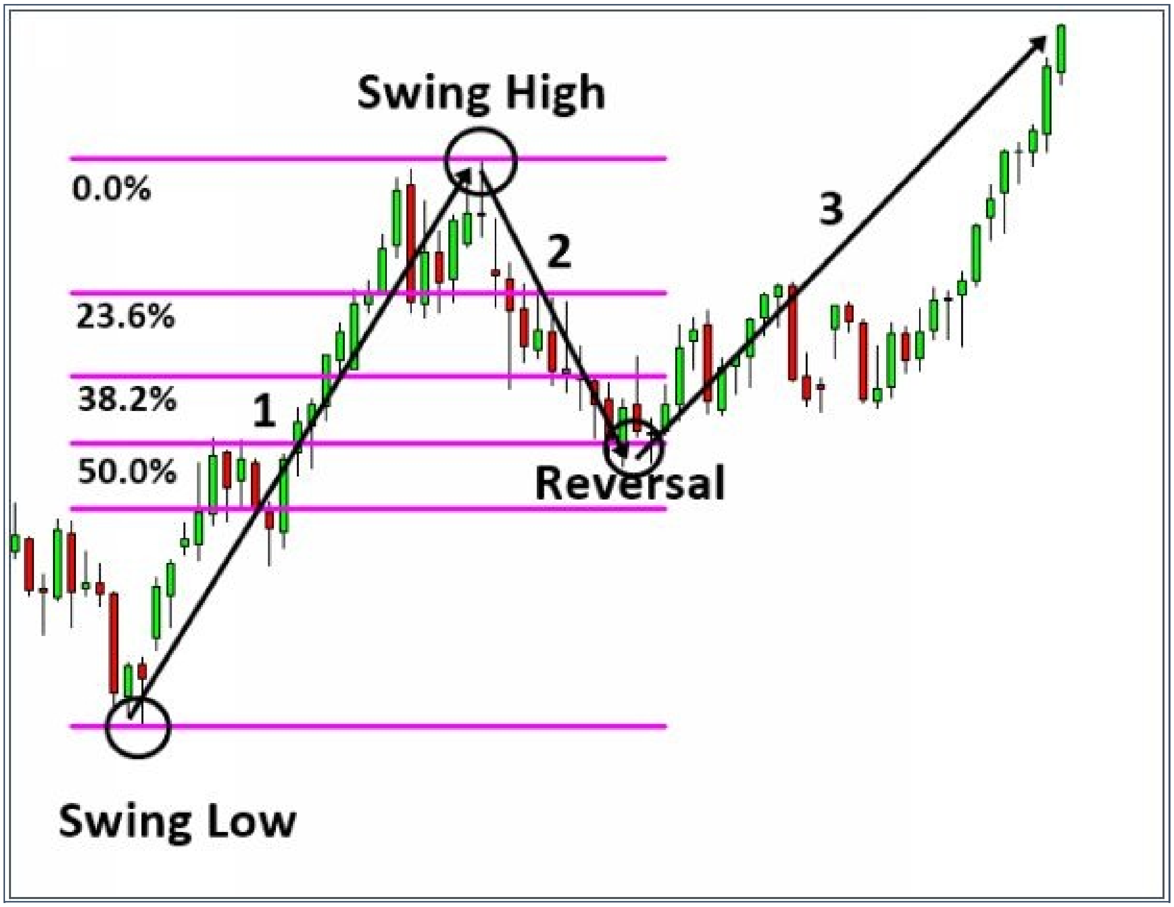

Figure 1-5: Fibonacci Retracement drawn over daily EURUSD candlestick chart for bullish setup.

Japanese candlestick pattern is a popular pattern analysis used by many traders. It provides visual insight for buying and selling momentum present in the market. Japanese candlestick pattern can provide both entry and exit signal for traders. At the same time, many traders use them as the confirmation techniques. Japanese candlestick patterns provide both trend continuation and trend reversal patterns as shown in Figure 1-6 and Figure 1-7. The main advantage of Japanese candlestick is that they are simple and universal. Japanese candlestick pattern can be detected visually without need of the sophisticated tool. At the same time, the accuracy of the Japanese candlestick can be quite subjective to traders. Unless you want to hold your trade for one bar or two bar only, sometime

Japanese candlestick pattern can predict the direction wrong against long-term price movement. So the caution must be made to use together with other technical indicator or other pattern analysis. From my experience, Japanese candlestick has more values as the confirmation technique rather than main signal for your trading.

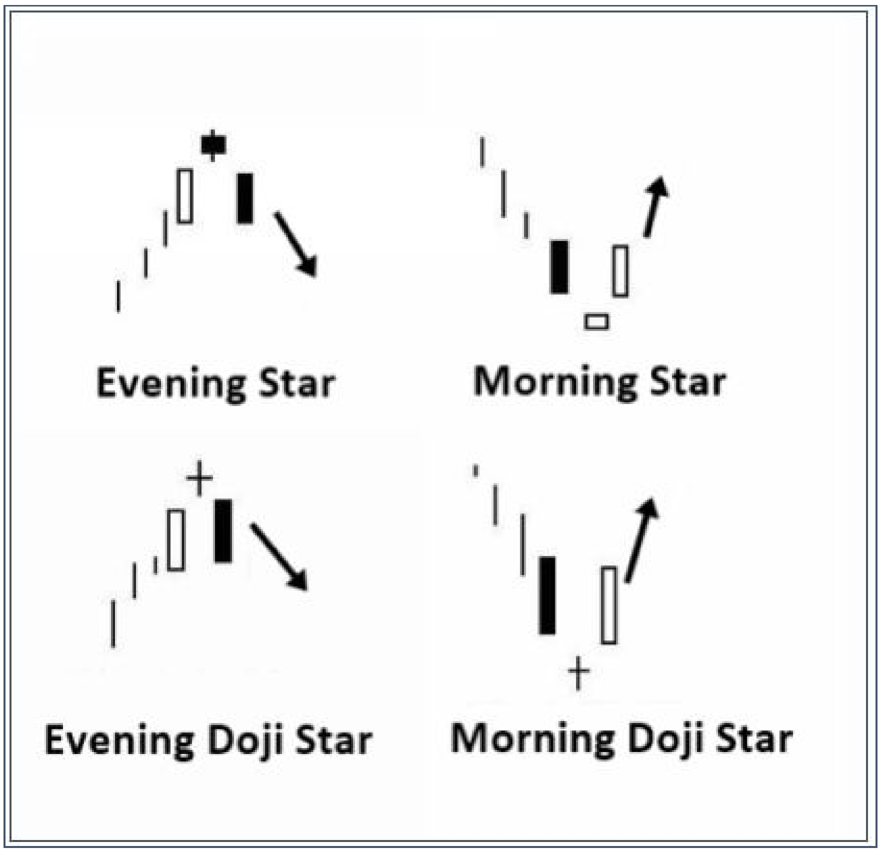

Figure 1- 6: Trend reversal Japanese candlestick patterns.

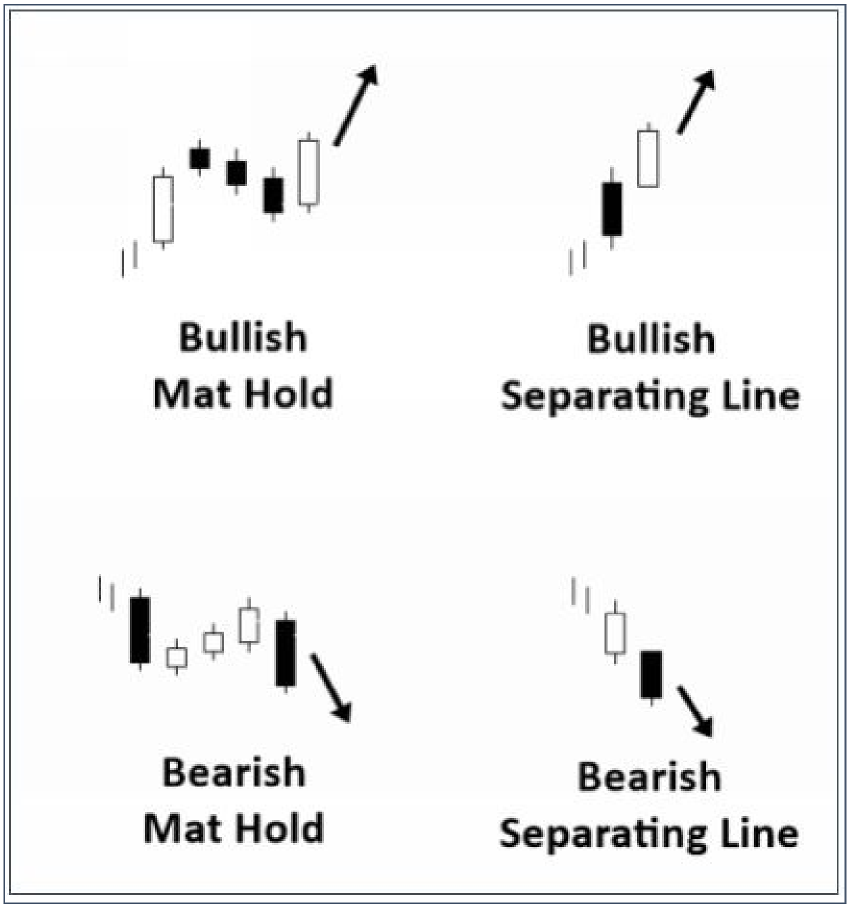

Figure 1- 7: Trend continuation Japanese candlestick patterns.

Mathematical method is one form of the technical analysis even though they were not originally developed for the financial trading. The common statistical method like multiple regressions is often applied for trading and investment. Principal Component Analysis is the common techniques used to extract some meaningful information from the financial price series. In addition, the Vector autoregressive method or error correction model is popular mathematical trading tool among mathematician. Advantage of mathematical method is their ability to incorporate robust analytical methodology. For example, with Monte Carlos simulation method, one can develop rigorous trading strategy with precise statistical inference about the trading setup. For example, traders can illustrate the worst and best outcome of the trading setup for the given volatility of the price series. The disadvantage of the mathematical method is that they might be too complex for average traders. Even though modern trading software comes with the built in script language, implementation of serious mathematical model takes considerable amount of time and efforts for trading and investment. It is also important for the model builder to understand the operating principle and practical limitation of the methods. For example, the Generalized Autoregressive Conditional heteroscedasticity (GARCH) model can be used to model the volatility of the financial market. When they built well, they can offer the considerable insight about the current and future volatility of the financial market. However, some people mistakenly uses the least square estimation in the place of the maximum likelihood estimation because of the readily available source code for the least square curve fitting method on online. The wrongly applied mathematical model can do more harm than good for your trading. Therefore, you must carefully think if the mathematical method can provide sufficient benefit to overcome the complexity. Considering that many investment banks hires applied mathematicians and physicists, exploring mathematical trading model is worth for your future career when you can afford the time and cost for building such a model.

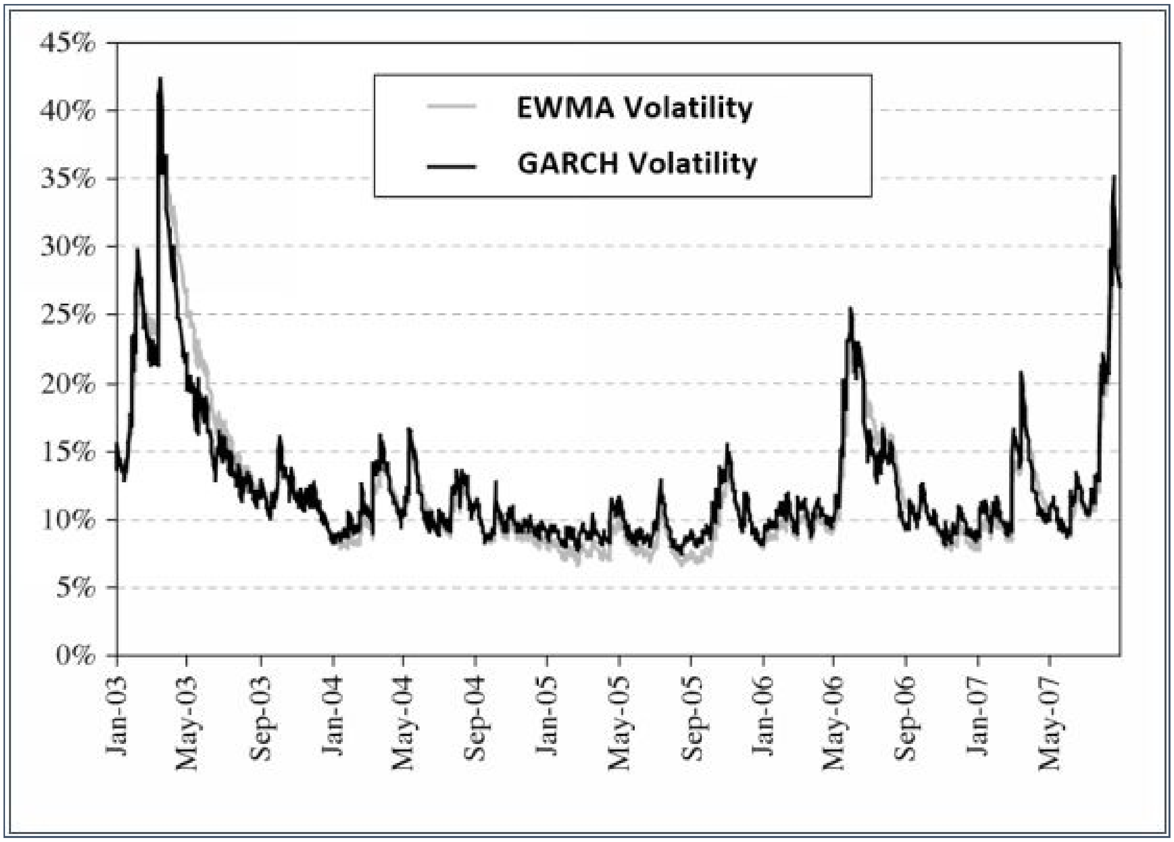

Figure 1-8: GARCH and EWMA Volatility for FTSE 100. (Alexander, 2008)

Artificial intelligence techniques are another alternative approach for technical analysis. In fact, the computer scientist had a long interest in using artificial intelligence for the financial market. They are often considered as more complex methods than the mathematical methods. For example, multilayer feedforward neural networks are one form of the nonlinear regression. The method extends the capability of multiple regression by connecting multiple of neurons, in which each neuron resembles multiple regression. Advantage of the artificial intelligence is that they are nonlinear method with the capability of capturing nonlinear patterns. The disadvantage of the artificial intelligence is that one requires quite a lot of data and high speed computing facility. Most of time, one requires impressive hardware to deal with the computation required for the artificial intelligence model. Apparently, the artificial intelligence has proven its ability for the real world application. For example, Google’s Alphago beat the world champion Lee Se-Dol and European champion Fan Hui at the board game GO with a best of five win. However, considering that Alphago used a larger network of computers that spanned about 1200 CPUs to match with Lee Se-Dol and Fan Hui, it is questionable if it was a fair match for one human to compete with 1200 CPUs. In addition, this also confirms that this technology is still rather expensive for the budget of the average traders. Applying artificial intelligence for making prediction for stock index and currency markets are not a new story any more. Artificial intelligence sounds so futuristic and promising. However, one caution must be made before you become a huge fan of artificial intelligence. Ability of artificial intelligence is limited by usefulness of the data feeding into the model. For example, artificial intelligence can deal with what is inside the data only. For the poor data, artificial intelligence can only predict with poor accuracy. Due to their complex internal structure, they are prone to noise in the data too. Artificial intelligence can produce non-reliable prediction for highly complex data sets sometimes. If the simple methods can produce more or less the same results in comparison to artificial intelligence, it is better to stick with the simple method. Simple method will provide you more reliable trading operation in long run.

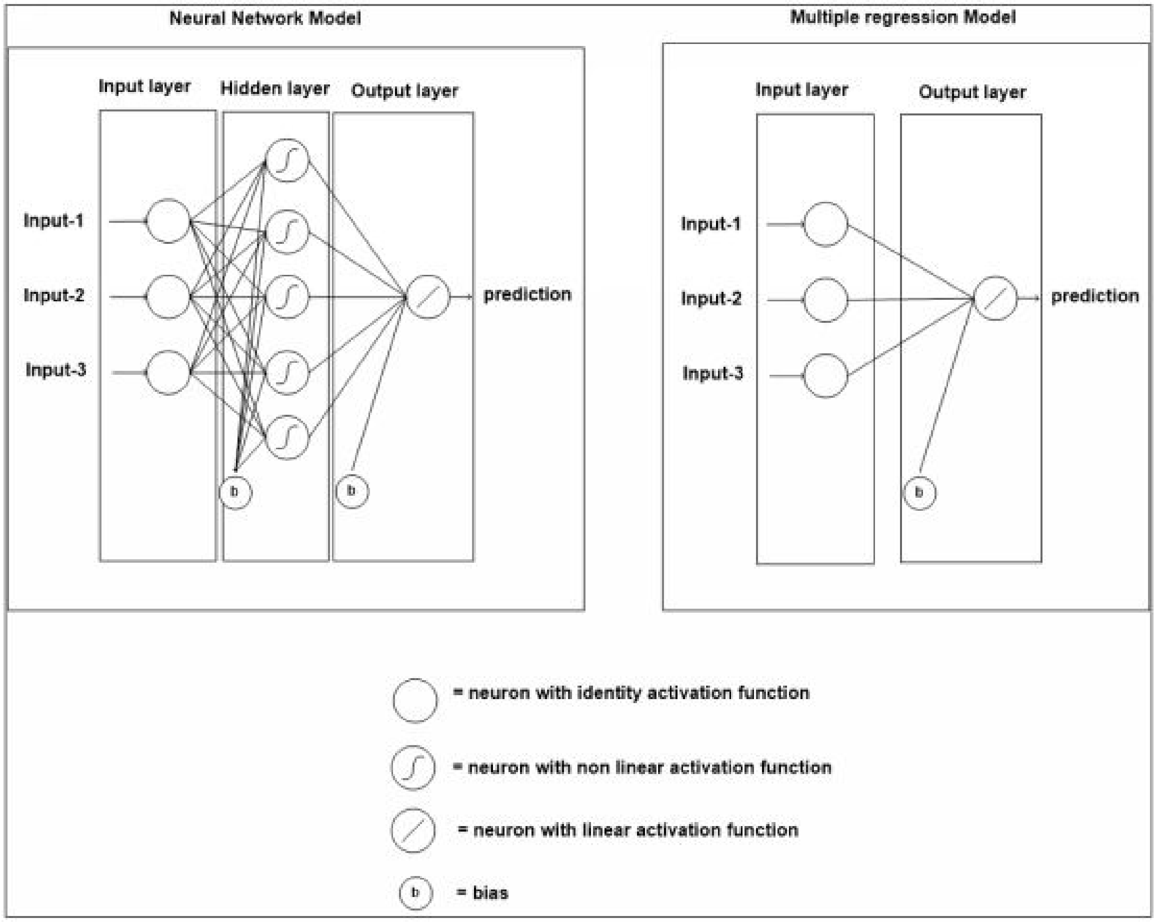

Figure 1-9: Topology of feed forward neural network model with 3 input neurons, 5 hidden neurons and 1 output neuron (Left) and multiple regression model expressed using neural network topology (right).

2. Introduction to Charting Techniques

For the Price Action and Pattern Analysis, it is important to have good visualization tools. Since we want to find important patterns for our trading, we will need a good size monitor and good visualization software. Of course, you should invest on them as much as you can afford. No single visualization techniques are perfect. They always possess some advantages as well as some disadvantages. Firstly, line chart is the most basic visualization technique for traders. Line is simply drawn by connecting each session's closing price. For example, 1-hour line chart is simply drawn by connecting the closing price of 1-hour candle. As line chart are produced by connecting two points at the fixed time interval, they can provide a great insight about some regularities in the price series. For this reason, not only traders use the line chart but also many mathematicians use them to visualize the price series data. Line chart is useful when we want to exam some cyclic behaviour like seasonality or any cyclic patterns made up from sine or cosine function. Line chart is also useful when you want to compare multiple price series in one chart. On the other hands, the disadvantage of the line chart is that it does not provide the trading range of each session. In addition, due to the continuously drawn line, it is difficult to see any gap between sessions. In addition, line chart miss some important attributes like highest and lowest prices of each session.

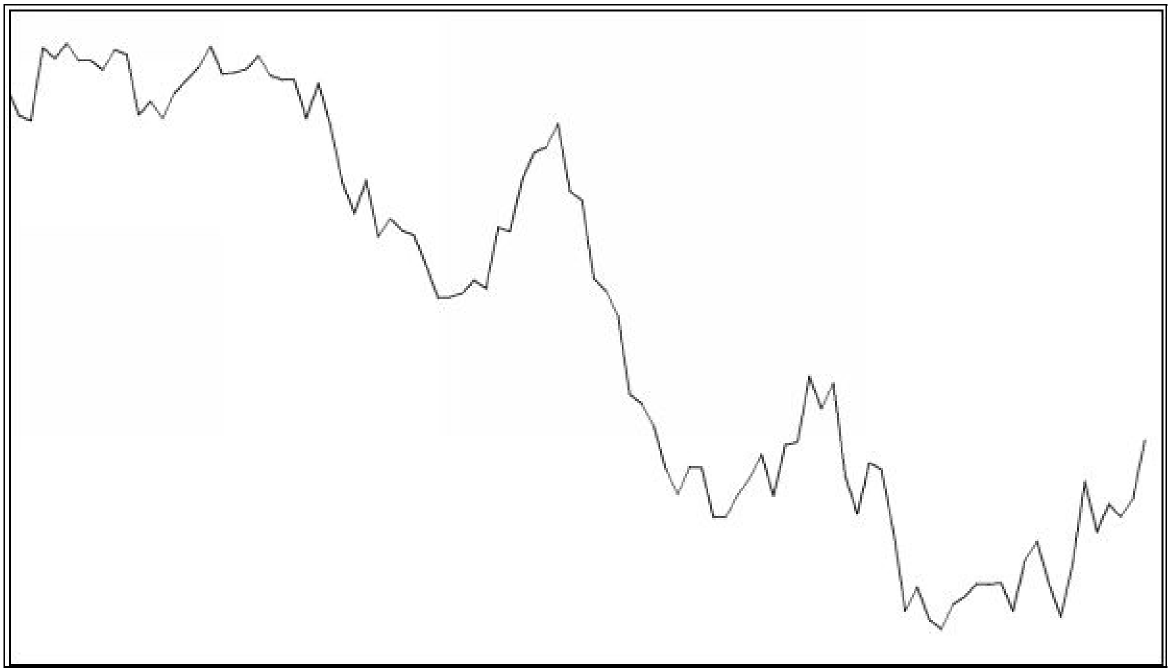

Figure 2-1: Line chart for EURUSD from 1 September 2016 to 16 January 2017

Candlestick chart provides some additional attributes, which line chart misses. Figure 2-2 presents the anatomy of the candlestick chart. Candlestick chart provides three important information. Firstly, the bottom and top of the box represents the opening and closing price of the session. Secondly, each candlestick shows the trading range between high and low for each session. Thirdly, candlestick shows the direction of movement for each session. In Figure 2-2, the green candle reveals the upward movement for the session immediately whereas the red candle shows the downward movement. From Figure 2-3, we can feel how richer information candlestick chart provide for each session comparing to the Line chart. As shown in Figure 2-3, Candlestick chart is useful to spot the gaps in between sessions. This is very useful property of the candlestick chart since Line chart or any other chart is difficult to spot the gaps. One of the drawbacks of the candlestick chart is that it does not provide the sequence of high and low price but this is the common problem for other visualization techniques too. It is simply because the sequence of high and low price was not collected traditionally by the Financial Institutions. If anyone starts to provide the historical sequence of high and low prices for each session, then this would reveal a lot of information on the psychology of the financial market. All they have to put some simple identifier which price comes first between high and low prices during the session. For example, one can put the letter “h” to highlight that high price comes first before low price. Therefore, storing cost is no more than just a letter for this crucial information. This might be cheap but useful alternative to the expensive tick history data, which often require enormous hard drive space. In addition, the candlestick chart is the basis for the popular Japanese candlestick patterns. Although the Japanese candlestick pattern alone does not provide the perfect trading entry, many traders uses them as the confirming tool for their entry or exit.

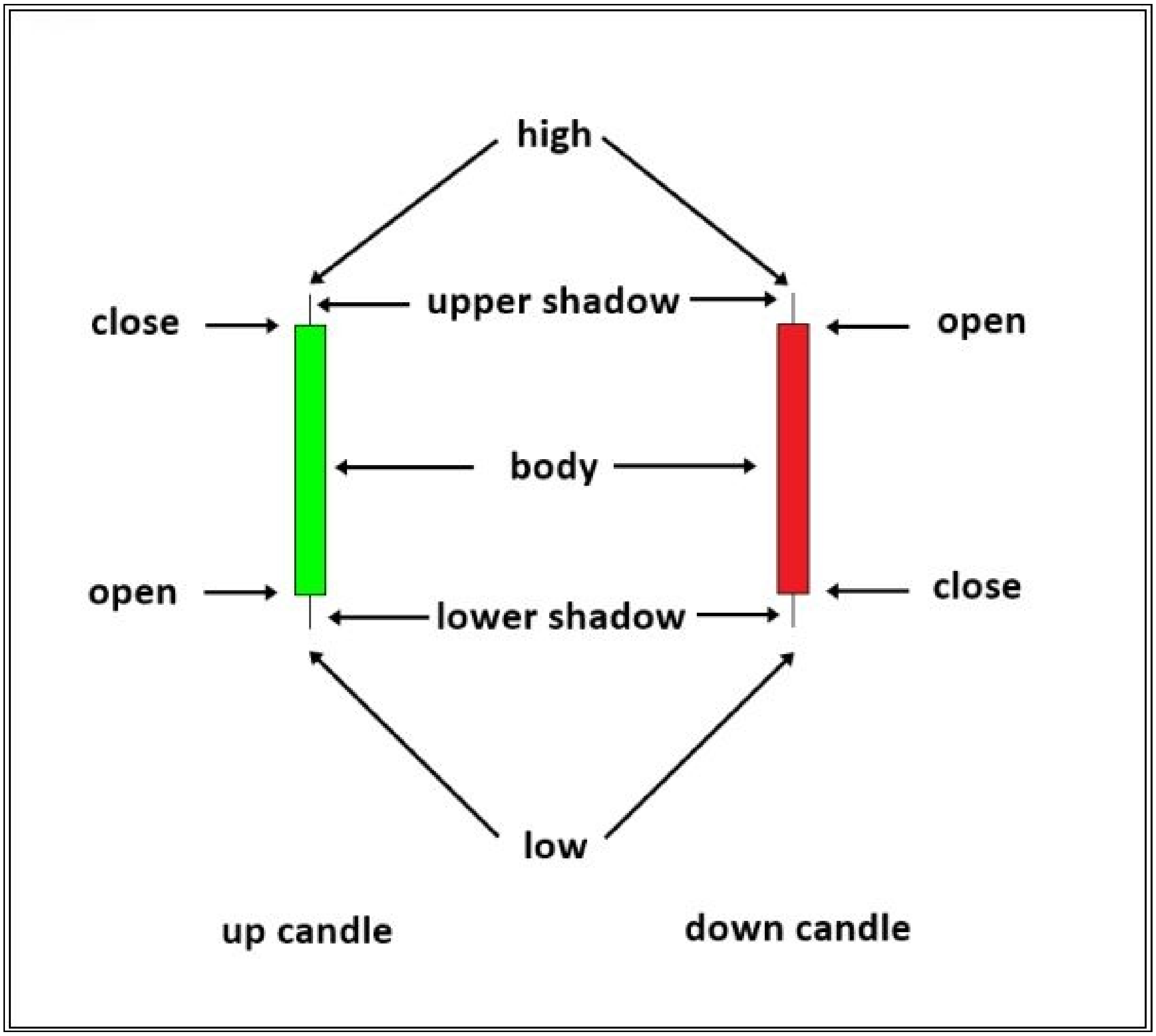

Figure 2-2: Anatomy of the Candlestick chart.

Figure 2-3: Candlestick chart for EURUSD from 1 September 2016 to 16 January 2017.

OHLC Bar chart is another popular form of visualization techniques. The OHLC bar chart has some improvement over the line chart. It provides all of the same data including open, close, range and direction to the candlestick chart. However, OHLC bar chart is not visually easy to follow like candlestick chart. In addition, spotting the gap between sessions is not easy with the OHLC bar chart. However, many traders still not given up to use OHLC bar chart over the candlestick and line chart.

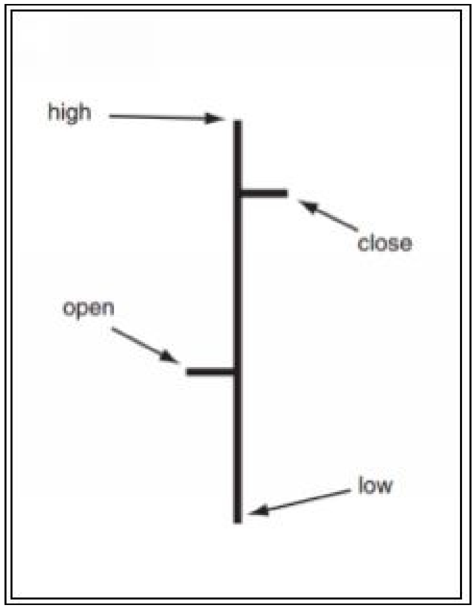

Figure 2-4: Anatomy of the Range Bar.

So far, we have introduced the visualization techniques with the fixed time interval. For example, line chart, candlestick chart and the OHLC bar chart uses the information collected in each session. The common time interval for the session is 1 hour, 4 hour, 1 day, 1 week and 1 month. Instead of using the fixed time interval, several techniques do not use the fixed time interval to construct the chart. For example, tick chart record the open, high, low and close prices during the fixed tick arrival intervals. Therefore, all the bars in the Tick chart have the same tick volumes. For example, 100 Tick chart will record the open, high, low and close price during 100 tick arrivals. All the bars in 100 Tick chart will have 100 tick volumes. One can construct line, candlestick chart and OHLC bar chart with Tick chart too. Tick chart will look like normal chart except that every bar has the identical tick volume. In Tick chart, during busy market hours, one candlestick can be formed fast but during slow market hours, one candlestick can be formed slowly. The tick chart is useful to replace the normal candlestick chart with lower timeframe when the candlestick chart produces the poor visual representation of the market with standard time interval. This is not always the case but when there is low interest in the market, this can happen. For example, Figure 2-5 shows the broken 1-minute candlestick chart for NZDSGD currency pairs. In this case, instead of using the candlestick chart with 1-minute chart, trader can use 100 tick chart. Because each candle is completed with 100 tick arrivals every time (Figure 2-6), we naturally have smoother looking chart in comparison to the broken chart in Figure 2-5. Once traders become familiar with tick chart, they tend to stick with them even for the higher timeframe. For example, you can use 500 tick chart or 1000 tick chart for your trading. Disadvantage of the tick chart is that tick is generally much heavier to store in the hard drive in terms of size. Therefore, not many trading package offer the capability of using tick chart for the time of writing this book. Just for your information, one-year worth of tick data can take up over some serous gigabytes of the space on your hard drives. In addition, Tick chart does not provide volatility information since every bar has identical tick volume. However, if programmatically doable, one can store time duration it takes to form the bar in the place of the tick volume. This would provide different insight, which the fixed time interval chart can't provide.

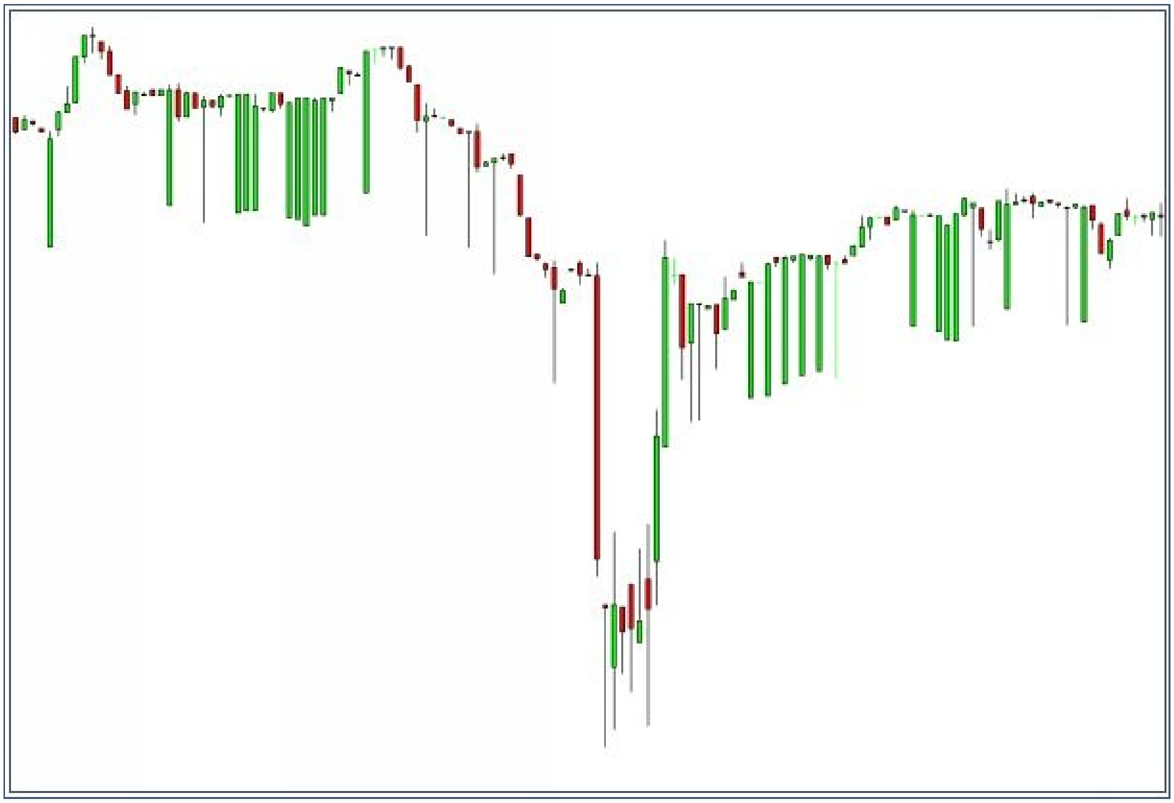

Figure 2-5: Broken candlestick chart for NZDSGD currency pairs in 1-minute timeframe.

Figure 2-6: EURUSD Tick chat with 100 tick volume. On average, each bar was formed in 182.36 seconds.

Another popular visualization technique, which does not use the fixed time interval, is the Renko chart. The charting principle of the Renko Chart is quite different from the rest. For example, Renko chart is constructed by drawing bricks of fixed height in series. To illustrate the idea, consider Figure 2-7, if the price moved up by 5 points from the top of brick, then we will draw one white up brick. Likewise, if the price moved down by 5 points from the bottom of the brick, then we will draw one black down brick. The brick will be drawn either on the top or on the bottom of the other brick always.

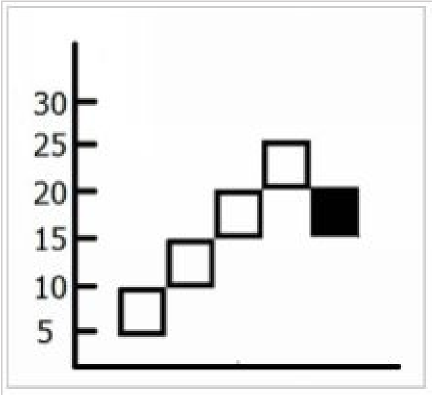

Figure 2-7: Conceptual representation of Renko chart.

Figure 2-8 shows what happens when we transform about 100 candlesticks into Renko bricks with height of 20 pips in EURUSD 1 hour chart. As you can see, Renko bricks are much more concise and 100 candlesticks was transformed into only 52 Renko bricks. During this transformation, we are losing time information of our candlestick chart. Another important point you can observe here is that the Renko chart provide much smoother and readable visualization representation of trend. This is because the equal height of Renko brick reduces a lot of noise present in candlestick chart. With Renko Brick chart, it is much easier to identify trend and reversal patterns.

Figure 2-8: Daily EURUSD price series and Renko chart on the same period.

There are some drawbacks in Renko chart too. Because Renko chart lose all time information from our candlestick chart, you are no longer able to compare your normal candlestick chart to your Renko chart. In addition, unlike the candlestick chart, you have to select the sensible height of brick. Since there are many benefits using Renko chart, some traders are never worried about these disadvantages. Overall, Renko chart provide quite a lot of features which other chart does not provide.

3. The Five Regularities in the Financial Market

The Financial Market is the place where different investors are trading securities like equities, bonds, currencies and derivatives. It is the market place to facilitate the exchange of securities between buyers and sellers. Loosely speaking, the financial market works like the auction market where buyers enter competitive bids and where sellers enter competitive offers at the same time. However, unlike auction market, in the financial market securities are often traded without delivering actual physical goods. Although some companies can use financial market to hedge their physical positions, in this book, we will assume that you are more of speculator who wants to profit from the market dynamics. Various buyers and sellers with different attributes, different geographic location, different purchasing power and different financial goals, forms the daily transactions of the financial market. Therefore, the dynamics of financial market can be represented as the crowd behaviour. It is not necessarily perfectly rational place but the fundamentals play some important role behind the market dynamics up to some degree.

For traders and investors, it is important to develop the right trading strategy for the market. Good trading strategy never comes blindly. Understanding the underlying dynamics for the financial market is the important requirement to build a solid trading strategy. Then, what is the underlying dynamics for the financial market and how can we study them to benefit our trading and investment? Scientists had a strong interest in the dynamics of the financial market for many decades. They have extensively studied the dynamics of the financial price series in the Stock and Forex market. The simplest but most effective way to study the dynamics might be the decomposition approach. In decomposition, literarily we are breaking down some complex system into the simple and digestible bits. Then we use this decomposed bits to predict the behaviour of the complex system.

When we apply the decomposing technique for price series, the price series can be decomposed into several sub price patterns. In fact, the sub price patterns are the regularities that constitute the dynamics of the financial price series (Figure 3-1). For trading and investment, we make use of the knowledge of these regularities to predict up or down movement of the financial market. All the known trading strategies, including simple and complex ones, are based on some of these regularities existing in the price series. Remember that none of trading strategies is merely created to offer you just some luck or based on some random theory.

Figure 3-1: The concept of the decomposition for the financial price series.

In Figure 3-1, what could be the pattern 1, pattern 2, pattern 3 and pattern N making up the real world financial price series? Yet, many different version of decomposition techniques exist to describe the price patterns in the financial market. Among them, Gardner's version considers the trend and seasonality as the main underlying components of the price series data (Gardner, 1987, p175). Many traders are already familiar with trend in the financial markets. For example, many technical indicators like moving average and MACD were developed to visualize trend in the financial markets. Seasonality is literally seasonal fluctuations in the market. It is also used by many traders. For example, because the sales of Ice Creams increase during summer, stock price for Ice Creams Company can go up due to the increased profits during summer. This sort of patterns will make up the seasonal fluctuations.

The Gardner's framework is intuitive and easy to understand because trend and seasonality are the backbone of many analysis techniques used for the univariate price series in many scientific fields. Although Gardner's framework does not mention about random process explicitly, his framework already assumed that any price series include some random process.

Depending on their underlying dynamics, the price series can show the multitude of behaviours because real world price series are made up from different magnitude of each price pattern. For example, sometimes, the price series can exhibit strong trend without seasonality and vice versa. Sometimes the price series can exhibit some trend with some seasonality. In the Gardner's trend-seasonality framework, we can generate twelve different behaviour of the price series by combining the basic trend and seasonal patterns as shown in Figure 3-2. Scientist uses this framework to categorize many real world price series data set for prediction purpose. Then, what is the practical use of the Price Pattern Table in Figure 3-2 for traders? As a trader, we can develop trading strategies to capture these price patterns within the price series. For example, most of technical indicators are created to capture trend pattern in the price series. Price patterns in price series are regularities, which help us to predict the price series into the future. Financial trading is based on our prediction for the future market. We buy EURUSD because we predict that EURUSD have the high chance to go up. We sell EURUSD because we predict that EURUSD have the high chance to go down. If we understand the existing regularities of the financial market better, then we will likely make better trading and investment decision too.

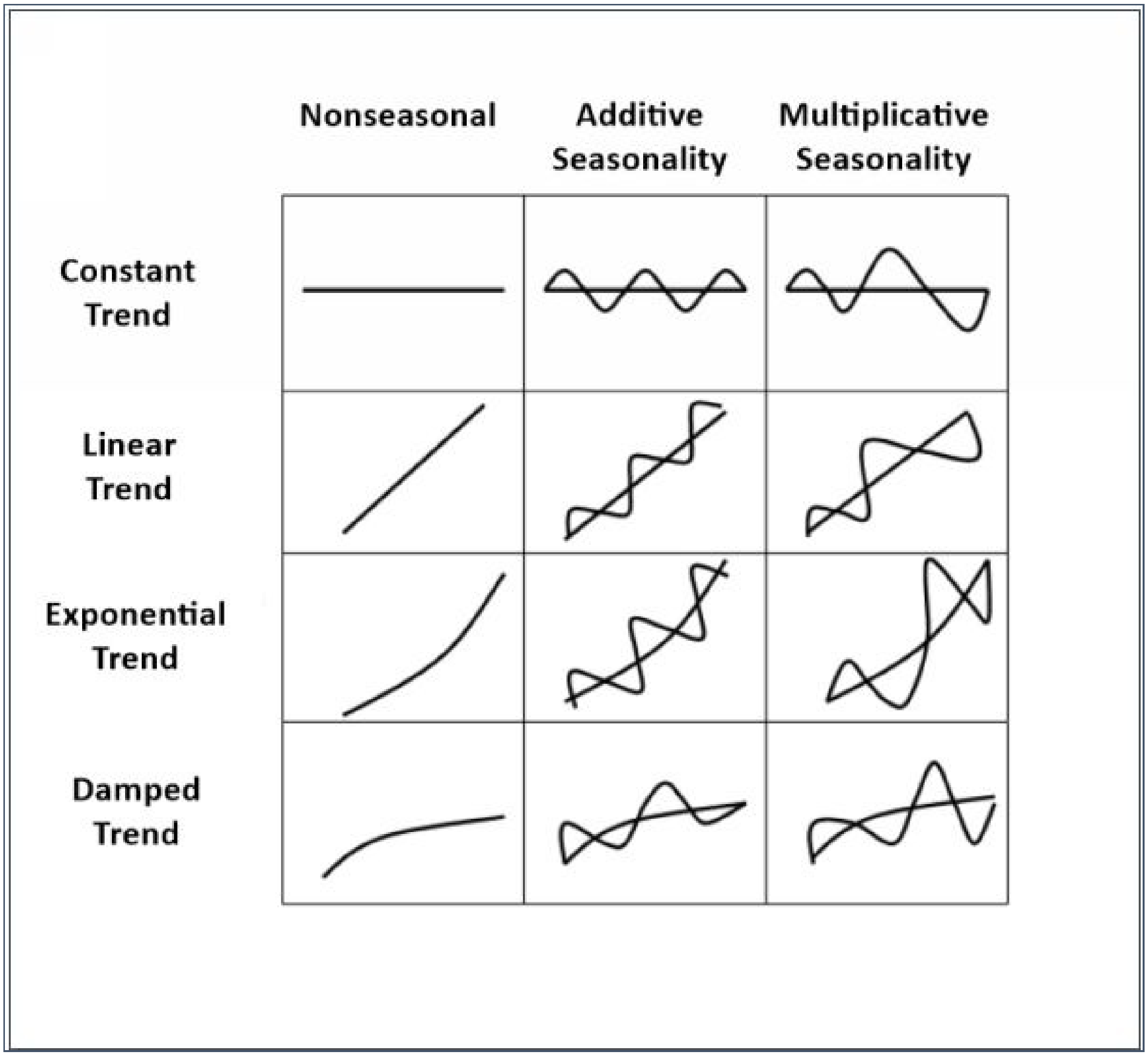

Figure 3-2: The original Gardner's table to visualize the characteristics of different time series data (Gardner, 1987, p175). Gardner assumed the three components including randomness, trend and seasonality in this table.

In spite of the fact that trend and seasonality are the important price patterns in the financial market, practically the entire financial market will not fit to this trend-seasonality framework alone. If the market was so predictable with these two components only, then traders and investors were able to make money much easier. Maybe you can also take advantage on buying shares of Ice Cream Company during April and selling them late August. If the pattern is there, then you should do that. However, in the highly competitive and liquid financial market, this is not the case. In many cases, the trend and seasonality might be the less significant components in the financial price series in the Stock Market and Forex in comparison to the data obtained from the business and social studies. The Gardner's trend and seasonal framework can work well for business and some social data set but it might be oversimplified for the case of the financial markets.

Instead of the two components framework with trend and seasonality, in this book, we propose the three components framework. The three components include Equilibrium process, Wave process and Fractal-Wave process. These three components can serve to conceptualize the basic price patterns existing in the financial price series. Just like the trend and seasonal components in the Gardner's framework, these three components are the building blocks to explain more complex price patterns in the financial price series and to predict the future movement of the price series. Just to convey our idea, we will explain these three components in brief, before we expand each in more details from the next chapter.

The Equilibrium process is equivalent to the trend in the Gardener's framework. However, it is also the same term "equilibrium" used in the supply- demand economic theory. Literarily it is the market force moving the price to release the unbalance between supply and demand. Wave process is any cyclic patterns repeating in the fixed time interval. Wave process includes the concepts of additive and multiplicative seasonality in the Gardner's model. Furthermore, Wave process includes other complex cyclic behaviour, which can be described with the multiple of combined sine and cosine waves. Finally, the Fractal-Wave process is the representation of the Fractal geometry in the time dimension. Therefore, it is the self-similar process repeating in different scales. In plain language, Fractal-Wave process refers to the repeating patterns with varying scales. For example, trader might remember that the price patterns in the S&P 500 before 2008 financial crisis. He can come across the similar price patterns in lower timeframe or in other instruments. Because he has already seen that the price pattern led to the huge bearish movement for S&P500 before 2008 financial crisis, he would take the sell action again whenever he recognize the similar patterns from lower timeframe or from other instruments.

Just as Gardner visualized the possible combinations of trend and seasonality in three columns in Figure 3-2, we can visualize the possible combinations of these three components in five columns. In Figure 3-3, first three columns including Equilibrium Process (=trend), Additive Seasonality and Multiplicative Seasonality are identical to the Gardner's three columns. Fourth column includes any simple and complex cyclic patterns, which can be described with the combined sine and cosine waves. Fifth column describes the Fractal-Wave process with Equilibrium process. Each column represents a distinctive regularity with its own behaviour. We can describe the five columns as the five regularities in the financial market (Figure 3-3 and Figure 3-4).

One most obvious distinction among the five regularities is that each regularity has the distinctive range of number of cycle periods as shown in Figure 3-5. In general, Second and Third Regularity have very few cycle periods. Fourth Regularity tends to have more cycles but the number of cycles is still finite. The Fifth Regularity can be characterized by the infinite number of cycles because the repeating patterns can have the infinitely varying scales within the price series. Therefore, it becomes very clear that we need to use different tactics when we deal with each regularities.

Especially, the fifth regularity is the underlying process behind many horizontal and diagonal price pattern used by traders. The horizontal and diagonal price pattern can include the popular price patterns like support, resistance, harmonic patterns, Elliott Wave patterns, Triangle, Wedge and Channels, etc. This book mainly focuses for the fifth regularity because the fifth regularity is the main price dynamics behind many price action and pattern trading strategies. In the book, we want to help you to understand the clear difference between this fifth regularity and the rest. We will focus to cover the practical trading knowledge for this fifth regularity. Finally, we will help you to learn the price action and pattern trading strategy in the practical level throughout this book.

There are many different data in the Stock Market and Forex. Remember that different players are participating in the different markets. Each financial price series will be played by different players with different attributes and different psychologies. Therefore, each price series can have their own dynamics because they possess different price patterns in different magnitude. For example, some stock market price series can possess much stronger Equilibrium process than currency price series in the Forex. Practically speaking, the most of the price series in the Stock market and Forex will have either the mixed effects of Equilibrium process and Wave process or the mixed effects of Equilibrium process and Fractal-Wave process. This means that they are a highly complicated system representing the crowd behaviour of millions of people.

Once again, the main purpose of this taxonomy is to identify regularities existing in the financial price series. Therefore, traders can make prediction for their trading. The five regularities framework can be used to build any trading strategy for different financial market. For example, there is no need to apply hammer when the entire house was built with bolts and nuts. In addition, the medical doctor will prescribe you the medicine for cold when your symptoms are very close to other patients having cold. Likewise, if the financial price series exhibit strong trend and multiple cycles, then you should just apply the right tools to capture the strong trend and multiple cycles for your trading. If you are applying the tool to capture trend only or if you are applying the tool to capture cycles only, then you will be underestimating the market. Therefore, you will be suffering more than enjoying the profits. Practically speaking, trader should know what regularities they are dealing with and what tools they need to apply to capture those regularities.

From next chapter, we will describe the sub price patterns under these five regularities in details (Figure 3-6). Especially, we will focus to explain the combined price patterns like Equilibrium Wave process and Equilibrium Fractal-Wave process. It is because the price patterns in the real world financial markets are likely to be one of these complex patterns. We will try our best to visualize each price patterns with example. However, for Forex and Stock market, it is not easy to find them showing simple trend pattern or seasonal pattern alone. As we have mentioned before, highly competitive and liquid market are likely showing more complex patterns like Equilibrium Wave process or Equilibrium Fractal-Wave process. Therefore, when we explain an obviously simple price patterns, then we might use some data set not from the Forex or stock markets because it is difficult to find Stock or Forex market data showing trend pattern alone. For example, in explaining the Equilibrium price patterns, we use UK housing price to show you how the typical Equilibrium dominated price series look like. Sometimes we might use some synthetic price series to visualize some price patterns in Figure 3-6.

After we have covered all the sub price patterns in next few chapters, we will move to the practical part focusing on the fifth regularity for your trading. The fifth regularity is the least understood but most confused price patterns among trader comparing to the rest of the regularities. Especially, the characteristic of the infinite cycle period tells us that many technical indicator, we were using without any doubt, can reduce your profitability or at least they can act as an inefficient element in your trading. Simply many technical indicators are not designed to deal with the infinity but they were designed rather to reduce the noise from the price series by smoothing or averaging. When you do not understand nature of wave in the price series, these technical indicators can take away many good trading opportunities from you.

In addition, traders observe many horizontal and diagonal price patterns every day because of the Equilibrium Fractal Wave propagation. We want to bring the unified view or just one simple concept encapsulating these price patterns for both educational and practical trading purpose. The commonly used term “raw price action” among the price action trading community does not provide much explanation for beginners or any relation to the already established trading practice and concepts.

In doing so, first, we will help you on how to identify those price patterns using the Peak Trough Analysis technique from your charts. We present several different Peak Trough Analysis technique for your trading. Please note that we provide free Peak Trough Analysis tool in our website. Second, we will presents the actual trading strategy especially designed to deal with the infinity of the fifth regularity. We will look at the increasingly popular trading strategies for this purpose. We will start with the support and resistance to introduce some fundamental trading knowledge on the price patterns. Then we will further expand it with the popular trading strategies like Harmonic Pattern, Elliott Wave, Triangle and Wedge patterns. These trading strategies are over 80 years old and used by many reputable traders in the world. Several traders thought that these strategies are connected but it is difficult to find the literature level of claim yet. We show that these advanced trading strategies can be explained in one notion, the fifth regularity (Figure 3-7). At the same time, we will reveal the powerful trading recipes you can use for your practical trading in this book.

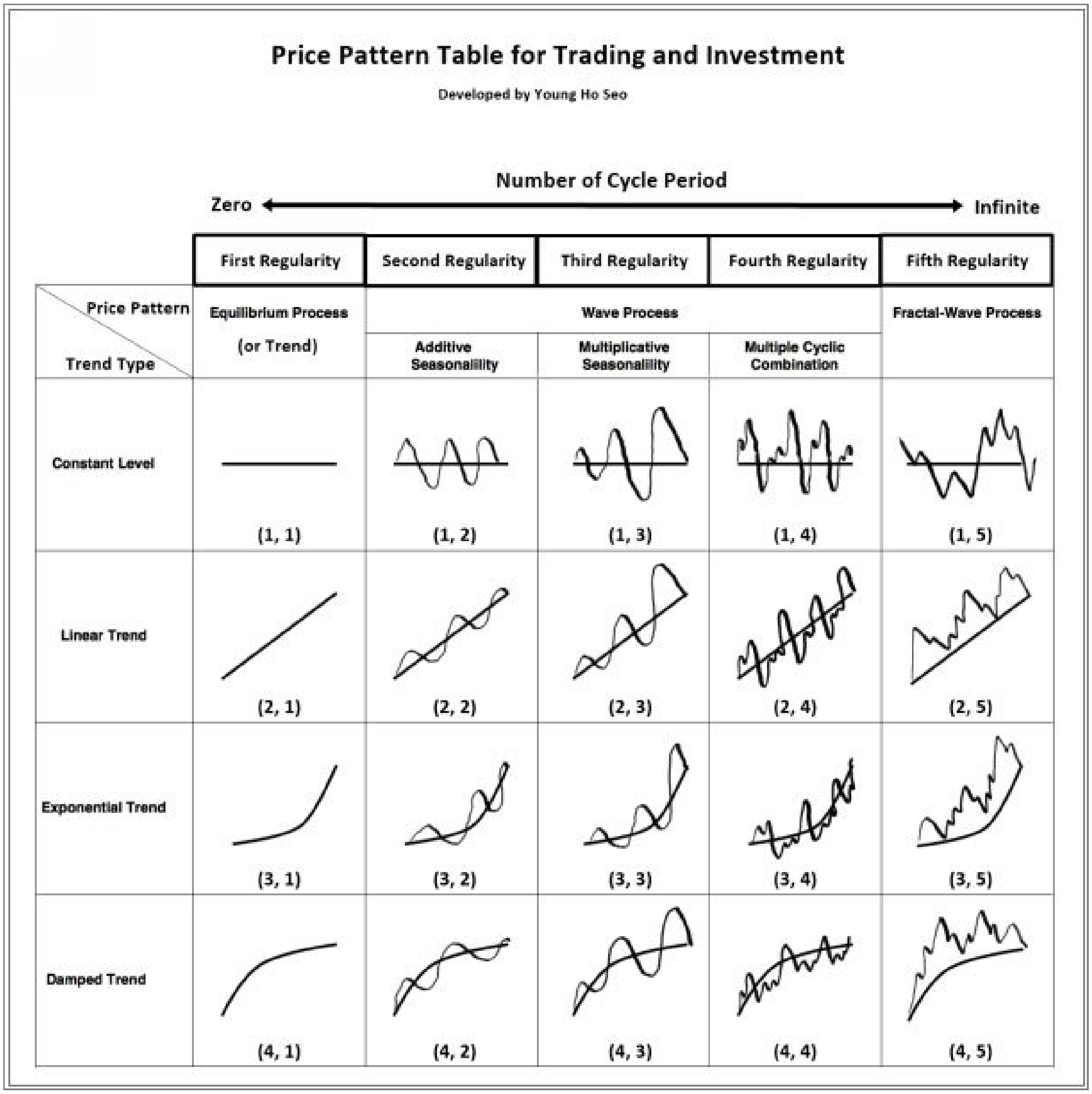

Figure 3-3: Five Regularities and their sub price patterns with inclining trends. Each pattern can be referenced using their row and column number. For example, exponential trend pattern in the third row and first column can be referenced as Pattern (3, 1) in this table.

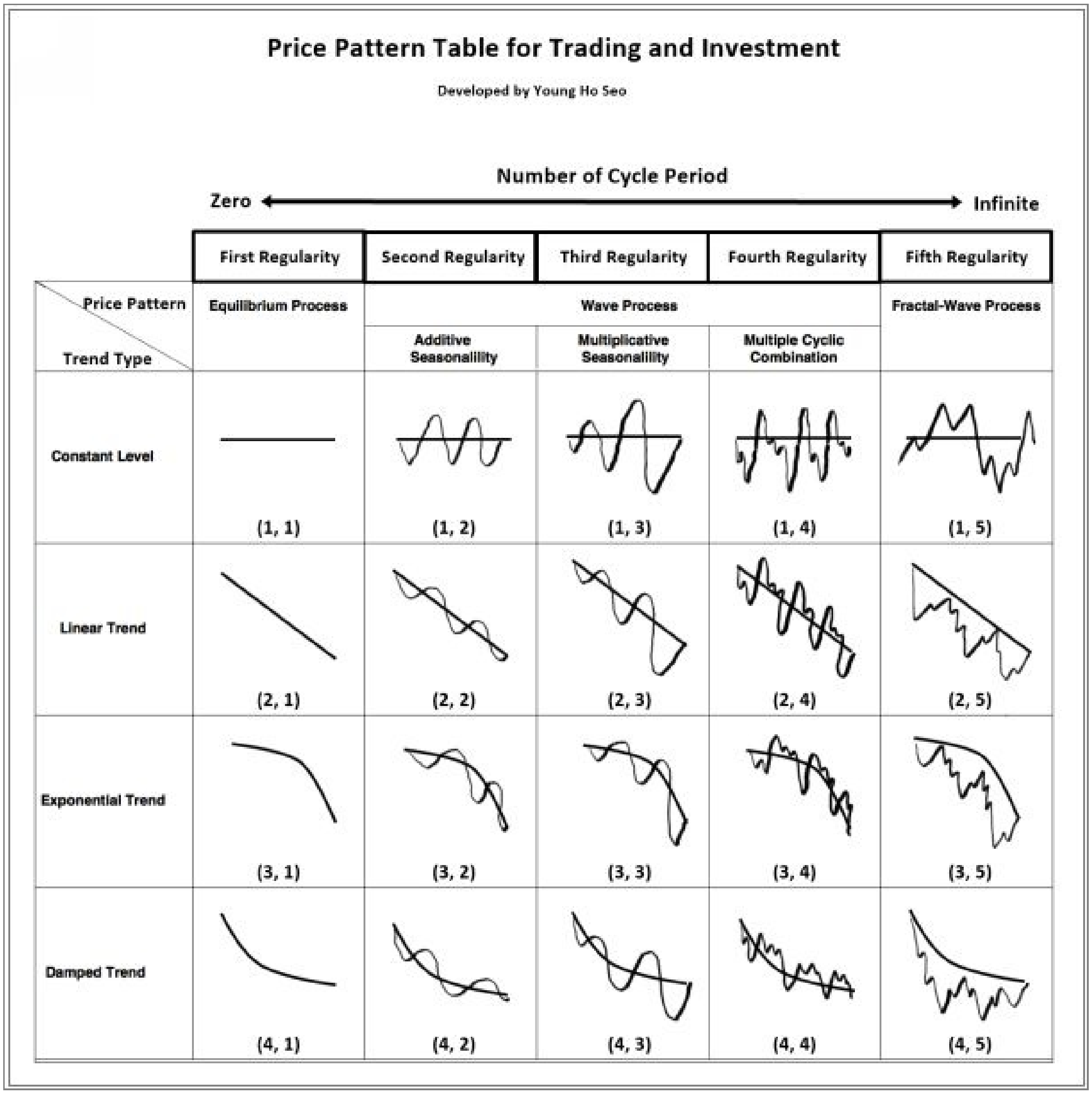

Figure 3-4: Five Regularities and their sub price patterns with declining trend. Each price pattern can be referenced using their row and column number. For example, exponential trend pattern in the third row and first column can be referenced as Pattern (3, 1) in this table.

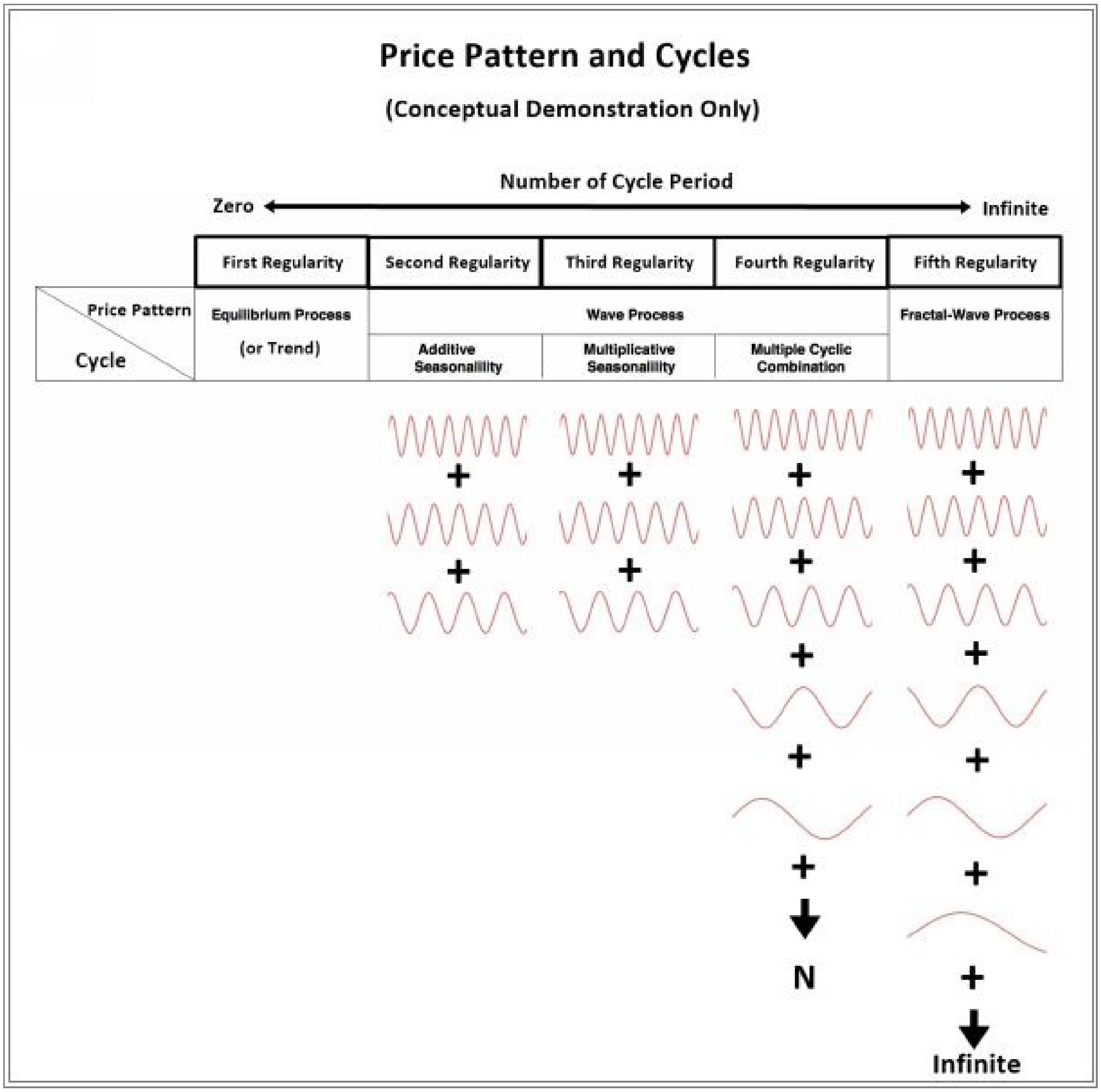

Figure 3-5: Visualizing number of cycle periods for the five regularities. Please note that this is only the conceptual demonstration and the number of cycles for second, third and fourth regularity can vary for different price series.

Price Pattern Table for Trading and Investment

Developed by Young Ho Seo

Number of Cycle Period

Zero ⟵⟶ Infinite

Price Pattern / Trend Type	First Regularity	Second Regularity	Third Regularity	Fourth Regularity	Fifth Regularity
	Equilibrium Process (or Trend)	Wave Process			Fractal-Wave Process
		Additive Seasonalility	Multiplicative Seasonalility	Multiple Cyclic Combination	
Constant Level	Stationary Process or Random Process (1, 1)	Wave Process (1, 2)	Wave Process (1, 3)	Wave Process (1, 4)	Fractal Wave Process (1, 5)
Linear Trend	Equilibrium Process (2, 1)	Equilibrium Wave Process (2, 2)	Equilibrium Wave Process (2, 3)	Equilibrium Wave Process (2, 4)	Equilibrium Fractal Wave Process (2, 5)
Exponential Trend	Equilibrium Process (3, 1)	Equilibrium Wave Process (3, 2)	Equilibrium Wave Process (3, 3)	Equilibrium Wave Process (3, 4)	Equilibrium Fractal Wave Process (3, 5)
Damped Trend	Equilibrium Process (4, 1)	Equilibrium Wave Process (4, 2)	Equilibrium Wave Process (4, 3)	Equilibrium Wave Process (4, 4)	Equilibrium Fractal Wave Process (4, 5)

Figure 3-6: Five Regularities and their sub price patterns.

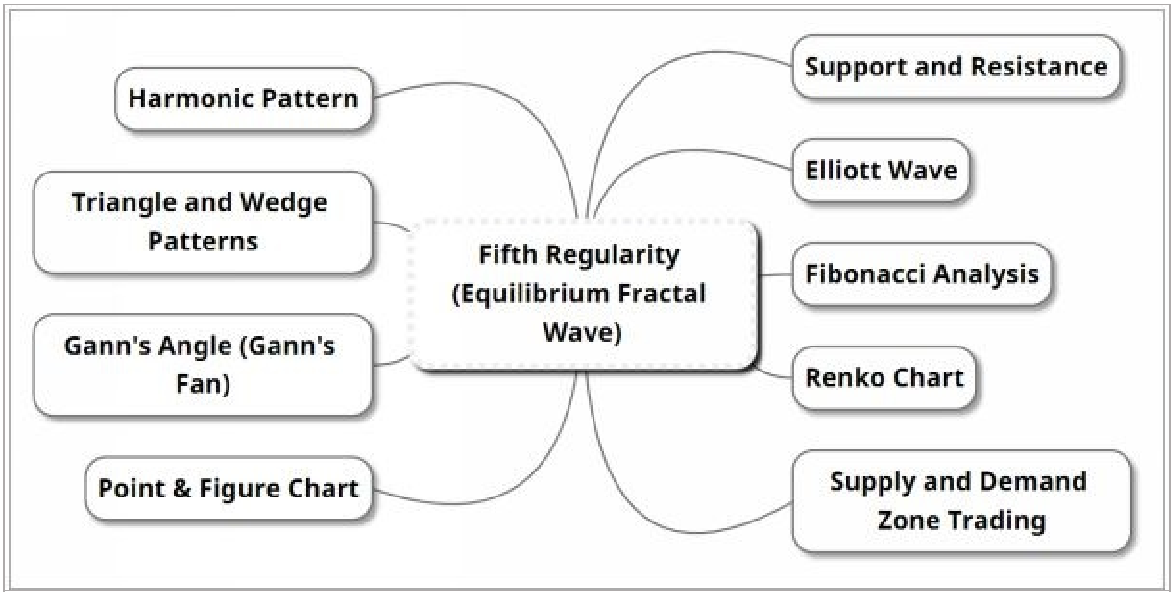

Figure 3-7: Trading strategies and charting techniques to deal with the fifth regularity.

4. Random Process

Most of time, the financial price series will exhibit some Random fluctuations. Therefore, you have to assume that some random process exists in the real world financial price series always. Random fluctuation is literarily independent from any causality and therefore they are not the predictable component in the price series. Randomness is an opposite component to the regularities we are looking to capture in the price series. Therefore, if the price series have strong randomness, it is bad for traders. It is always better for traders to assume that any real world price series possess the randomness because they really do. Such a random process in the financial market data might be either white noise or something else. When the random process exists on their own, they are simple in terms of modelling and analysing because you can only describe the random series with mean and standard deviation. However, when Random process is mixed with some other process, the mixed effect can confuse both traders and investors. We will talk about the mixed effect in the later chapter of this book. For now, we will talk about the random process on its own in this chapter. Just imagine that we have isolated the random parts from our price series into a container in our laboratory. Then they will look like as in Figure 4-1.

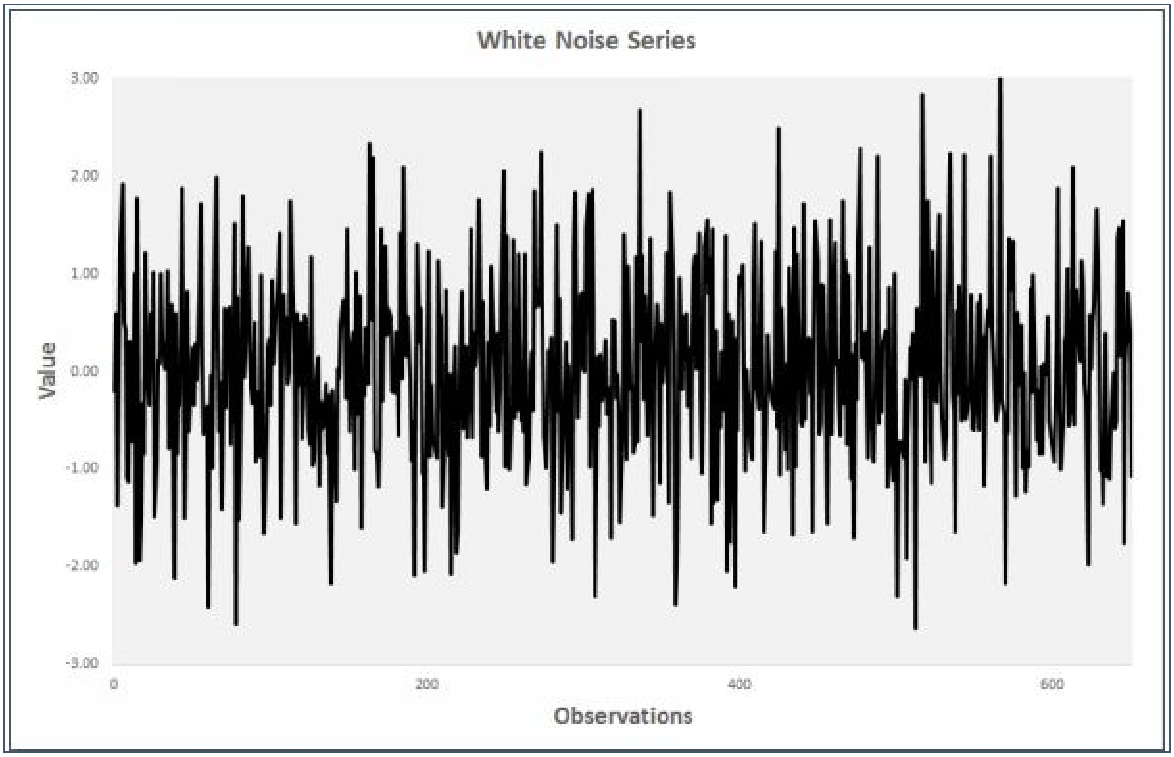

Figure 4-1: White Noise series with fixed mean and average.

In fact, the best trading strategy is often the one robust to the random process. At the same time, the best predictive model or trading strategy is those separating random process perfectly from rest of meaningful components from data too. However, the perfect isolating of randomness from the rest is almost impossible because the perfect quantification of randomness is not possible in first place. Normally the daily return series for Stock and Forex market data is considered as white noise process. If they are really white noise process, then the return series will have the fixed mean and standard deviation. The mean of the return series for a particular stock can be positive or negative rather than zero. If the mean of the return series is positive, you can buy and hold the stock for long run. If the mean of the return series is negative, you can sell and hold.

If the return series have zero mean, then you will lose money either buying or selling because of the commission you have to pay for. Buy and hold or sell and hold strategies are the typical long run passive strategies and this type of passive strategy need to be reinforced with modern portfolio theory. Otherwise, the long run strategy might suffer from the long period of drawdown.

If we synthetically generate a random price series by summing up the value of the previous random price series, this series is called the Random Walk series. In contrast to the White noise series, we cannot recognize the fluctuation around the fixed mean any more for Random Walk series (Figure 4-2). Instead, they look like they are moving upwards or downwards. Sometimes, the Random Walk series move as if they will never come back to their origin any more. Since the Random Walk series are generated from summing unpredictable white noise series, the Random Walk series are also unpredictable too. In general, Random Walk series look like real world stock or forex market price series but it will not show any regularities like trend or cyclic behaviour. Many people blindly assume that the price series are the perfect random walk series and they are not predictable. However, remember that there are the fundamentals moving the market. Traders and investors are not perfectly rational but they will also make their trading and investment decision based on the market fundamentals. For example, if USA increases the interest rate, then US dollar will be appreciated by pushing US dollar high against Euro. If the company director is involved with some serious sex scandals risking his director's position, then the share price can be depreciated or this might cause the increased volatility of that share price at least. Of course, you might find many instances where fundamentals did not move the market. Even in such a case, it is better to assume that some unknown factors cancelled out the fundamental effect rather than assuming the market is totally Random Walk. You should assume the random walk process only if you have gathered strong evidence either statistical or causal for the price series. If the return of the price series is strictly random with zero mean, then you should not trade such instruments because the expected value of the return is zero always.

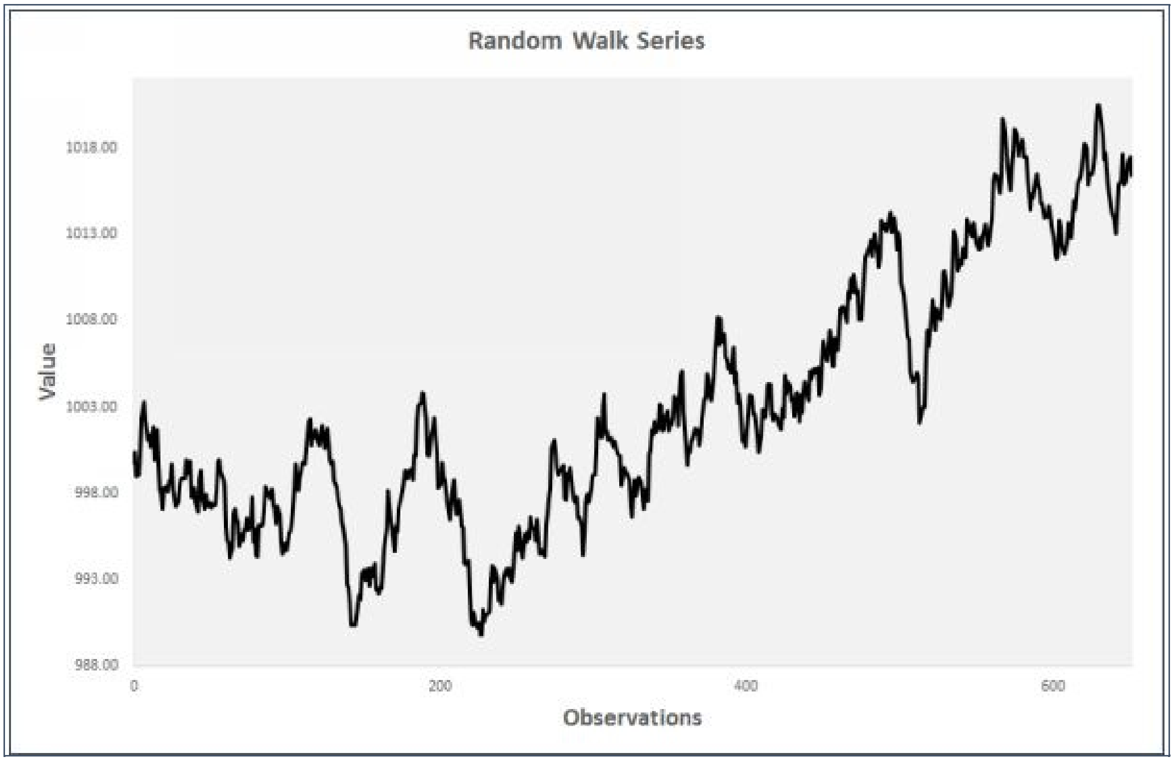

Figure 4-2: Synthetic Random Walk series.

Technical Note

ARIMA (Autoregressive Integrated Moving Average) model is a popular econometric model used to study the different properties of the price series data in Finance and Economics. A white noise series can be modelled using ARIMA (0, 0, 0) since white noise is assumed to be stationary. At the same time, Random walk can be modelled using ARIMA (0, 1, 0) involving one order of the difference term. Therefore, we can clearly see that the difference between White Noise and Random Walk process is the presence of stationary process. To confirm the white noise process, the price series must be free from the serial correlation in the data. The distribution is assumed as the normal Gaussian distribution too.

Trader’s Note

If the price series is the pure Random Walk series, traders and investors have a very few choices for his strategy. If the return of the price series has the mean of zero, then there is no point to trade. However, with some positive return, you can construct portfolio of many assets according to the Modern Portfolio theory (Harry Markowitz, 1952). This is a systematic approach to reduce the risk dramatically across many different assets. However, this strategy is limited to the investors with large capitals since one has to split his investment over the reasonable number of assets. In addition, this strategy requires to solve the optimization problem to calculate weights for the capital allocation for the given correlation matrix between assets. Therefore, one will require a specialized software package to construct the optimal portfolio using this methodology. In addition, there are some fund management company make use of skewness in the return series for their investment strategy. This information is probably worth to note for your strategy development. Skewness can be readily obtained in many analytical tools like MS-Excel and MatLab.

5. Stationary Process

Simply speaking stationary process is the horizontal pattern where data fluctuate around a constant mean. Stationary process corresponds to Pattern (1, 1) on the Price Pattern Table in Figure 3-3. If the price series are non-stationary, then the variance and mean will change over time. Strong white noise series are definitely stationary because they are fluctuating around the mean. However, even if they are not random series, they can still be stationary. For example, some commodity and stock price series can exhibit the stationarities too. Good example of non-stationary price series is the Random Walk series (Figure 4-2). Many stock price and currency price series are in fact non-stationary. Sometimes, you can find many ratio series are stationary. For example, the ratio series of S&P 500 and earning is well known stationary series (Figure 5-1). Typically, the ratio of S&P 500 and its earning tends to revert to the mean. Many traders make use of this fact for their trading. In addition, many ratio series of currency pairs can be stationary too. This assumption is the basis for the popular pair trading strategy.

Normally the very first step of analysing any financial price series involves checking if they are stationary or non-stationary. This horizontal pattern is very important in determining your trading strategy. For example, if any price series exhibit stationary process, then mean reversion-trading strategy should be used for your trading. If the price series are non-stationary, then choice of trading strategy is dependent on the dominant price patterns of the financial price series. Now you wander how to detect stationarity of the price series. In fact, some well-trained traders or analyst can tell the stationary by visual inspection of the chart. However, it is common to use a statistical testing to check the stationarity of the price series.

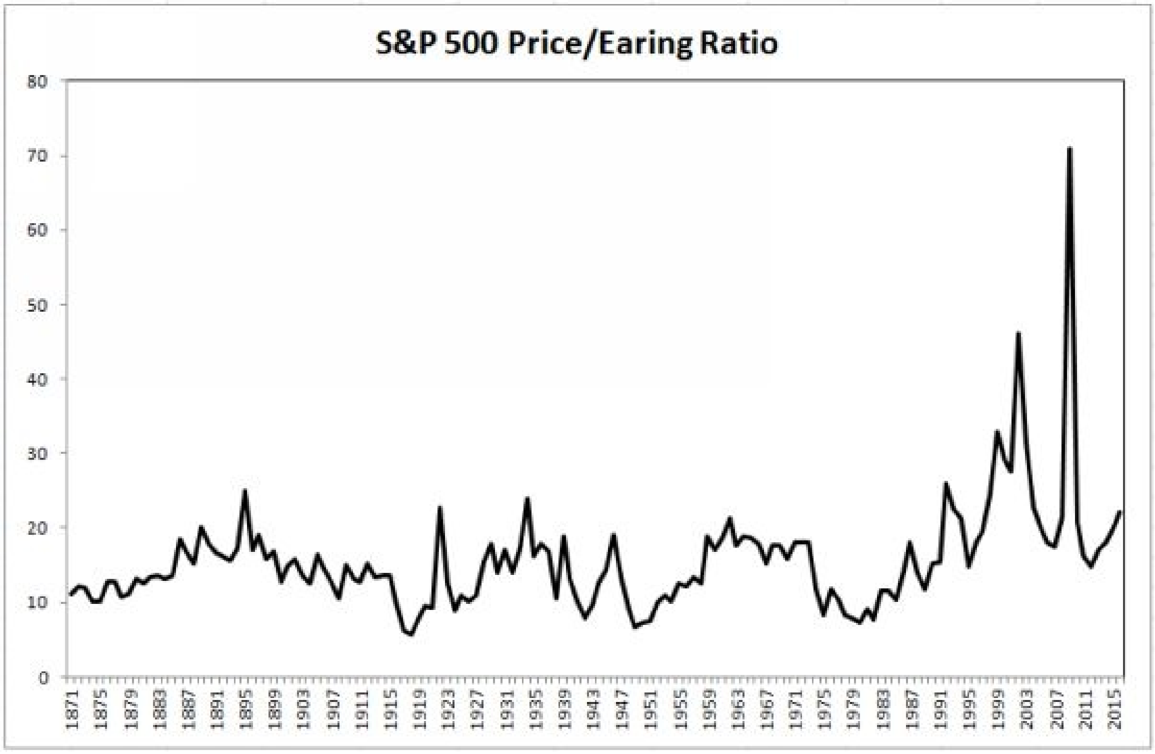

Figure 5-1: S&P 500 Price/Earning series. This is a good example of stationary process.

Technical Note

You can use several different techniques to confirm stationarity of the price series. Mostly the testing procedures are based on the statistical Hypothesis Testing. The commonly used one is the Augmented Dickey Fuller test. Some other techniques include Philipps-Perron test, KPSS test and Variance Ratio test. In addition, Hurst Exponent might be used to check the stationary characteristics of the price series too. Since price series might show stationarity during some period of the data set temporally, it is important to use the entire data set to test stationarity. It is often better to use more than one techniques to confirm stationarity for better accuracy. If you have no access to these testing tools, then you can simply make the visual inspection on your chart. In general, stationary price series will not show any strong growth or trend patterns. If they do, then they are not stationary price series.

Trader’s Note

It is less common to see any financial price series in stock and forex market exhibiting stationary process in its original form. Having said that, if any financial price series show stationarity, then it is extremely easy to trade with this series. Therefore, you should always check if such an opportunity exists first before using any other complex trading strategy. For the stationary price series, trader can use the typical mean reversion trading strategy. For example, one can buy if the price stays below three standard deviations from the mean. One can sell if the price stays above three standard deviations from the mean. Sometimes one can use four standard deviation rule instead of three standard deviation rule. For good mean reversion trading, then you might look at ratio for the potential trading opportunities. For example, Price/Earnings ratios are the popular ways to trade for stock. Trader can also look at Price/Price ratio too for potential pair trading opportunities.

Figure 5-2: Mean reversion trading for stationary price series.

6. Equilibrium Process

Equilibrium process is not so much different from the term "Equilibrium" you finding in the classic supply-demand economic theory. Literally, it is the force-moving price to release the unbalance between supply and demand. Simply speaking it is a trend price pattern. There are many types of Equilibrium process. They might be linear trend like Pattern (2, 1) in Figure 3-3 or they might be nonlinear trend like Pattern (3, 1) and (4, 1) in Figure 3-3. The three trend patterns, that are linear, exponential and damped, are common. Exponential trend represents the strong trend with increasing momentum. Damped trend represent the trend with reducing momentum.

Beside the three trend patterns, any other known patterns behind information diffusion process can be categorized under the Equilibrium process. For example, the trend pattern might show the patterns of the logistic function (Figure 6-1) or threshold function or other nonlinear patterns.

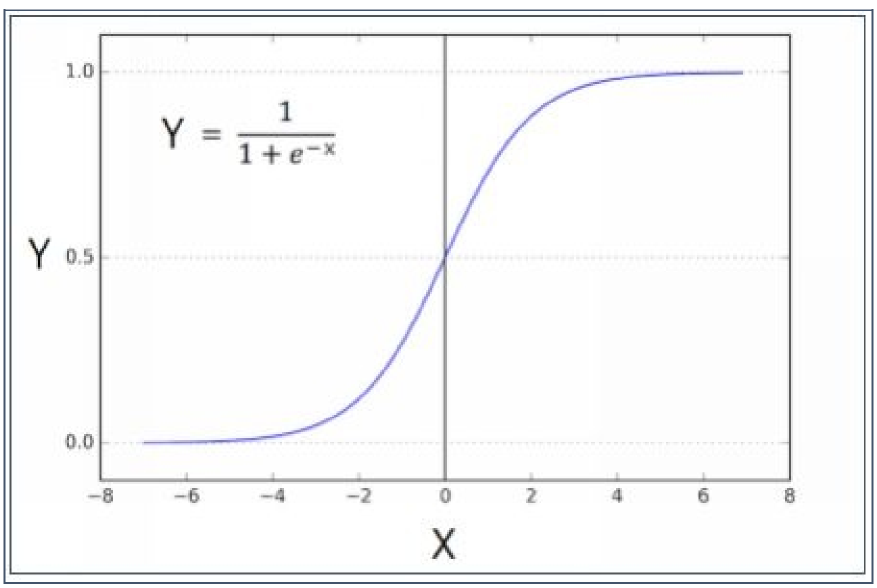

Figure 6-1: Logistic function is the common function to describe the diffusion process of the information in social science.

Equilibrium process is highly related to market fundamentals. Equilibrium process is what creates trend patterns in the price series. If the financial market exhibit Equilibrium process alone without random process, the market will show clear trend patterns in either linear or non-linear structure but this is the ideal case only. Such a market can be predicted with visual inspection alone without the need of the sophisticated analytical tools. Equilibrium process is one of the favourite regularities for traders and investors.

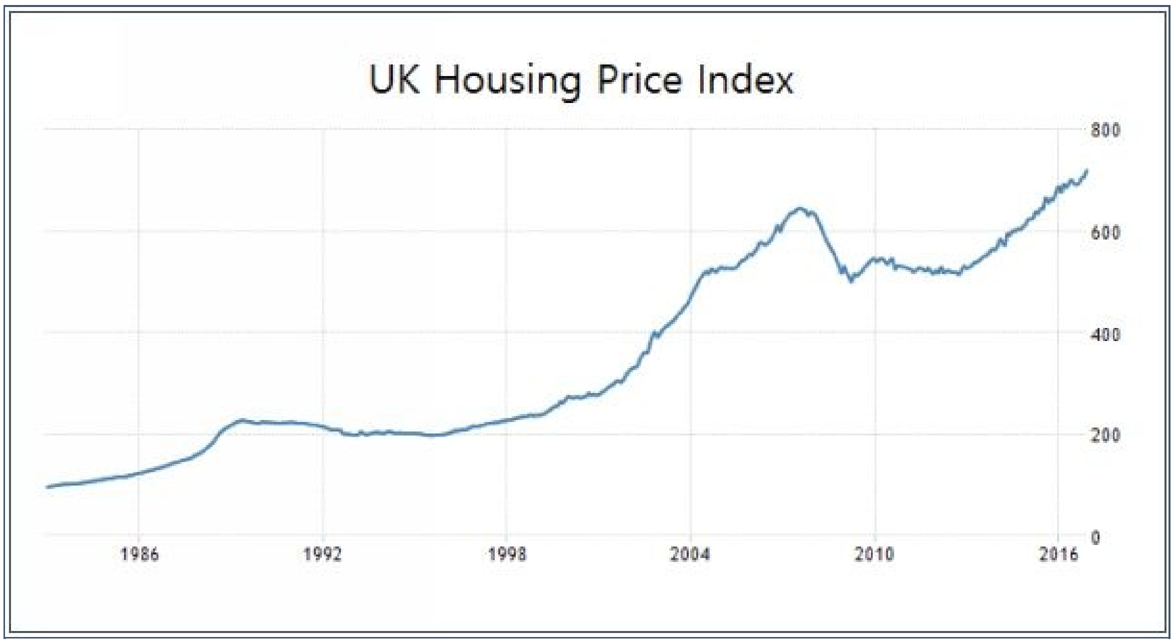

Figure 6-2: UK Housing Price Index exhibiting the clear upwards trend. Note that in the highly competitive and liquid financial market it is difficult to find the price series only exhibiting the Equilibrium process along. Therefore, we bring the example from another area to provide a feel for the Equilibrium process.

Equilibrium process is often the direct representation of the supply demand force in the financial market. Assuming there is the fixed number of shares for Google, if more people want to buy a stock than sell it, then the share price for Google will move up. Likewise, if more people want to sell a stock than buy it, there would be greater supply than demand and the price would fall. When there is the imbalance in supply and demand force, then the price will try to move towards equilibrium to release the imbalance. The supply demand imbalance is often caused by the fundamental change in the market. For example, change in the taxation or interest rate can change the quantity of supply and demand force dramatically. Natural disasters like Earthquake or Hurricanes or other serious transmissible diseases can influence the dynamics of supply demand too in the financial markets. War, terror, or other political corruption can reduce the demand of the financial assets affected by them.

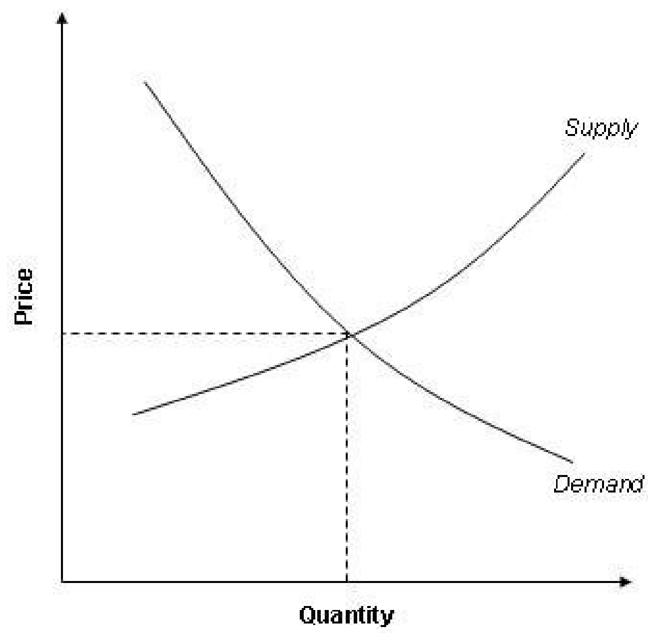

Figure 6-3: Economic Supply Demand curve.

If the Equilibrium process is much more dominating than random process in the price series, then the prediction is much easier. However, portion of Equilibrium process differ for different financial price series. It is also not easy to quantify or to isolate the portion of Equilibrium process from rest of processes. In reality, Equilibrium process can be caused by multiple sources introduced in different time. Some source will introduce the positive Equilibrium process, which increase demand and reduce supply. Some other source will introduce the negative Equilibrium process, which reduce demand and increase supply. Since each traders and investors will react differently to different information sources, the diffusion process for each information source can vary dramatically. Normally modelling diffusion process of multiple sources follow very complex path. If there are many positive and negative Equilibrium process acts together in the price series, it is more difficult to guess the direction of the market for traders and investors. However, they might leave some footage, which can be traced using mathematical tool or technical indicators.

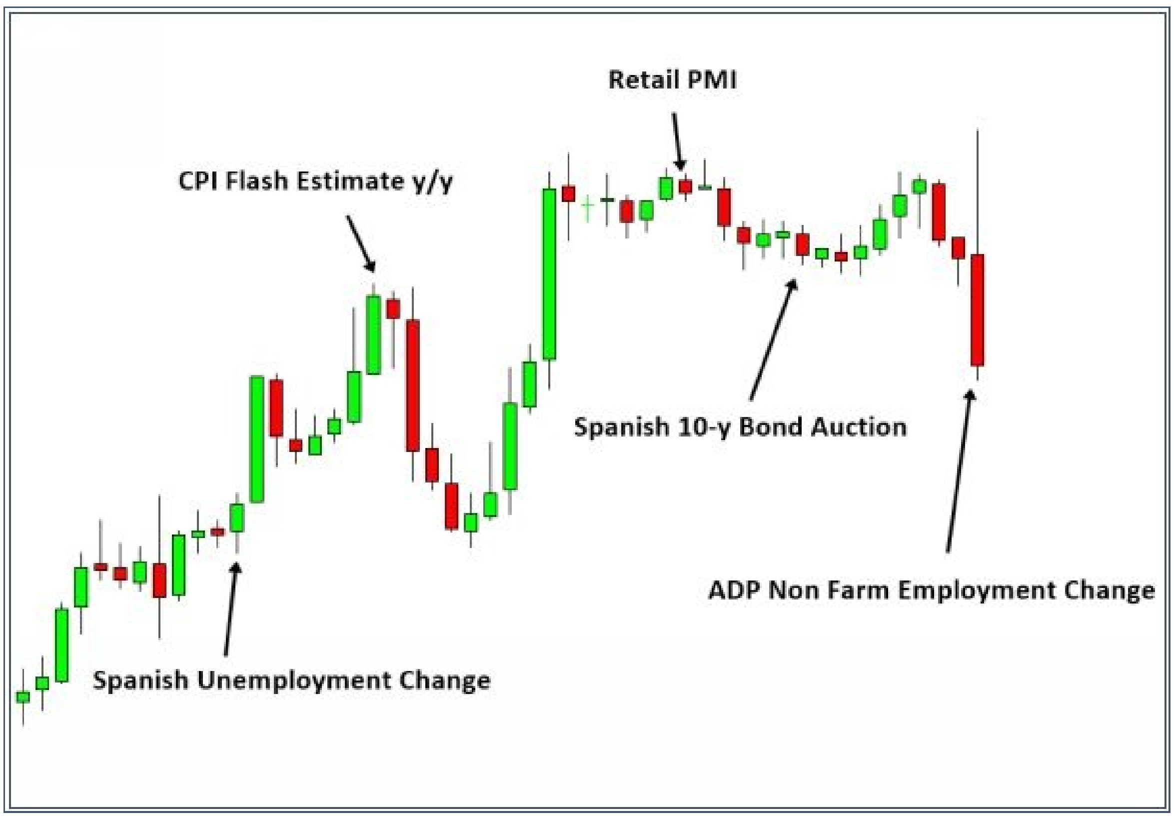

Figure 6-4: EURUSD candlestick chart with various Fundamental Data Release.

Technical Note

When the financial market exhibit strong Equilibrium process with little Random process, you can use some mathematical tools to project the trend from the price series. For example, Holt’s linear method or additive damped trend exponential smoothing methods can be applied to project the future trend of the Equilibrium process. When Equilibrium process is strong, market can exhibit long memory process. High order of autoregressive process is often the strong evidence of the long memory process. Therefore, one can apply ARIMA model to forecast future trend. To perform ARIMA forecasting, follow the well-established guideline of the Box-Jenkins model Identification approach as shown in Figure 6-5. In addition, you can apply some de-noising techniques like Principal Component Analysis or Wavelet transformation to remove the noise present in the data.

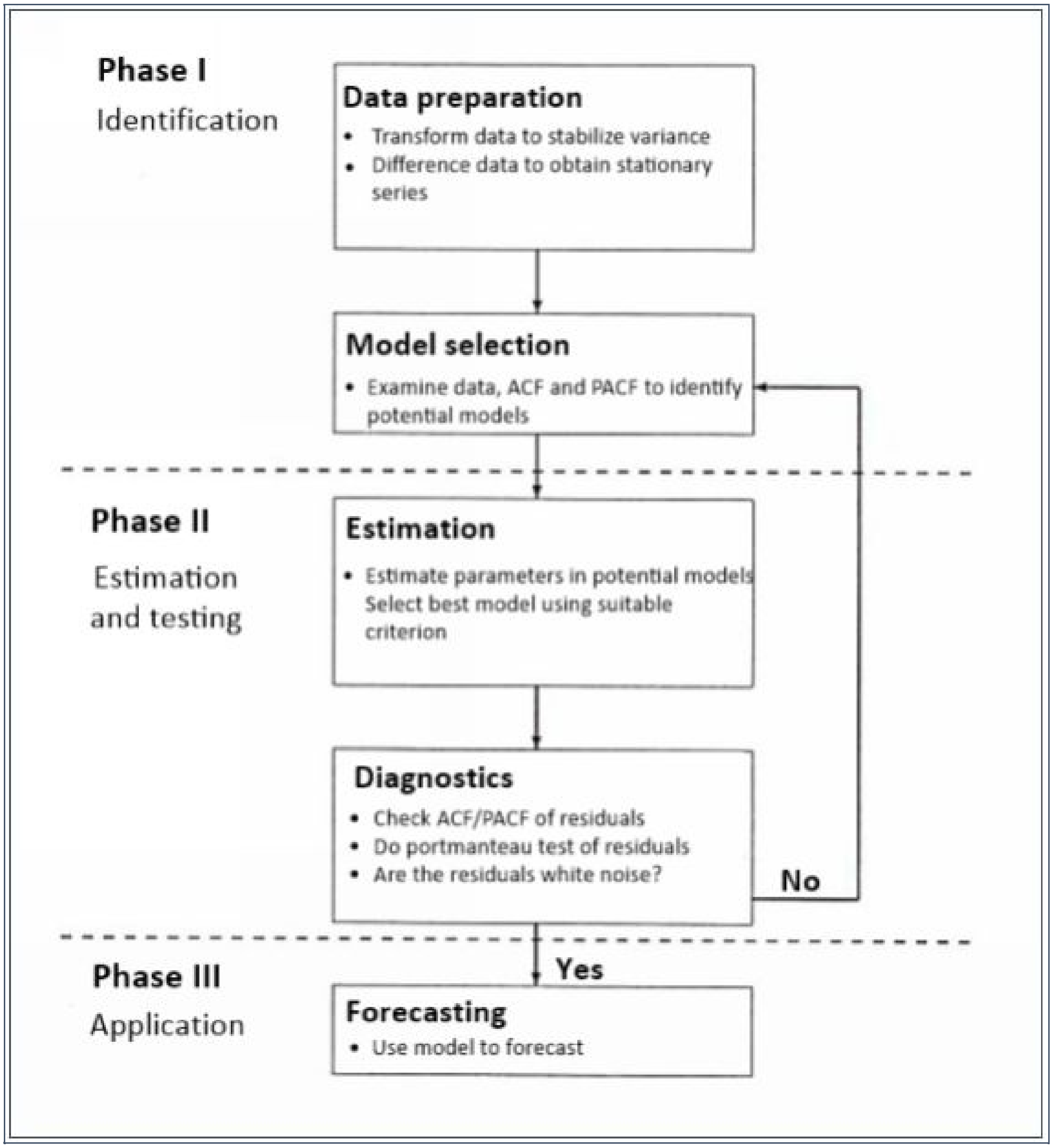

Figure 6-5: The Box-Jenkins methodology for ARIMA models.

<u>Trader's Note</u>

Strong Equilibrium process can develop the momentum of the market. Therefore, the price can often move much more than the actual equilibrium price. Typical technical indicators using the averaging algorithm can work well for this type of market because they eliminate randomness and leave the trend components in the price series. For example, MACD and Moving average indicators can be the great help for this type of market. Normally the strong Equilibrium process can be captured with typical momentum trading strategy. For example, all moving average cross over strategy will work well. In this type of market, following trend is wiser than using the counter trend trading strategy.

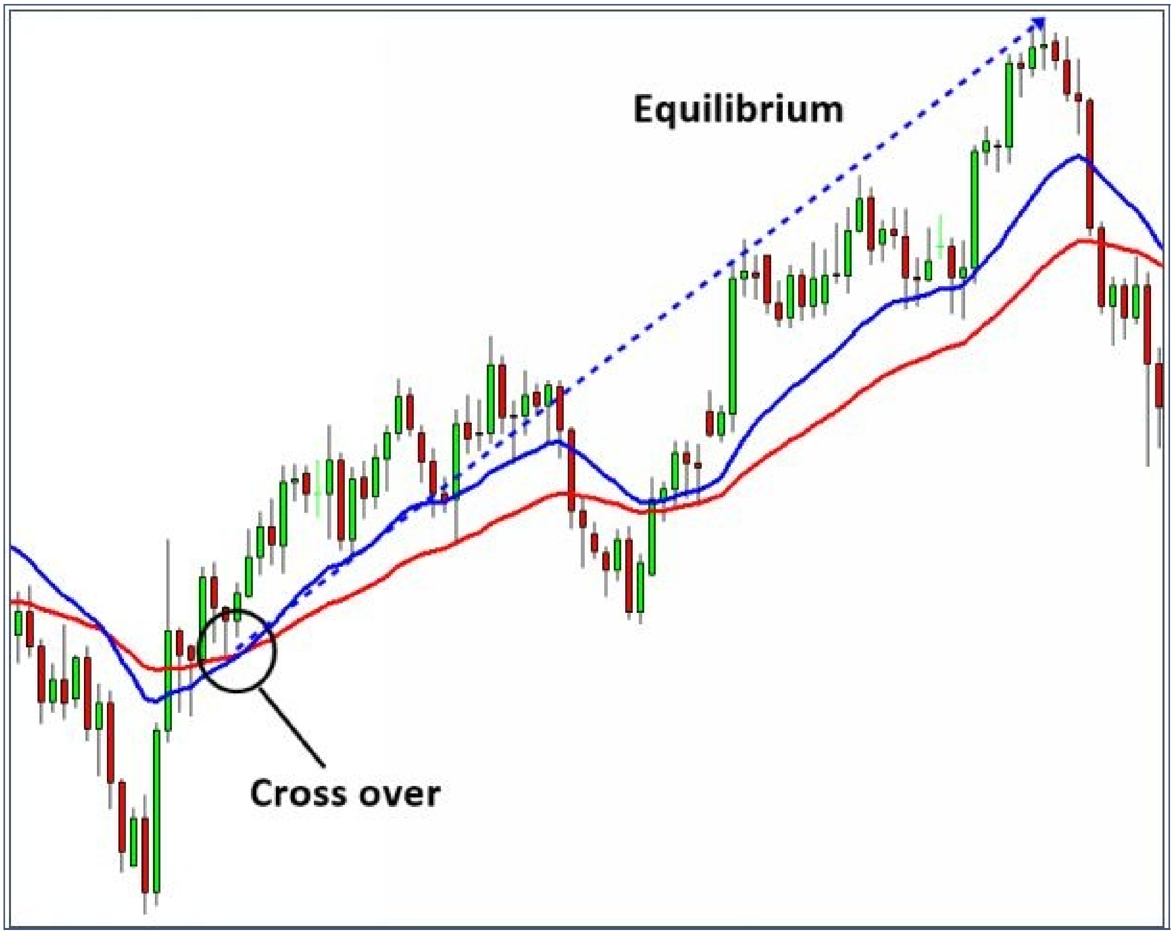

Figure 6-6: Moving Average Cross over strategy. Fast simple moving average is cross over slow simple moving average for buy opportunity.

Figure 6-7: Moving Average Cross over strategy. Fast simple moving average is cross down slow simple moving average for sell opportunity.

7. Wave Process

Wave process is any cyclic patterns repeating in the fixed time interval. Two main references for Wave process can be found from Physics and Time series Analysis area. Both references deal exclusively with cyclic behaviour of an object or a signal. However, they use different methodology to describe the cyclic behaviour. In physics, wave is the main term describing the cyclic behaviour of an object or a signal. In time series analysis, they use the term “Seasonality” to deal with seasonal fluctuations in the price series. In our term, Wave Process incorporates both wave in Physics and seasonality in time series analysis. To better illustrate the Wave process, we provide simple description for Wave and Seasonality in this section.

In Physics, Wave can be described by three independent variables, which are frequency, wavelength and amplitude. Frequency is the number of waves passing a point in certain time interval. Scientists and engineers normally use a time of one second. Therefore, number of waves passing a point in 1 second is described by the unit called Hertz. 1 Hertz equals to one Wave per second. Wavelength is the distance from any point on one wave to the same point on the next wave along. Amplitude is the height of wave from the top of a crest to the centre line of the wave.

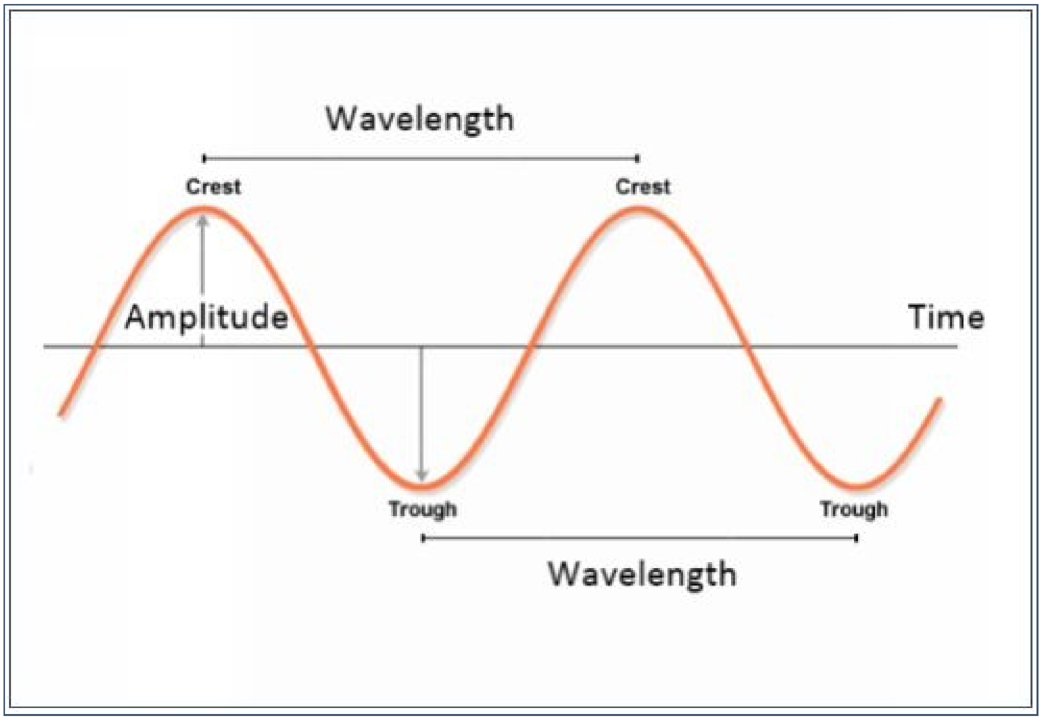

Figure 7-1: Description of Wave in Physics.

Normally textbook will show you a clean sine or cosine wave function to describe the property of wave. In the real world, the wave often consists of multiple cyclic components. For example, Figure 7-2 shows the synthetic multiple cycles built by adding three Sine Wave Functions: Sine (2x) + Sine (13x) + Sine (30x). Many real world signals can have more complex cyclic structure than this example. In addition, many real world signal will exhibit decreasing or increasing amplitude too as shown in Figure 7-3.

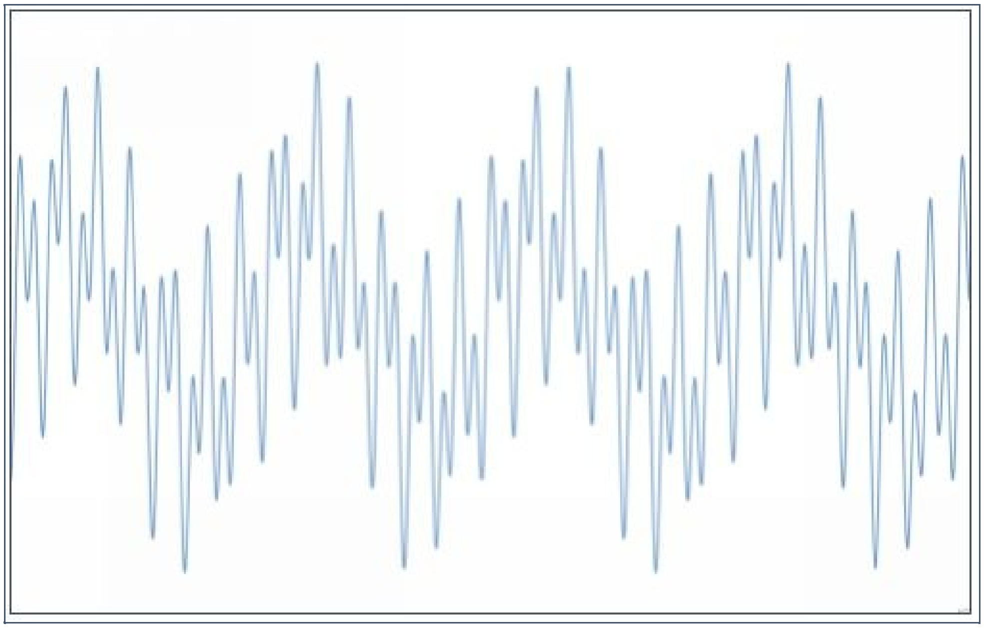

Figure 7-2: Synthetic Cyclic Function of Sine (2x) + Sine (13x) + Sine (30x).

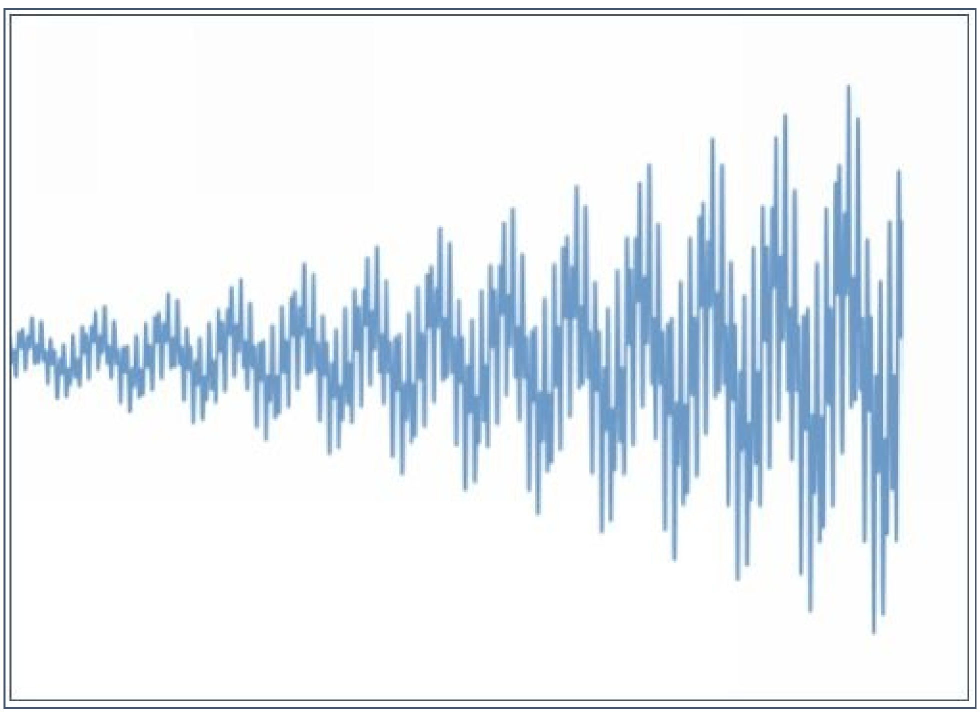

Figure 7-3: Synthetic Cyclic Function with increasing amplitude.

In time series analysis, seasonal fluctuation is described as seasonality with smoothing factor gamma. Alternatively, many other analysts use multiple regression with dummy variable to deal with the seasonality. Of course, methodology dealing with seasonality is not limited to these techniques only. For example, one can use artificial intelligence techniques for the same task. However, these two methodologies are simple and effective. Figure 7-4 shows typical annual seasonal fluctuations in the data. Like the amplitude of wave can decrease or increase, seasonality can also grow or decline with time too. Either additive seasonal exponential smoothing or multiplicative seasonal exponential smoothing techniques can be used to model seasonality in time series data.

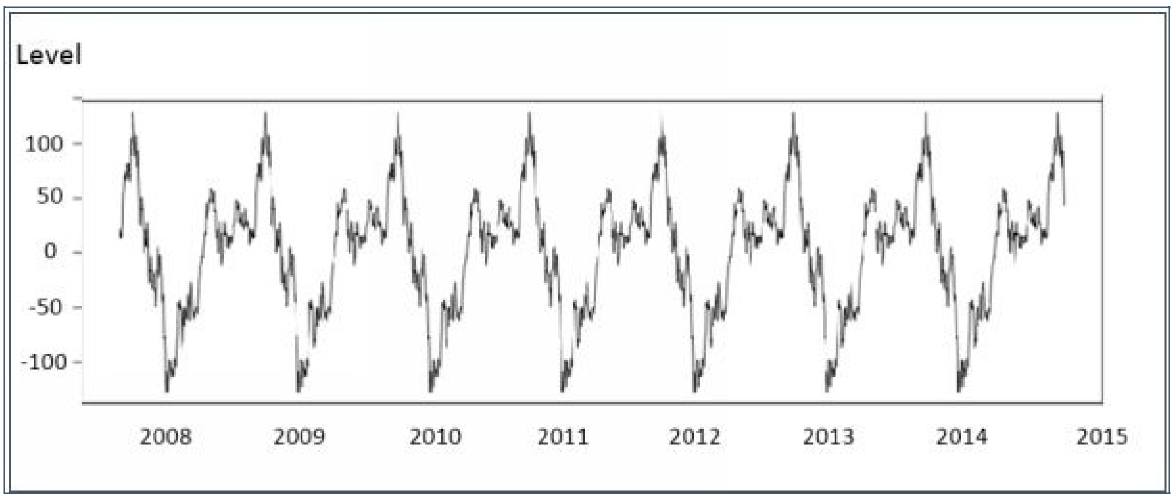

Figure 7-4: Annual Seasonal fluctuations in the price series.

The main difference of the seasonality from the classic wave in Physics is that they express the seasonality against the level at previous season with smoothing factor gamma. Seasonality are normally assumed to have some common seasonal period in calendar like hourly, daily, monthly or quarterly. Although modelling methodology might differ, the seasonality can be detected with Fourier Transformation and periodogram. Both wave concept in physics or seasonality in time series analysis can be used to model any cyclic patterns repeating in the fixed time interval. The disadvantage of seasonal exponential smoothing is that the math become quite complex if we have to model multiple seasonality. For example, if we have more than three distinctive seasonal fluctuations in our data, say hourly daily, weekly and monthly, then it is quite difficult to model using seasonal exponential smoothing model. At the same time, multiple cyclic patterns present in price series can be modelled readily with sine and cosine curve with various amplitude and wavelength.

Technical Note

The simplest ways to identify the seasonality is to draw seasonal plot as shown in Figure 7-5. To draw seasonal plot, one have to partition the price series into sub series each year when the seasonal period is annual. For example, if you have 20 years historical price series, then you will have 20 sub series. Once you have partitioned the price series, create stacked plot of each sub series as shown in Figure 7-5. If your data have seasonality, then you will normally observe the clear patterns across each month. Complex methods of detecting seasonality include periodogram and Partial autocorrelation function. To draw periodogram, you need a tool for Fourier transformation. Partial Auto Correlation Function are normally provided with some statistical software like Stata or SAS.

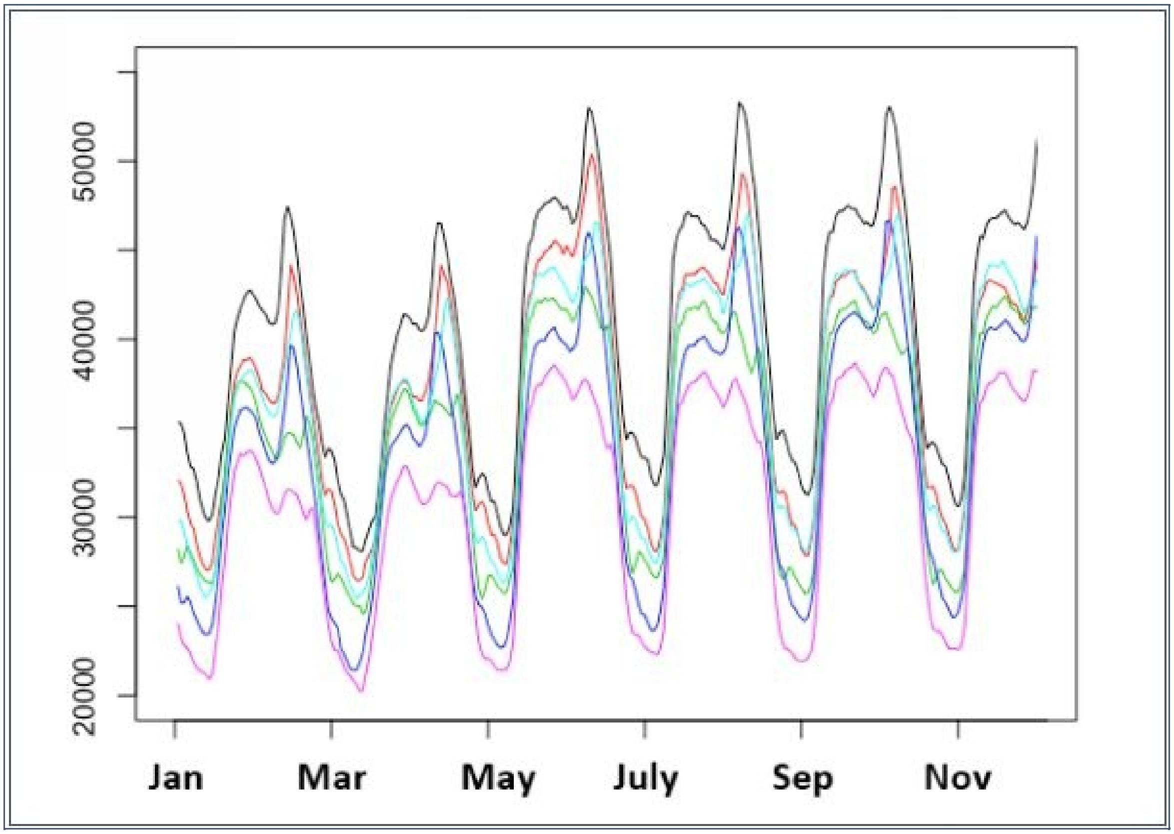

Figure 7-5: Example Seasonal plot for 6 years of historical price series.

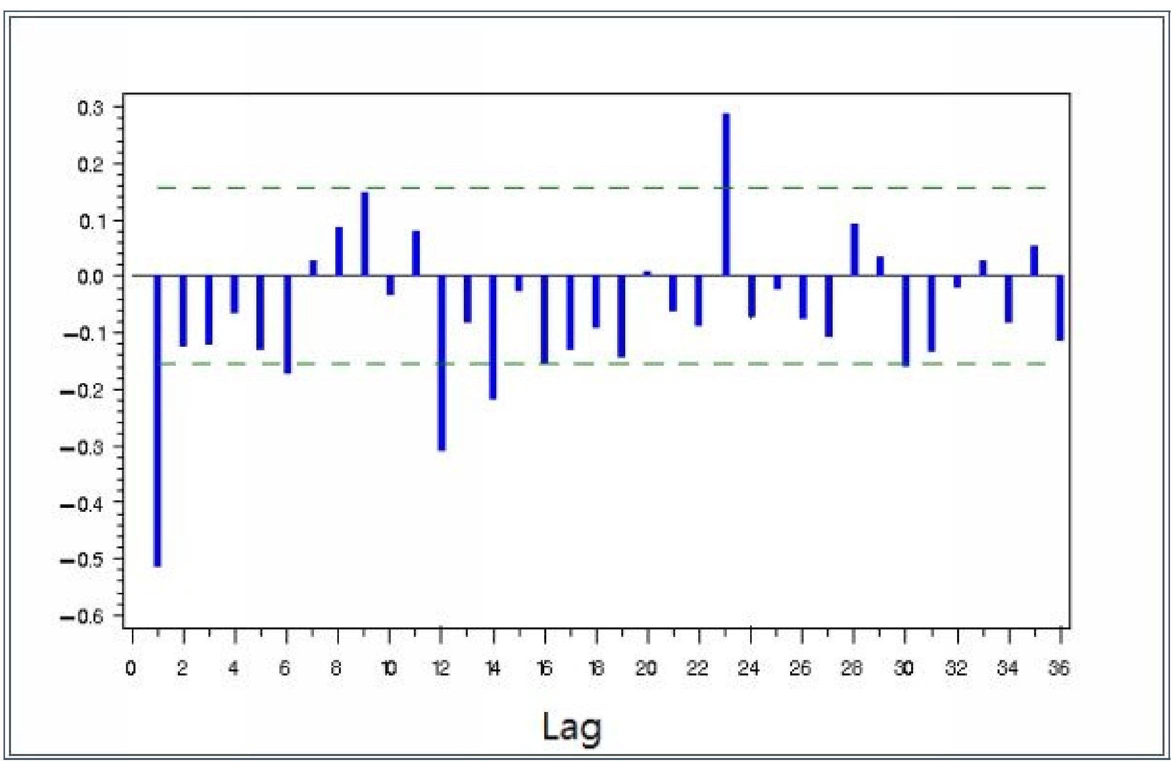

Figure 7-6: Example Partial Autocorrelation Function exhibiting seasonality in

the data.

<u>Trader's Note</u>

It is very difficult to observe any strong seasonality in Forex market data. It is probably because the currency markets are traded all years around with high liquidity. However, some weak form of seasonality might be observed from Stock market and commodity market. If any price series exhibiting wave process, then it is important to define seasonal period, the time interval repeating its cycle. With the identified seasonal period, one can determine period where price stays below or above the seasonal average for your trading advantage. For example, in Figure 7-7, we can observe some bullish effect on April and December on S&P500 monthly data.

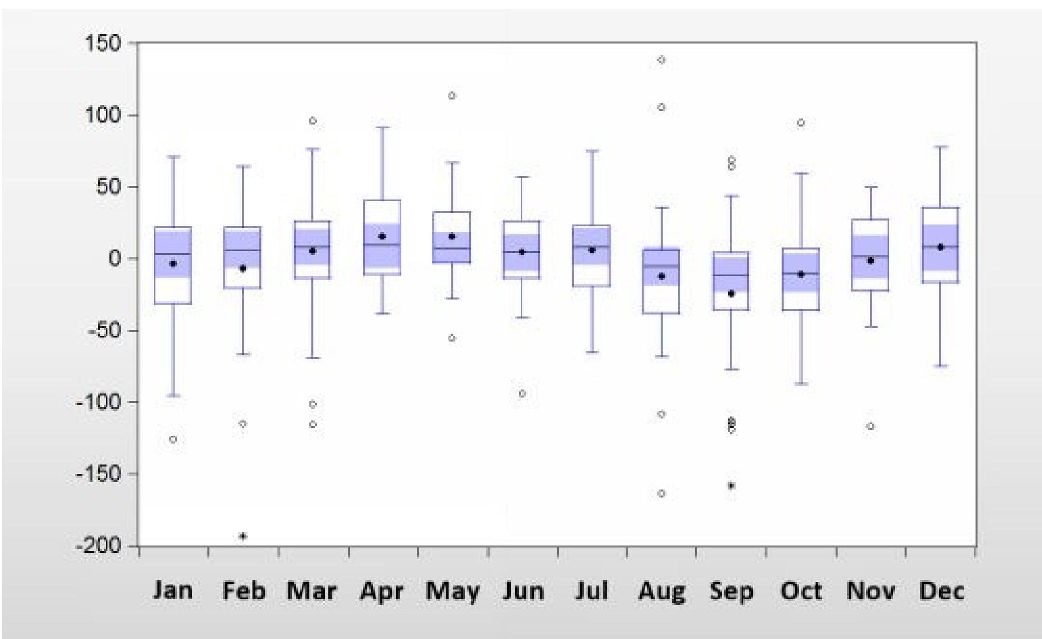

Figure 7-7: Seasonal Effects of the S&P 500 monthly price series. Seasonality was extracted from the central moving average construction.

8. Fractal-Wave Process

Fractal-Wave process is the representation of the Fractal geometry in the time dimension. Fractal geometry is made from a repeating pattern at many different scales. Simply speaking it is repeating patterns with varying pattern size. Fractal geometry can be a self-similar pattern with the strictly same patterns across at every scale. Even if the pattern loosely matches to the past one, this can be still considered as fractal geometry. We call this as near self-similarity against the strict self-similarity. Many examples of Fractal geometry can be found in nature. Snowflakes, coastlines, Trees are the typical example of the Fractals geometry in space. Fractal-Wave is the fractal geometry generated in time dimension. Just like Fractal Geometry can be described by self-similar patterns. Fractal-Wave can be described by self-similar patterns repeating in time. The concept of Fractal-Wave can be illustrated well by Weierstrass function

$$f(x) = \sum_{n=0}^{\infty} a^n \cos(b^n \pi x).$$

Loosely speaking, Weierstrass function is the cyclic function generated from infinite number of Cosine functions with different amplitude and wavelength. By combining infinite number of Cosine functions, it can generate a complex structure repeating self-similar patterns in different scales. This is a typical synthetic example of Fractal-Wave patterns with strict self-similar patterns. We present this function to help you to understand the properties of the self-similar process. The real world financial market shows the loose fractal geometry. They do not repeat in the identical patterns in shape and in size. The repeating patterns are similar to each other up to certain degree. Since Weierstrss function is the synthetic example for the strict fractal geometry, reader should note that Weierstrss function does not represent the real world financial market.

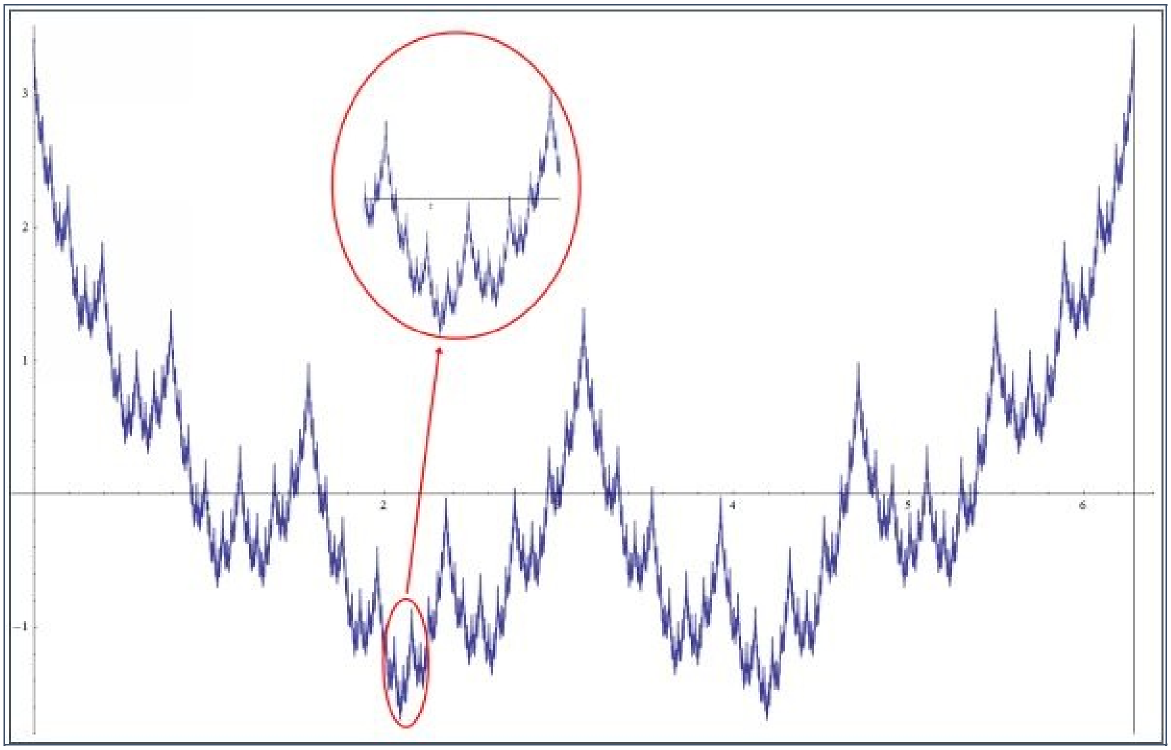

Figure 8-1: Weierstrass function to give you a feel for the Fractal-Wave process. Note that this is synthetic Fractal-Wave process only and this function does not represent many of real world cases.

In the real world application, Fractal-Wave process appears with the near self-similar patterns most of time. Therefore, detecting them is not easy. The Heart Beat Rate signal is one typical example of the Fractal-Wave process in nature. If we zoom in on a subset of time series, we can see the apparent self-similar patterns. In Financial Market, Fractal-Wave process occurs frequently but the market typically exhibits the near self-similarity too. In terms of pattern shape, the financial market and Heart beat rate signal are different because their underlying pattern generating dynamics inside human organ and crowd behaviour are substantially different.

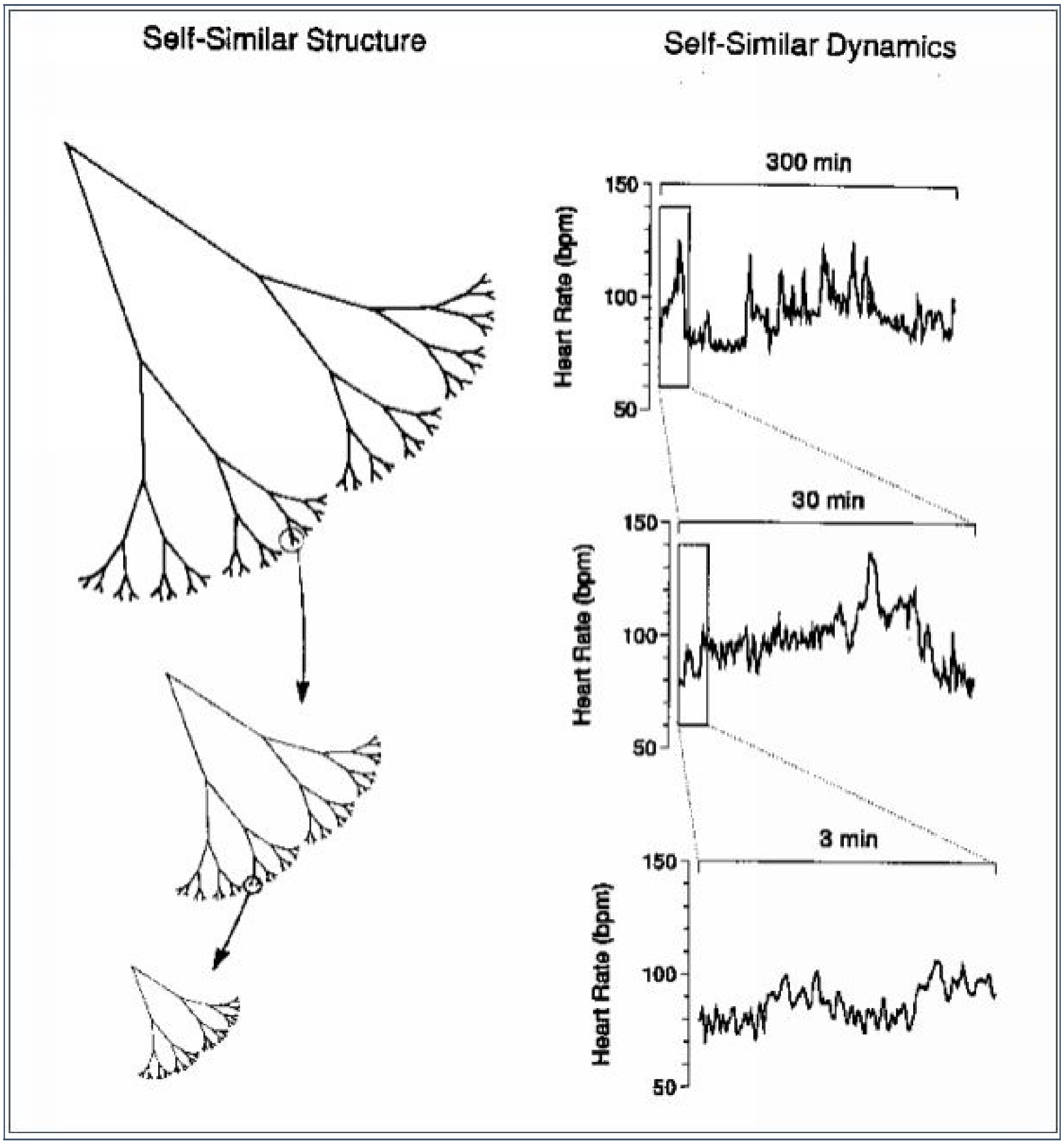

Figure 8-2: Self-similar process in Heart Beat rate (Goldberger et al, 2000).

Figure 8-3: Self-similar geometry in EURUSD daily series.

Technical Note

In the Fractal Geometry, two important quantifiable properties are fractal dimension and self-similarity. Fractal dimension is a measure of how much an N dimensional space is occupied by an object. For example, a straight line have dimension of 1 but a wiggly line has a dimension between 1 and 2. More precisely, their Fractal Dimension can be expressed as Log (N)/Log (r) where N = number of self-similar pieces and r = linear scale factor. Now to illustrate the concept, we will present the four cases from dimension 1 to 2. If we reduce size of straight line by linear scale factor r = 2, then then we get two self-similar piece, N = 2. Therefore, the dimension of the straight line is 1.

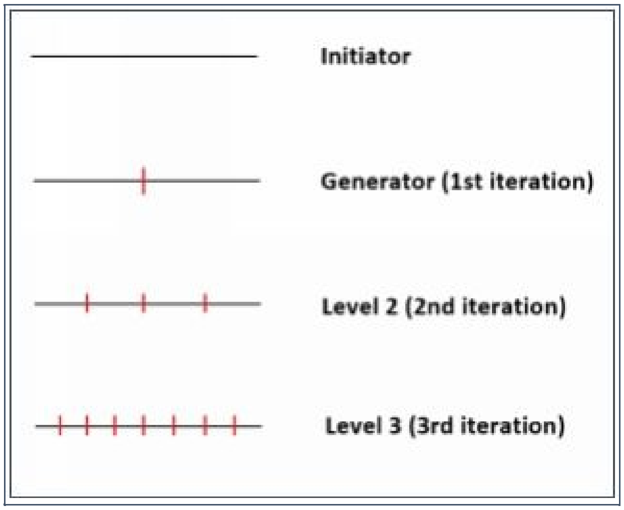

Figure 8-4: Iteration of self-similar process for straight line (Dimension = 1).

Likewise, if we remove the middle third of the straight line and replace it with two lines with the same length, then we get the first iteration of the Koch Curve. In this example, for the linear scale factor r = 3, we get the four self-similar pieces. Therefore, the dimension of Koch Curve is 1.26816 = Log (4) / Log (3).

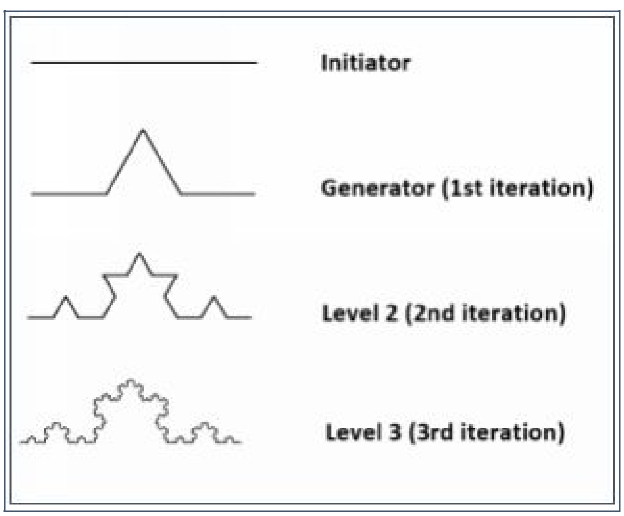

Figure 8-5: Iteration of self-similar process for Koch Curve (Dimension = 1.26816).

Sierpinski Triangle is another good example of Fractal Geometry. If we connect the mid points of the three side inside an equilateral triangle, then we get 3 equilateral triangles inside the first equilateral triangle. Note that we do not count the resulting upside down triangle as a self-similar piece. In this case, the linear scale factor r is 2 since generated triangle have the half of the width and height. The Fractal dimension D = 1.585 = Log (3)/ Log (2).

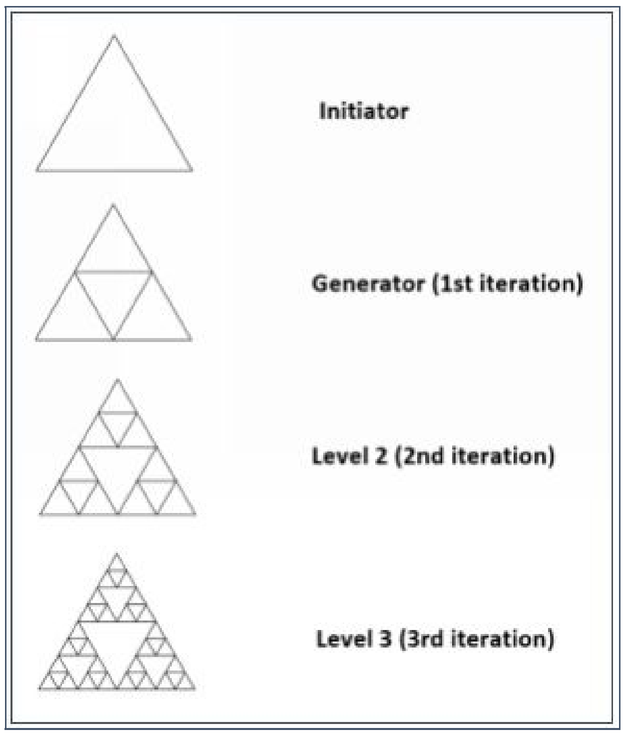

Figure 8-6: Iteration of self-similar process for Sierpinski Triangle (Dimension = 1.585).

Finally consider a square. For the linear scale factor r = 2, we will get four squares inside the first one. Therefore, our fractal dimension for a square is D = 2 = Log (4) / Log (2). Even we make the linear scale factor r = 3, we still get the same Fractal dimension D = 2 = Log (9) / Log (3). As we have illustrated in the four examples, Fractal Dimension generalize the topological integer dimensions to a fraction. Higher the fractal dimension means that the fractal geometry to occupy more space in the dimension. Therefore, a square have the Fractal Dimension 2 as the smaller square fits larger one without leaving any empty space. If our fractal geometry is kept removing space, then we could get the Fractal Dimension less than 1 too.

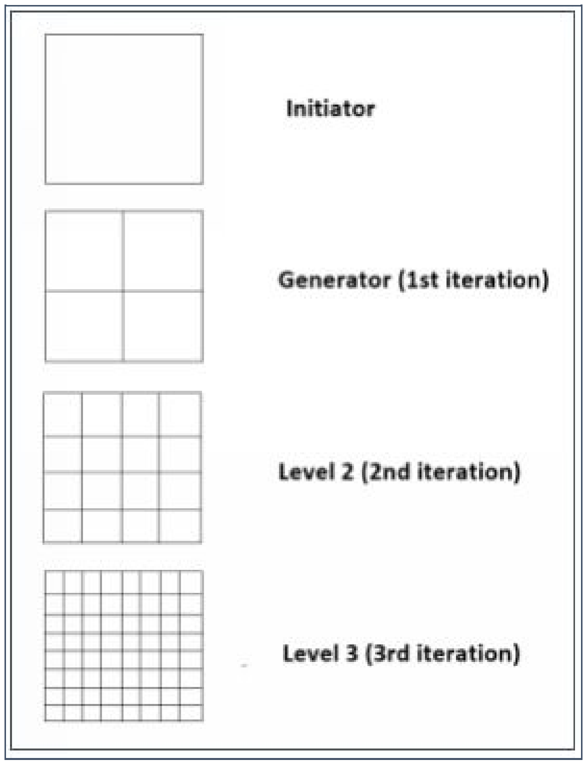

Figure 8-7: Iteration of self-similar process for square (Dimension = 2).

If the fractal geometry is known like our four examples above, then calculating Fractal dimension for that fractal geometry is straightforward. However, in many practical applications, the self-similar patterns are not strict and difficult to identify. For example, the rocky coastline have the fractal dimension with near self-similarity. In such a case, we can still calculate the Fractal Dimension using some iterative methods. To calculate the length of wiggly line in the rocky coastline, one can measure the length by counting how many times a measuring stick with a known length can be fitted along the coastline: L(s) = N x s. By plotting the length of the coastline versus the length of the measuring stick on a double logarithmic scale, one obtains the following equations to calculate the Fractal Dimension for the coastline: Log (L (s)) = (1-D) Log (s) + constant. Therefore, the measured slope can be used to calculate the Fractal Dimension. For example, Figure 8-8 shows the plot of the length of the coastline versus the length of the measure stick on double logarithmic scale for different countries. For Great Britain, the Fractal dimension can be calculated as D = 1 – (-0.24) = 1.24. Higher the Fractal Dimensions means greater the jaggedness or non-smoothness of the coastline.

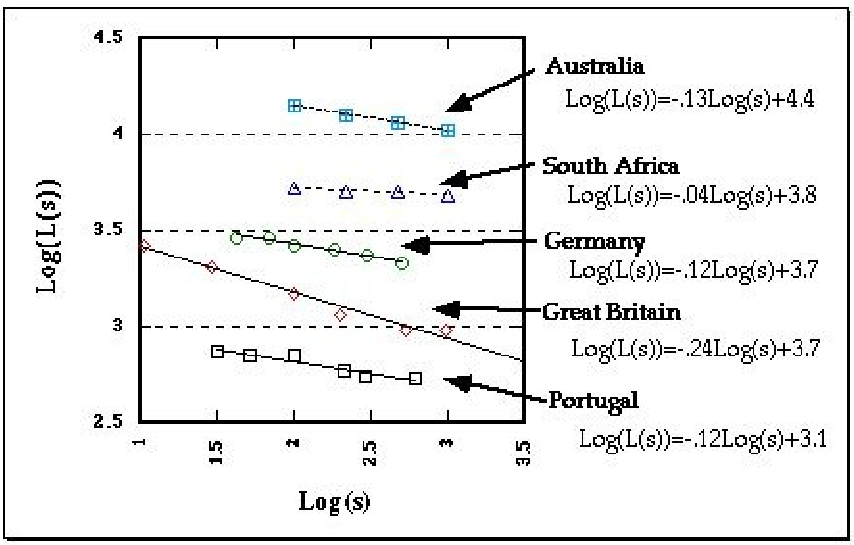

Figure 8-8: Measured slope of Log (L (s)) versus Log (s) for the coastline of the five countries including Australia, South Africa, Germany, Great Britain and Portugal. (Source: Vanderbilt University Webpage, http://www.vanderbilt.edu)

Calculating the Fractal Dimension for financial market data is not easy because it is harder to use such a measuring stick to measure the length of the line. Alternatively one might use Hurst Exponent (H) to calculate Fractal Dimension (D = 2–H) for a rough estimation of Fractal Dimension. Table 1 shows Hurst Exponents for several international Stock Indices including Dow Jones Index.

Using the relationship between Hurst Exponent and Fractal dimension, we can find that Fractal Dimension for many stock index lies somewhere between 1.2 and 1.5. Of course, this is very rough estimation only with some margin of error. Considering our four example earlier, we can imagine that the complexity of the financial price series might lies between Koch Curve and Sierpinski Triangle.

Trader's Note

Fractal-Wave process without any Equilibrium process corresponds to Pattern (1, 5) in Figure 3-3. In fact, Pattern (1, 5) in Figure 3-3 is not common patterns found in financial market although many signals from nature might exhibit this pattern like the heart beat rate. Therefore, we will not discuss any trading strategy in regards to this pattern.

9. Equilibrium Wave Process

Equilibrium Wave process are the mixed process between Equilibrium process and Wave Process. Wave process include the second, third and fourth regularities in the Price Pattern Table (Figure 3-3 and Figure 3-4). The second, third and fourth regularities are respectively additive seasonality, multiplicative seasonality and multiple combined cycles. We have explained how the additive seasonality, multiplicative seasonality, and multiple combined cycles look like in the Wave process chapter when they are existing without trend. Nine patterns including Pattern (2, 2), (2, 3) and (2, 4) in Figure 3-3 corresponds to the Equilibrium Wave process. Between equilibrium and wave process, one of them might be more dominating factor between the two. The Random process will present in the data for sure. Therefore, Equilibrium process, Wave process and Random process together can generate some complex behaviour of price series in real world application. Some real world data set can illustrate how these three processes are mixed in one series as a textbook example. For example, the airline passenger series are such a good example because the series is made up from trend and single seasonal cycle. From the airline passenger series, one can easily identify the presence of equilibrium process and Wave process. However, most of time, this mixed process are less clear for the financial price series. It is because financial price series are made up from multiple of cycles instead of single cycle. For this reason, it is not easy to tell, how much Equilibrium process exist or how much Wave process exist or even how much Random process exist in the price series.

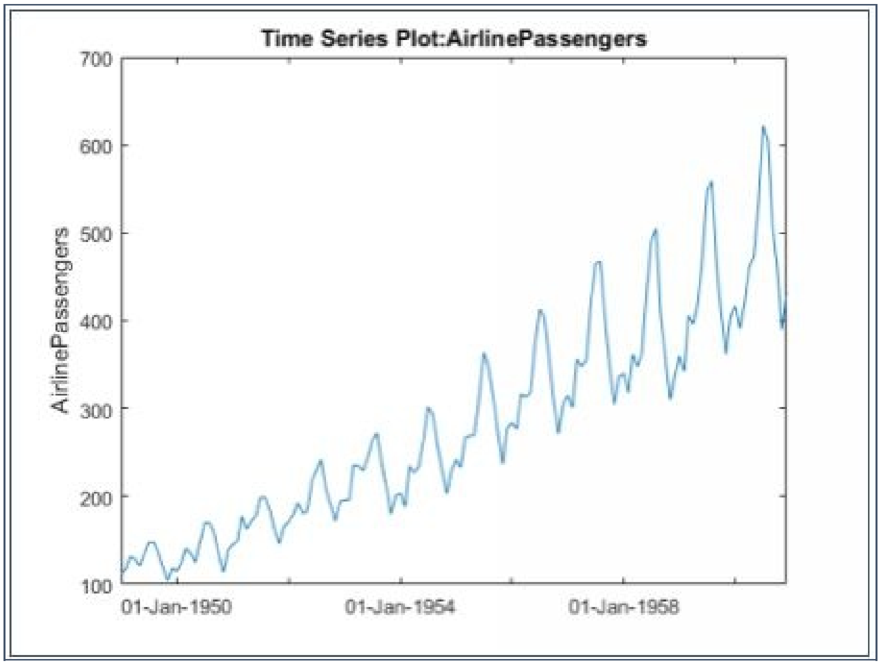

Figure 9-1: Airline passenger series. This is the typical textbook example of Equilibrium Wave process made up from a single cycle. We present this as the less complex example to provide a feel for the Equilibrium Wave process.

From the Price Pattern Table (Figure 3-3 and Figure 3-4), second, third and fourth regularities correspond to additive seasonality, multiplicative seasonality and multiple combined cycles respectively. In general, seasonality follows the cycle of earth. It is common to have the seasonality of 12 months, 7 days and 24 hours. Because we have hot weather in summer and cold weather in winter, the temperature difference can affect many of the human affairs like usage of electricity, farming, clothing, etc. Likewise, since we have 7 days in a week including Monday, Tuesday, Wednesday, Thursday and Friday, Saturday and Sunday, this can also affect our daily life on what we do. Likewise, since we have 24 hours in a day, the financial market cans response differently each hour. For example, it is commonly known that the overlapping trading hours between US and European session typically have much greater volatility than rest of trading hours.

Seasonality can have few cycles like one, two, or three for most of time. Typically, they can include 12 months, 7 days and 24 hours cycles. Sometimes, all these seasonal effects can exist in the financial price series but zero seasonal effect can exist in the financial price series too. Since dealing with one or two cycles are already well known problem, there is already some well-established routines to handle them. In addition, James W. Taylor at Oxford University developed an algorithm to deal with triple seasonality in the price series many years ago. Therefore, it is not impossible to deal with three seasonal cycle at the same time. For average traders, the mathematical algorithm to deal with seasonality may be not available. If you have to deal with multiple of seasonality when you do not have an access to such a tool, then you should identify the dominating seasonal cycle. Then you should focus to materialize the dominating seasonal cycle for your trading application.

For your trading, it should be noted that the routine for materializing seasonality is well established. Assuming the seasonality is definitely dominating in the price series, and then you should not ignore them but you can follow these simple routines.

1. Identify the existing seasonal cycles in the price series
2. Find the dominating seasonal cycles
3. Find the relationship between the trend and the dominating seasonal cycles in the price series
4. If you can extract the dominating seasonal cycle and trend, then you might reconstruct the price series to predict future market.
5. If you cannot extract the exact seasonal behaviour and trend, you have to build some backtesting routines to test the significant profitability of the seasonality and trend.
6. If the seasonality and trend provide the significant profitability, you can generate buy and sell signal for your trading

If you have an access to some mathematical tool, then you might use classic decomposition approach or X12 ARIMA decomposition techniques (Figure 9-3). With the decomposition approach, you can separate trend and seasonality to exam their potential profitability. If you do not have an access to these mathematical tools, then at least you can calculate the seasonal average of the price series. For example, Figure 9-4 shows the seasonal average of S&P 500. When you find significant seasonal fluctuation, then you should incorporate the knowledge into your trading system. If you ignore the significant seasonality, then your trading system can suffer from the long drawdown period. In some case, it is possible to build some sort of brutal force search algorithm to find the highly predictable stock price series with trend and seasonality. If the seasonal effect is not significant in the price series, then there is no need to concern about it. In that case, you can assume that other regularities can be more dominating than seasonality in that price series.

Figure 9-2: S&P 500 monthly series. S&P 500 monthly series shows much weak seasonal fluctuation comparing to the Airline passenger series in Figure 9-1.

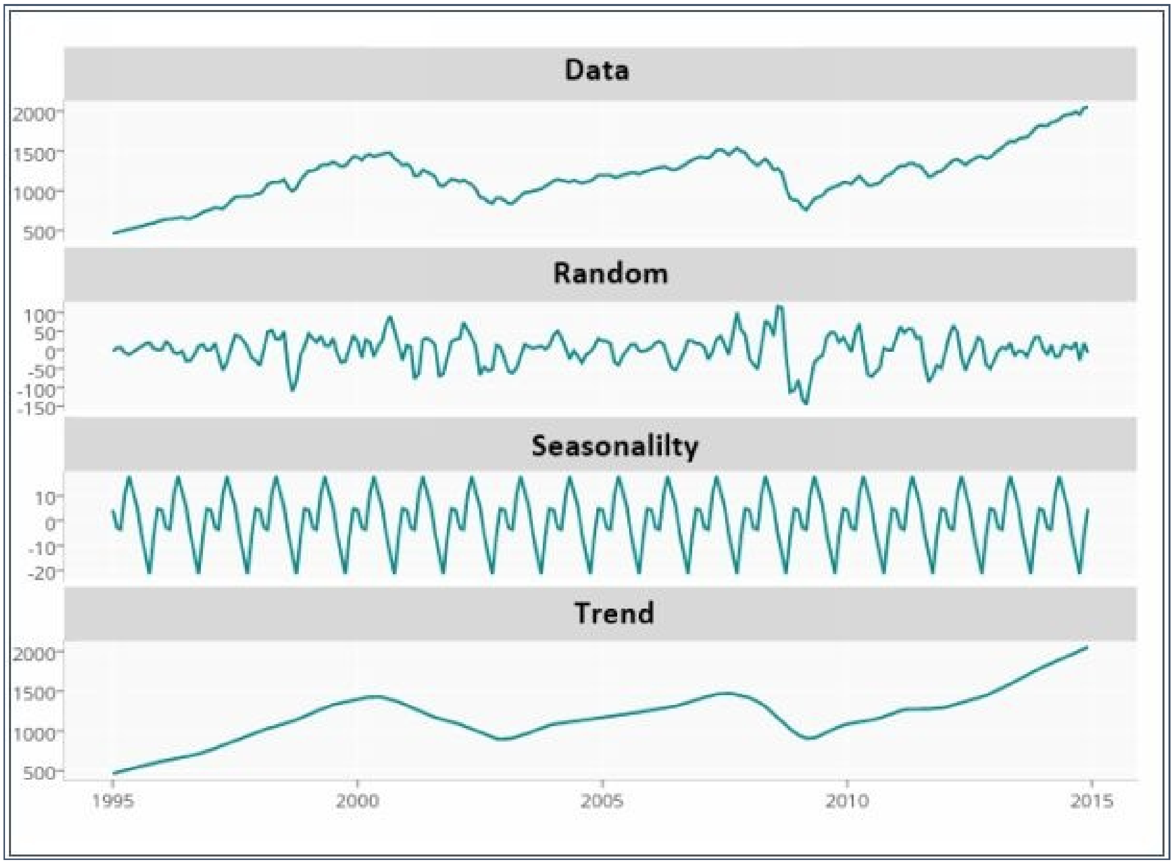

Figure 9-3: S&P 500 Monthly Data Decomposition.

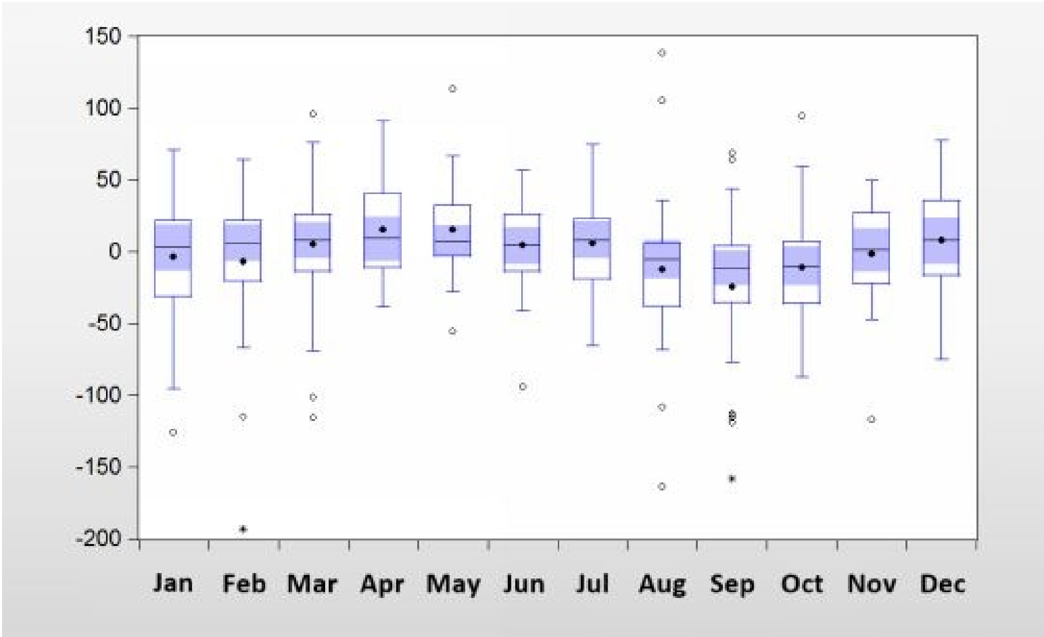

Figure 9-4: Seasonal Effects of the S&P 500 monthly price series. Seasonality was extracted from the central moving average construction.

Most of time, seasonality is lesser problem for traders because we know what to look for with 12 month seasonal cycle or 24 hour seasonal cycles for our trading system. Since the seasonality is expressed in the common timeframe like 12 months or 1 day, it is much more straightforward to apply them in our trading application. The main problem for traders often comes from dealing with multiple combined cycles, fourth regularity in the Price Pattern Table (Figure 3-3 and Figure 3-4). It is simply because these multiple combined cycles possess the greater number of cycles than just two or three cycles as in the seasonality problem. Sometimes, we have to deal with 20 or even more number of cycles in the real world financial price series. At the same time, the cycle period does not come in the standard timeframe like 12 months or 1 day. Some cycle period might have some odd periods like 3.78 days or 2.561 month, etc. Since these odd cycle period does not make much sense in our daily life, quite often we have to rely on statistical examination to find existing cycles in the price series. The main steps are not so different from how to use seasonality for your trading. For example, you can follow these general steps for your trading application.

1. Identify the existing cycles in the financial price series
2. Find the dominating cycles
3. Find the relationship between the trend and the dominating cycles
4. If you can extract the dominating cycles and trend from the price series, then you might reconstruct the model price series to predict future market.
5. If you cannot extract the dominating cycles and trend, you have to build some backtesting routine to test the significant profitability of the cycles and trend.
6. If the cycles and trends provide the significant profitability, you can generate the buy and sell signal for your trading

Finding the dominating cycle in the prices series often requires skills and significant knowledge in signal processing topics. If you are interested in entering the new world of the cycle trading, then you might look at some techniques like wavelet transformation, principal component analysis, empirical mode decomposition, Hilbert Transformation and Fourier Transformation. Finally, you should have some clear idea that each regularity in the Price pattern Table (Figure 3-3 and Figure 3-4) has distinctive number of cycles from each other. So far, multiple cycle combination provides the highest number of cycles. In the next chapter, we will discuss the fractal Wave process, which have the infinite number of cycles.

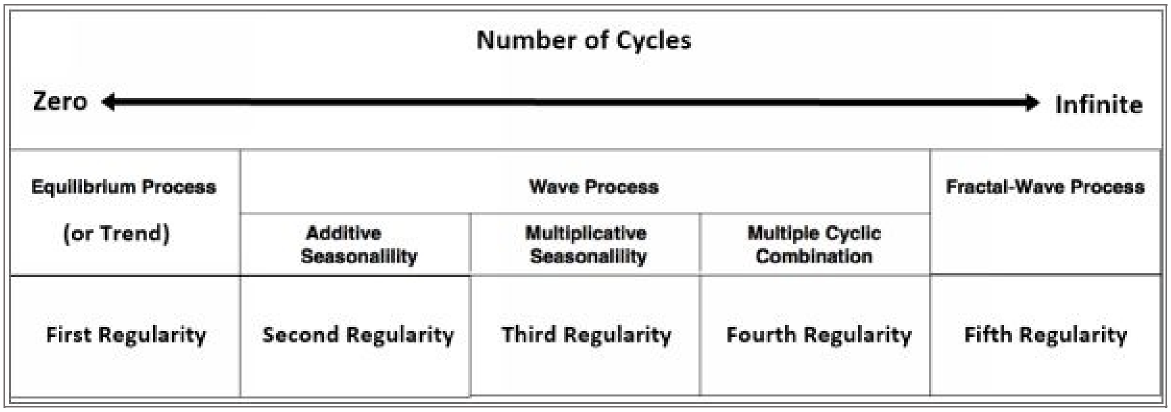

Figure 9-5: Number of cycle periods for the five regularities.

10. Equilibrium Fractal-Wave Process

Like Equilibrium Wave Process, Equilibrium Fractal-Wave process combines Equilibrium process with Fractal-Wave process. In real world financial market, some Random process can present together with the Equilibrium and Fractal-Wave process. Considering that Fractal-Wave process alone shows complex behaviour, you might guess how complex the Equilibrium Fractal-Wave Process can be. Simply speaking, Equilibrium Fractal-Wave will exhibit some trend patterns together with self-repeating wave patterns. Many financial prices series exhibit Equilibrium Fractal-Wave process in the Stock, Forex and Future markets. In Chapter 8, we have shown that in nature the building block of the fractal geometry can take many forms from line to square. Then what would be the building block of the fractal geometry in the financial market?

The basic building block of the fractal geometry in the financial market is a scalene triangle as shown in Figure 10-1. The scalene triangle is made up from two price moves in the financial market. Since these triangles are propagating to reach the market equilibrium price, we can call these triangles as the equilibrium fractal wave. By definition, the single unit of equilibrium fractal wave is equivalent to a simple triangle. Since equilibrium fractal wave have the fractal nature, it only concerns its shape regardless of its size. Equilibrium fractal wave can have many different shapes. Since equilibrium fractal wave is made up from two price moves, the one possible way to describe the shape of equilibrium fractal wave is by relating these two price moves. One can take the ratio of current price move to previous price move (Y2/Y1) to describe the shape of the equilibrium fractal wave typically.

The shape ratio of equilibrium fractal wave = current move in price units (Y2)/

previous move in price units (Y1).

Using the shape ratio, we can differentiate a specific shape of equilibrium fractal wave from the other shapes. For example, Figure 10-3 shows two identical equilibrium fractal waves in their shape. Their shape can be considered as identical as their shape ratio is identical. Likewise, if the shape ratios of two equilibrium fractal waves are different, then two equilibrium fractal waves can be considered as being non-identical in their shape (Figure 10-4).

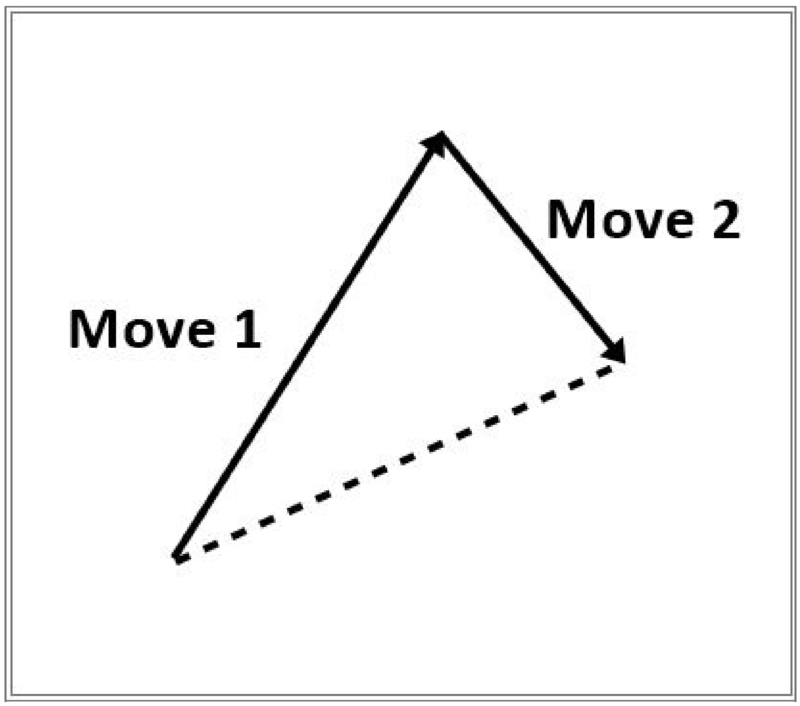

Figure 10-1: One unit cycle of Equilibrium Fractal Wave is a triangle made up from two price movements (i.e. two lags).

Figure 10-2: one unit cycle of an equilibrium fractal wave in the candlestick chart.

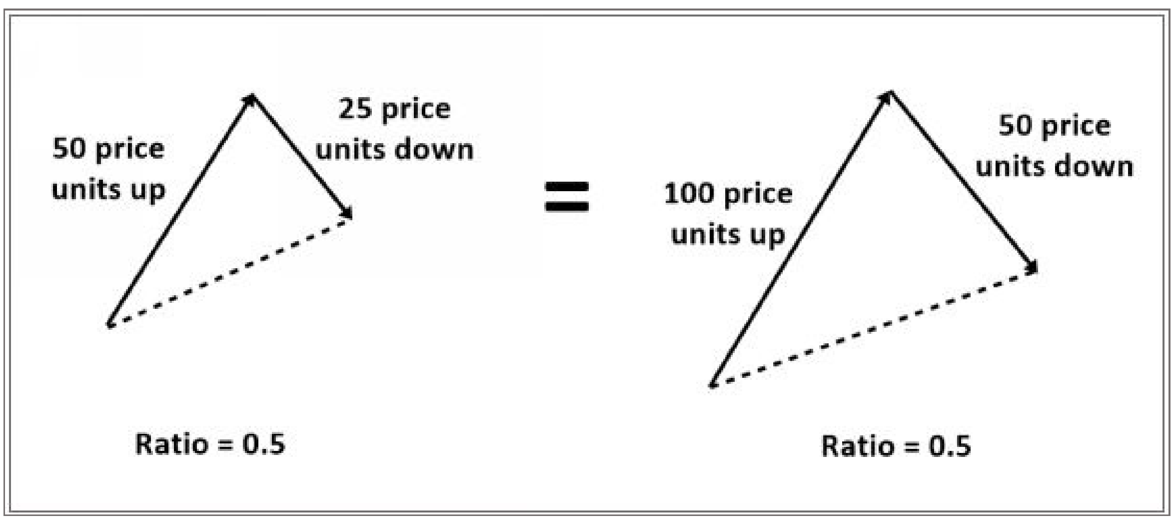

Figure 10-3: An example of two identical equilibrium fractal waves in their shape.

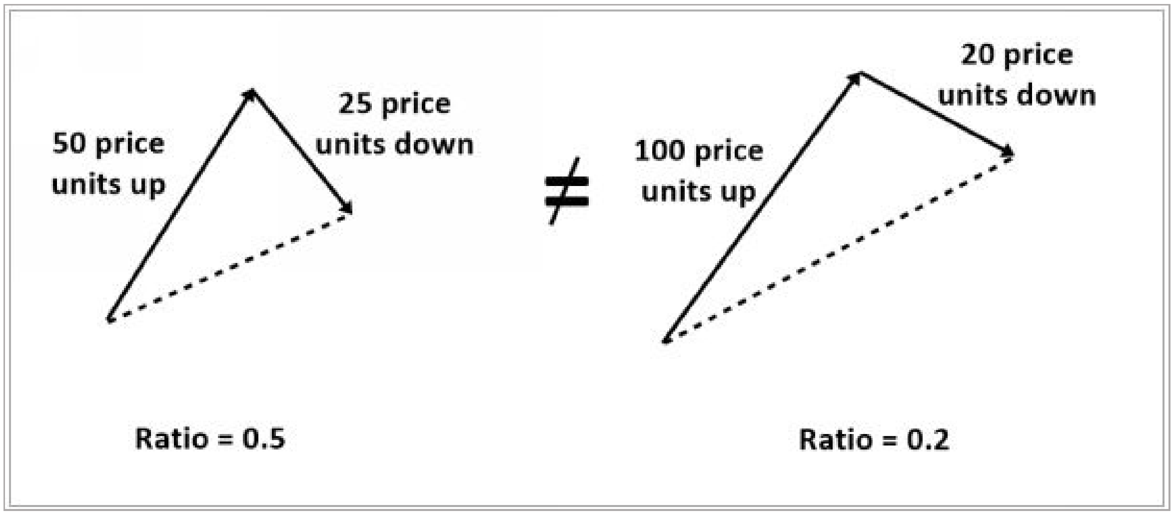

Figure 10-4: An example of non-identical equilibrium fractal waves in their shape.

To make use of equilibrium fractal wave for your trading, you have to understand the characteristics of equilibrium fractal wave. In this book, we outline the five most important characteristics for your trading. When you trade with equilibrium fractal wave or other EFW derived patterns, you will find out that the trading strategies are based on one or few of these characteristics.

The first characteristic of equilibrium fractal wave is the repeatability. While the price is moving to its equilibrium price level, we observe the zigzag path of the price movement. After extensive price rise, the price must fall to realize the overvaluation of the price. Likewise, after extensive price fall, the price must rise to realize the undervaluation of the price. This price mechanism builds the complex zigzag path of the price movement in the financial market. During the zigzag path, the price shows the four possible triangle shapes as shown in Figure 10-5. These four equilibrium fractal waves are the mirrored image of each other. Therefore, they are the fractal. The complex price path in the financial market is in fact the combination of these four equilibrium fractal waves in alternation.

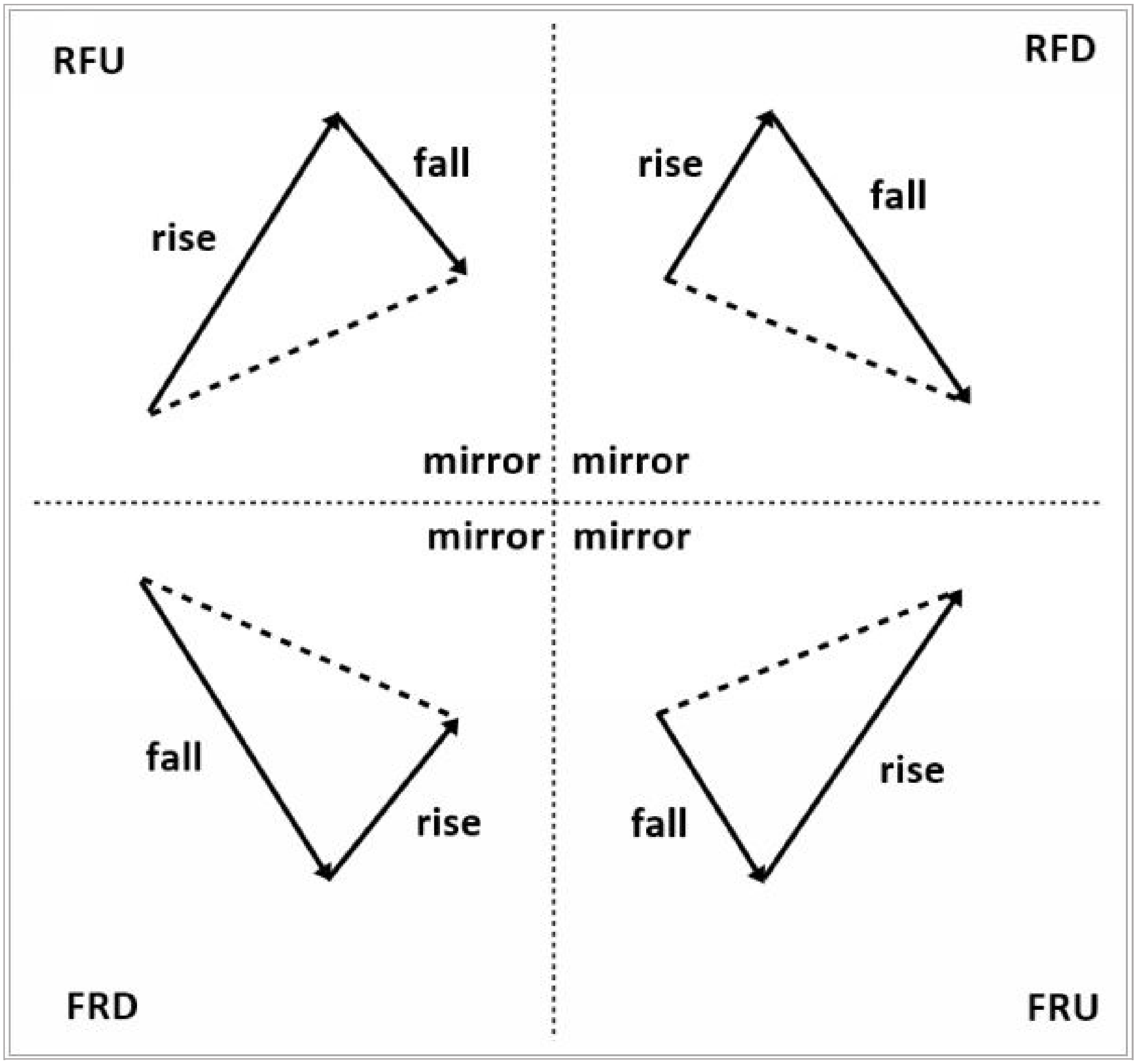

Figure 10-5: Equilibrium fractal wave in the Zig Zag price path where RFU = Rise Fall UP pattern, RFD = Rise Fall Down pattern, FRD = Fall Rise Down pattern and FRU = Fall Rise Up pattern.

The second characteristic of equilibrium fractal wave is that equilibrium fractal wave can be extended to form another bigger equilibrium fractal wave as shown in Figure 10-6. During the important data release or market news release, the financial market can experience a high volatility or shock. When the market experiences the high volatility or shock, the last lag of equilibrium fractal wave can extends to adapt the shock or volatility introduced in the market. Even after the extension, the equilibrium fractal wave still maintains its fractal geometry, the triangle. Hence, the fractal nature of financial market is unbreakable. This price extension often determines the reversal or breakout movement around the important support and resistance levels.

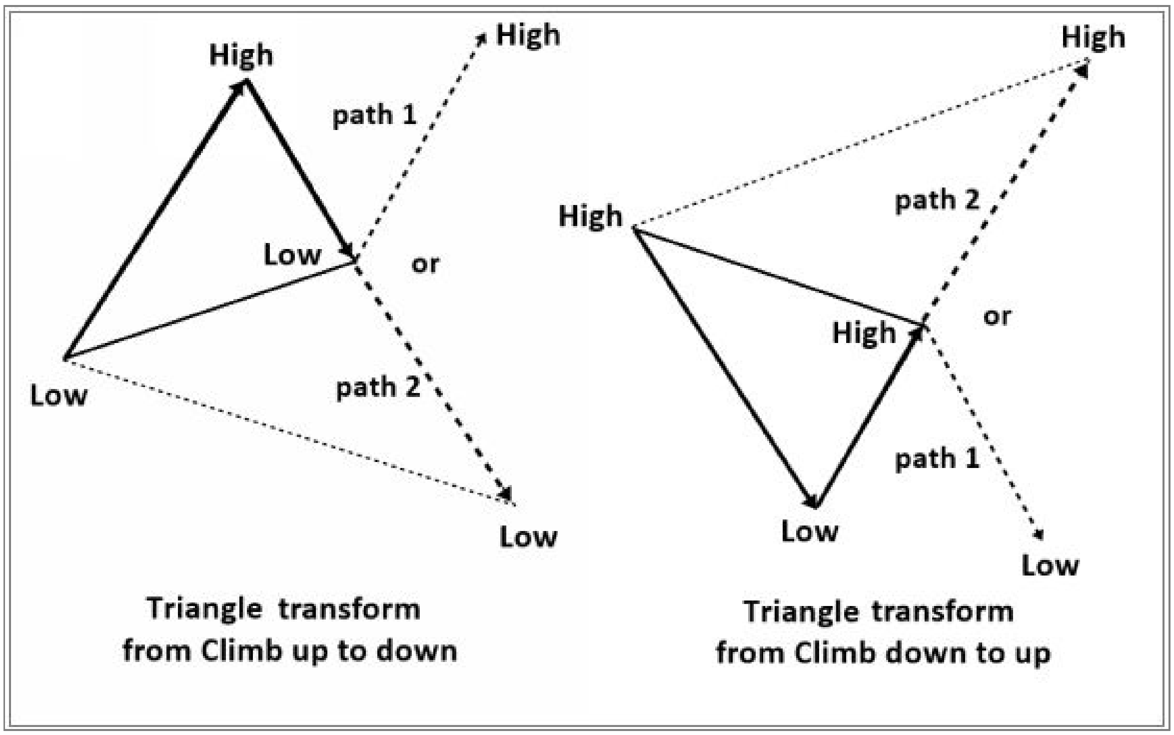

Figure 10-6: Illustration of price transformation (extension) from path 1 to path 2 to meet new equilibrium price due to an abrupt introduction of new equilibrium source in the financial market.

Third characteristic of equilibrium fractal wave is that they can overlap on each other. For example, when the equilibrium fractal wave is propagating, we can observe the jagged patterns repeatedly as shown in Figure 10-7. To untrained eyes, this complex pattern might look like random patterns. They are not random pattern. Later part of the 1st training, we will show you how even untrained individual can readily identify equilibrium fractal waves in your chart with the peak trough analysis.

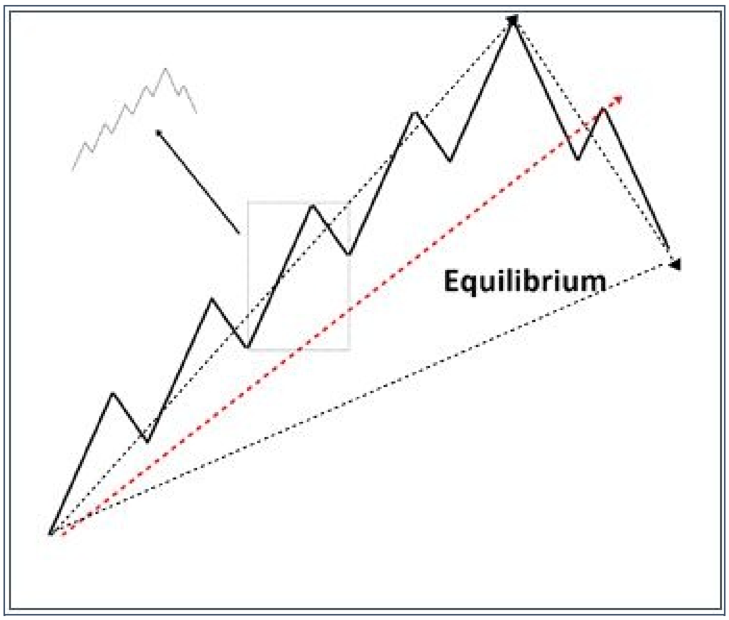

Figure 10-7: Pictorial representation of jagged equilibrium fractal wave with a linear trend.

The fourth characteristic of equilibrium fractal wave is the infinite scales. The infinite scales mean that you will see the similar patterns repeatedly in the price series while their sizes are keep changing. The repeating pattern can come in any size from small to large. For example, if we stack the varying size of equilibrium fractal waves with the particular shape ratio, then literarily we can stack the infinite number of triangle as shown in Figure 10-8. This implies the infinite number of cycle periods in Figure 3-3 and Figure 3-4. This is exactly why "Equilibrium Fractal-Wave" process is much harder to be handled by traditional technical indicators or mathematical models because they were not designed to deal with the infinite cycle periods mostly. In the next several chapter, we will introduce several important techniques and concepts to deal with these equilibrium fractal waves for practical trading.

Figure 10-8: Infinite number of stacked triangles.

The fifth characteristic of equilibrium fractal wave is the loose self-similarity (heterogeneity). In nature, it is easy to find the strict self-similarity. However, we can only expect the loose self-similarity in the financial market due to the highly heterogeneous players, participating in the market. Even though all the equilibrium fractal waves will have the same form of triangle, their shape ratio will be different to each other. For example, if we display the shape ratios of all the series of equilibrium fractal waves in the chart, then we will expect the shape ratios to vary to its adjacent one (Figure 10-9). This does not mean that we will never have the similar shape ratios in history. In fact, we can get lots of them repeating in the history. For example, we get to see the shape ratio of 0.618 all the time in the financial market. However, we are just saying that the same shape ratios will not come in the successive manner. This heterogeneous characteristic also implies that the financial market have the shapes more frequently occurring than the other shapes. For example, last hundreds years, traders had a solid trust in using the Fibonacci ratios like 0.618, 0.382 and 1.618 for their trading. Some traders used these ratios for Elliott wave analysis or some traders used these ratios for the Fibonacci retracement measurement. Likewise, each financial instrument has different shapes dominating than the rest. Hence, each financial instrument shows more idiosyncratic behaviour of their own.

Figure 10-9: Equilibrium fractal waves with different shape ratios.

To give you some idea of equilibrium fractal wave, let us have some real world example using currency pairs. Regardless of how long the market goes on, the market can be described with few cycles of equilibrium fractal waves due to the fractal nature of the financial market. For example, the financial prices series with 20 years of history can be described using two unit cycles of equilibrium fractal wave (Figure 10-10). Likewise, the price series with 2 weeks historical data can be described using two unit cycles of equilibrium fractal wave too (Figure 10-11). The main difference is that there are more jagged patterns inside the financial price series for 20 years comparing to the two weeks data.

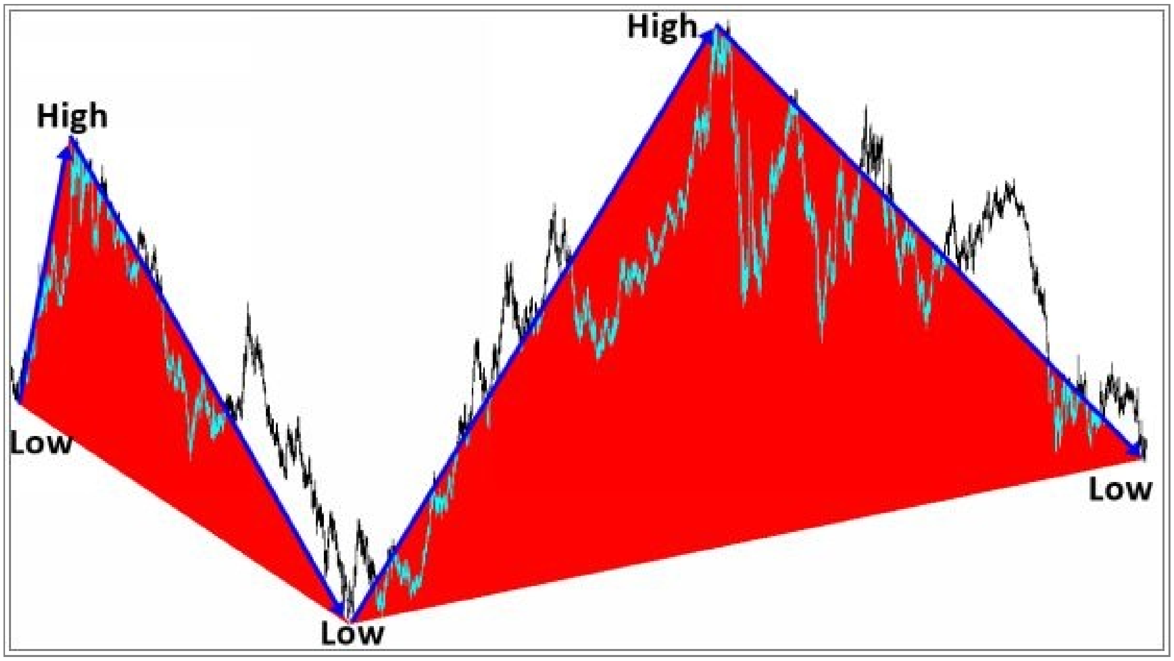

Figure 10-10: EURUSD twenty years' historical data from 1992 to 2016.

Figure 10-11: EURUSD two weeks historical Data from 2015 August 28 to 2015 September 16.

Each equilibrium fractal wave can be combined to form the patterns that are more complex. Several popular tradable patterns can be derived by combining several equilibrium fractal waves. For example, Harmonic patterns are typically made up from three equilibrium fractal waves. Impulse Wave 12345 pattern in Elliott Wave Theory is typically made up from four equilibrium fractal waves. Corrective Wave ABC pattern in Elliott Wave Theory is made up from two equilibrium fractal waves. Like the case of Elliott Wave patterns and Harmonic patterns, some derived patterns can have some definite number for equilibrium fractal wave for the defined patterns. However, there are some derived patterns does not have the definite number of equilibrium fractal wave. For example, rising wedge, falling wedge and triangle patterns does not require the definite number of equilibrium fractal wave. Rising wedge, falling wedge and triangle patterns are envelops connecting highs and lows of each equilibrium fractal wave.

EFW Derived patterns	**Number of equilibrium fractal waves**	**Number of points**
ABCD pattern	2	4
Butterfly pattern	3	5
Bat pattern	3	5
Gartley pattern	3	5
Impulse Wave 12345	4	6
Corrective wave ABC	2	4
Falling wedge pattern	Not defined	Not defined
Rising wedge pattern	Not defined	Not defined
Symmetric triangle	Not defined	Not defined

Ascending triangle	Not defined	Not defined
Descending triangle	Not defined	Not defined

Table 10-1: List of derived patterns for trader from equilibrium fractal waves

The properties of these derived patterns remain identical to the equilibrium fractal wave itself because the derived patterns are also fractals by nature. Therefore, the derived patterns are repeating in different scales. They exhibit loose self-similarity. They will not look like two identical twins but they will be similar to each other. For example, the size of butterfly pattern detected in EURUSD today will be different to the butterfly pattern detected 1 month ago. In addition, the size of butterfly pattern detected in EURUSD will be different to the butterfly pattern detected in GBPUSD. The detected patterns can have slightly different shape too. It is also possible to have nested patterns inside larger patterns. For example, we can have a small bullish butterfly pattern inside the greater bullish butterfly pattern. Likewise, we can have a nested bullish Impulse Wave 12345 pattern inside greater bullish Impulse Wave 12345 pattern. Another important point about these derived patterns is that they will serve for the price to propagate in the direction of the market equilibrium. The formation of the repeating patterns will typically guide the price to the end of the equilibrium price. Some derived patterns like Harmonic Patterns are the leading indicator for trend reversal. Some patterns like impulse wave 1234 are the leading indicator of trend continuation. Therefore, these derived patterns provide good clue about trading direction for us. Presence of these derived patterns can represent the existence of fifth regularity, equilibrium Fractal-Wave process in the financial price series.

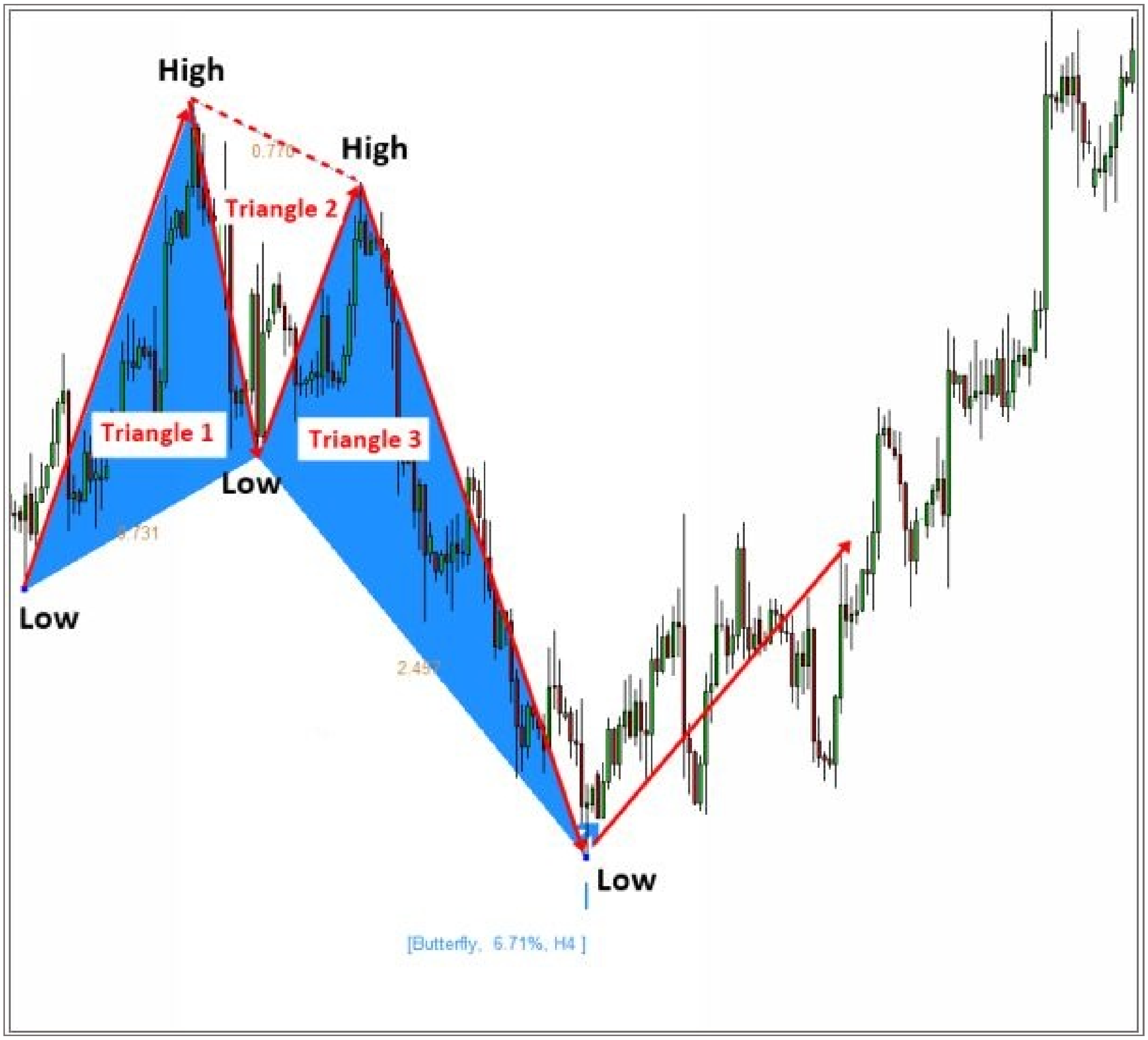

Figure 10-12: Butterfly pattern formed in EURUSD H4 timeframe.

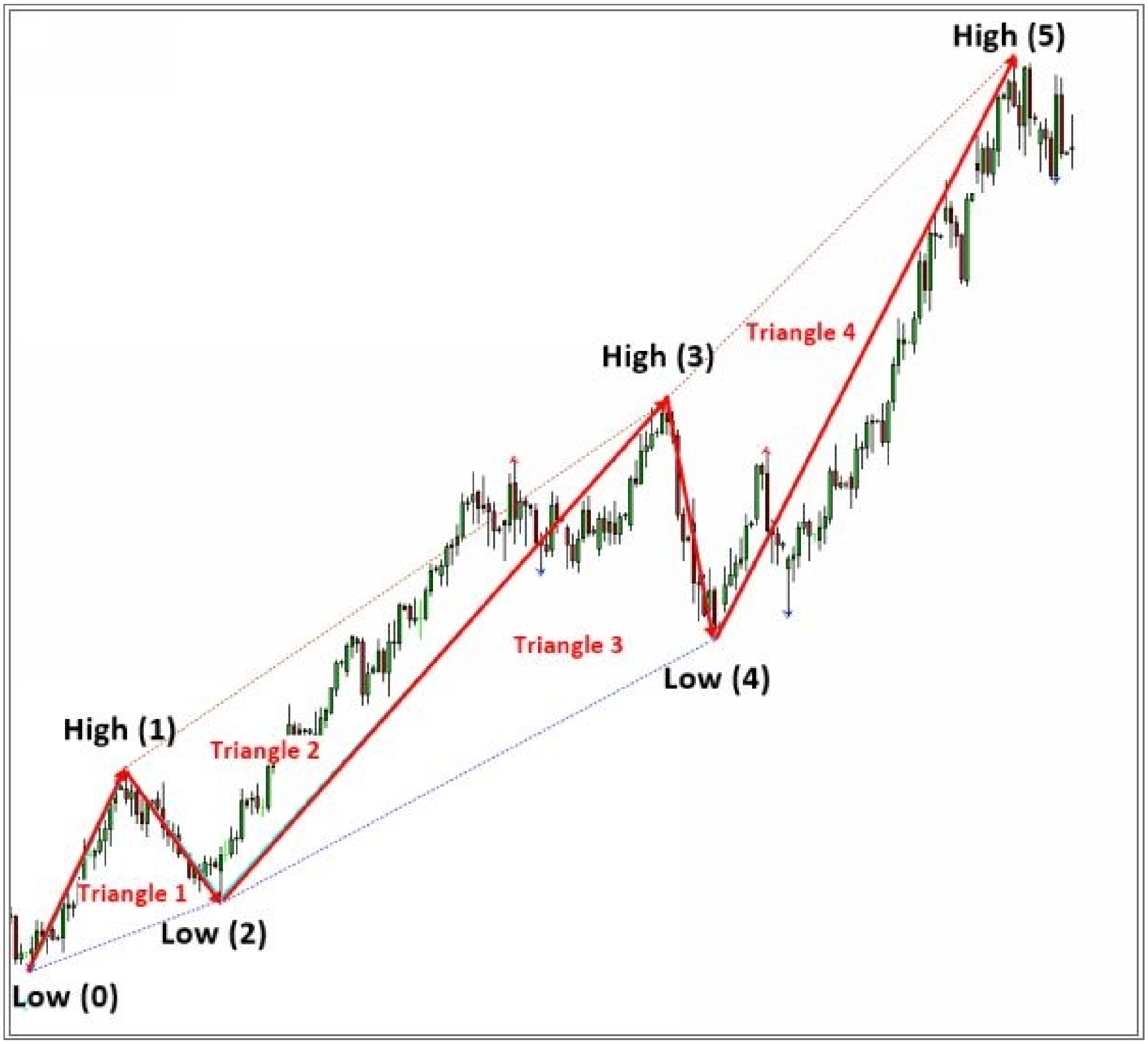

Figure 10-13: Impulse Wave 12345 pattern formed in EURUSD D1 timeframe.

Figure 10-14: Corrective Wave 123 pattern formed in EURUSD D1 timeframe.

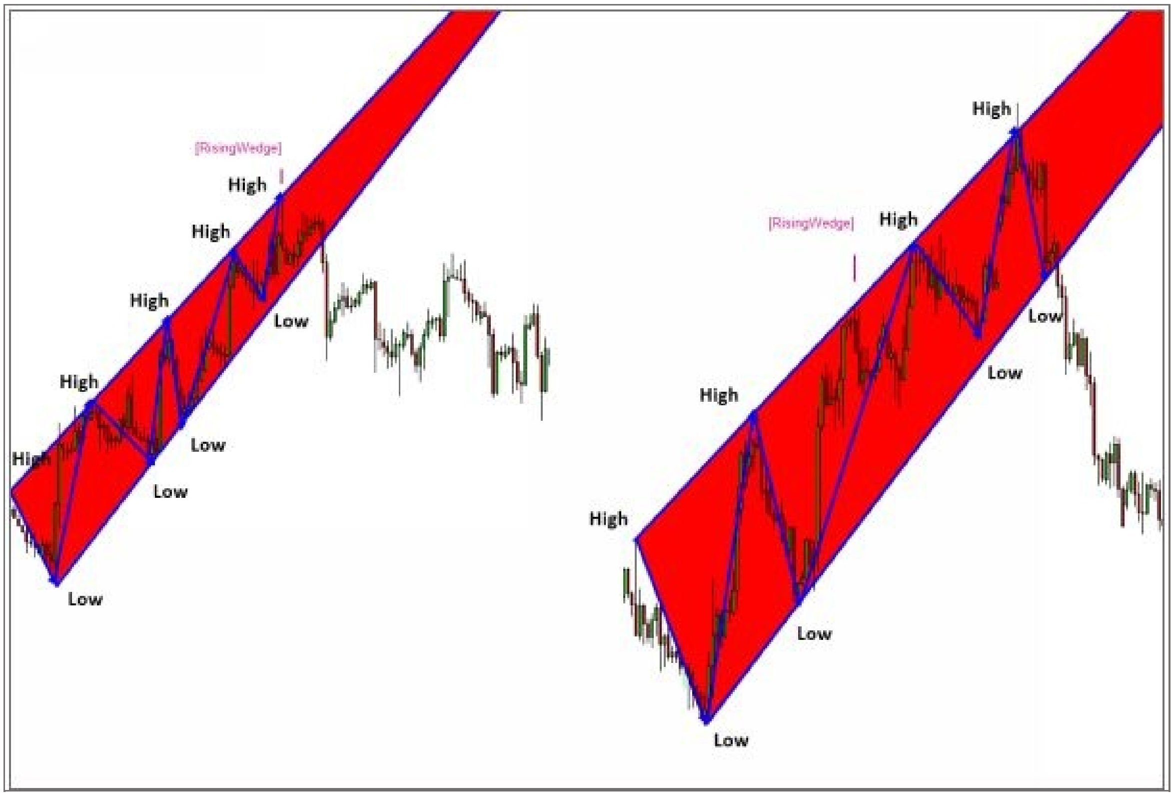

Figure 10-15: Rising Wedge pattern A (left) and another Rising Wedge pattern B (right) formed in EURUSD H4 timeframe.

11. Choice of trading strategy and Price Patterns

So far, we have explained seven price patterns in details from chapter 4 to chapter 10 in regards to our Price Pattern Table shown in Figure 3-3 and Figure 3-4. The whole purpose of illustrating these price patterns was to help you to choose the right trading strategy for your trading and to help you to predict the financial market better. Choosing the right trading strategy is almost impossible without knowing which price patterns are dominating inside the price series. In general, there are two important questions to ask for your choice of trading strategy. Firstly, we need to know which trading strategy or technical analysis is designed to deal with which price pattern in the price table (Figure 3-3 and Figure 3-4). Secondly, we need to know what price patterns are dominating in the financial market. First question is straightforward to answer. By looking at the detailed algorithm inside the trading strategy or technical analysis, we can tell which price pattern they can deal with best. For example, since moving average indicator averages out the price series, it can be used where we need to filter out noisy in our data. Therefore, moving average indicator can be best used to deal with the combined price patterns between Random process and Equilibrium process. If you are not able to access to the detailed algorithm, then it is also helpful reading the detailed description or the instruction of the technical analysis written by other traders.

We list some trading strategies and technical analysis to deal with each price pattern. For your information, Table 11-1 is only the rough guideline because trader can use the technical analysis in several different purposes. For example, typically the moving average indicator is used to identify the trend presents in the price series. However, if you centre the moving average, the centred moving average can be used to extract the seasonal fluctuation of the price series. Therefore, please assume the guideline in the Table 11-1 as very general cases only. The most important take away here is that you have to understand if your technical analysis or trading strategy can handle the specific price patterns in the financial market. Blindly applying any trading strategy for wrong price patterns will yield poor outcome in your trading.

Dominating price patterns	**Useful Trading or prediction Strategy**	**Useful algorithm or technical analysis**
Stationary process (reverting to mean)	Mean Reversion Trading Strategy	• Z Score • Bollinger Bands trading strategy • Standard deviation indicator • Average True Range indicator • Relative Strength indicator • Commodity Channel Indicator
Equilibrium process (Trend only in first regularity)	Materialize trend (i.e. Momentum Trading Strategy)	• Moving Average • MACD as a trend indicator • General trend based technical indicator
Equilibrium Wave process (Trend + Seasonality in second and third regularity)	Materialize trend and seasonal fluctuation together	• Trend based technical indicator • Relative Strength Indicator • Commodity Channel index • MACD as an oscillator • General oscillator based technical indicator • Centered moving average • Holt's winter's method • Seasonal ARIMA • Seasonalgram or Periodogram
Equilibrium Wave process (Trend + Cycle in fourth regularity)	Materialize trend and cycle together	• Trend based technical indicator • Relative Strength Indicator • Commodity Channel index • MACD as an oscillator • General oscillator based technical indicator • Principle Component Analysis • Wavelet transformation • Fourier Transformation • X-12 ARIMA from the US Bureau

		of the Census
Equilibrium Fractal-Wave process (Trend + Repeating patterns in fifth regularity)	Materialize trend and repeating patterns together	• Peak-Trough Analysis • Fractal indicator by Bill Williams • Modified Fractal indicator • Zig Zag indicator • Support and Resistance with direct pattern recognition • Fibonacci Analysis • Gann's Angle (Gann's Fan) • Harmonic Pattern • Triangle and Wedge pattern • Elliott Wave Theory • Renko chart • Point and Figure chart

Table 11-1: Rough guideline for trading strategies and technical analysis to deal with each price patterns.

Second question is more difficult to answer because it is not easy to measure how much of each price patterns are present in the financial price series. To most of average traders, such information is not accessible. Even to scientist, these quantities are only measurable up to the certain degree. The single price pattern including Equilibrium process, Wave process, Random process and Stationary process are measurable up to some degree with existing methodology. For example, the strong presence of Equilibrium process might be identifiable by some experienced trader by inspecting chart without any additional tool. Wave process, Stationary process and Random process requires some statistical techniques to check their presence. Wave process can be checked using seasonalogram and periodogram using Fourier transformation. Stationary process can be checked using Augmented Dickey Fuller test or Phillips-Perron test. When two or more price patterns are combined like the cases of Equilibrium Wave process or Equilibrium Fractal-Wave process, it is more difficult to identify the presence of these complex price patterns. Unfortunately, in the highly competitive and liquid financial market, most of time, they will likely to have the complex price patterns like Equilibrium Wave process or Equilibrium Fractal-Wave process. For these complex price patterns, statistical technique is not too useful.

One alternative way over statistical analysis can be backtesting. The direct backtesting of some trading strategy to the financial market can yield a lot of useful insight about the price patterns dominating in the financial market. Since we can find the direct trading outcome of the trading strategy, backtesting is often useful to trader. One disadvantage of backtesting is that it is not easy to build the backtesting algorithm for some complex trading strategies. Both cost and time are the limitation of building the backtesting algorithm. If backtesting is not accessible option, then the trial and error of applying different strategy manually can be another alternative. Simply speaking, if you have lost some money using the moving average cross over strategy for some period, then this can be good indication for which this trading strategy is not suitable for that financial market. However, you should only conclude it for the specific market and you should not conclude it for all general financial market. To save time and efforts in trial and error, it is often useful to read some textbooks, to join the training course or to interact with other experienced traders. More you perform the trial and errors with different strategies, you can make better educated guess about the dominating price patterns in the financial market. Just like anything else, trial and errors are probably an inevitable process to build up good domain knowledge about trading. However if possible, we should reduce them by looking at the alternative approach. You might need some exploratory tools for that.

Choosing the right trading strategy for the financial market has both artistic and scientific elements. Trader should not forget to ask two important questions before choosing the trading strategy. What price patterns are dominating in the financial market? Which trading strategy or technical analysis is suitable to deal with the dominating price pattern? When you trade blindly with any trading strategy, then you will get the blinded outcome, which will result in the serious financial loss. In this book, we will provide you two distinctive ways to answer these millions dollar questions. Firstly, we will introduce the peak trough analysis in the next chapter. Then secondly, we will introduce you the brand new technique called the “Equilibrium Fractal Wave index”. The peak trough analysis is the useful tool to identify the visual form of the equilibrium fractal wave (EFW) in your chart. You can identify equilibrium fractal waves and many other derived patterns from equilibrium fractal wave. The derived patterns are typically more complex than pure equilibrium fractal waves. The identifiable derived patterns include harmonic patterns, Elliott wave patterns, triangles and wedges patterns. For some derived patterns, you might prefer to use some automated pattern scanner because of their complexity. However, it is valuable to understand how to detect these patterns manually because they will reveal significant amount of useful information for your trading. If you can get the intuition behind the pattern detection using the peak trough analysis, you can soon become the advanced trader among others.

Beside the peak trough analysis, the “Equilibrium Fractal Wave index” (EFW index) can bring you the rich information in the measurable form. With the EFW index, you can not only confirm the presence of equilibrium fractal waves and other derived patterns in the financial market but also you can build the best trading strategy to suit for the market. In the next two chapters, we will be unpacking all these untold stories about these two powerful techniques in the angle of the practical trading. After that, we will expand further to teach you the proven trading strategies over the decades using the EFW framework taught in this book.

12. Peak Trough Analysis to visualize equilibrium fractal wave

Due to the infinite number of cycle periods, dealing with the “Equilibrium Fractal-Wave” patterns are much harder to be dealt with traditional technical indicator or mathematical models. In our previous chapter, we have pointed out that the direct pattern recognition based on pure geometric analysis is a good way to study the price patterns derived from equilibrium fractal waves. How can we conduct the direct pattern recognition for our trading? Among many other techniques, one of the most effective method to study these repeating price patterns is the peak-trough analysis (Figure 12-1). In the peak-trough analysis, literally we are picking up the highest top and the lowest bottom in our chart for further pattern analysis. Simply speaking, the peak-trough analysis is the mathematical algorithm to decompose the price series into the triangle building block (i.e. the unit cycle of equilibrium fractal wave) we have described in Chapter 10.

Figure 12-1: Peaks and troughs detected in EURUSD Daily chart.

For our practical trading, the peak-trough analysis can offer the three important benefits to decompose the price patterns derived from equilibrium fractal waves. The three important benefits include:

- Pattern recognition by identifying the boundary of the patterns.
- Ratio analysis for the scale free pattern recognition.
- Scenario reduction in the Fibonacci sequence analysis.

Before we give the example of the three benefits above, let us explain bit about how to construct the peak-trough analysis in your chart mechanically. Fortunately, the peak-trough analysis can be conducted using some simple technical indicators, which is freely available on the net. Firstly, you can use the Fractal indicator devised by Bill Williams. In the Fractal indicator, up fractal and down fractals are respectively identified with the highest highs and the lowest lows in the successive five candle bars (Figure 12-2). The fractals are the middle bar among the five candle bars. Some traders uses fractals to identify turning point in the market. Fractal indicators alone will provide only limited opportunity to spot the true turning point. However, fractals are a good indicator to spot the important peaks and troughs in your chart. The disadvantage of the fractal indicator is that it is lagging by two candle bars always to the present. In addition, up fractals and down fractals do not appear in turn but they can appear in a random order. For example, three or four up fractals can show up in row sometimes (Figure 12-3). Likewise, three or four down fractals can show up in row too (Figure 12-3). This can sometimes confuse traders in identifying some significant peaks and troughs in their charts.

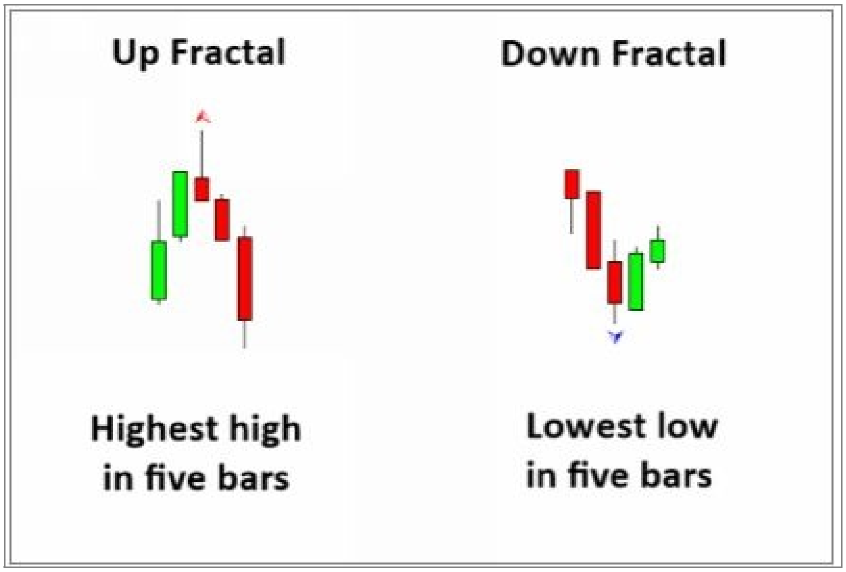

Figure 12-2: The original definition of Up Fractal and Down Fractal in fractal indicator.

Figure 12-3: Peaks and troughs detected using the Fractal indicator by Bill Williams in EURUSD Daily chart from 2016 July 18 to 2016 October 31.

In spite of the fact that you can perfectly use the original fractal indicator by Bill Williams, the original fractal indicator can show too many insignificant peaks and troughs in your chart. With more peaks and troughs, you have to work harder with your chart to identify important peaks and troughs to detect patterns. To overcome this limitation, one can create its modified version of the Fractal Indicator to reduce the insignificant peaks and troughs from your charts. Instead of detecting up or down fractals in five bars, one can detect up fractals and down fractals in N number of bars. For example, we can detect up fractals with highest highs in ten bars to the left side (N left = 10) and two bars to the right side (N right = 2) as shown in Figure 12-4 and Figure 12-5. When you use this modified version of the Fractal indicator, it is important not to increase N for right side because lagging of the indicator can increase too. The advantage of this modified fractal indicator is that you can filter out many insignificant peaks and troughs detected from the original fractal indicators. For example, in Figure 12-6, we have only 11 peaks and troughs in our chart whereas we have nearly 28 peaks and troughs in Figure 12-3 for the same period. With the reduced number of peaks and troughs, it is much easier for traders to identify the important price patterns from their charts. However, the Modified Fractal indicator still carries the weakness of the original indicators. For example, several up fractals or down fractals can appear in row. The modified Fractal indicator can still lag by two candle bars.

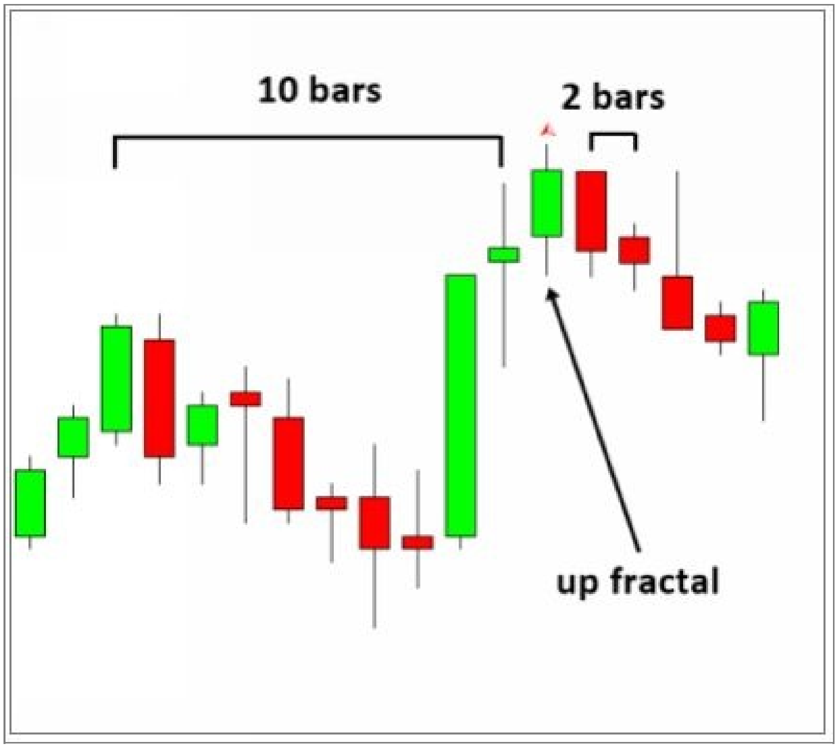

Figure 12-4: Up fractal, the highest high in 13 bars (10 bars to left and 2 bars to right).

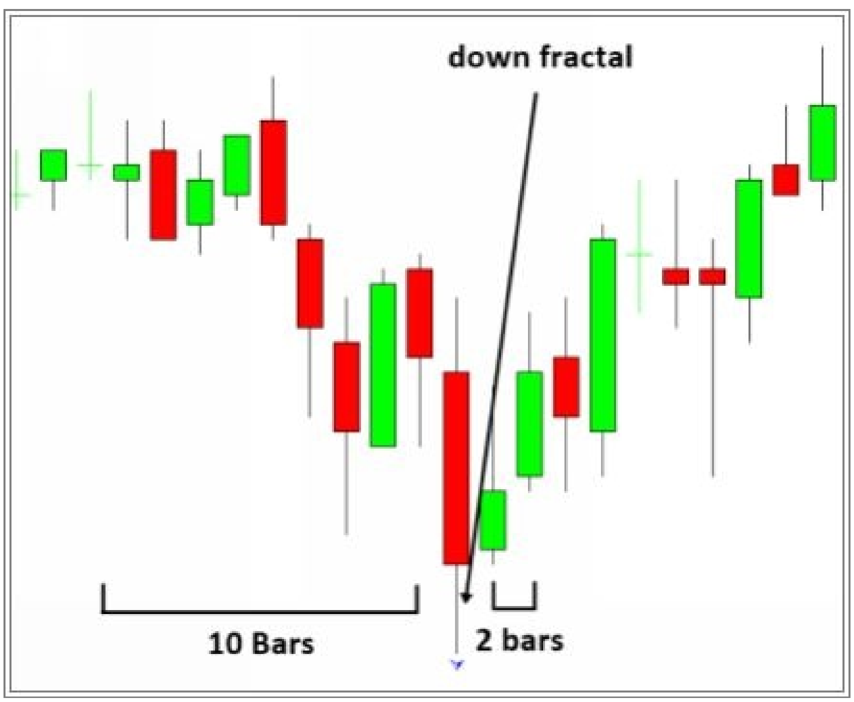

Figure 12-5: Down fractal, the lowest low in 13 bars (10 bars to left and 2 bars in right).

Figure 12-6: Peaks and troughs detected using the modified Fractal indicator in EURUSD Daily chart from 2016 July 18 to 2016 October 31.

More advanced version of the peaks and troughs identifier is the Zig Zag indicator. The Zig Zag indicator works in the similar manner to the Modified Fractal indicator. However, in the Zig Zag indicator, a peak and trough appears in turn. When a peak and trough appears in turn, it is much easier for traders to use these peaks and troughs to detect the price patterns. It also reduces many insignificant peaks and troughs making the pattern recognition process much easier. For example, the Zig Zag indicator only produced three peaks and troughs whereas the Bill Williams Fractal indicator and the Modified Fractal indicators produces respectively 28 and 11 peaks and troughs (Figure 12-7) for the same periods. Another advantage of Zig Zag indicator is that it does not have the lagging properties. Remember that the Bill Williams Fractal indicator and the Modified Fractal indicators will always lag by two candle bars.

Figure 12-7: Peaks and troughs detected using the Zig Zag indicator in EURUSD Daily chart from 2016 July 18 to 2016 October 31.

As usual, nothing is perfect in this world. In spite of the superb non-lagging properties with the Zig Zag indicator, the Zig Zag indicator can suffer from false peaks and troughs. False peaks and troughs need to be differentiated from insignificant peaks and troughs from the Bill Williams Fractal indicator and the Modified Fractal indicators. False signal is found because the Zig Zag indicator detects peaks and troughs by looking at left side of bars only. To illustrate this problem, please consider Figure 12-8. After the trough 4 appears, the Zig Zag indicator will detect the false peak 4-A at 1.0602 level because the high of the 3rd candle bar is the highest peak after trough 4. As the price continue to move up, the Zig Zag indicator will keep overriding the false peak 4-A with the false peak 4-B and 4-B with 4-C later until the true peak 4 arrive at 1.0675 level. The main difference between insignificant peak and false peak is that insignificant peak remains in the chart whereas the false peak is removed from chart when new peak arrives.

Figure 12-8: False peak demonstration for Zig Zag indicator.

For the peak-trough analysis, the primary goal is to find significant peaks and troughs to identify the tradable patterns. Choosing the indicators for your peak-trough analysis is really depending on the preferences and objectives of traders. Some traders do not like to have the false peaks. In that case, the traders should use the original Fractal indicator by Bill Williams or the Modified Fractal indicator. If you prefer to detect a peak and trough in turn without lagging, then the Zig Zag indicator should be your choice. Usually with Zig Zag indicator, you will work with far less peaks and troughs in your chart. Furthermore, Renko chart can be used alternatively over the candlestick chart. Renko chart can provide the powerful peak-trough analysis. Many professional traders found that the Renko chart provides the high clarity for detecting the price patterns shown in Figure 12-9. The basic principle of detecting peaks and troughs in the Renko chart are the same. One can apply the Fractal indicator and Zig Zag indicators to the Renko chart to detect peaks and troughs. However, in the Renko chart, sometimes, you can detect peaks and troughs with your own eyes without applying those Fractal and Zig Zag indicators.

Figure 12-9: Peaks and troughs detected on the Renko chart in EURUSD chart using 20 pips brick height from 2016 July 18 to 2016 October 31.

Once you have chosen your preferred peak-trough analysis tool, apply them to your chart for the pattern recognition task. Firstly, we illustrate how to use the peak-trough analysis to recognize patterns by identifying the boundary of the patterns in your chart. Consider Figure 12-10 in detecting consolidating price area for breakout trading. We have connected peaks to identify the top boundary of the pattern. Likewise, we have connected troughs to identify the bottom boundary of the price pattern. The overall process we have demonstrated here is not too difficult if you have the right peak-trough analysis tool. In fact, this type of pattern recognition process is typically involved in detecting the popular falling wedge and rising wedge patterns from your chart.

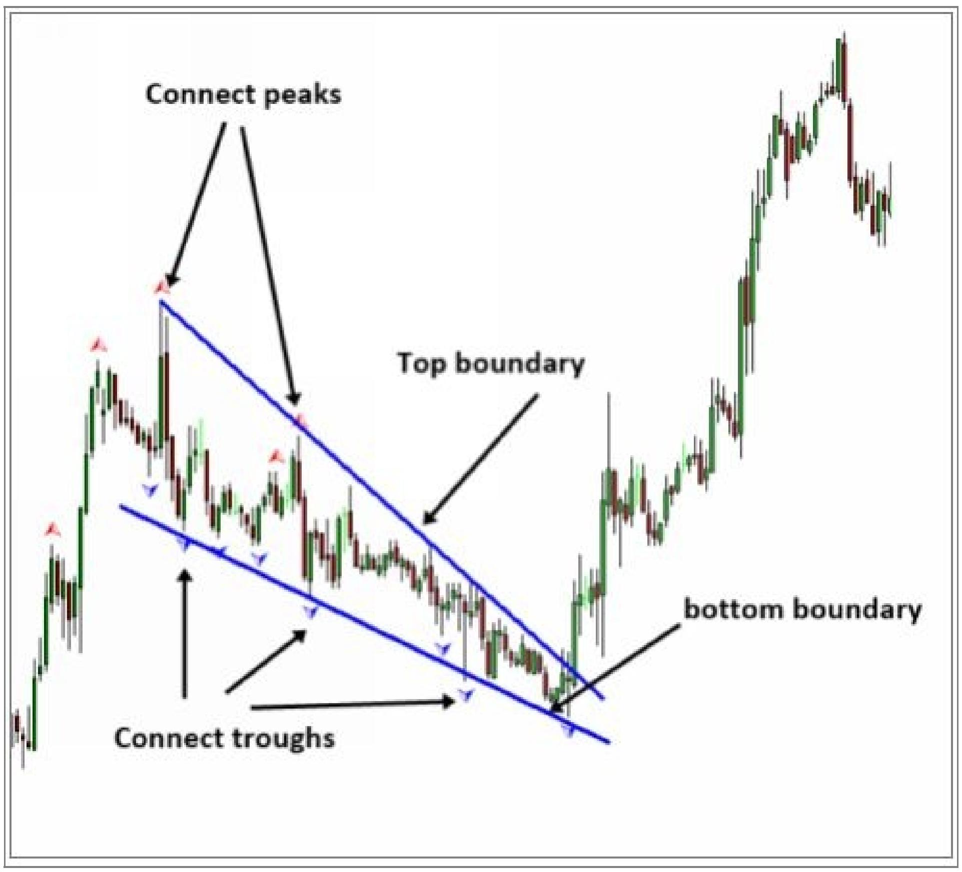

Figure 12-10: Connecting peaks and troughs to identify the price pattern for buy set up.

With the peak-trough analysis, you can also perform the ratio analysis for the scale free pattern recognition. For example, Fibonacci analysis is the typical ratio analysis conducted by traders. Before applying the Fibonacci analysis, you need to detect one significant peak and one significant trough. In the empty candlestick chart, you might have no clue where to apply your Fibonacci analysis. When the peak-trough analysis is applied in your chart, it makes your task to spot the important peak and trough much easier because you should only consider the peaks and troughs recommended by the peak-trough analysis. In Figure 12-11, we have detected the 61.8% retracement for good sell opportunity.

Figure 12-11: Detecting significant peak and trough to apply Fibonacci analysis.

The third benefit of the scenario reduction in the Fibonacci sequence analysis is generally not appreciated too much when you are doing some simple tasks as shown in Figure 12-10 and 12-11. When you detect harmonic patterns or Elliott Wave patterns from your chart, we have to exam if the multiple of peaks and troughs are in the right sequence with the specified Fibonacci ratios. For Harmonic Pattern, we need to exam the Fibonacci sequence of the successive five points. For Elliott wave, sometimes we need to exam the Fibonacci sequence for more ten successive points. To illustrate the benefits better, consider to detect a harmonic pattern from this empty candlestick chart in Figure 12-12. How many of you can detect harmonic patterns presents in this empty chart? This is not an easy task to anyone. Especially, with this empty chart, we have thousands of possibility of detecting five points for the Harmonic pattern. However, each possibility does not guarantee the successful harmonic pattern detection (Figure 12-12).

Figure 12-12: Empty candlestick chart of GBPUSD in H1 timeframe.

Now let us apply the peak-trough analysis to the same portion of the chart. With the peak-through analysis, our candidate peaks and troughs are now only six to detect the harmonic pattern (Figure 12-13). So many possibilities of drawing patterns have been reduced to few possibilities. You can certainly tell how much time and efforts you can save for your pattern recognition task with the peak-trough analysis. When we connect the two peaks and three troughs in the bottom of the chart, we can construct the bullish butterfly pattern as shown in Figure 12-14. To finalize your detection, you have to check the shape ratios for each equilibrium fractal wave (i.e. triangle). We will skip this process in this chapter because later we will dig more about harmonic patterns.

Figure 12-13: Peak-Trough Analysis applied to GBPUSD in H1 timeframe.

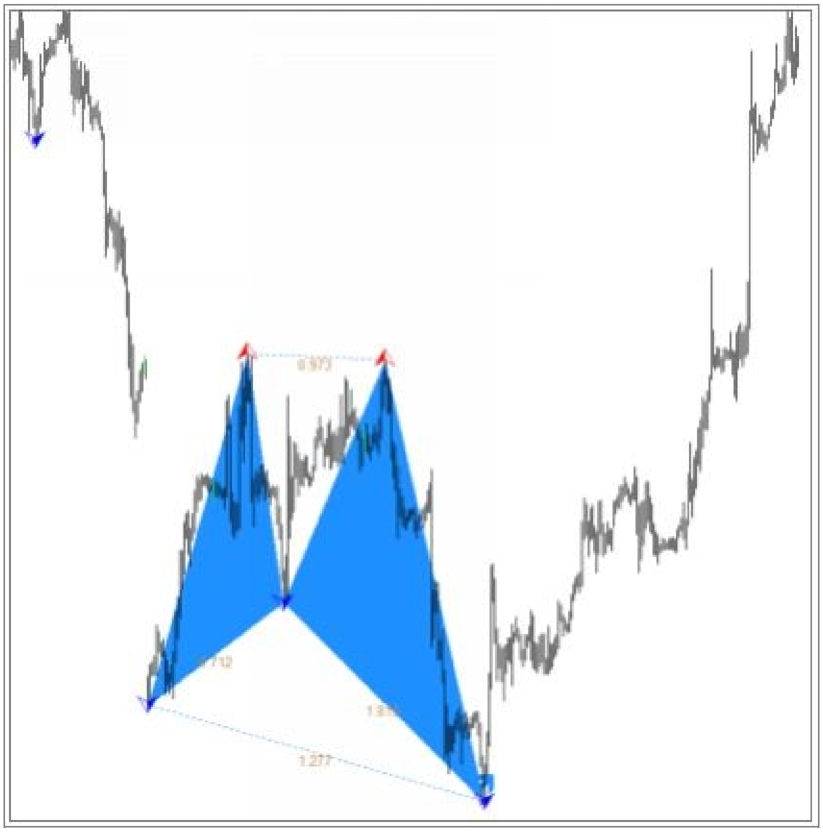

Figure 12-14: Butterfly pattern detected in GBPUSD in H1 timeframe.

13. Using Equilibrium Fractal Wave Index to Select Your Trading Strategy

We have shown the several mechanical methods of handling the peaks and troughs using the peak trough analysis. The peak trough analysis is a powerful method to visualize the equilibrium fractal waves and other EFW derived patterns in the financial market. The limitation of the peak and trough analysis is that it does not help to quantify our findings in a single quantity. There is a need for a convenient method to detect the presence of equilibrium fractal waves in the single quantity. If we can quantify them in the single quantity, then we can choose the technical analysis or trading strategy much easier for a particular currency pairs or stock prices. One might suggest to use Hurst exponent by Harold Edwin Hurst (1880-1978) or Fractal dimension coined by Mandelbrot in 1975 for the task. I spent much time with these two methods to extract some valuable information for trading. However, I found that these two methods are too general and theoretical. For the practical trading purpose, they are not so intuitive to use. The output we get from these two methods can not be readily translated into the information we need for our day trading. Instead of these two methods, I propose to use the equilibrium fractal wave index. This technique was invented by myself because I could not find other alternative method to quantify the presence of the equilibrium fractal wave. The mathematical equation for the Equilibrium Fractal Wave index is like below:

Equilibrium fractal wave index = number of the particular shape of equilibrium fractal wave / number of peaks and troughs in the price series.

As you can see from the equation, this is not rocket science at all. Although the calculation of EFW index is straightforward, the EFW index tells us the useful information in the single quantity. This gives another advantage over the peak trough analysis. For example, EFW index tells us that how often we can encounter a particular shape of equilibrium fractal wave in the financial price series. The high EFW index tells us that the frequency of having a particular shape of equilibrium fractal wave is high. Likewise, the low EFW index tells us that the frequency of having a particular shape of equilibrium fractal wave is low. Based on the relative comparison of the EFW index, we can plan which financial instrument we can trade and which particular shape of equilibrium fractal wave we will be materializing when we trade that financial instrument.

The calculation of the EFW index requires two inputs. The first input, the number of peaks and trough can be obtained by counting the peaks and troughs using the peak trough analysis. For this purpose, you can use the original fractal indictor by Bill Williams, the modified fractal indicator or Zig Zag indicators. Since the original fractal indicator can show too many insignificant peaks and troughs, we recommend using either the modified fractal indicator or Zig Zag indicators to get more accurate EFW index. In this book, we used the Zig Zag indicator to count the peaks and troughs in the price series.

After we have counted the number of peaks and troughs in our chart, we need to count number of a particular shape of equilibrium fractal waves in the price series. Before counting them, we need to decide which particular shape of equilibrium fractal wave we want to use. We have introduced the shape ratio in Chapter 10 to describe the shape of equilibrium fractal wave. Therefore, we can simply use the shape ratio to identify the particular shape of equilibrium fractal wave in the price series. To recap, the shape ratio is the ratio of current price move to the previous price move.

The shape ratio of equilibrium fractal wave = current move in price units (Y2)/

previous move in price units (Y1).

Then which shape ratio shall we choose to calculate the EFW index? Is there any guidance for it? Traditionally traders like to use the Fibonacci ratios for their trading. Therefore, we can start with the Fibonacci ratios in the first place. For example, trader often uses the Fibonacci ratios of 0.618, 0.382, 1.618 and 2.618 for their trading. Especially, these Fibonacci ratios are the important structutal assumptions in other EFW derived patterns including Harmonic patterns and Elliott Wave patterns. However, we do not have to limit our study to the Fibonacci ratios due to their popularity. We can still use the non-Fibonacci ratios if they show the significant EFW index. In this book, we will use both the Fibonacci ratios and non-Fibonacci ratios. Later we will compare the results to extract some interesting information for our trading.

Figure 13-1: one unit cycle of an equilibrium fractal wave is equivalent to a triangle.

In this demonstration, we show the EFW index for the ratios of 0.618, 0.500 and 0.382. For your information, you can always expand your experiments to other Fibonacci ratios not covered in this book like 0.786 or anything else. Table 13-1, Table 13-2 and Table 13-3 shows the EFW index respectively for the ratio 0.618, 0.500 and 0.382 for the ten major currency pairs. We found few interesting results from these tables. Firstly, we can tell that the number of a particular shape of equilibrium fractal wave present in the price series is different for different currency pairs. For example, the equilibrium fractal waves with 0.618 ratio are more common than equilibrium fractal waves with 0.500 ratio and with 0.382 ratio in general for the ten major currency pairs. This results double confirms the classic emphasis on using the ratio 0.618 for the Elliott Wave analysis. Another thing we can learn from the results is that we have to be careful with using the ratio for a specific instrument. Based on the EFW index in Table 13-1, the ratio 0.618 can yield better trading outcome for USDJPY and AUDCAD. At the same time, the ratio 0.382 can result in poor trading outcome for the USDJPY and AUDCAD because they only scores 24.2% and 23.1% respectively. This exactly complies with the statement “One trading strategy will yield different trading outcome for the different financial instruments”. In addition, we have provided the mean and sum over the aggregated EFW index for each instrument in Table 13-4 and Table 13-5. Overall, you will expect at least three equilibrium fractal waves to be formed among ten peaks and troughs (32.3%). This value justifies why we should apply the EFW based trading strategies and Fibonacci ratios for these major currency pairs.

Instrument	Start	End	Number of Equilibrium Fractal Wave	Number of Peaks and troughs	EFW Index 0.618
EURUSD	2006 09 20	2018 01 20	108	321	33.6%
GBPUSD	2007 01 04	2018 01 20	116	339	34.2%
USDJPY	2008 04 01	2018 01 20	134	326	41.1%
AUDUSD	2008 03 08	2018 01 20	117	333	35.1%
USDCAD	2008 02 19	2018 01 20	120	328	36.6%
NZDUSD	2007 08 15	2018 01 20	122	330	37.0%
EURGBP	2008 05 01	2018 01 20	130	342	38.0%
AUDNZD	2007 08 03	2018 01 20	107	325	32.9%
AUDCAD	2006 08 26	2018 01 20	137	342	40.1%
AUDJPY	2007 04 17	2018 01 20	121	315	38.4%
Average			121.20	330.10	36.7%
Stdev			9.56	8.54	2.60%

Table 13-1: Counting number of EFW triangles with the ratio 0.618 on D1 timeframe for over 3000 candle bars.

Instrument	Start	End	Number of Equilibrium Fractal Wave	Number of Peaks and troughs	EFW Index 0.382
EURUSD	2006 09 20	2018 01 20	99	321	30.8%
GBPUSD	2007 01 04	2018 01 20	95	339	28.0%
USDJPY	2008 04 01	2018 01 20	79	326	24.2%
AUDUSD	2008 03 08	2018 01 20	96	333	28.8%
USDCAD	2008 02 19	2018 01 20	73	328	22.3%
NZDUSD	2007 08 15	2018 01 20	88	330	26.7%
EURGBP	2008 05 01	2018 01 20	92	342	26.9%
AUDNZD	2007 08 03	2018 01 20	93	325	28.6%
AUDCAD	2006 08 26	2018 01 20	79	342	23.1%
AUDJPY	2007 04 17	2018 01 20	83	315	26.3%
Average			87.70	330.10	26.6%
Stdev			8.28	8.54	2.57%

Table 13-2: Counting number of EFW triangles with the ratio 0.382 on D1 timeframe for over 3000 candle bars.

Instrument	**Start**	**End**	**Number of Equilibrium Fractal Wave**	**Number of Peaks and troughs**	**EFW Index 0.500**
EURUSD	2006 09 20	2018 01 20	102	321	31.8%
GBPUSD	2007 01 04	2018 01 20	124	339	36.6%
USDJPY	2008 04 01	2018 01 20	107	326	32.8%
AUDUSD	2008 03 08	2018 01 20	112	333	33.6%
USDCAD	2008 02 19	2018 01 20	111	328	33.8%
NZDUSD	2007 08 15	2018 01 20	108	330	32.7%
EURGBP	2008 05 01	2018 01 20	129	342	37.7%
AUDNZD	2007 08 03	2018 01 20	103	325	31.7%
AUDCAD	2006 08 26	2018 01 20	109	342	31.9%
AUDJPY	2007 04 17	2018 01 20	108	315	34.3%
Average			111.30	330.10	33.7%
Stdev			8.22	8.54	1.94%

Table 13-3: Counting number of EFW triangles with the ratio 0.500 on D1 timeframe for over 3000 candle bars.

Instrument	**Start**	**End**	**Number of Equilibrium Fractal Wave**	**Number of Peaks and troughs**	**EFW Index Mean**
EURUSD	2006 09 20	2018 01 20	103.00	321.00	32.1%
GBPUSD	2007 01 04	2018 01 20	111.67	339.00	32.9%
USDJPY	2008 04 01	2018 01 20	106.67	326.00	32.7%
AUDUSD	2008 03 08	2018 01 20	108.33	333.00	32.5%
USDCAD	2008 02 19	2018 01 20	101.33	328.00	30.9%
NZDUSD	2007 08 15	2018 01 20	106.00	330.00	32.1%
EURGBP	2008 05 01	2018 01 20	117.00	342.00	34.2%
AUDNZD	2007 08 03	2018 01 20	101.00	325.00	31.1%
AUDCAD	2006 08 26	2018 01 20	108.33	342.00	31.7%
AUDJPY	2007 04 17	2018 01 20	104.00	315.00	33.0%
Average			106.73	330.10	32.3%
Stdev			4.68	8.54	0.93%

Table 13-4: Average of the EFW index for ten major currency pairs for the Fibonacci ratio 0.618, 0.382 and 0.500.

Instrument	**Start**	**End**	**Number of Equilibrium Fractal Wave**	**Number of Peaks and troughs**	**EFW Index Sum**
EURUSD	2006 09 20	2018 01 20	309	963	96.3%
GBPUSD	2007 01 04	2018 01 20	335	1017	98.8%
USDJPY	2008 04 01	2018 01 20	320	978	98.2%
AUDUSD	2008 03 08	2018 01 20	325	999	97.6%
USDCAD	2008 02 19	2018 01 20	304	984	92.7%
NZDUSD	2007 08 15	2018 01 20	318	990	96.4%
EURGBP	2008 05 01	2018 01 20	351	1026	102.6%
AUDNZD	2007 08 03	2018 01 20	303	975	93.2%
AUDCAD	2006 08 26	2018 01 20	325	1026	95.0%
AUDJPY	2007 04 17	2018 01 20	312	945	99.0%
Average			320.20	990.30	97.0%
Stdev			14.03	25.61	2.80%

Table 13-5: Sum of the EFW index for ten major currency pairs for the Fibonacci ratio 0.618, 0.382 and 0.500.

In addition, we have listed the EFW index for the non-Fibonacci based ratios to release your curiosity. Table 13-6, Table 13-7 and Table 13-8 shows the EFW index respectively for the ratio 0.300, 0.450 and 0.850. We intentionally selected some random shape ratios. These ratios are not typically considered as the Fibonacci ratios among traders. To provide you some additional information for your trading, we did the same experiment for these non-Fibonacci ratio based triangles on the ten major currency pairs. If you are a trader, you might think that non-Fibonacci ratios will not provide us any significant results. You are only partially right on it. For the ratio 0.300, indeed, the EFW index was much less significant comparing to the EFW index with the three Fibonacci ratios. However, for the ratio 0.450 and the ratio 0.850, we have equally significant EFW index for the ten major currency pairs in comparison to the Fibonacci ratio based triangles. Especially, the average EFW index for the ratio 0.850 was even higher than the average of the ratio 0.618 by 8%. This leaves us an interesting question why the ratio 0.850 can beat the golden ratio 0.618, which were used for decades by traders and scientist. At the moment, no clear answer can be found. What is certain here is that the shape of equilibrium fractal wave isn't limited on the Fibonacci ratio only.

Based on the analysis, using the traditional Fibonacci ratios like 0.618, 0.500 and 0.382 is not a bad idea for your trading. However, there are definitely some rooms we can use the non-Fibonacci ratio triangles for our trading too. Since the EFW index can help you to find the most frequently occurring shape of the equilibrium fractal wave, you can do some brutal force search to find the most optimal ratios for any specific currency pairs or stock price series. What should we do if the currency pairs or stock price have very small EFW index? The small EFW index tells that there is no significant number of equilibrium fractal waves in the financial market. For example, if your EFW index is less than 10% for any of the Fibonacci ratios including 0.618, 0.382 or 0.500, etc, then you should not use the Fibonacci ratios or other EFW derived patterns including the Elliott Wave, Harmonic Pattern Trading.

If the EFW index for the financial instrument is generally low for both for the Fibonacci based ratios and non-Fibonacci based ratios, then you might assume that that financial instrument consist of other price patterns than the equilibrium fractal wave patterns. Therefore, you will need to consider using the trading strategies or technical analysis designed for first, second, third or fourth regularities. If they are the financial instruments with high liquidity, then you might try to apply the trading strategy or technical analysis designed for the fourth regularity. To get evidence of fourth regularity, you need to use some cycle analysis tools like Fourier transformation, Principle component analysis, wavelet transformation, etc. Besides the fourth regularity, they might possess the seasonality and trend together. Then, you might have to apply the trading strategy or technical analysis designed for second and third regularities. Assuming the presence of seasonality and trend are strong, several techniques like classic decomposition theory, X12 ARIMA and other exponential smoothing based techniques. The good news is that there are well-established routine for this already among the science community.

If the EFW index is high, then it is the generally good sign that the currency pairs or stock price possesses the strong fifth regularity. In that case, we can use the EFW based trading strategies including harmonic pattern, Elliott wave, triangle and wedge patterns or you can trade equilibrium fractal wave directly. In addition, you can fine tuning your trading strategy based on the EFW index values. For example, if you find the EFW index for a particular shape ratio is weak, then you should avoid using the ratio in your trading. For example, in Table 13-2, USDCAD shows only 22.3% of the EFW index for the ratio 0.382 while AUDUSD shows 36.6% of the EFW index for the ratio 0.618. In that case, you can try to avoid using the ratio 0.382 in your trading for AUDCAD.

In summary, we have introduced the brand new technique called “Equilibrium fractal wave index” to confirm the presence of the particular shape of equilibrium fractal wave in the financial market in a single quantity. EFW index can be calculated for any financial market data including currency pairs, stock market and commodity market as long as their open, high, low and close price are available in series.

For your trading, the EFW index can be used:

- To confirm the presence of equilibrium fractal waves and other EFW derived patterns including harmonic pattern and Elliott wave.
- To fine tune your trading strategy and the Fibonacci ratios.

- To select the financial market which your trading strategy can perform the better.

In this book, we have only listed the EFW index for ten major currency pairs. We have already introduced how to calculate EFW index in this book. Calculating EFW index for any financial price series is simple. If you are trading other financial instruments rather than the ten major currency pairs, then you might consider conducting your own research for the financial market of your interest using the EFW index. They will reveal a lot of useful information for your winning trading and investment.

Instrument	Start	End	Number of Equilibrium Fractal Wave	Number of Peaks and troughs	EFW Index 0.300
EURUSD	2006 09 20	2018 01 20	65	321	20.2%
GBPUSD	2007 01 04	2018 01 20	62	339	18.3%
USDJPY	2008 04 01	2018 01 20	65	326	19.9%
AUDUSD	2008 03 08	2018 01 20	75	333	22.5%
USDCAD	2008 02 19	2018 01 20	51	328	15.5%
NZDUSD	2007 08 15	2018 01 20	53	330	16.1%
EURGBP	2008 05 01	2018 01 20	56	342	16.4%
AUDNZD	2007 08 03	2018 01 20	72	325	22.2%
AUDCAD	2006 08 26	2018 01 20	54	342	15.8%
AUDJPY	2007 04 17	2018 01 20	58	315	18.4%
Average			61.10	330.10	18.5%

Stdev			7.73	8.54	2.47%

Table 13-6: Counting number of EFW triangles with the ratio 0.300 on D1 timeframe for over 3000 candle bars.

Instrument	**Start**	**End**	**Number of Equilibrium Fractal Wave**	**Number of Peaks and troughs**	**EFW Index 0.450**
EURUSD	2006 09 20	2018 01 20	101	321	31.5%
GBPUSD	2007 01 04	2018 01 20	114	339	33.6%
USDJPY	2008 04 01	2018 01 20	88	326	27.0%
AUDUSD	2008 03 08	2018 01 20	109	333	32.7%
USDCAD	2008 02 19	2018 01 20	91	328	27.7%
NZDUSD	2007 08 15	2018 01 20	90	330	27.3%
EURGBP	2008 05 01	2018 01 20	113	342	33.0%
AUDNZD	2007 08 03	2018 01 20	92	325	28.3%
AUDCAD	2006 08 26	2018 01 20	90	342	26.3%
AUDJPY	2007 04 17	2018 01 20	104	315	33.0%
Average			99.20	330.10	30.1%
Stdev			9.72	8.54	2.81%

Table 13-7: Counting number of EFW triangles with the ratio 0.450 on D1 timeframe for over 3000 candle bars.

Instrument	**Start**	**End**	**Number of Equilibrium Fractal Wave**	**Number of Peaks and troughs**	**EFW Index 0.850**
EURUSD	2006 09 20	2018 01 20	138	321	43.0%
GBPUSD	2007 01 04	2018 01 20	147	339	43.4%
USDJPY	2008 04 01	2018 01 20	150	326	46.0%
AUDUSD	2008 03 08	2018 01 20	145	333	43.5%
USDCAD	2008 02 19	2018 01 20	170	328	51.8%
NZDUSD	2007 08 15	2018 01 20	146	330	44.2%
EURGBP	2008 05 01	2018 01 20	150	342	43.9%
AUDNZD	2007 08 03	2018 01 20	135	325	41.5%
AUDCAD	2006 08 26	2018 01 20	152	342	44.4%
AUDJPY	2007 04 17	2018 01 20	140	315	44.4%
Average			147.30	330.10	44.6%
Stdev			9.22	8.54	2.64%

Table 13-8: Counting number of EFW triangles with the ratio 0.850 on D1 timeframe for over 3000 candle bars.

Instrument	**Start**	**End**	**Number of Equilibrium Fractal Wave**	**Number of Peaks and troughs**	**EFW Index Mean**
EURUSD	2006 09 20	2018 01 20	101.33	321.00	31.6%
GBPUSD	2007 01 04	2018 01 20	107.67	339.00	31.8%
USDJPY	2008 04 01	2018 01 20	101.00	326.00	31.0%
AUDUSD	2008 03 08	2018 01 20	109.67	333.00	32.9%
USDCAD	2008 02 19	2018 01 20	104.00	328.00	31.7%
NZDUSD	2007 08 15	2018 01 20	96.33	330.00	29.2%
EURGBP	2008 05 01	2018 01 20	106.33	342.00	31.1%
AUDNZD	2007 08 03	2018 01 20	99.67	325.00	30.7%
AUDCAD	2006 08 26	2018 01 20	98.67	342.00	28.8%
AUDJPY	2007 04 17	2018 01 20	100.67	315.00	32.0%
Average			102.53	330.10	31.1%
Stdev			4.03	8.54	2.6%

Table 13-9: Average of the EFW index for ten major currency pairs for the Fibonacci ratio 0.300, 0.450 and 0.850.

Instrument	**Start**	**End**	**Number of Equilibrium Fractal Wave**	**Number of Peaks and troughs**	**EFW Index Sum**
EURUSD	2006 09 20	2018 01 20	304	963	94.7%
GBPUSD	2007 01 04	2018 01 20	323	1017	95.3%
USDJPY	2008 04 01	2018 01 20	303	978	92.9%
AUDUSD	2008 03 08	2018 01 20	329	999	98.8%
USDCAD	2008 02 19	2018 01 20	312	984	95.1%
NZDUSD	2007 08 15	2018 01 20	289	990	87.6%
EURGBP	2008 05 01	2018 01 20	319	1026	93.3%
AUDNZD	2007 08 03	2018 01 20	299	975	92.0%
AUDCAD	2006 08 26	2018 01 20	296	1026	86.5%
AUDJPY	2007 04 17	2018 01 20	302	945	95.9%
Average			307.60	990.30	93.2%
Stdev			12.10	25.61	3.55%

Table 13-10: Sum of the EFW index for ten major currency pairs for the Fibonacci ratio 0.300, 0.450 and 0.850.

14. Appendix-Equilibrium Fractal Wave Derived Patterns

Equilibrium Fractal Wave process is the fifth regularity in the Price Pattern Table. Simply speaking, the regularity is based on the repeating geometric patterns in the financial market. The fifth regularity is characterized by its infinite cycle. In this appendix, we share the moments that we have captured the appearance of the equilibrium Fractal Wave process in the financial market. We hope that you can develop some intuition behind the Equilibrium Fractal-Wave process or the fifth regularity in our Price Pattern Table (Figure 3-3 and Figure 3-4). Reader should also note that the infinite cycles in Equilibrium fractal wave process are implicitly resulted from the varying scale of the repeating patterns.

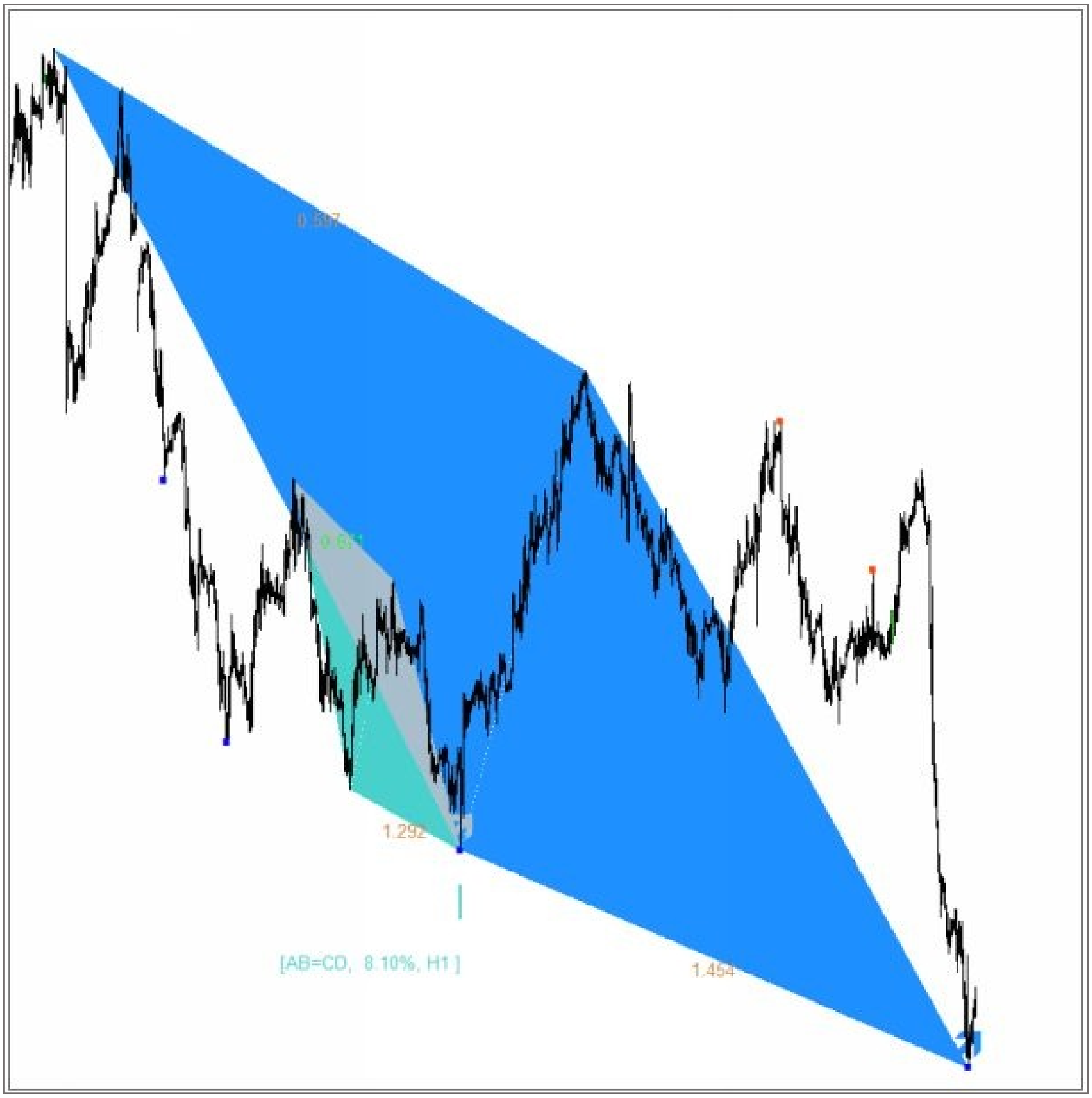

Figure 14-1: Small ABCD pattern (H1 timeframe) inside greater ABCD pattern (D1 timeframe) in EURUSD. All patterns were detected by automatic pattern detection algorithm.

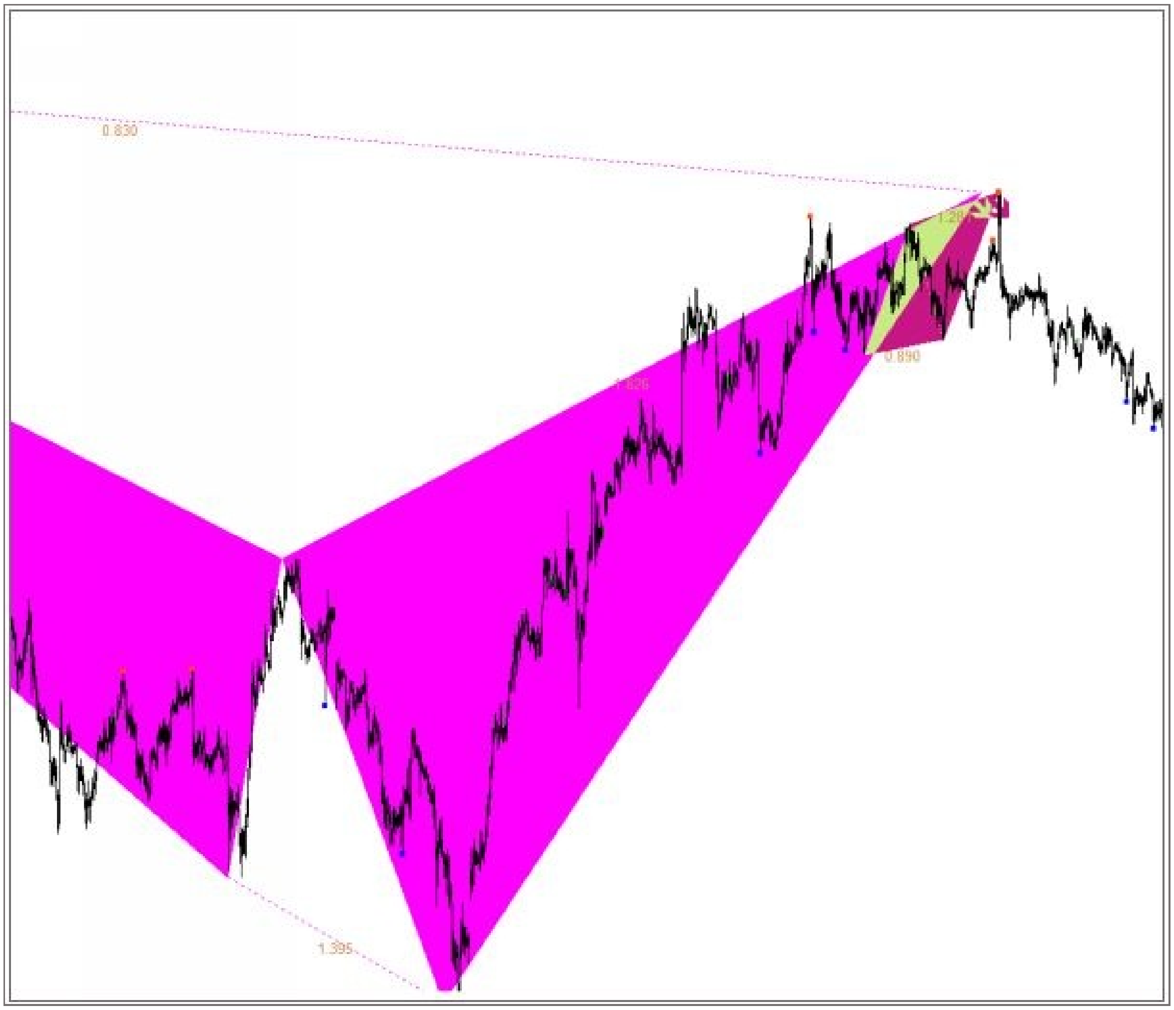

Figure 14-2: ABCD pattern (H1 timeframe) inside greater Cypher pattern (D1 timeframe) in USDJPY. All patterns were detected by automatic pattern detection algorithm.

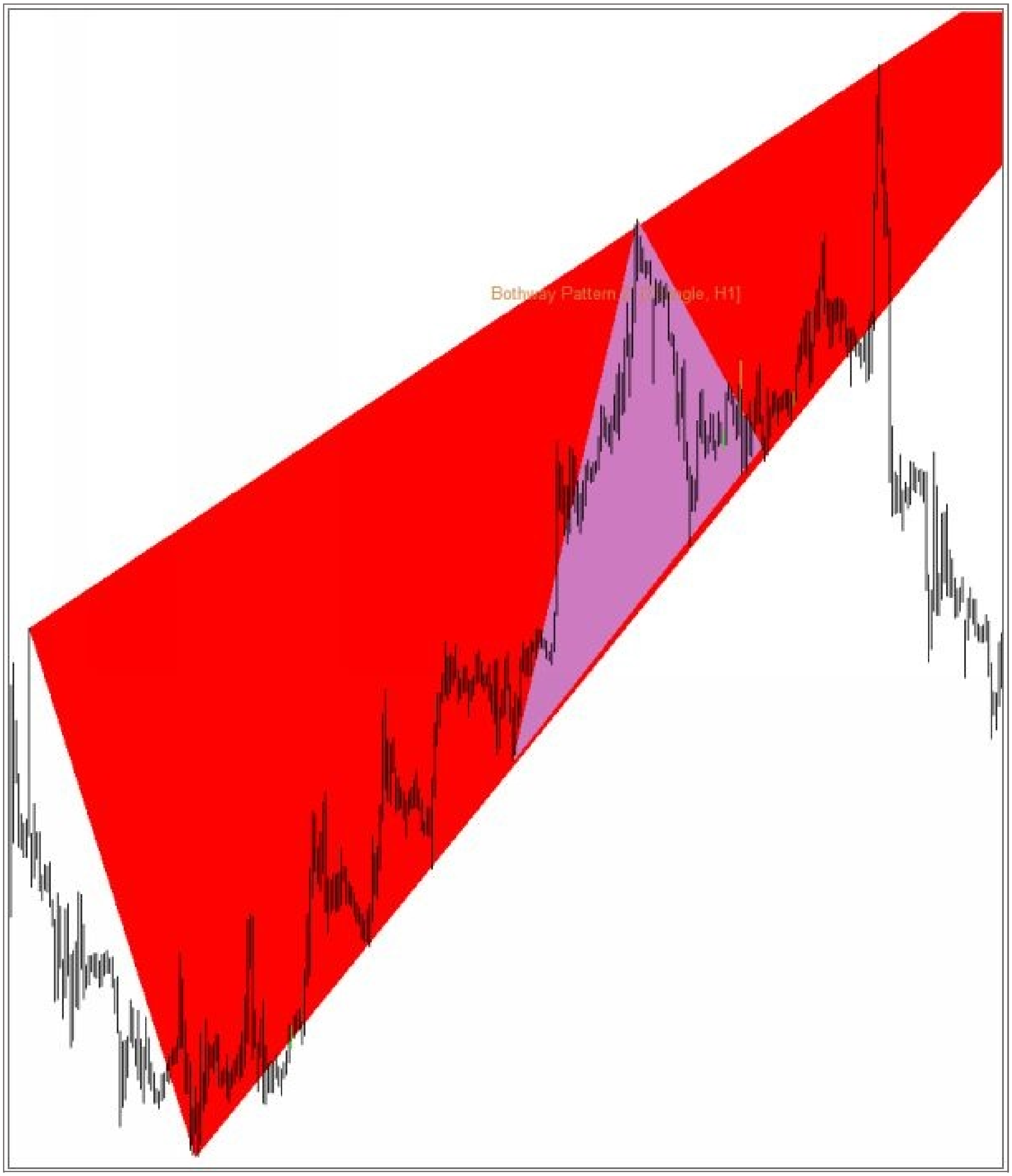

Figure 14-3: Triangle pattern (H1 timeframe) and rising wedge pattern (H1 timeframe) in EURGBP. All patterns were detected by automatic pattern detection algorithm.

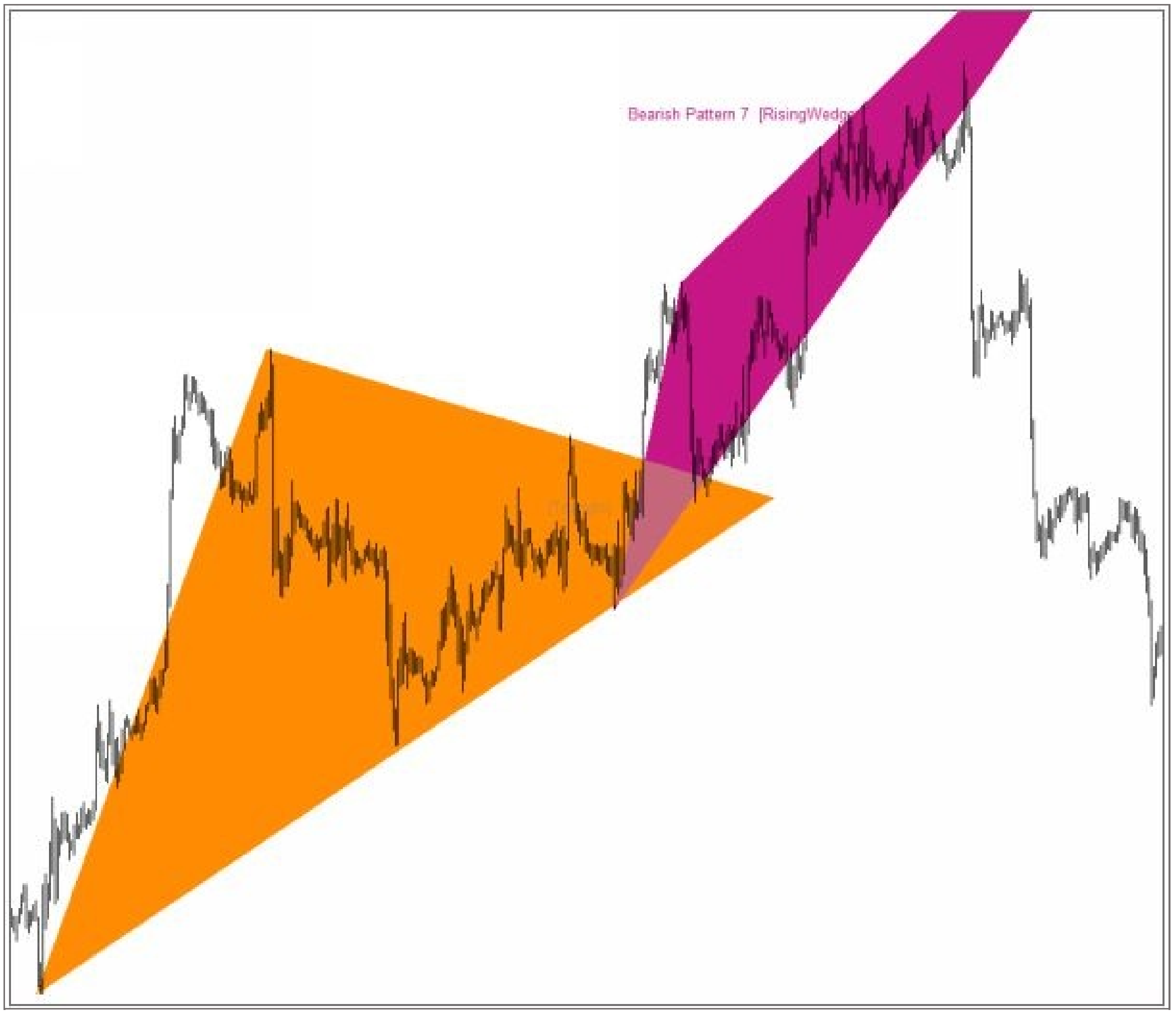

Figure 14-4: Triangle pattern (H1 timeframe) and rising wedge pattern (H1 timeframe) in GBPUSD. All patterns were detected by automatic pattern detection algorithm.

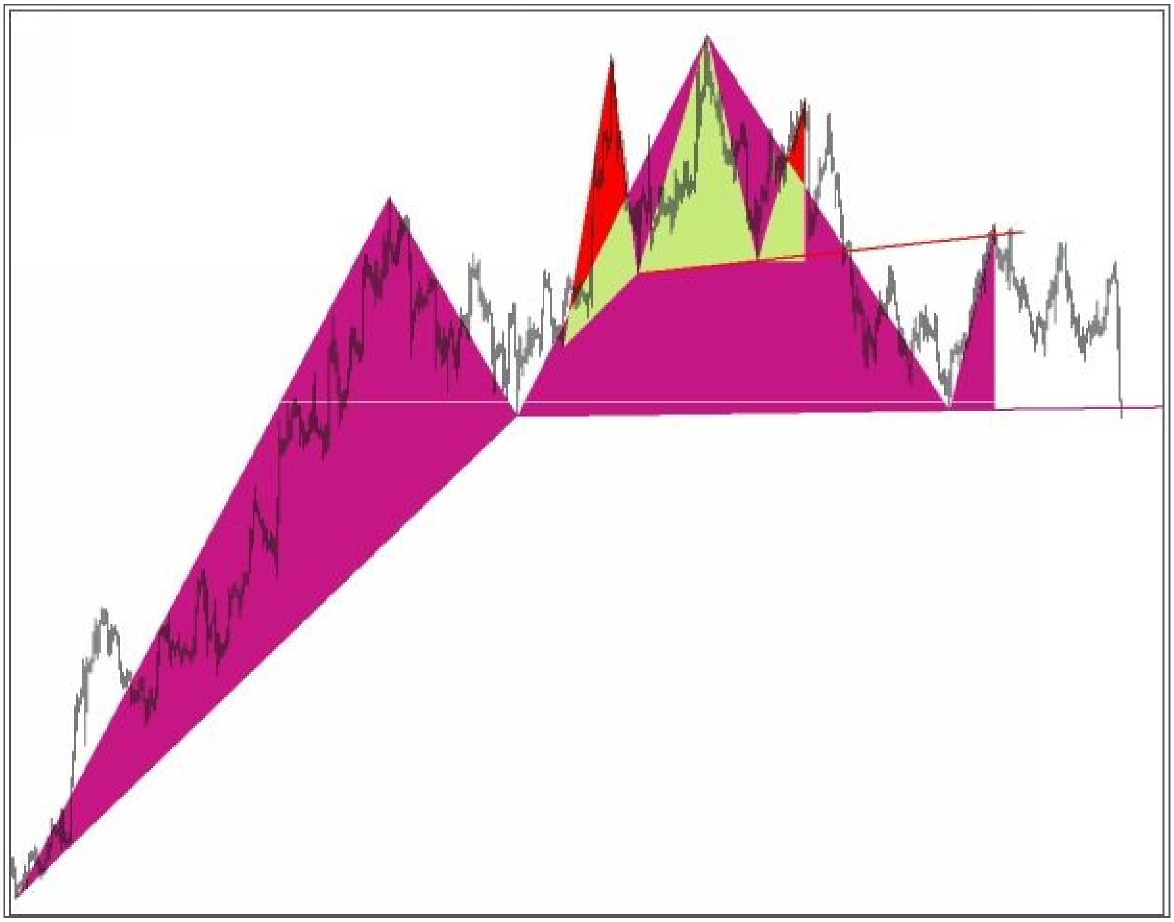

Figure 14-5: Head and Shoulder pattern (H1 timeframe) inside greater head and shoulder pattern (D1 timeframe) in EURUSD. All patterns were detected by automatic pattern detection algorithm.

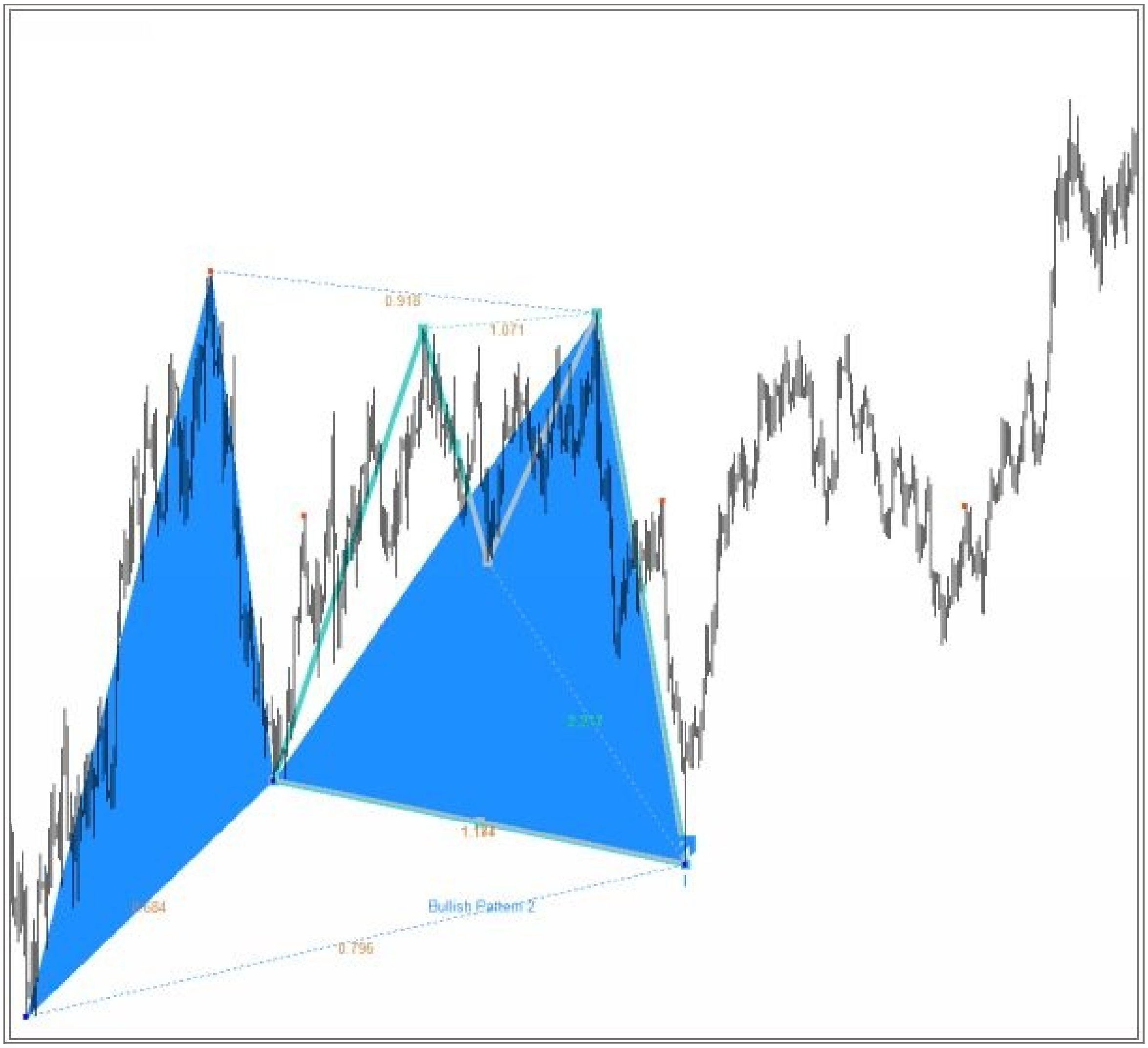

Figure 14-6: Shark pattern (H4 timeframe) inside greater Gartley pattern (D1 timeframe) in AUDUSD. All patterns were detected by automatic pattern detection algorithm.

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Price Action and Pattern Trading

Subtitle: 2nd Training in Price Action and Pattern Trading Course

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Overview on Practical Trading with the Fifth Regularity

As we have shown in the Price Pattern Table in Figure 3-3 and Figure 3-4 in the 1st training course, we have identified the five regularities in the financial market. We can make use of these five regularities to predict financial market for our trading. It is wise to assume that no single trading strategy can work for all the price patterns or for the five regularities listed in Figure 3-3 and Figure 3-4. In fact, a trading strategy is designed to deal with one or few price patterns in Figure 3-3 and Figure 3-4. For this reason, we have to make the choice over the trading strategy we are going to use. It is important to use the right trading strategy to deal with the specific price patterns in our chart. The focus of this book is to present the practical trading strategies to deal with equilibrium fractal waves and other EFW derived patterns in the price series. The five characteristics of equilibrium fractal wave include:

- Repeatability
- Extension (transformation)
- Jaggedness (overlapping)
- Infinite scales (or infinite cycle periods)
- Loose self-similarity (heterogeneity)

These five characteristics can be used to guide your trading with equilibrium fractal wave or other EFW derived patterns. Trading with equilibrium fractal wave or the EFW derived patterns require both discipline and experience. If you try to practice your trading without understanding these five characteristics, then it will take long time to master those techniques. Therefore, we do recommend going back to the first training if you are still clear about these five characteristics.

Since varying scales of the patterns represents the infinite number of cycle periods, the smoothing algorithm based techniques can fail to extract useful insight from these price patterns. In fact, the pattern recognition for the practical trading is a challenging task for traders. In the 1st training course, we have emphasized that the Peak Trough Analysis can be a great help for our pattern recognition task. We have also outlined the three important benefits of using the peak-trough analysis for our practical pattern recognition. The three important benefits include:

- Pattern recognition by identifying the boundary of the patterns.
- Ratio analysis for the scale free pattern recognition.
- Scenario reduction in the Fibonacci sequence analysis.

Furthermore, we have shown how to use "Equilibrium Fractal Wave index" to confirm the presence of particular shape of equilibrium fractal waves in the financial price series. The EFW index can be used:

- To know that any EFW based trading strategies, like harmonic pattern and Elliott wave theory, are suitable for the financial market of your interest.
- To fine tune your trading strategy and Fibonacci ratios.
- To select the financial market which your trading strategy can perform the best.

In the 2nd training, we will present the several practical trading strategies, which is designed to deal with equilibrium fractal wave and the EFW derived patterns. In the first chapter, we will cover the support and resistance trading in details. The support and resistance trading is one of the most popular trading techniques used in the world of trading. At the same time, the concept of support and resistance is the backbone of many advanced trading strategies. If you understand how support and resistance work, you can typically accelerate your learning with other trading strategy. Furthermore, the book connects the concept of support and resistance to the equilibrium fractal wave trading. In the equilibrium fractal wave trading, we introduce how to use the “equilibrium fractal wave index”, “shape ratio” and “equilibrium fractal wave channel” for your trading. After equilibrium fractal wave trading, we will introduce three other trading strategies based on the EFW derived patterns.

The three trading strategies for the EFW derived patterns include Harmonic Pattern, Elliott Wave Theory and triangle and wedge patterns. These three trading techniques are nearly 80 years old but still practiced by many financial traders. Harmonic Pattern is one of the best example to trade with the repeating price patterns from the financial market. The first Harmonic Pattern was discovered by Gartley in 1935. Since it was described in the 222 page on his book, trader calls it as Gartley 222 pattern. Later the Harmonic Pattern becomes more popular with the work of Pesavento and Shapiro in 1997. After that, many other variations of harmonic patterns were reported among traders. They follow the similar rule to Gartley 222 pattern but they use different Fibonacci ratios in defining the patterns. Elliott Wave Theory is another popular technique to study the repeating price patterns from the financial market. The technique was developed by Elliott in 1930s. He developed the theory to describe the price pattern made up from the crowd behaviour in the stock market. The detailed description about his theory is illustrated well in his two books in 1948 and 1982. Apparently, his two books were published much later due to his illness. Triangle and wedge patterns are another important class of the patterns to explain the existence of Equilibrium Fractal-Wave process in the financial market. Triangle and wedge patterns were extensively illustrated under the same book published by Gartley in 1935. Gartley’s work on triangle and wedge patterns was the extended work from the work done by Schabacker in 1932. Some years later, Elliott also tried to explain triangle and wedge patterns using his Wave Principle.

1. Support and Resistance

As a trader, I can not emphasize enough about the importance of support and resistance. Support and resistance is the most popular technical analysis tool in the world of trading. Furthermore, the concept of support and resistance are the basis of many advanced trading strategies too. In fact, many of the advanced trading strategies taught in this book including Harmonic Pattern and Elliott Wave are also partly based on the concept of support and resistance. If you do not have good understanding over the support and resistance, it is recommended staying away from the day trading. Many educational materials do mention about support and resistance but in brief. Different textbooks only discuss them in several different angles and it is difficult to find some unified language talking over the support and resistance. Many book will suggest that support and resistance consists of three or more points touching the same line. On the other hand, some book might mention that support and resistance are the respective levels that you should watch out for your trading. They are correct. However, comparing to its mega popularity, most of the textbook provide the very brief description only. Such a brief description is generally not sufficient for your trading.

With the help of the concept of the Fifth Regularity (i.e. the Equilibrium Fractal-Wave), we can visualize the price action much clearly around the support and resistance. At the same time, the visualized price action can be further used to derive the entry and exit for your trading. The visualized price action can be applied when you trade with the support and resistance purely. However, the same knowledge can be used to trade with Harmonic Pattern, Elliott Wave, Triangle and Wedge Patterns as these techniques are designed to deal with the Fifth Regularity too. Therefore, we recommend this chapter as the compulsory reading for your trading. In this chapter, we will show you several important classes of support and resistance for your trading. Then we will visualize the price action around the support and resistance to help you get going with your trading. In identifying the support and resistance in this book, we use the free Peak Trough Analysis tool from our website: www.algotrading-investment.com.

1.1 Horizontal Support and Resistance

Support and resistance techniques are one of the most popular trading strategy for many day traders. Support is the price level at which buying is stronger than selling. Hence, the declining of the price below the support levels is often refused. Typically, support level is located below the current market price. Likewise, resistance is the price level at which selling is stronger than buying. Hence, the rising of the price above the resistance level is often refused. Typically, the resistance level is located above the current market price of the instrument. In fact, several support and resistance techniques are the direct pattern recognition techniques to deal with the equilibrium fractal waves in the price series. However, trader should note that not all the support resistance techniques are the valid tool to deal with the equilibrium fractal waves. For example, the pivot levels derived from the pivot analysis can be used as support and resistance for your trading. In fact, many textbook will introduce the pivot analysis as the kind of the support and resistance tool. However, consider how to derive the pivot levels from the standard pivot calculation equations below:

- Pivot Point (P) = (High + Low + Close)/3
- Support 1 (S1) = (P x 2) - High
- Support 2 (S2) = P - (High - Low)
- Resistance 1 (R1) = (P x 2) - Low
- Resistance 2 (R2) = P + (High - Low)

, where High, Low and Close are the High, Low and Close of the previous candle bar.

As you can see, the median price, Pivot Point, of the previous candle bar is calculated first. Then the median price is used to derive the support and resistance 1 and 2. We can clearly see that this pivot analysis have nothing to do with any pattern recognition from your chart. It rather uses the concept of averaging and volatility from the centre of the pivot point. One can extend the standard pivot analysis using Fibonacci ratio. However, the extended pivot analysis is still not the direct pattern recognition either.

When we say the support and resistance as in the direct pattern recognition, we are talking about creating support and resistance levels by connecting peak to peak and by connecting trough to trough in your chart. For example, Figure 1-1 shows the support example on GBPUSD H4 timeframe. By connecting three troughs in the chart, we could identify the important support level and we can project the level for the next point for our trading. When the price was approaching to the support level fourth time, the price made a reversal (turning point) movement on the support level. This is what happened at least on the surface. However, what is exactly going on behind the scene? In fact, the support levels are the manifest of the propagation of the Equilibrium Fractal Wave through the price. To demonstrate the propagation of the Equilibrium Fractal Wave, we have added the Zig Zag line on each trough in Figure 1-1. When the price touches the support level each time, new triangle is added to the price wave. The price can continue like this making few more touches on the support level. Sometimes, it is common to see the support with five or more touches. In general, when the vertexes of several non-overlapping triangles are aligned through a straight line below the market price, the straight line becomes the support level.

In our first support example (Figure 1-1), we have visualized the reversal price action around the support. However, it is possible that we can have the support predicting the breakout movement instead of the reversal. For example, the USDJPY in Figure 1-2 penetrated through the support making the breakout on its fourth touch. When the price breakout below the support level, we can see that the size of the last triangle was transformed to be bigger. This is the typical price action when the new equilibrium source is introduced to the market.

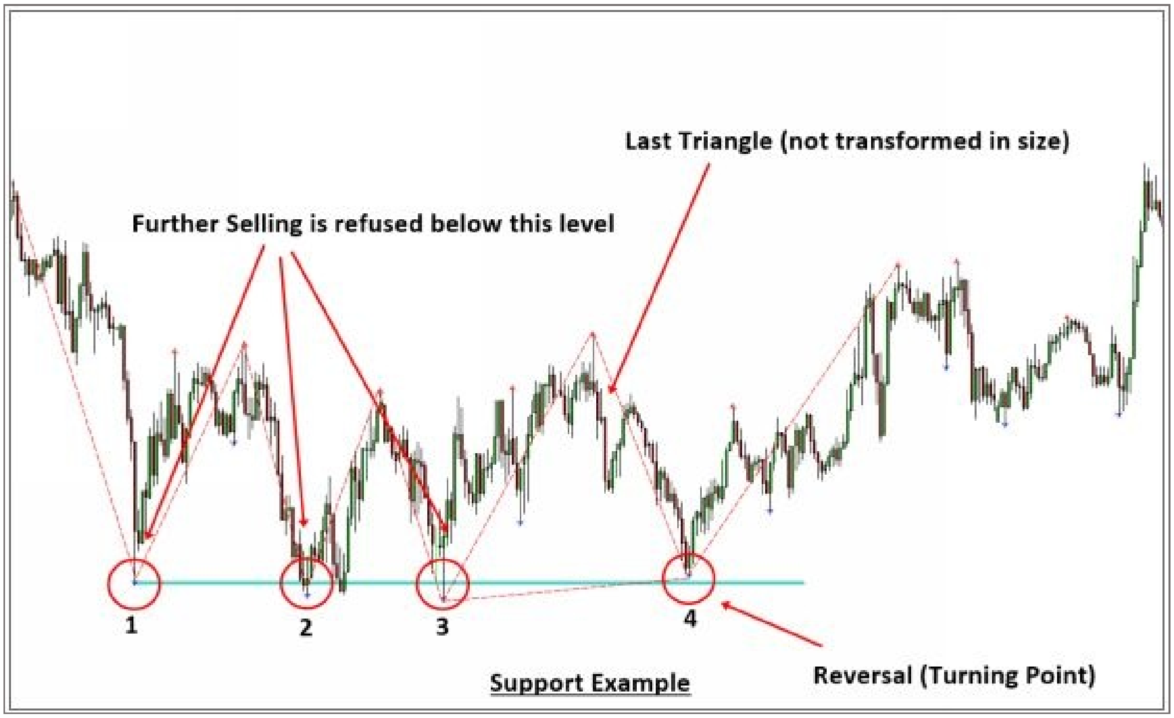

Figure 1-1: Support example as in the direct pattern recognition on GBPUSD H4 timeframe.

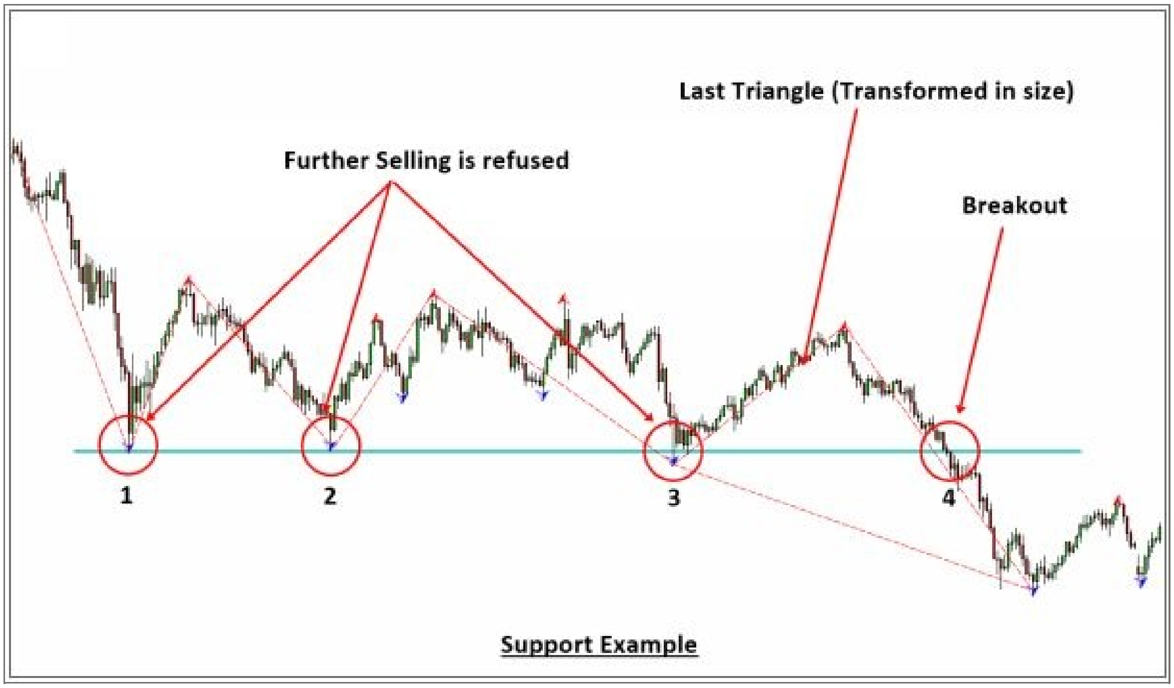

Figure 1-2: Support Example as in the direct pattern recognition on USDJPY H4 timeframe.

Now let us have a look at the resistance example. As before, we can identify the important resistance levels by connecting peak to peak. In Figure 1-3, we have connected three peaks to identify the resistance level. The price made a reversal (turning point) in its fourth touch on the resistance level. As in the support level, the resistance levels are formed when the vertexes of the several non-overlapping triangles are aligned near the same horizontal level. In this time, the horizontal levels will be located above the market price. As in the support example, it is possible to have a breakout through the resistance too. For example, the EURUSD in Figure 1-4 made a clean breakout on its seventh touch on the resistance level. In this example, the last triangle was transformed in its size as in the support example of Figure 1-2. By summarizing both support and resistances examples, we can identify four different horizontal support and resistance patterns for your trading as shown in Table 1-1.

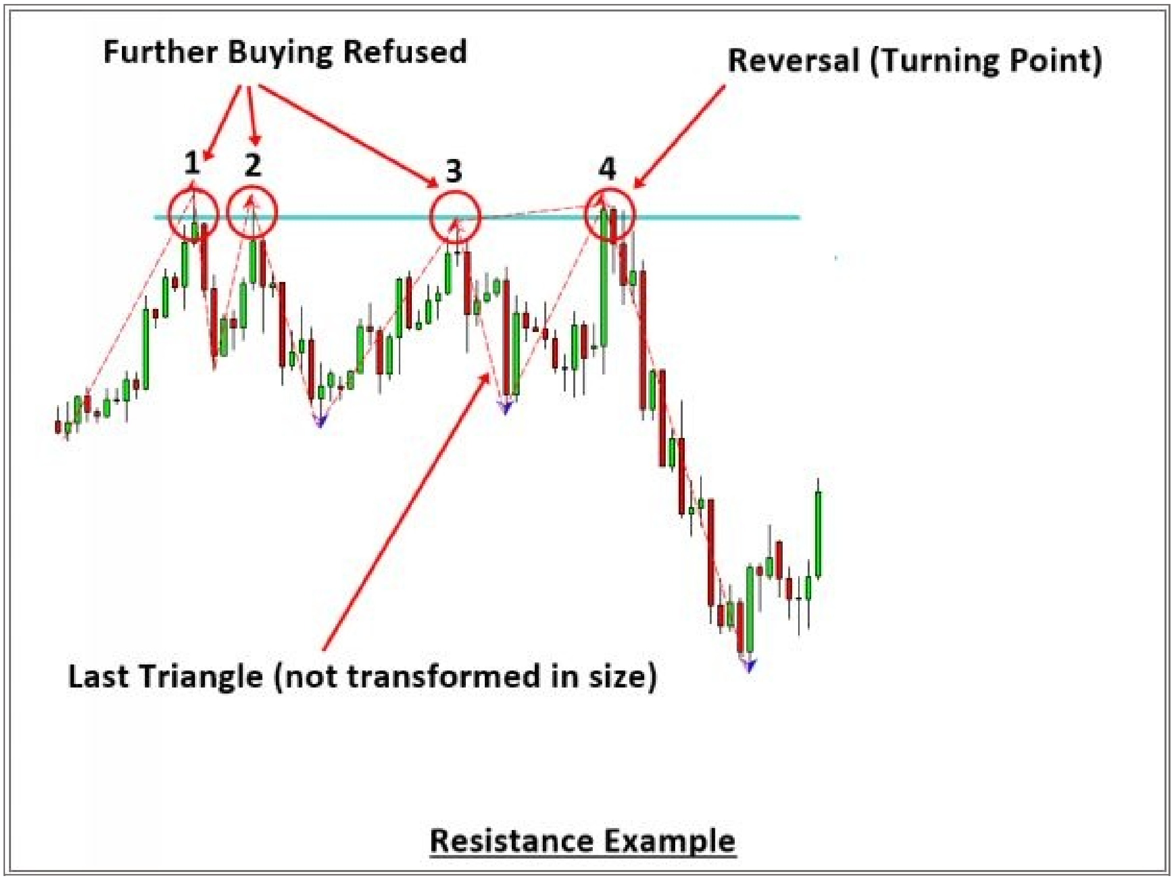

Figure 1-3: Resistance example as in the direct pattern recognition on GBPUSD H4 timeframe.

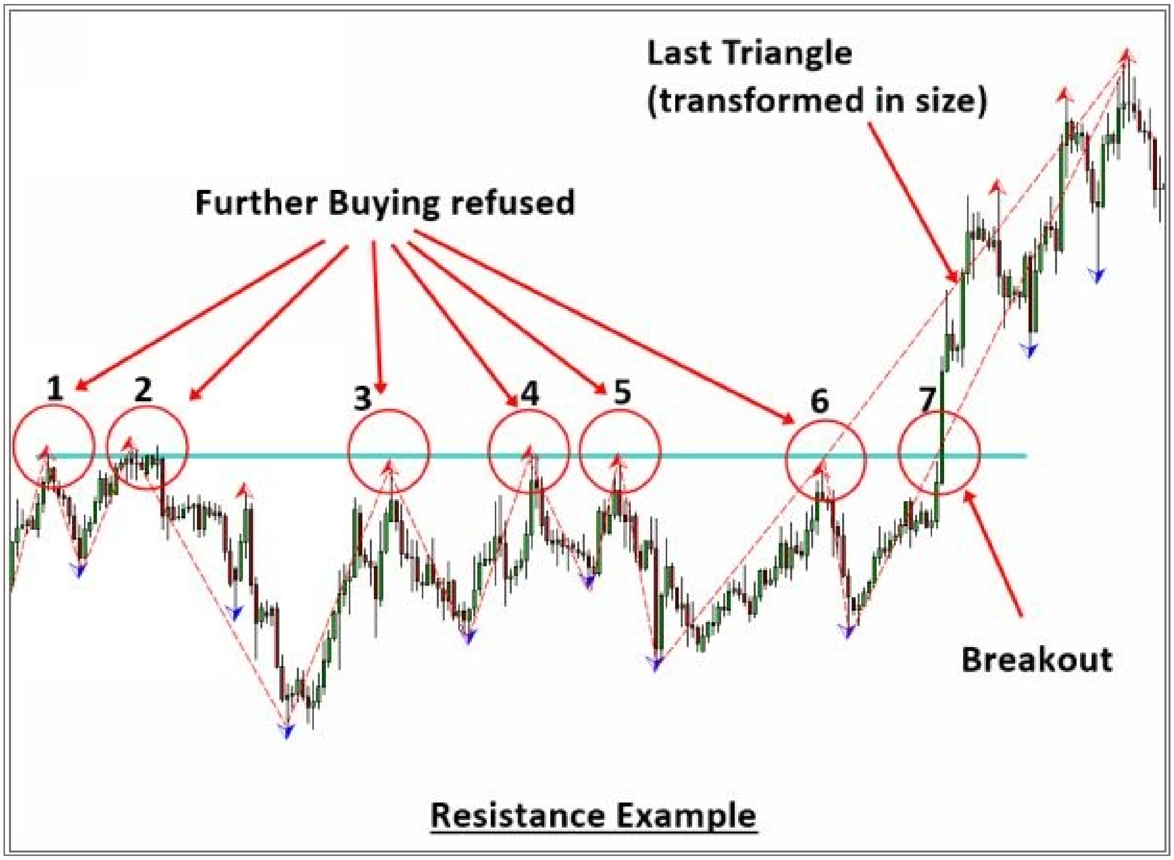

Figure 1-4: Resistance example as in the direct pattern recognition on EURUSD H4 timeframe.

Support and resistance	**Price Action**	**Direction**	**Example**
Horizontal Support	Reversal	Buy	Figure 1-1
Horizontal Support	Breakout	Sell	Figure 1-2
Horizontal Resistance	Reversal	Sell	Figure 1-3
Horizontal Resistance	Breakout	Buy	Figure 1-4

Table 1-1: List of horizontal support and resistance patterns for your trading.

What is the main catchy behind the above support and resistance examples for our trading? In the practical trading with support and resistance levels, we are betting on the transformation of the last triangle, equilibrium fractal wave in fact. In another words, we are betting on the size of the last triangle. When you are trading with support and resistance levels, you are literally asking the questions like: Would the last triangle will transform in its size to make the breakout move? Or Would the last triangle will not transform in its size to make the reversal move? In our practical trading, how the size of the last triangle will end is the matter for our profit. If we are not using any other supplementary techniques to trade, then we can set a threshold level to trigger for buy and sell entry as shown in Figure 1-5. Y Buy and Y Sell in Figure 1-5 is the price level to trigger the buy and sell entry respectively. If the last triangle is transformed in its size, then the price will penetrate the threshold level for sell. If the last triangle is not transformed in its size, then the price will reverse back through the threshold level for buy. To measure the distance Y Buy and Y Sell, we can use few different methods. Firstly, we can define Y Buy and Y Sell in proportion of the height of the last triangle (Y Height). For example, Y Buy and Y Sell can be expressed using the following formula for Figure 1-5:

Y Buy = Proportion (%) x Y Height   and

Y Sell = Proportion (%) x Y Height, where Y Height = the height of the last triangle and Proportion is fraction of the height of the last triangle expressed in percentage.

The typical proportion to calculate Y Buy and Y Sell can range from 5% to 20%. When you choose the proportion, you might have to consider few points. If you choose to use small proportion, then you might experience the false signal frequently. In addition, you might be suffering from the price pull back due to the tight stop loss. If you choose to use large proportion, then you might be reducing your reward/risk ratio. Therefore, you have to win more frequently to maintain your profits.

Another method to set the buy and sell threshold level is using the Fibonacci ratio. Again, the Fibonacci threshold level will be calculated in terms of the height of the last triangle. For example, Y Buy and Y Sell can be expressed using the following formula for Figure 1-5:

Y Buy = Fibonacci Ratio x Y Height and

Y Sell = Fibonacci Ratio x Y Height, where Y Height = the height of the last triangle and Fibonacci ratio include the typical Fibonacci ratios like 0.236, 0.382, 0.500, and 0.618, etc.

Both the proportional threshold method and the Fibonacci threshold method are valid for your entry. You can pick up one between them according to your own preferences. Fibonacci threshold method tends to provide the entry with greater distance from the stop. Hence, it should be noted that the Fibonacci threshold method could reduce your rewards/risk ratio. However, if the size of the last triangle is too small, then you might prefer to use the Fibonacci threshold method because too tight stop loss can be hunted too easily. You can set your stop loss at the support or resistance level for your trading. However, it is possible that the price can come back to the support or resistance level for retesting. It is sensible to place your stop slightly greater than the support and resistance level. Hence, the support or resistance level can be only minimum stop for your trading. You should always set your stop loss slightly greater than the minimum stop level.

Figure 1-5: Support Trading example as in the direct pattern recognition on GBPUSD H4 timeframe.

1.2 Diagonal Support and Resistance

In the financial market, we can observe the diagonal price patterns frequently. Diagonal support and resistance are the typical price patterns we can observe as the results of the combined effect of Equilibrium and Fractal Wave process. Diagonal support and resistance are not different from the horizontal support and resistance. When the connected peaks and troughs provide the diagonal slope rather than the horizontal line, then that slope can be considered as the diagonal support and resistance. However, there can be more variations comparing to the horizontal case. Firstly, we can have the ascending diagonal support and resistance. Secondly, we can also have the descending diagonal support and resistance. For your convenience, we have listed all the possible diagonal support and resistance patterns in Table 1-2. We have also listed the corresponding example for each pattern from Figure 1-6 to Figure 1-13. How to trade diagonal support and resistance levels are the same as the horizontal support and resistance. You can apply the proportional threshold method and the Fibonacci threshold method for your entry for the case of diagonal support and resistance too. The trading example is shown in Figure 1-14. How to calculate the threshold level for Y Buy and Y Sell are identical to the case of horizontal support and resistance. As in the horizontal support and resistance, it is sensible to set your stop loss level greater than the minimum stop level.

Support and resistance	**Price Action**	**Direction**	**Example**
Ascending Diagonal Support	Reversal	Buy	Figure 1-6
Ascending Diagonal Support	Breakout	Sell	Figure 1-7
Ascending Diagonal Resistance	Reversal	Sell	Figure 1-8
Ascending Diagonal Resistance	Breakout	Buy	Figure 1-9
Descending Diagonal Support	Reversal	Buy	Figure 1-10
Descending Diagonal Support	Breakout	Sell	Figure 1-11
Descending Diagonal Resistance	Reversal	Sell	Figure 1-12
Descending Diagonal Resistance	Breakout	Buy	Figure 1-13

Table 1-2: List of diagonal support and resistance patterns for your trading.

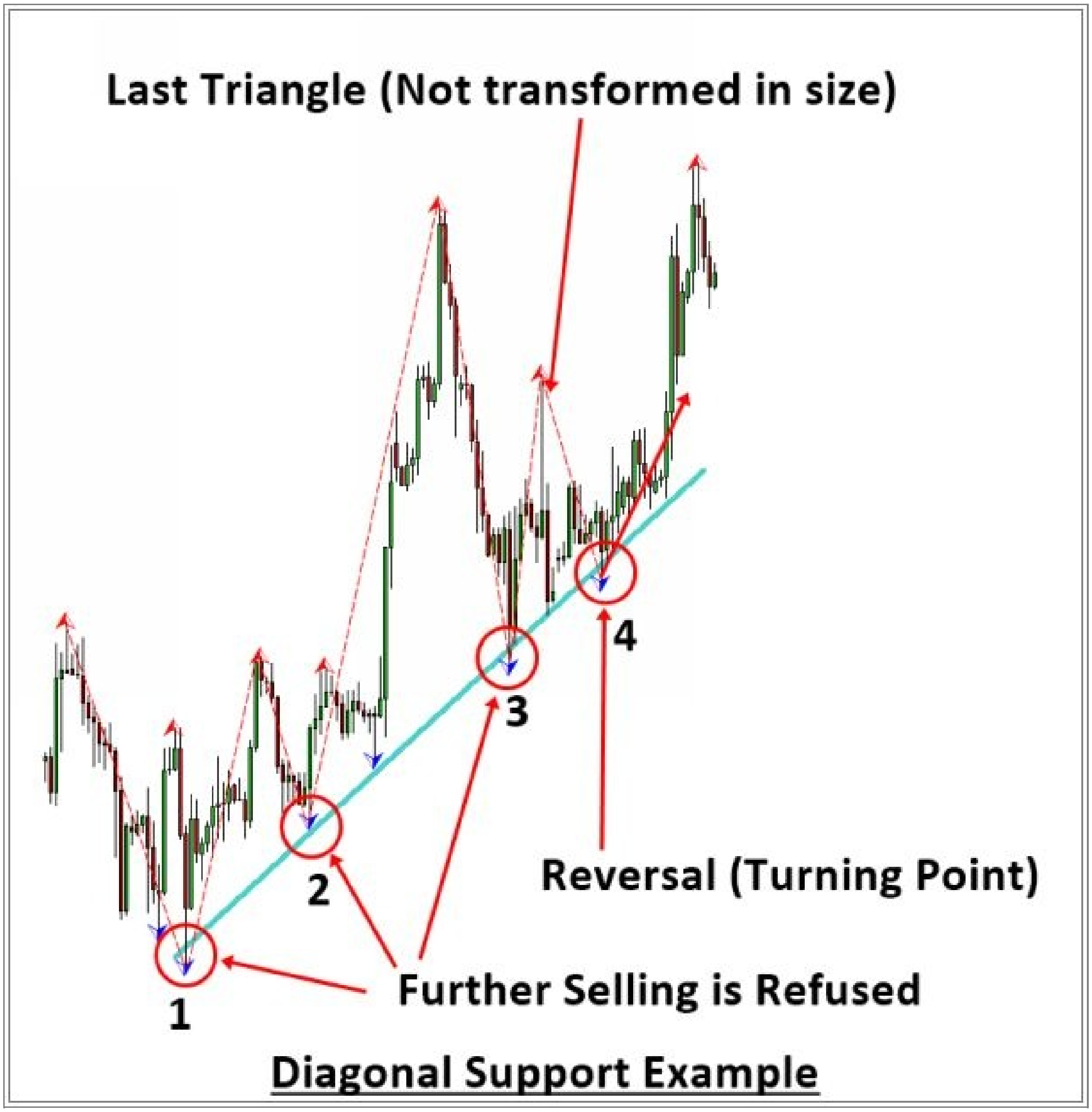

Figure 1-6: Support example as in the direct pattern recognition on EURUSD H4 timeframe.

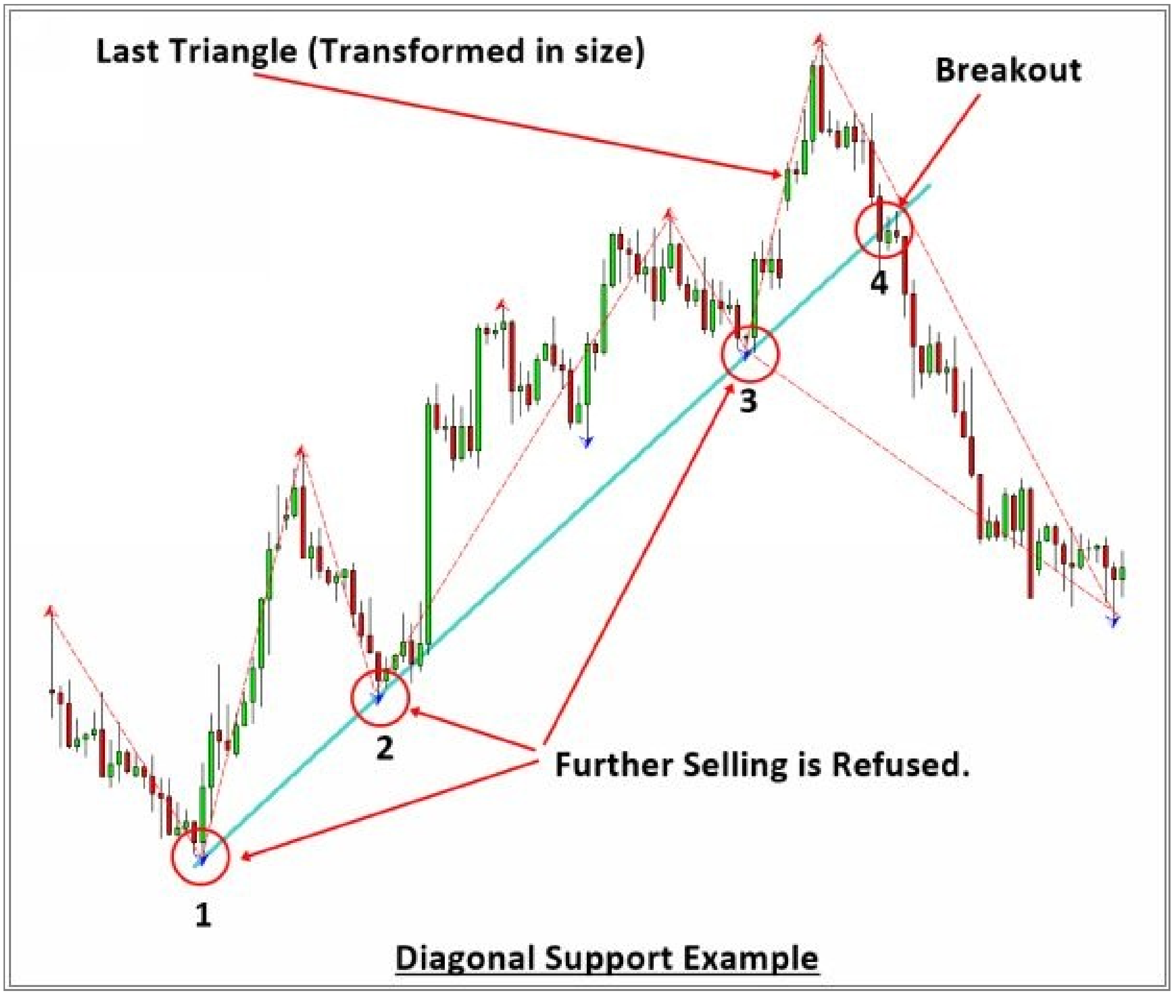

Figure 1-7: Support example as in the direct pattern recognition on EURUSD H4 timeframe.

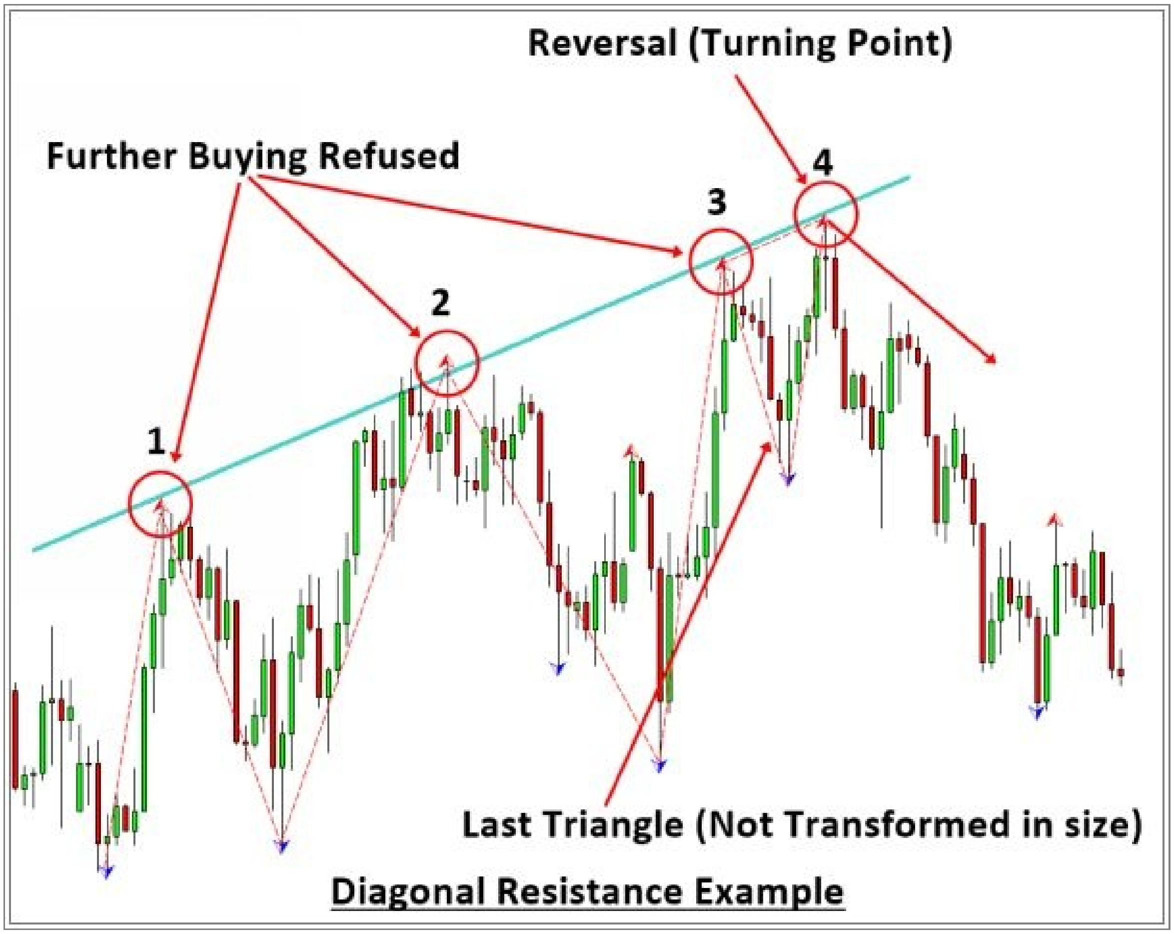

Figure 1-8: Resistance example as in the direct pattern recognition on EURUSD H4 timeframe.

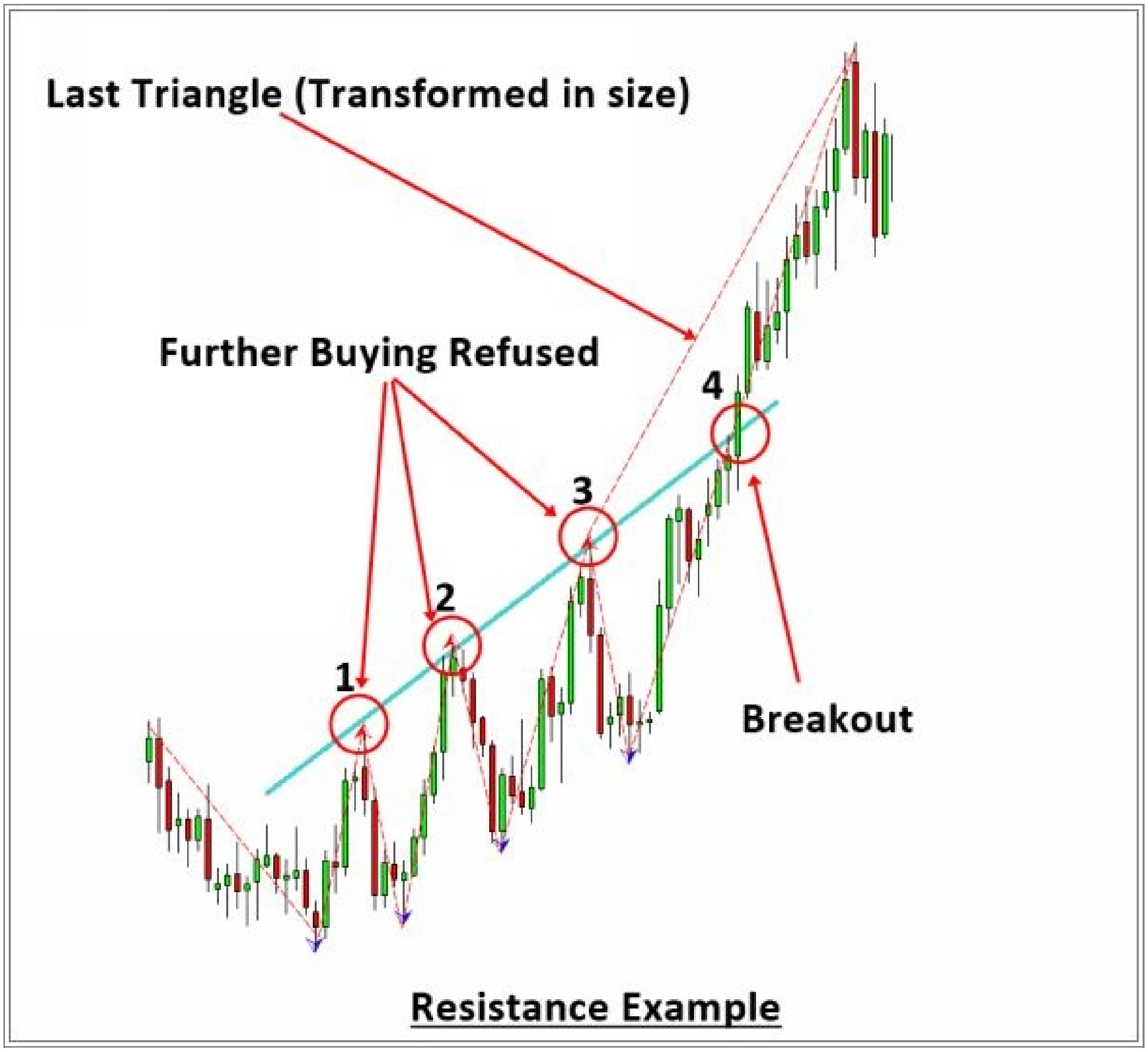

Figure 1-9: Resistance example as in the direct pattern recognition on EURUSD D1 timeframe.

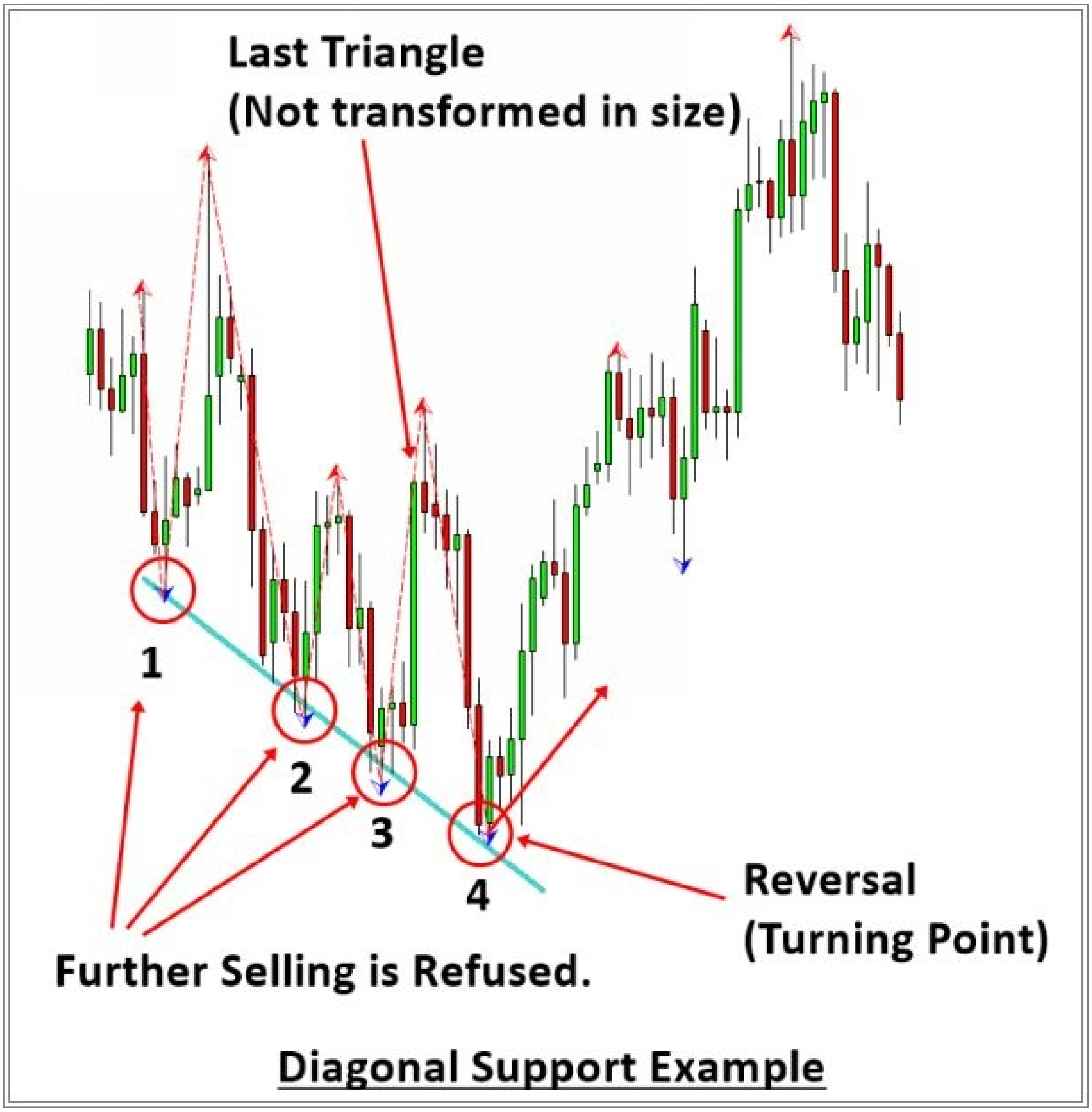

Figure 1-10: Support example as in the direct pattern recognition on EURUSD H4 Timeframe.

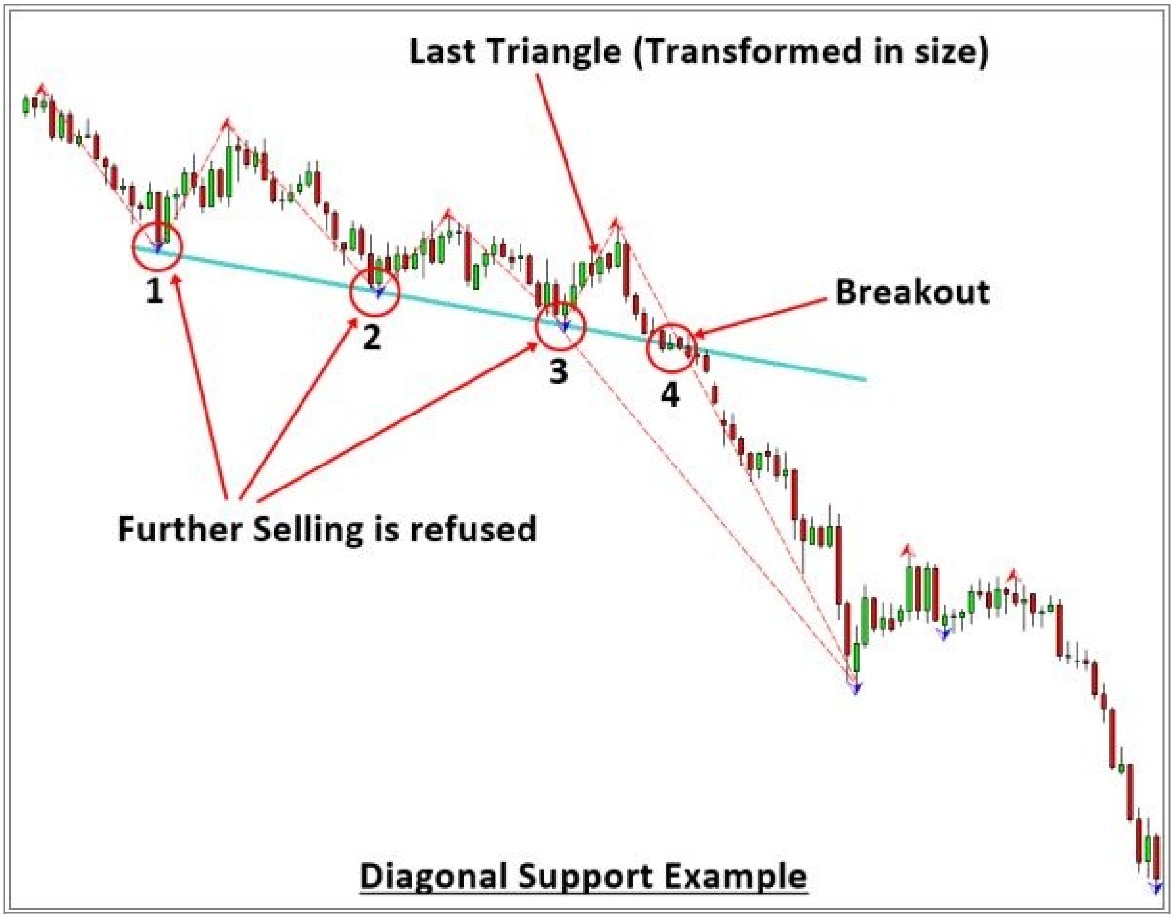

Figure 1-11: Support example as in the direct pattern recognition on EURUSD H4 Timeframe.

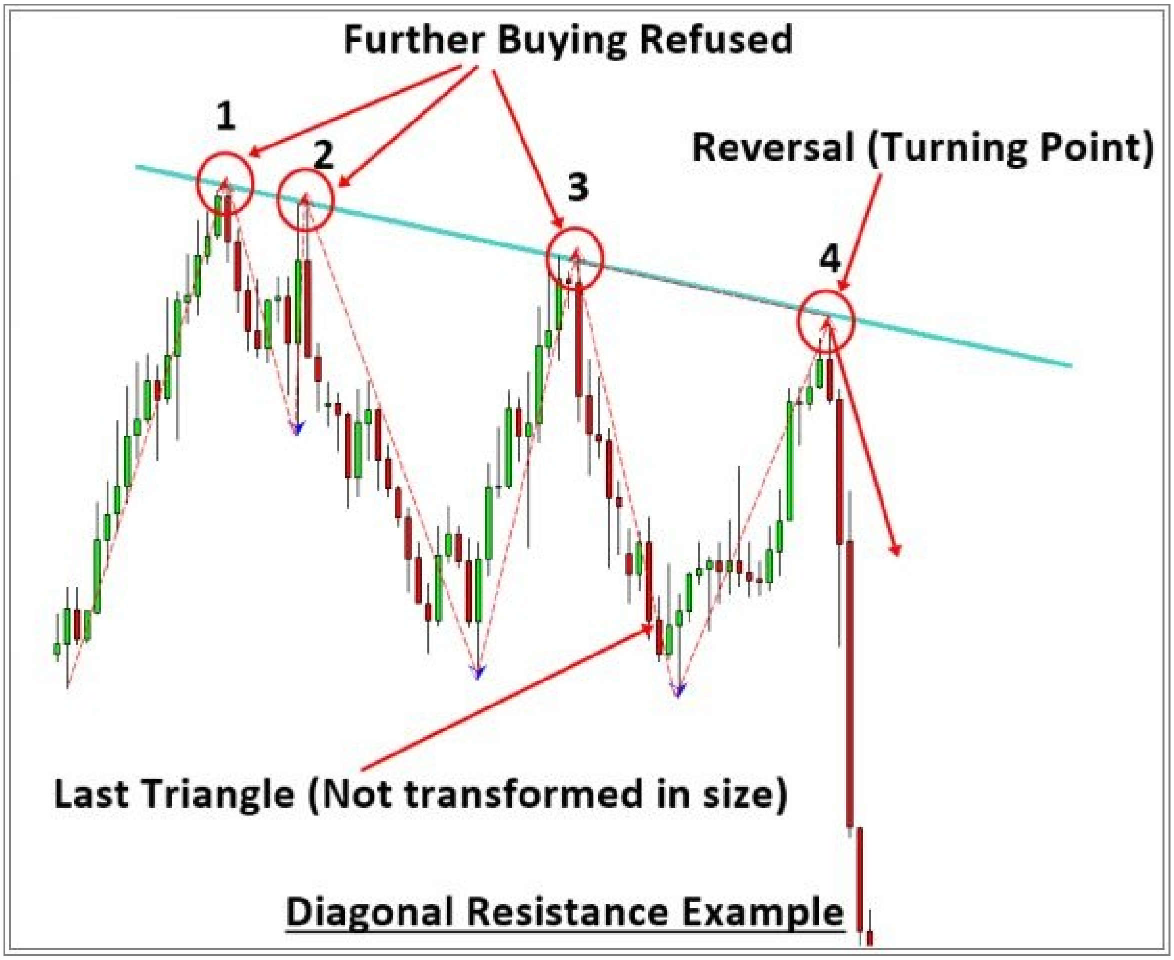

Figure 1-12: Resistance example as in the direct pattern recognition on EURUSD H4 timeframe.

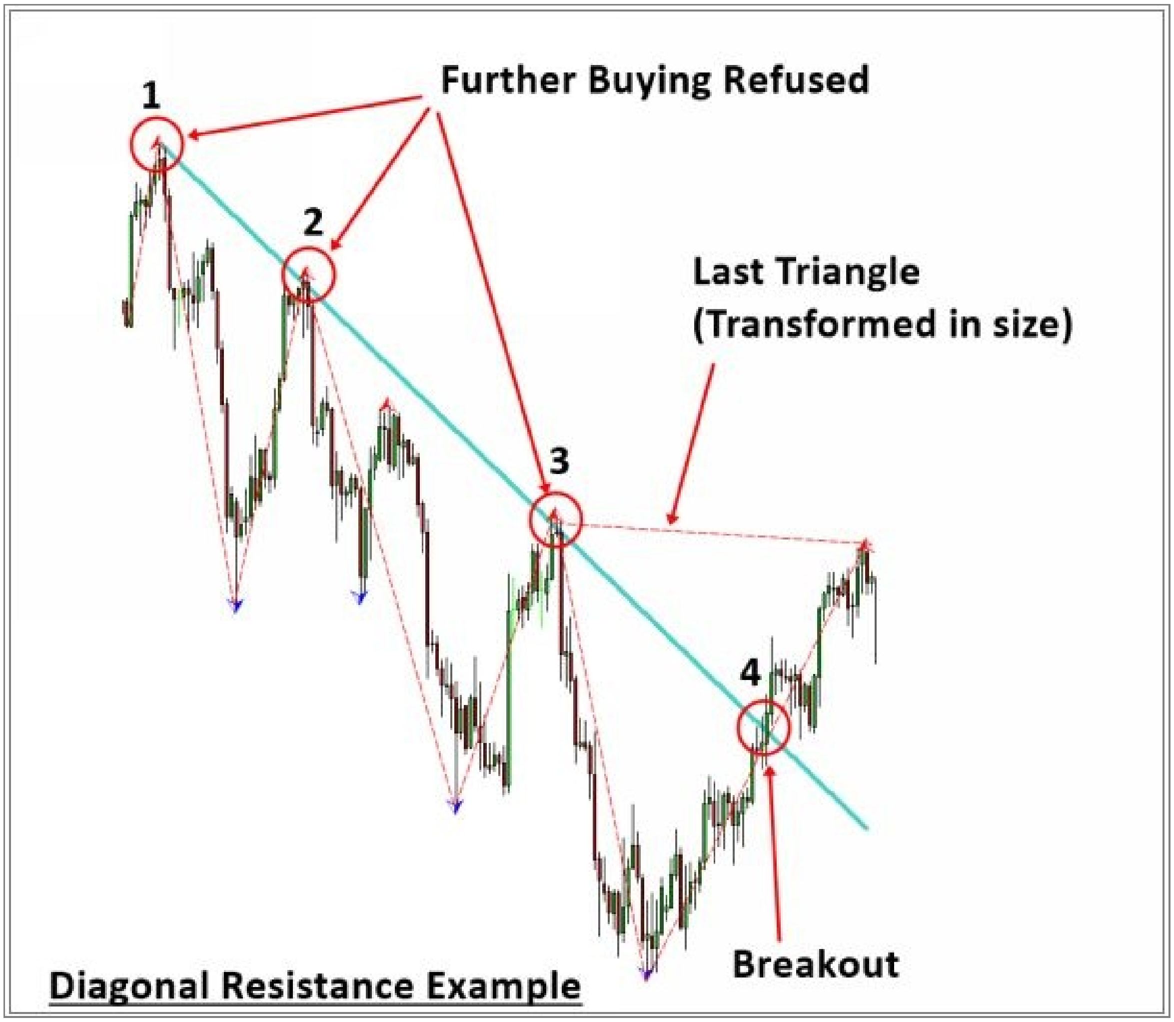

Figure 1-13: Resistance example as in the direct pattern recognition on GBPUSD H4 timeframe.

Figure 1-14: Resistance Trading example as in the direct pattern recognition on GBPUSD H4 timeframe.

1.3 Identification of Support and Resistance with the Template and Pattern Approach

When you detect the support and resistance in your chart, it is important that you are trading with quality support and resistance. In our 1st training, we have shown how to use the Peak Trough Analysis to study the Equilibrium Fractal Wave patterns in your chart. Once again, the Peak Trough Analysis can be used as a starting template for support and resistance identification. However, the use of template is not compulsory though. In addition, it should be noted that the Peak Trough Analysis could only provide the rough guideline for the identification of the support and resistance. In spite of the fact that the Peak Trough Analysis is not the perfect tool to identify the support and resistance, I found that at least it is extremely useful tool for starters because it provides some starting points. It can be even useful for the experienced trader too. To detect the high quality support and resistance lines, you can consider few things. In detecting the support and resistance, you might use the following general rules:

- One vertex of several non-overlapping triangle should be aligned over one straight line (i.e. you should be able to connect one vertex of several non-overlapping triangles in one straight line.)
- Connect peak to peak to detect resistances and connect trough to trough to detect supports (i.e. do not mix peak and trough.)
- There should be at least three touches around the support and resistance
- You can expect that most of time the touching point over support and resistance will not be dead accurate but you can use 5% or 10% margin to detect the support and resistance. 5% and 10% margin can be measured in relative to the triangle height. You can use the same method to calculate Y Buy and Y Sell for 5% and 10% margin calculation.
- Each touching point should have some distance from the adjacent touching point. If two touching points are too close to each other, then count them as one touching point only.

For your convenience, we provide the simplified diagram for each support and resistance patterns in Figure 1-15. In addition, we have listed the twelve support and resistance patterns and their price action in the Table 1-3. These six support and resistance patterns can be used for your trading without any other additional tool. However, it is possible that you can combine these patterns with other trading strategies, which we will discuss in the next chapter. As we will explain in the later chapter, typically the combined trading strategy can provide the powerful entry with higher winning rate. At the same time, these six support and resistance patterns can be the backbone of other price patterns. Most of Triangle, Wedge and Channel patterns shown in Figure 1-16 can be expressed in terms of these six support and resistance patterns in Figure 1-15. For example, the symmetric triangle price pattern can be made from one ascending diagonal support and one descending diagonal resistance. Likewise, other triangle and wedge patterns can be expressed using Support and Resistance patterns too. We list the Triangle, Wedge and Channel patterns and their sub price patterns in Table 1-4.

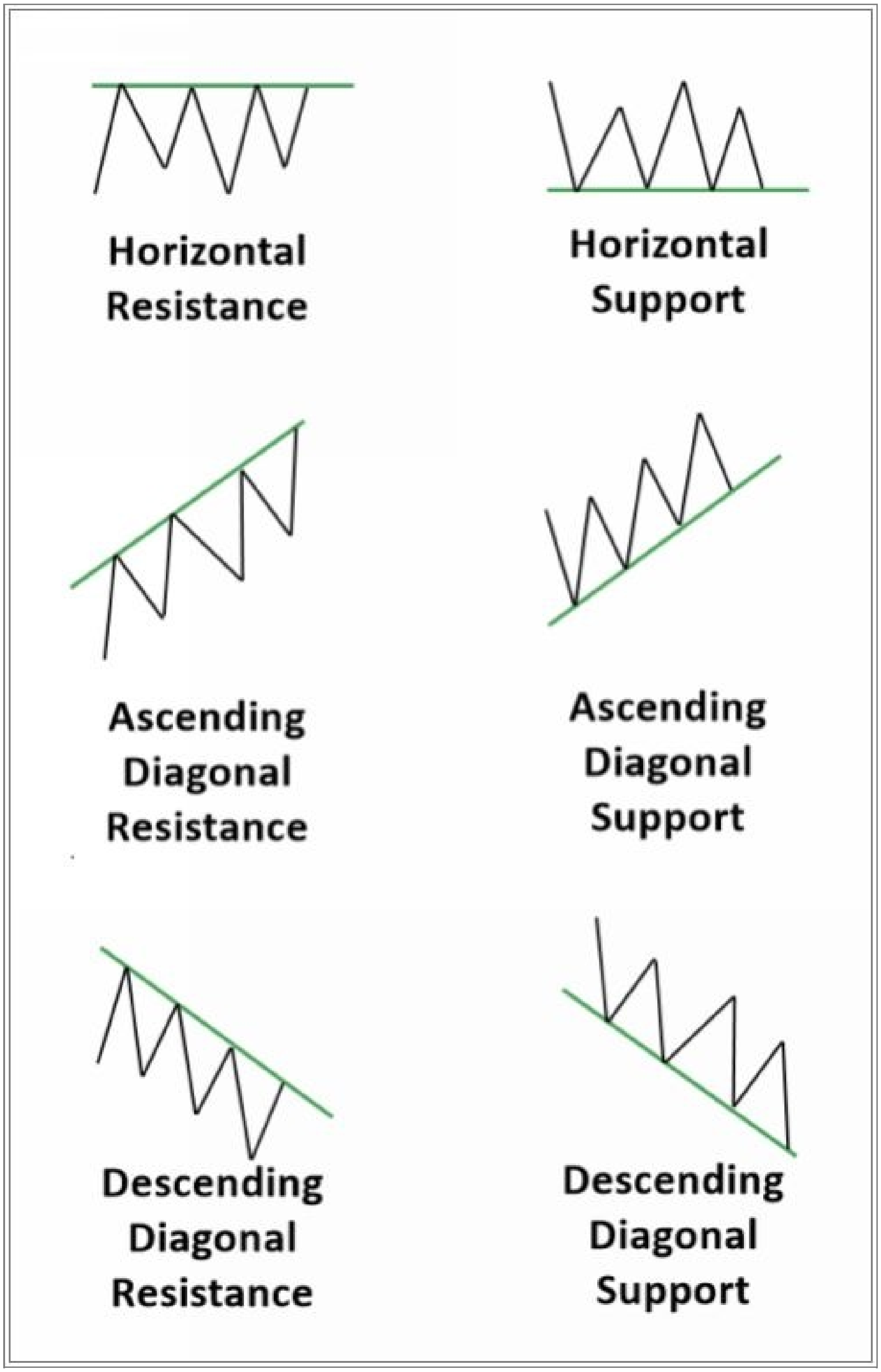

Figure 1-15: List of six support and resistance patterns.

Support and resistance	Price Action	Direction	Example
Horizontal Support	Reversal	Buy	Figure 1-1
Horizontal Support	Breakout	Sell	Figure 1-2
Horizontal Resistance	Reversal	Sell	Figure 1-3
Horizontal Resistance	Breakout	Buy	Figure 1-4
Ascending Diagonal Support	Reversal	Buy	Figure 1-6
Ascending Diagonal Support	Breakout	Sell	Figure 1-7
Ascending Diagonal Resistance	Reversal	Sell	Figure 1-8
Ascending Diagonal Resistance	Breakout	Buy	Figure 1-9
Descending Diagonal Support	Reversal	Buy	Figure 1-10
Descending Diagonal Support	Breakout	Sell	Figure 1-11
Descending Diagonal Resistance	Reversal	Sell	Figure 1-12
Descending Diagonal Resistance	Breakout	Buy	Figure 1-13

Table 1-3: List of support and resistance patterns.

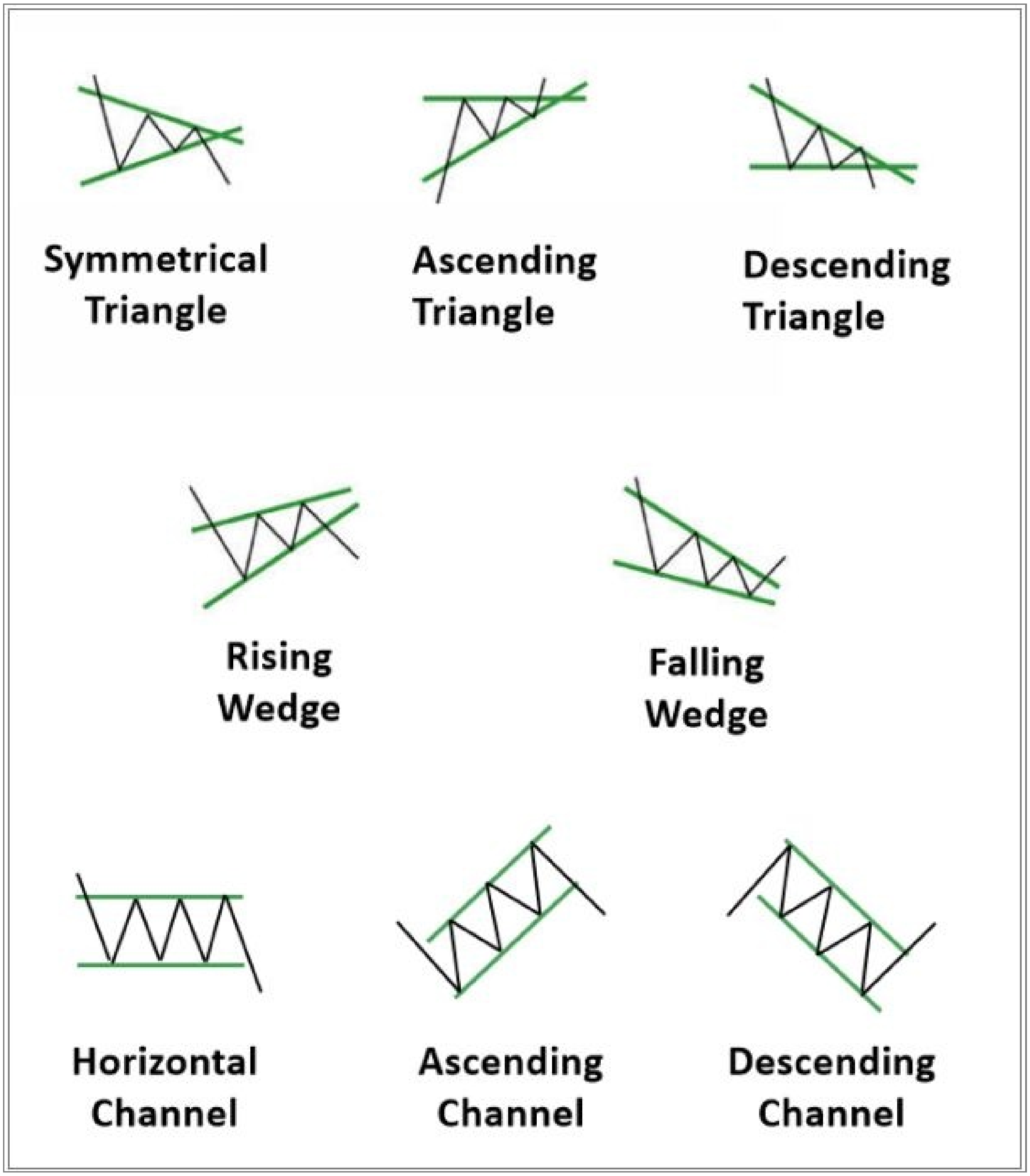

Figure 1-16: List of Triangle, Wedge and Channel patterns.

Triangle, Wedge and Channel Pattern	Sub Price Patterns
Symmetrical Triangle	Ascending Diagonal Support + Descending Diagonal Resistance
Ascending Triangle	Horizontal Resistance + Ascending Diagonal Support
Descending Triangle	Horizontal Support + Descending Diagonal Resistance
Rising Wedge	Ascending Diagonal Resistance + Ascending Diagonal Support
Falling Wedge	Descending Diagonal Resistance + Descending Diagonal Resistance
Horizontal Channel	Horizontal Resistance + Horizontal Support
Ascending Channel	Ascending Diagonal Resistance + Ascending Diagonal Support
Descending Channel	Descending Diagonal Resistance + Descending Diagonal Resistance

Table 1-4: List of Triangle and Wedge Patterns and their sub price patterns.

2. Trading with Equilibrium Fractal Wave

2.1 Introduction to EFW Index for trading

By definition, an equilibrium fractal wave is a triangle made up from two price movements in opposite direction. When the price is moving towards the equilibrium price, the equilibrium fractal waves propagate. In the financial market, various shapes of equilibrium fractal wave exist. They are often mixed and jagged to form more complex price patterns. The shape of each equilibrium wave can be described by their shape ratio. This shape ratio can be used to identify the shape of an individual equilibrium fractal wave in the complex price patterns. As you can tell from the equation, the shape ratio of equilibrium fractal wave is independent from their size.

The shape ratio of equilibrium fractal wave = current move in price units (Y2)/ previous move in price units (Y1).

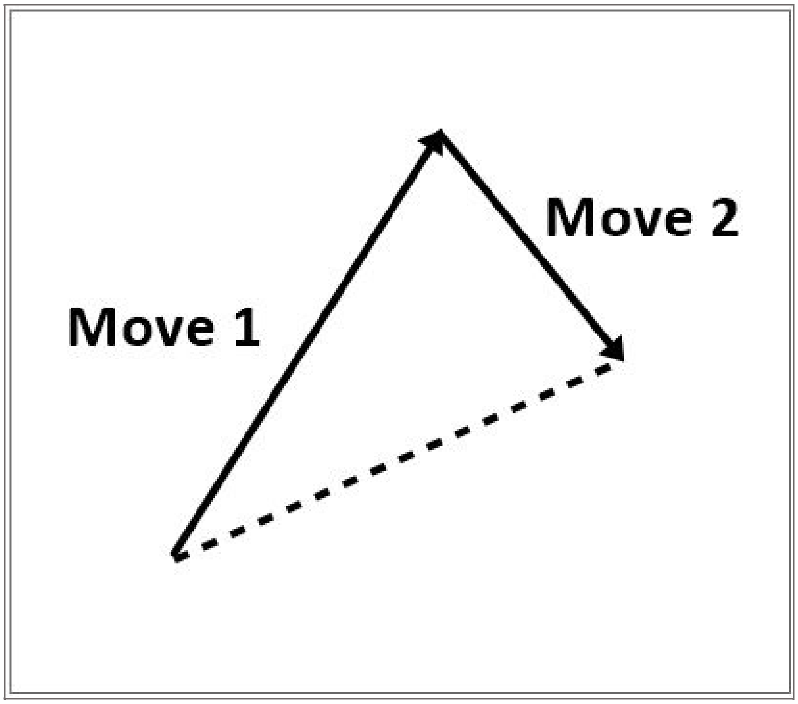

Figure 2-1: One unit cycle of Equilibrium Fractal Wave is a triangle made up from two price movements.

Figure 2-2: one unit cycle of an equilibrium fractal wave in the candlestick chart.

Two important shape classes for equilibrium fractal wave include Fibonacci based ratios and non-Fibonacci based ratios. Trader can trade both ratios if they wish. However, traders are required to have a knowledge on which shape of equilibrium fractal wave is more suitable for your trading. To find out the suitable EFW shape, you can simply use the "Equilibrium Fractal Wave (EFW) Index" to do a simple exploratory analysis. The EFW index can be calculated using following equation.

Equilibrium fractal wave index = number of the particular shape of equilibrium fractal wave / number of peaks and troughs in the price series.

The very best part of equilibrium fractal wave trading is that it combines both the exploratory analysis and trading in one practice. In the exploratory analysis, you will build your trading logic. In the trading, you will use the logic to build the best outcome for your trading. In the exploratory analysis, you will use the EFW index exclusively. With the EFW index, you can answer the following questions:

- What particular shape of equilibrium fractal wave exists in the price series?
- Which particular shape of equilibrium fractal wave is dominating in the price series?
- How frequently have they occurred in the past?
- Which financial instruments like currency pairs and stocks prices are easier to trade than rest of the market?
- Is the fifth regularity the most dominating characteristics of this financial market?

For example, Figure 2-3 shows the EFW indices for EURUSD daily timeframe for the three ratios including 0.618, 0.500 and 0.382. We have shown the three

EFW indices over the time. From the chart, it is possible to figure out that 0.618 is the most dominating ratio for EURUSD followed by the ratio 0.500. Would this tendency hold the same for GBPUSD too? Let us check the Figure 2-4 for this. You can tell that the ratio 0.500 is more frequently occurring than the ratio 0.618. For GBPUSD and EURUSD, the ratio 0.382 is the least occurring shape of the equilibrium fractal wave. By inspecting the EFW indices, we can tell that EURUSD and GBPUSD have a strong presence of equilibrium fractal wave. For this reason, we can use any trading analysis and strategies designed for the fifth regularity. To calculate the EFW index, we typically recommend using as much data as you can. For example, in Figure 2-2 and Figure 2-3, we have used more than 3000 bars (i.e. around 10 years long history) to calculate each EFW index. You might be able to use more data if you wish.

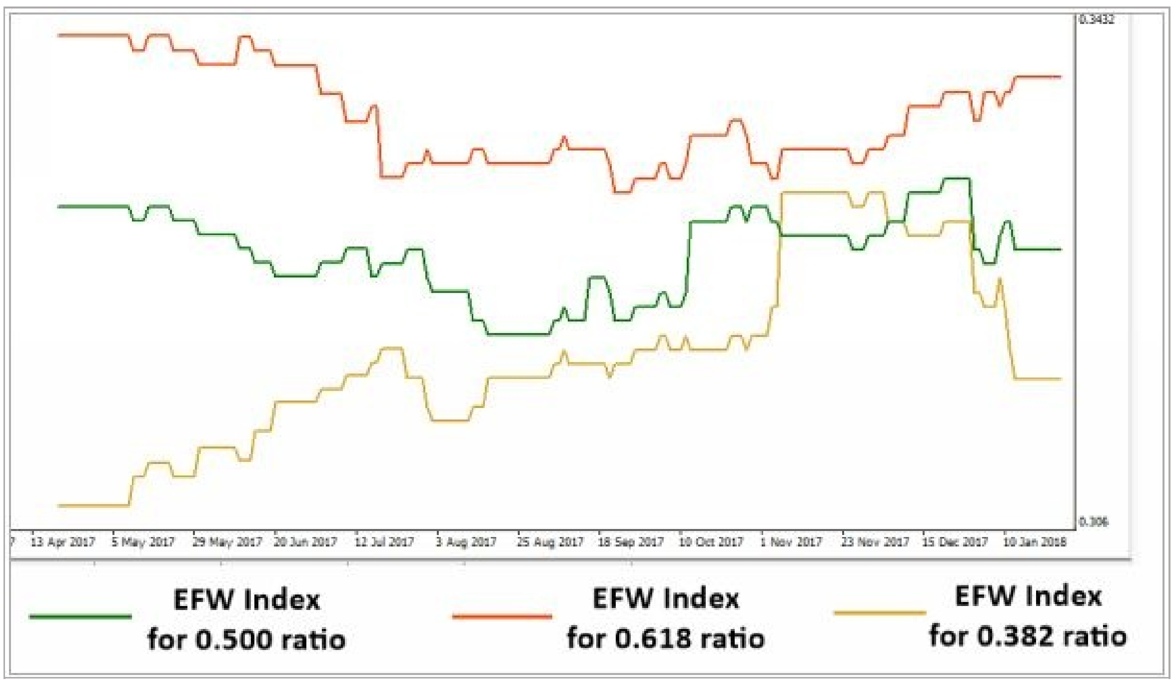

Figure 2-3: EFW index for EURUSD D1 timeframe from 2006 09 20 to 2018 01 20.

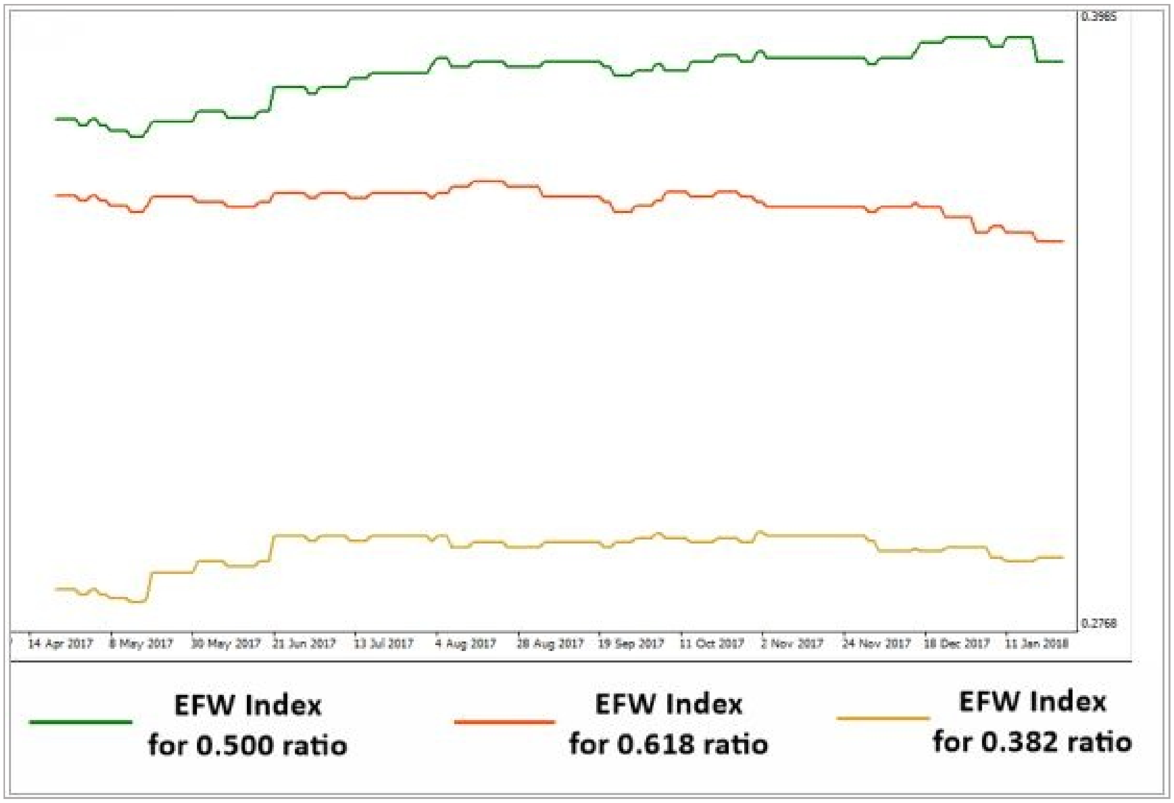

Figure 2-4: EFW index for GBPUSD D1 timeframe from 2007 01 04 to 2018 01 20.

2.2 Trading with the shape ratio of equilibrium fractal wave

The simplest way to trade with a single equilibrium fractal wave is to trade with their shape ratio. The shape ratio is a unique identifier of the shape of individual equilibrium fractal wave in the financial market. Hence, each equilibrium fractal wave has one corresponding shape ratio. The way the shape ratio trading works is very similar to the Fibonacci retracement trading. Fibonacci retracement trading is a popular trading technique. In the Fibonacci retracement trading, we predict the potential reversal area by projecting 38.2% , 50% or 61.8% the retracement. Anyone understanding this simple Fibonacci retracement trading can readily understand the trading operation with the shape ratio too because they are similar in term of operation. However trading with shape ratio has several distinctive advantages against the Fibonacci retracement trading. Trader must thoroughly understand the difference between shape ratio trading and Fibonacci retracement trading to yield the better performance.

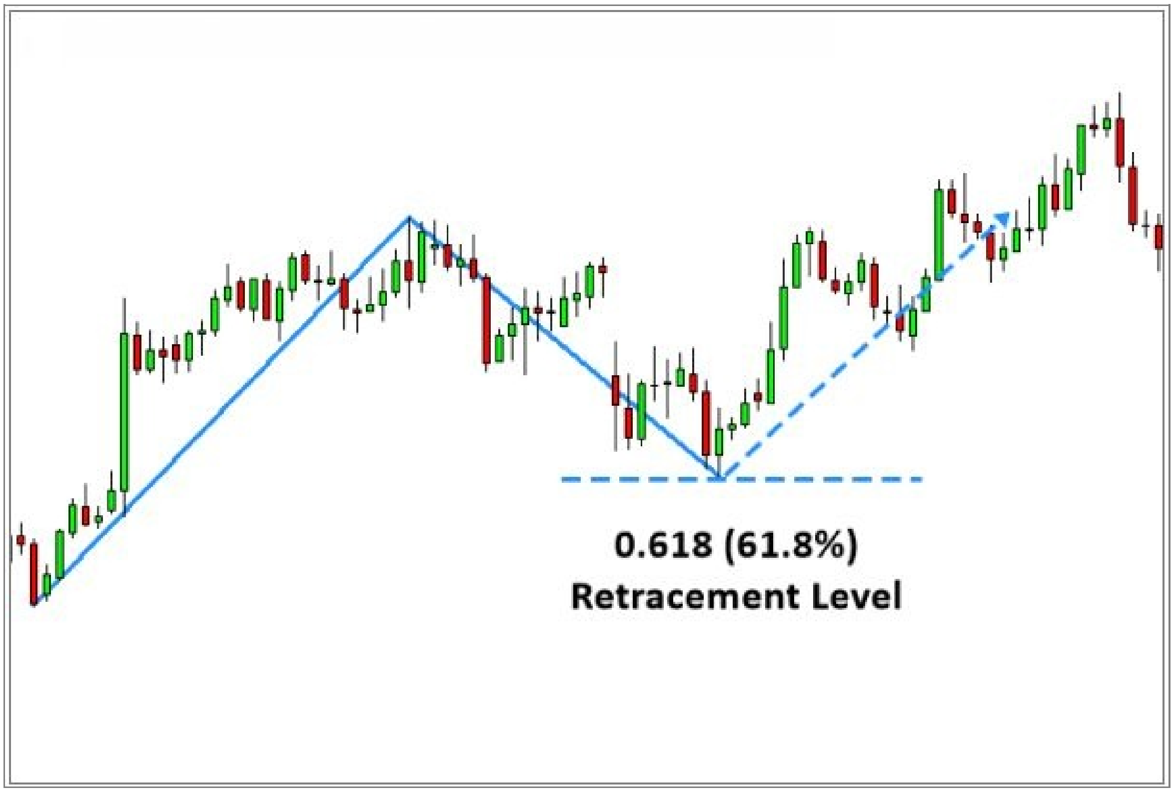

Figure 2-5: Fibonacci retracement trading example with ratio 0.618 on EURUSD daily timeframe.

Firstly, in the shape ratio trading, we do not limit our trading opportunity to Fibonacci ratios only. In the Fibonacci retracement trading, traders assume that the Fibonacci ratios like 0.382, 0.500 or 0.618 or some other Fibonacci ratios are only ratios they can trade. In the shape ratio trading, this assumption is not valid any more. Trader can trade with any shape ratios including the Fibonacci ratios and non-Fibonacci ratios. Since the EFW index tells us exactly which shape ratio is dominating in the particular financial market, it is possible we can pick up the shape ratio based on the EFW index. For example, trader can even trade the shape ratio 0.850 or 0.450 if the EFW index indicates the strong presence of the shape ratio 0.850 or 0.450 in the financial market. Of course, the ratio 0.850 and 0.450 are not the Fibonacci ratios. As we have shown in the previous chapter, it is possible to have the higher EFW index with non-Fibonacci ratios. For example, in EURUSD daily timeframe, the ratio 0.850 had much stronger presence than the golden ratio 0.618.

Figure 2-6: Shape ratio trading example with ratio 0.850 on EURUSD daily timeframe.

Secondly, in the shape ratio trading, we believe that some ratios will perform better than the other ratios. At the same time, we also believe that the same ratio can perform differently for other financial instrument. This is related to the loose self-similarity (heterogeneity) characteristic of equilibrium fractal waves. For this reason, we do not blindly apply any ratios for our trading even they are

Fibonacci ratios or even golden ratios. We can get the guidance for choosing the ratios from the EFW index too. By applying the EFW index, we can get the good ideas on which shape ratios we should avoid and which ratios we should use for the particular financial market.

Thirdly, in the Fibonacci retracement trading, trader assumes that price will reverse at the projected level. In the shape ratio trading, we do not assume that the price will reverse at the projected level, but we are open to both reversal and breakout trading. It is related to the extension (transformation) characteristic of equilibrium fractal waves. We have already covered that the last lag of equilibrium fractal wave can be extended to form the bigger equilibrium fractal wave. This extension can happen when new equilibrium source arrived to market including any economic data release or any significant market news release. The extension will never be able to break the fractal nature of the financial market because the extension creates merely another bigger equilibrium fractal wave (i.e. another bigger triangle). For this reason, in the shape ratio trading, we prefer to bet on the size of equilibrium fractal wave rather than assuming the reversal. How to trade is nearly identical to the support and resistance trading. We will take buy or sell action when the price enter the buy and sell trigger level around the projected level.

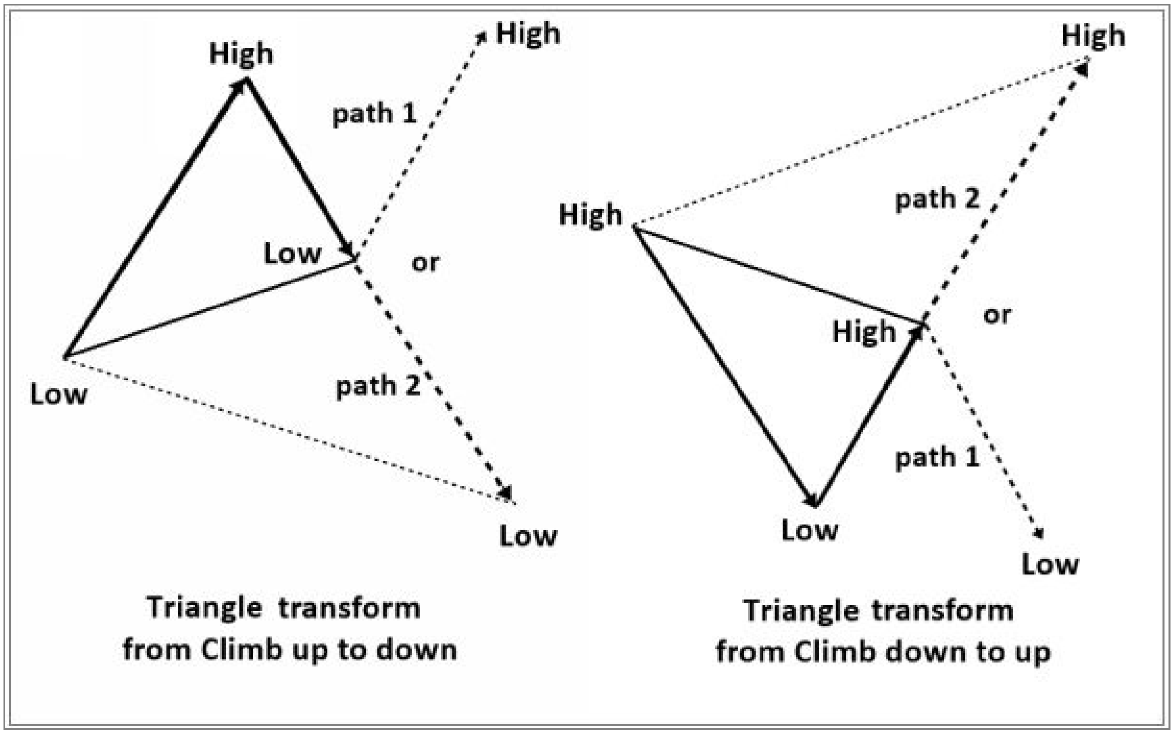

Figure 2-7: Illustration of price transformation (extension) from path 1 to path 2 to meet new equilibrium price due to an abrupt introduction of new equilibrium source in the financial market.

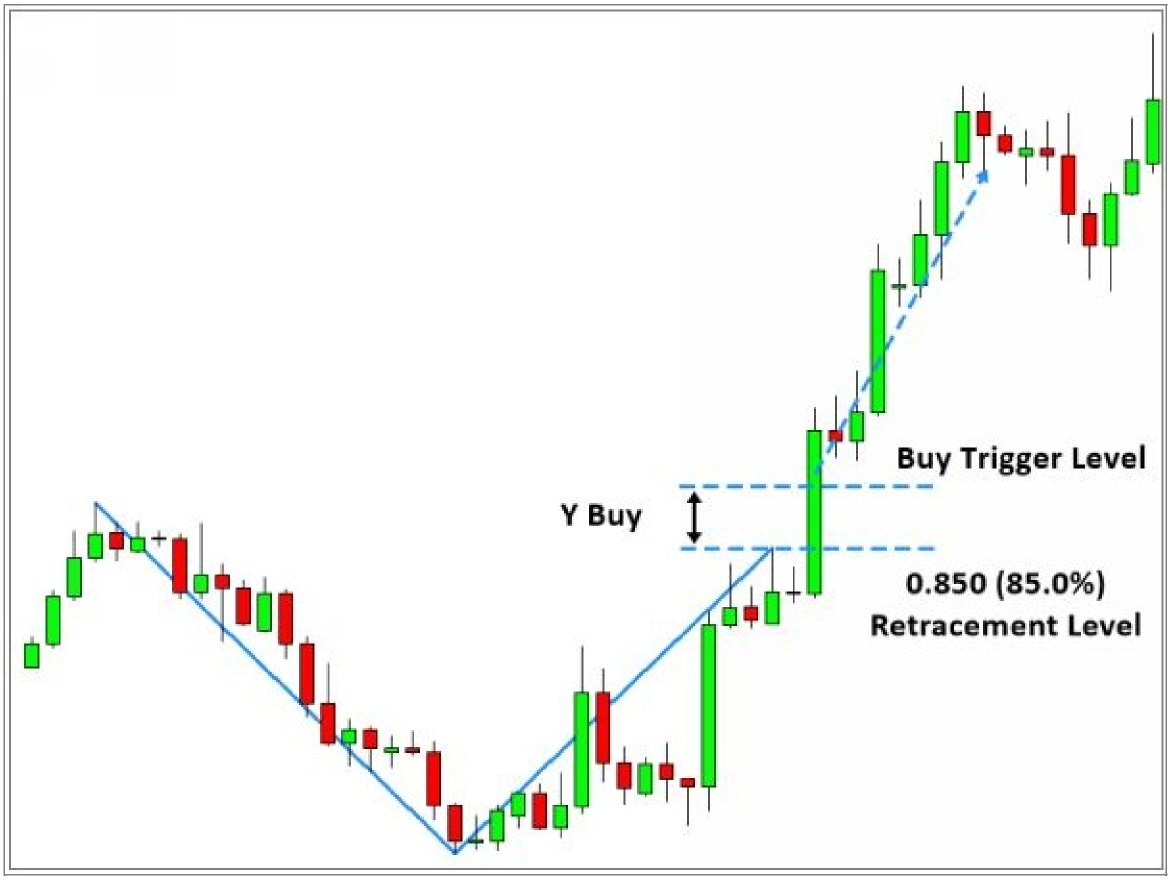

Figure 2-8: Shape ratio trading with breakout example on EURUSD H4 timeframe.

2.3 Introduction to Equilibrium Fractal Wave (EFW) Channel

Unlike many other EFW derived patterns including harmonic patterns and Elliott wave patterns, equilibrium fractal wave is relatively easy to use for our trading. In spite of its simplicity, equilibrium fractal wave can provide an extremely useful insight for our trading. One of the very important usage of equilibrium fractal wave is a channelling technique. In the previous chapter, we have spotted that channels are merely a pair of support and resistance lines aligned in parallel. In general, there is various way of drawing channels for your trading.

Sometimes, you can simply draw the channel by connecting several peaks and troughs in your chart. You may not need any additional tools to do so. However, if you have to control the angle of channel, then it is different story. There are not many techniques providing the mean of controlling the angle of channel. When you want to control the angle of channel, equilibrium fractal wave provide the most efficient way of controlling the angles. For example, sometimes you might prefer to trade with horizontal channel. Sometimes, you might prefer to trade with a channel with stiff angle. With equilibrium fractal wave, the angle of channel is simply controlled by the shape ratio. The shape ratio close to 1.000 provides near the horizontal channel or a channel with a near flat angle (Figure 2-9). On the other hands, the shape ratio close to 0.000 provides a channel with a stiff angle (Figure 2-10). The shape ratio around 0.500 provides a channel with a moderate angle (Figure 2-11).

Figure 2-9: Equilibrium fractal wave channel with the shape ratio around 1.000.

Figure 2-10: Equilibrium fractal wave channel with the shape ratio around 0.100.

Figure 2-11: Equilibrium fractal wave channel with the shape ratio around 0.500.

Channel can be used for many different purposes for our trading. Trader can use channel for the reversal trading. At the same time, trader can use channel for the breakout trading. Trader can use channel for market prediction. For example, an experienced trader can predict the short-term or long-term market direction with a channel or with several channels. In terms of usage, the EFW channel can be used in the same manner as the typical channels. You can trade both reversal and breakout trading using the EFW channels. It is also possible to predict market direction too. For example, if the price moves below the channel, we can assume that market is bearish. If the price moves above the channel, then we can assume that market is bullish. The main difference between the typical channels and EFW channel is that EFW channel is drawn using only three points of a triangle whereas the typical channels are drawn with more than three points.

2.4 Practical trading with Equilibrium Fractal Wave (EFW) Channel

Trading with the EFW channel is almost identical to the support and resistance trading described earlier. The main trading principle is that we are betting on the potential size of the equilibrium fractal wave. If the equilibrium fractal wave does not extend, the price will make the reversal movement. If the equilibrium fractal wave extends due to any surprise in the market, then the price will likely to show the breakout movement. To catch either reversal or breakout move, we can apply the threshold approach again from the concept of support and resistance trading in the previous chapter as shown in Figure 2-12 and Figure 2-13. Trader can use both proportional approach and Fibonacci approach. Since we are dealing with angle, it is much easier to use the proportional approach. To calculate the trigger level for buy and sell, we can use the same formula as before:

Y Buy = Proportion (%) x Y Height and

Y Sell = Proportion (%) x Y Height, where Y Height = the height of the channel and Proportion is fraction of the height of the channel expressed in percentage.

Some proportions you can use include 20% and 30% for your trigger level. You can even use greater proportion like 50% if you wish. The upper and lower channel lines can be used as the minimum stop loss level. To avoid the tight stop loss, you should always have the greater stop loss size than the minimum stop loss level. You can set the take profit according to your preferred rewards/risk level. With the EFW channel, it is possible to achieve Reward/Risk ratio greater than 3.

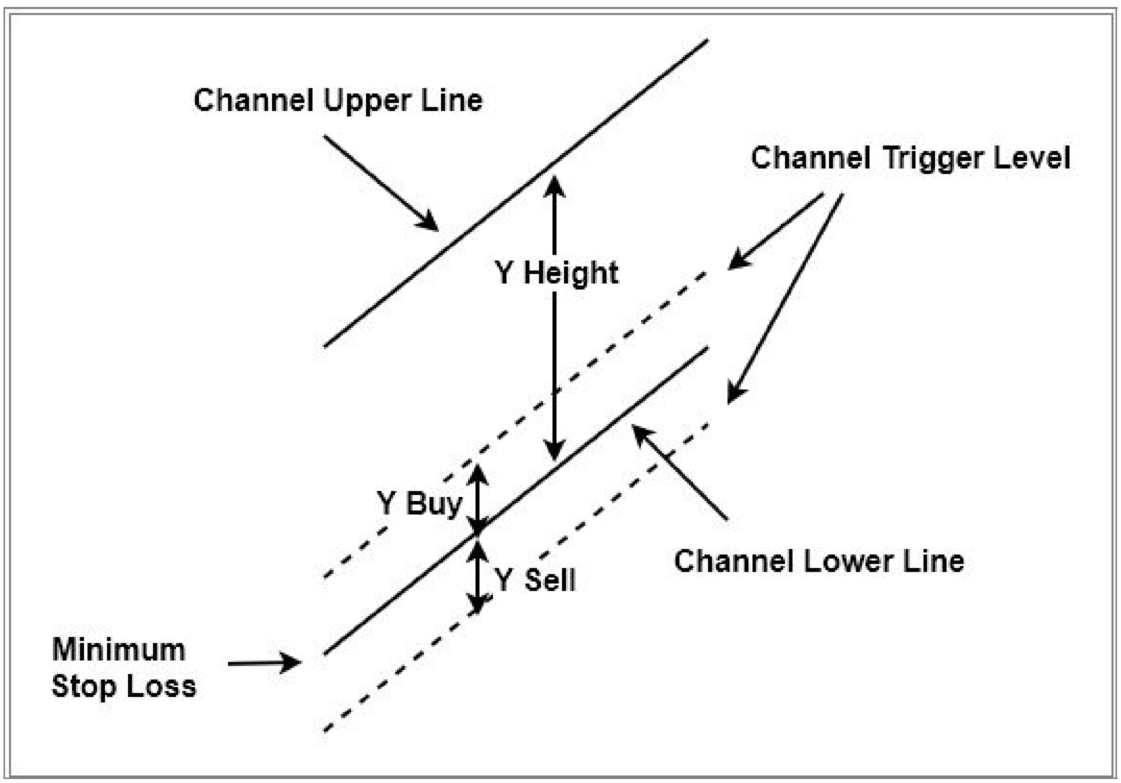

Figure 2-12: EFW Upwards Channel trading setup.

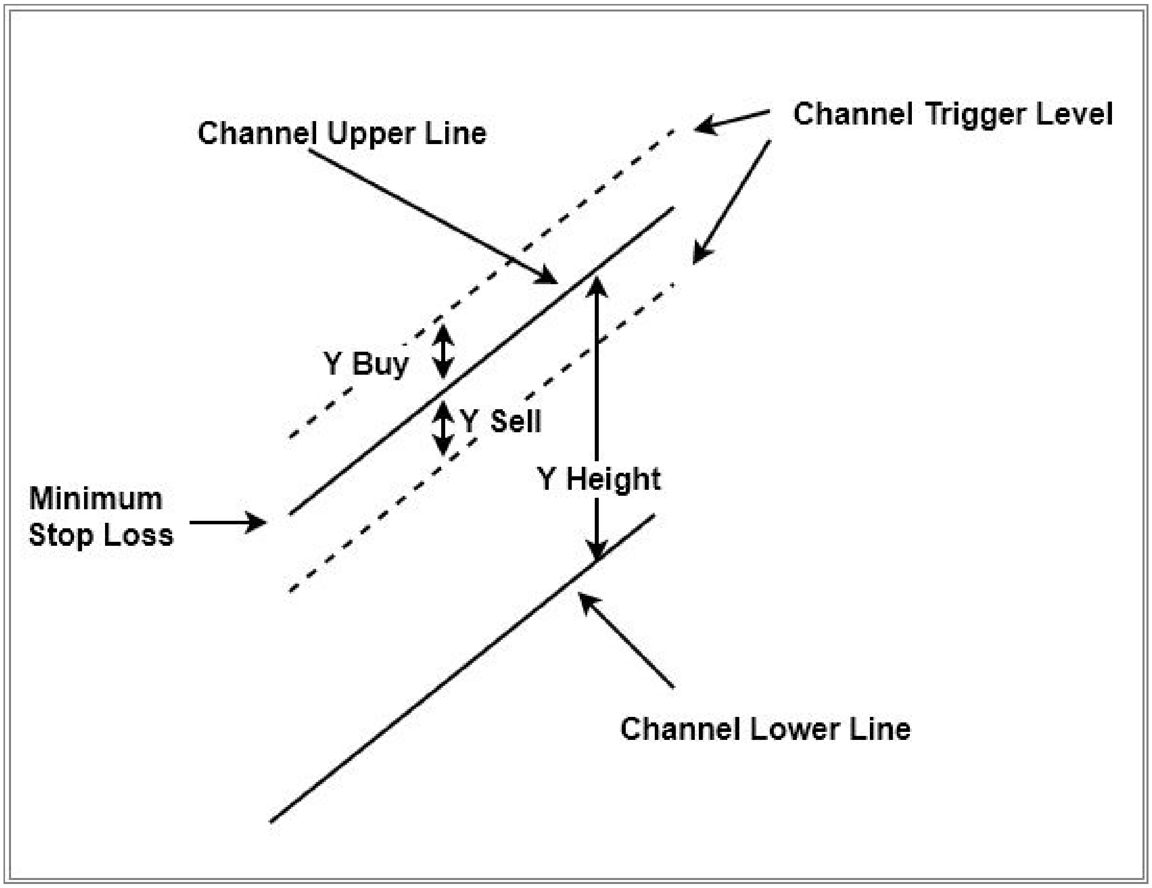

Figure 2-13: EFW Upwards Channel trading setup.

Figure 2-14: EFW Upwards channel sell trading setup on EURUSD D1 timeframe.

Figure 2-15: EFW Upwards channel buy trading setup on EURUSD H4 timeframe.

Figure 2-16: EFW Downwards channel buy trading setup on EURUSD D1 timeframe.

Figure 2-17: EFW Downwards channel sell trading setup on EURUSD D1 timeframe.

2.5 Combining the shape ratio trading and (EFW) Channel

Combing different trading system can often yield better trading performance in general because each technical analysis has their own blind area. For this reason, trader should learn multiple of technical analysis to reinforce their trading decision. Likewise, it is possible to combine the shape ratio trading and EFW channel to improve your trading performance. There can be several unique approaches when we combine these two techniques. Among them, the most simple and effective approach is to use EFW channel to see the big picture of market range and to use the shape ratio to trigger actual buy and sell. With this combined trading setup, you can also trade both reversal and breakout trading too. How to trade is straightforward. We presents the several trading examples in Figure 2-18, Figure 2-19, Figure 2-20 and Figure 2-21.

Figure 2-18: Trading example with the combination of shape ratio trading and EFW Channel for EURUSD H4 timeframe.

Figure 2-19: Trading example with the combination of shape ratio trading and EFW Channel for EURUSD H4 timeframe.

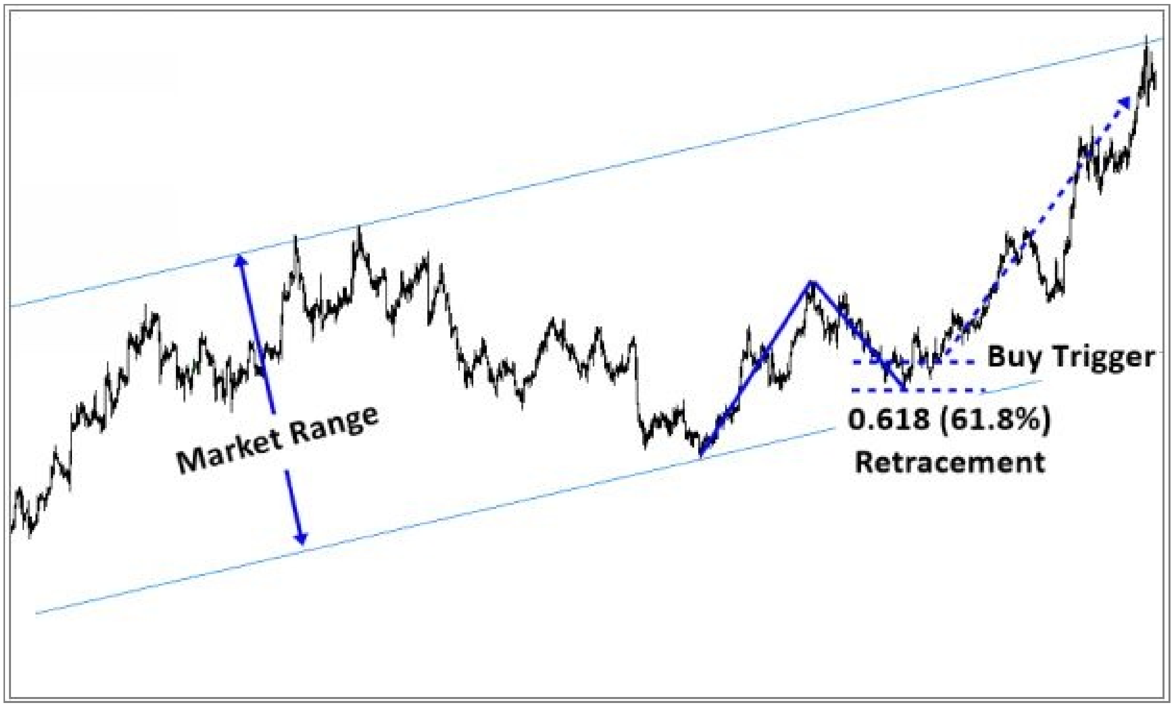

Figure 2-20: Trading example with the combination of shape ratio trading and EFW Channel for EURUSD H4 timeframe.

Figure 2-21: Trading example with the combination of shape ratio trading and EFW Channel for GBPUSD D1 timeframe.

3. Harmonic Pattern

3.1 Introduction to Harmonic Pattern

Harmonic patterns are one of the frequently occurring patterns due to the underlying Equilibrium Fractal-Wave process in the market. It is typically made up from three equilibrium fractal waves. Occasionally there are few harmonic patterns with two equilibrium fractal waves or four equilibrium fractal waves. The structure of the equilibrium fractal waves in the harmonic pattern are typically based on the Fibonacci ratios. The main premise of the harmonic pattern is the repeatability. The history of the harmonic pattern goes back to the Gartley's book "Profits in the Stock Market" in 1935. At that time, Gartley described the trend reversal pattern on page 222 of his book. The pattern become popular in the late 1990s (Pesavento and Shapiro, 1997). Since then, many traders developed the common interest in looking for the repeating patterns in the financial markets. The harmonic patterns were refined many times in several decades. Harmonic trader emphasizes that the patterns are not only repeating in history but they also follow natural orders. Although few different references exist about the meaning of the natural orders, the natural orders mostly means the periods of the neighbouring waves in the Fibonacci relationship (Pesavento and Shapiro, 1997). Fibonacci ratio derived from Fibonacci numbers are the core relationship used in harmonic pattern identification. To have a feel about the Fibonacci ratios, here is the 21 Fibonacci numbers derived from the relationship: $F_n = F_{n-1} + F_{n-2}$. Many traders uses these Fibonacci number sequences to derive some important Fibonacci ratio.

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

As the Fibonacci number become large, the constant relationship is established between neighbouring numbers. For example, every time, when we divide the former number by latter: F_{n-1}/F_n, we will get nearly 0.618 ratio. Likewise, when we divide the latter number by former: F_n/F_{n-1}, we will get nearly 1.618. These two Fibonacci ratio 0.618 and 1.618 are the very important basis for the harmonic pattern. These two ratios are even used by many Elliott Wave practitioner too. In addition, harmonic pattern traders like to use 0.786 and 1.272 ratio. The ratio 0.786 and 1.272 are derived from the square root of 0.618 and 1.618 respectively. Likewise, one can derive the secondary ratio 0.382 and 2.618 by squaring 0.618 and 1.618. Many more secondary ratios can be derived using mathematical operations like square rooting, squaring, inversing, adding and subtracting the primary ratio 0.618 and 1.618. In addition, primary Fibonacci numbers like 2, 3, 5 and 13, which have no positive divisor other than one and itself, can be used to further generate the secondary ratios. In Figure 3-1, we list some commonly used Fibonacci ratios and their calculation generally used by trader. In Figure 3-2, we sort the Fibonacci ratios in ascending order for your convenience.

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

Figure 3-1: Fibonacci ratios and corresponding calculations to derive each ratio.

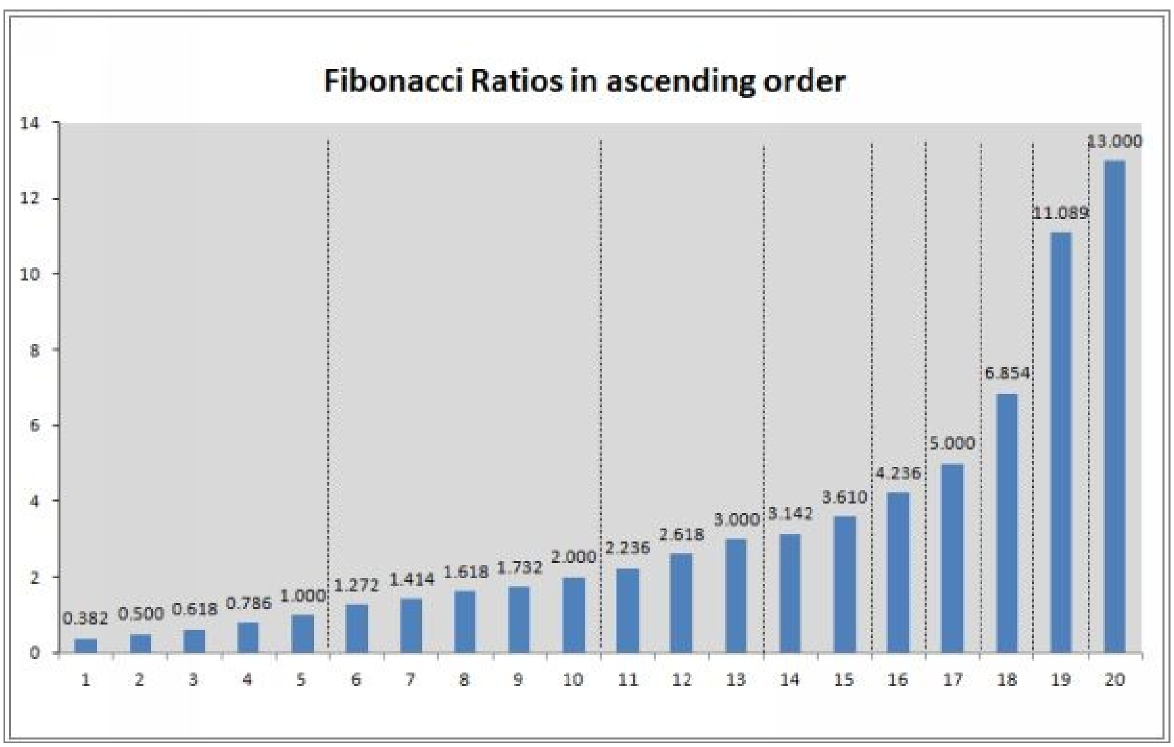

Figure 3-2: Sorted Fibonacci ratio in ascending orders.

When you derive the secondary ratios, it is important not to produce too many secondary ratios. Remember that one can produce almost endless list of secondary ratios like 0.236 (= 0.618-0.382), 0.146 (=0.382-0.236), 0.090 (=0.236-0.146) and so on. Practically speaking, too many ratios can do more harm than good. It is better to keep reasonable number of ratios for your operational range. For example, three or four ratios are reasonable between zero and one. It is better not to have more than six ratios as the maximum. Although we have listed nearly twenty Fibonacci ratios, harmonic pattern trader mostly uses primary ratios and few secondary ratios only for their trading. In next part, we will illustrate how one can detect harmonic pattern with these Fibonacci ratios.

3.2 Harmonic Pattern Trading

Two main elements of Harmonic pattern trading are the pattern recognition and the market timing. Between those two elements, the pattern recognition is the prior task before the market timing. Mostly harmonic patterns consist of five points except few patterns. The five points are often denoted as XABCD conventionally. When we want to detect harmonic pattern manually, the peak-trough analysis can be very helpful. For example, trader can apply the peak-trough analysis on their chart to find the five points of the harmonic pattern. With the peak-trough analysis, traders can get rid of a lot of alternative possibility for the pattern detection. Since the Zig Zag indicator produces the least number of peaks and troughs to work with, it is easier to work with the Zig Zag indicator. However, if you do not like the false peaks and troughs of the Zig Zag indicator, then you can use the modified Fractal indicator alternatively. With the modified Fractal indicator, you will work with more number of peaks and troughs in your chart. However, this will not stop traders to detect harmonic patterns. In Figure 3-3, we present the example of detecting bullish Gartley pattern using the Zig Zag indicator. With the help of the peak-trough analysis, we can identify five probable points for the patterns. In first attempt, you might be wrong in selecting the five probably points. With more practice, you will become good at it. Once you have selected five probable points, next you have to measure the ratios between lags to check if the pattern is the qualified Gartley pattern. For example, for Gartley pattern, you can expect to have the following Fibonacci ratio relationship between lags:

$$AB/XA = 0.618 \text{ or } 0.786$$

$$BC/AB = 0.618,$$

$$CD/BC = 1.272 \text{ or } 1.618 \text{ and}$$

$$CD/XA = 0.786.$$

When you detect the patterns manually, it is important to use high and low price of the candle bar for the five probable points. In the past, I have met some traders connecting the five points with close price or open price. Sometimes, they use two or three points with high and low price from the candle bar, then they use close price for the rest of points. The pattern detection process must have some consistent logic. The best ways to practice the pattern detection is to select the important peaks and troughs using the peak-trough analysis. Using close price or open price is not recommended practice in general.

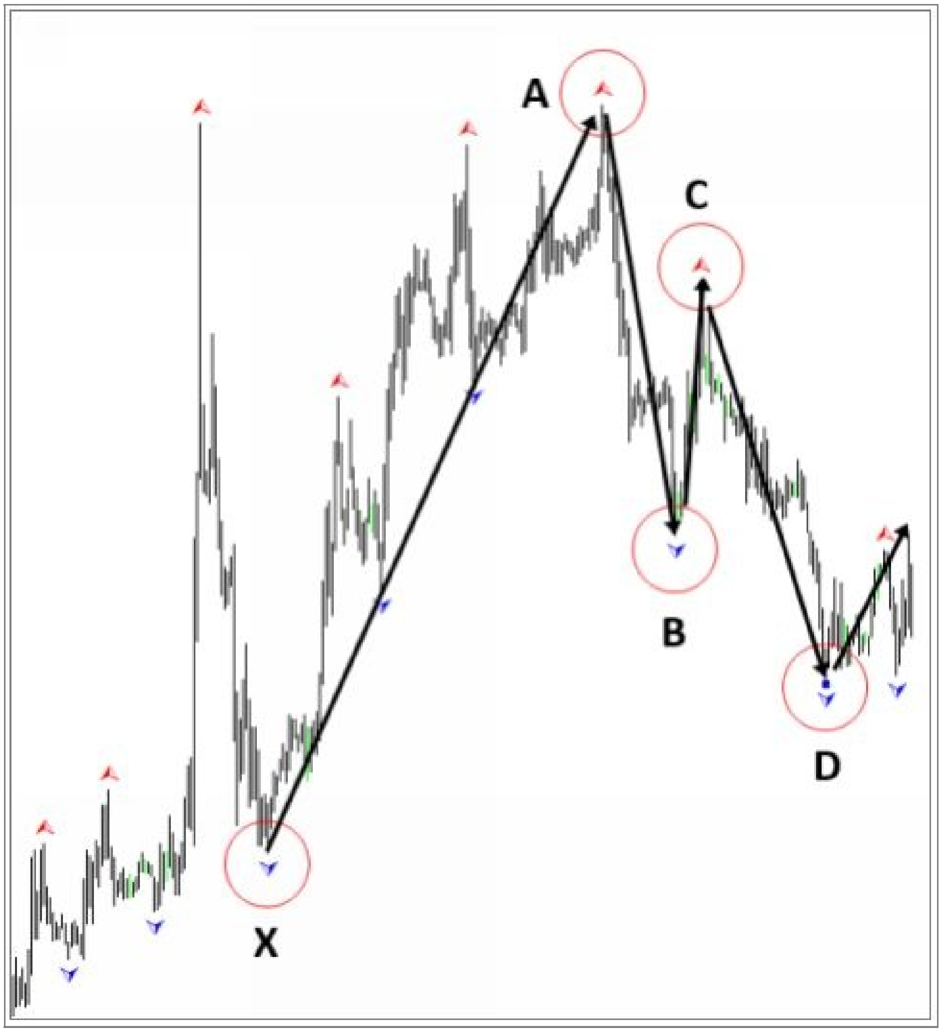

Figure 3-3: Hourly EURUSD Chart Hourly. Five points were selected to exam Gartley 222 pattern.

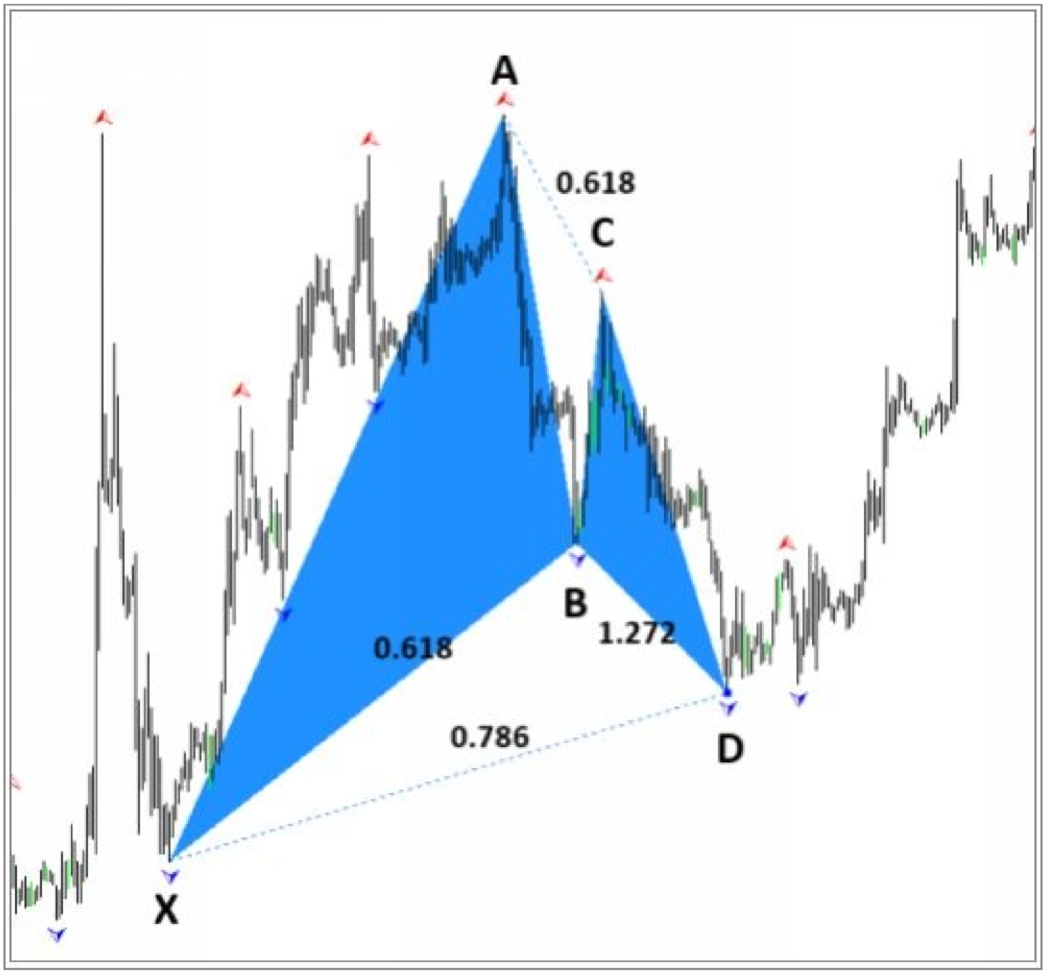

Figure 3-4: Hourly EURUSD Chart Hourly. Fibonacci ratio confirmation between lags for Gartley Pattern.

Harmonic Pattern trading is the typical mean reversion trading strategy. It assumes that the market will change direction, for example, from buy to sell or from sell to buy. In fact, the harmonic pattern detection is equivalent to detecting the turning point in the market. Recognizing the trading direction is simple with harmonic patterns. If the final point D show up above point C, then the pattern tells you the bearish turning point. If the final point D show up below point C, then the pattern is the bullish turning point (Figure 3-5).

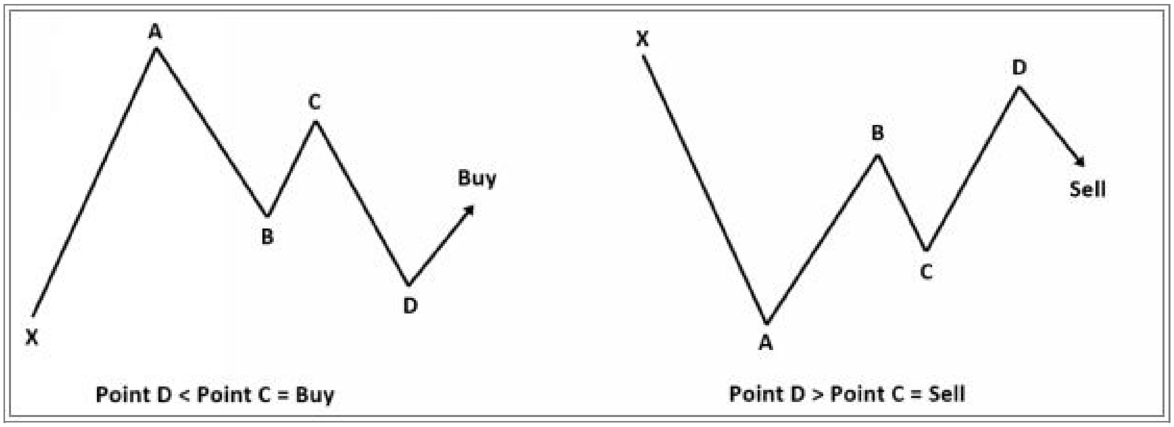

Figure 3-5: Harmonic Pattern and expected price path after the final point D.

Harmonic pattern can be used to spot the turning point for both continuation and reversal of the long-term trend. For trading, the differentiation must be made between these two cases because trading preparation for the two cases can be different. Figure 3-6 show the typical turning point detection in the case of continuation of the long-term trend. This type of scenario is often found when the harmonic pattern appears during the correction phase of the long-term trend. For example, in Figure 3-6 the correction phase started after the Peak A, then harmonic pattern told us to be ready for buy since the correction phase would end at the point D. To improve your trading decision, you can do some background check before your trading. For example, you can measure the Fibonacci ratio of AD in regards to some important peaks found before the harmonic pattern. If the harmonic pattern is corresponding well to the correction phase, then the lag AD must have some meaningful Fibonacci relationship with some important peaks found before the harmonic patterns. In Figure 3-7, we can found that the point D of our harmonic pattern was corresponding to the trough at 50% retracement level from one of the peaks. In addition, the turning point during the continuation of the long-term trend, the price will likely make further small correction before the main buy trend show up.

Figure 3-6: Example of Continuation Harmonic pattern on EURUSD Hourly chart.

Figure 3-7: Measuring the Fibonacci ratio relationship between lag AD and the peak found earlier.

For the case of the reversal against the established long-term trend, the harmonic pattern can still serve its purpose by detecting turning point. Unlike the case of continuation, we make our trading decision against the established long-term trend (Figure 3-8). This might make the typical momentum trader uncomfortable because they think they are trading against the trend. Spotting the turning point against long-term trend is harder statistically. At the same time, it offers greater advantage to trade. So your risk is greater as well as your reward. When you can enter at the very start of the trend, you can have the maximum profitable range for the trend. Typically, for the momentum based trading strategy, their entry comes much after the harmonic pattern signal. In this case, the background check is not useful. Therefore, traders must use other secondary confirmation techniques. Several confirmation techniques can be used to support your trading decision. Mostly we recommend using the secondary confirmation techniques suitable for mean reversion trading. For example, Bollinger bands, Divergence indicator and Oscillator in higher timeframe might be good candidates to confirm your entry. Since we want to confirm your entry against long term established trend, you need to use greater indicator period for the secondary indicators. For Bollinger bands, it is recommended using the moving average period greater than 50 at least. For Oscillators like RSI and CCI, it is recommended using the indicator reading from higher timeframe. For example, if you have detected Harmonic Pattern from H1 timeframe, then you might use RSI or CCI reading from D1 or H4 timeframe to confirm your entry.

Figure 3-8: Example of Reversal Pattern after long-term trend was established.

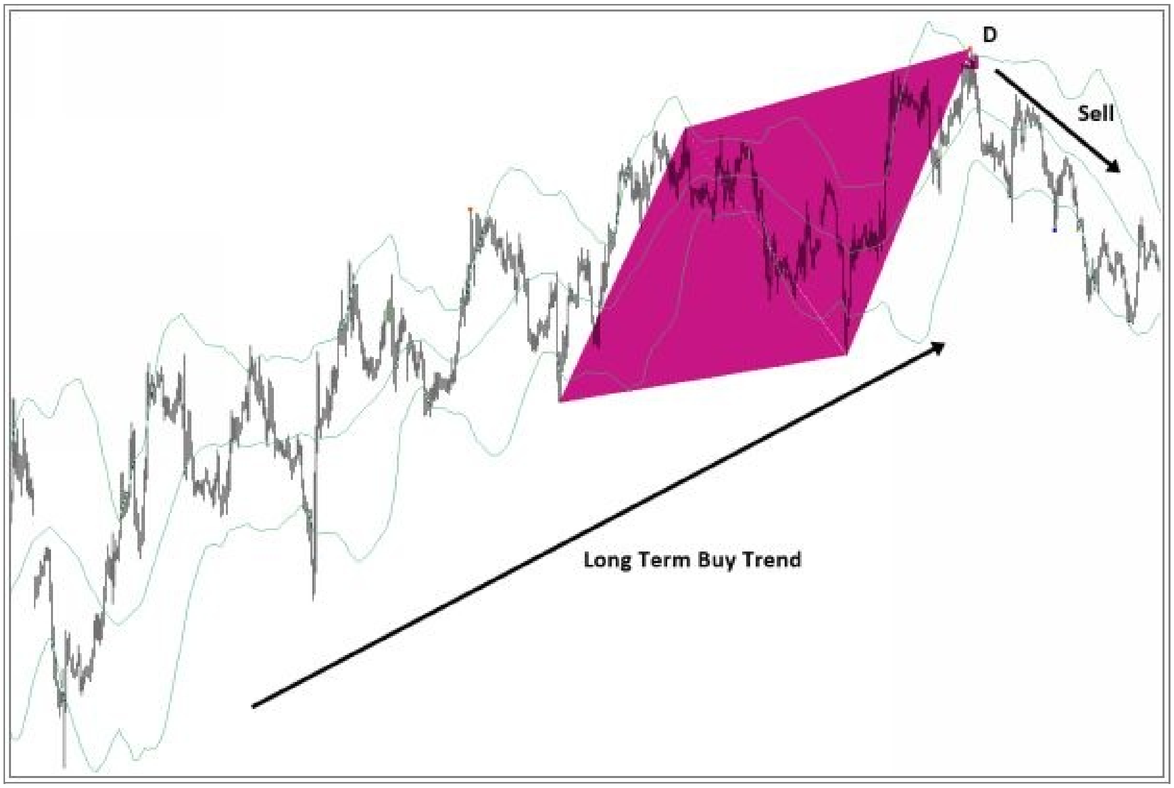

Figure 3-9: Bearish AB=CD pattern after long-term buy trend. Entry Confirmation with Bollinger Bands indicator.

3.3 Pattern Matching Accuracy and Pattern Completion Interval

When we detect a harmonic pattern, we need to filter out some bad patterns from good one. Fibonacci ratios are the important rule in detecting harmonic patterns. For example, when we want to detect the Bullish Gartley pattern, we will select five probable points first. Then we will measure the ratios of AB/XA, BC/AB, CD/BC and CD/XA to check the structural integrity of the pattern. We can call it as the perfect Gartley pattern if the patterns have the precise Fibonacci relationship between lags like below:

$$AB/XA = 0.618 \text{ or } 0.786$$

BC/AB = 0.618,

CD/BC = 1.272 or 1.618 and

CD/XA = 0.786.

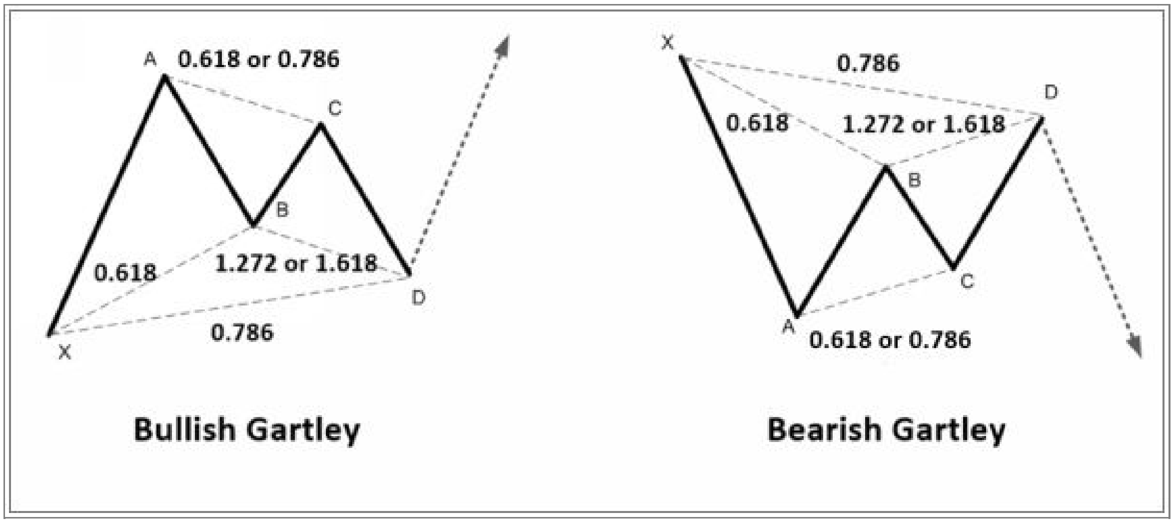

Figure 3-10: Structure of Gartley Pattern for Bullish and Bearish Pattern.

However, it is very rare to find the perfect pattern. Most of time, they will come close to the ideal ratio but they will never be dead accurate. Therefore, trader can assign some quantity to the pattern matching accuracy. For example, trader might use one of the following four error metrics to measure the pattern matching errors first.

$$Mean\ Squred\ Error, MSE = Mean(E_t^2)$$

$$Root\ Mean\ Squred\ Error, RMSE = \sqrt{MSE}$$

$$Mean\ Absolute\ Error, MAE = Mean(|E_t|)$$

$$Mean\ Absolute\ Percent\ Error, MAPE = Mean(|P_t|)$$

Where E_t = measured ratio from chart – reference ratio, P_t = 100 x (measured ratio – reference ratio)/reference ratio.

Figure 3-11: Possible error metrics for Harmonic pattern matching.

Since percentage values are often easy to compare, the Mean Absolute Percent Error (MAPE) might be the most intuitive error metrics among these four error metrics.

$$MAPE = \frac{1}{n}\sum_{t=0}^{n}\left|\frac{measured\ ratio_t - reference\ ratio_t}{reference\ ratio_t}\right|$$

To calculate pattern matching accuracy, you just need to subtract MAPE value from 100 (i.e. Pattern matching accuracy (%) = 100 - MAPE). To help your understanding, we will give you the working example using MAPE error metrics for Gartley pattern detection case. Let us assume that we have the following ratios from the detected Gartley pattern:

AB/XA = 0.598

BC/AB = 0.632,

CD/BC = 1.211 and

CD/XA = 0.750.

Then error from each ratio can be calculated like this:

Error for AB/XA = 100 * |0.598 -0.618|/0.618 = 3.24%

Error for BC/AB =100 * |0.632-0.618|/0.618 = 2.27%,

Error for CD/BC = 100 * |1.211-1.272|/1.272 = 4.8% and

Error for CD/XA = 100 * |0.750-0.786|/0.786 = 4.58%.

By averaging all these four errors, we can conclude that our Gartley pattern have the pattern matching error of 3.72% in MAPE and pattern matching accuracy of 96.28%.

Pattern Matching Error = (3.4% + 2.27% + 4.8% + 4.58%)/4 =3.72% and

Pattern Matching Accuracy = 100-3.72% =96.28%.

If your Gartley pattern has the pattern matching accuracy of 96.28%, it is quite close to the ideal Gartley pattern. Depending on your trading style, you might want to use tight criteria or loose criteria. For example, you can set the trading rules like that you will trade with the harmonic pattern over 90% pattern matching accuracy or you can even set that over 95% pattern matching accuracy if you wish. What you need to know is that less number of patterns will be detected if you set the pattern matching accuracy too high. For example, if you set pattern matching accuracy to 99%, then you might not have a chance to trade because it is very rare to find the patterns with 99% pattern matching accuracy. If you set the pattern matching accuracy to 60%, then you will have too many patterns to trade but many of them can be quite ugly patterns with low pattern matching accuracy. From my experience, the bottom line of the pattern matching accuracy for trading can be 80%. If they want to set little tougher criteria for trading, then they can use 90% as the minimum required pattern matching accuracy. One important thing to remember is that the pattern matching accuracy is not the success rate of the pattern. Success rate is the winning rate for your trading. For example, 96% pattern matching accuracy is not the same as 96% success rate for your trading. Such misinterpretation must be prevented in communication.

Figure 3-12: Bullish Cypher Pattern Example on EURSUD H1 timeframe.

Now, let us try to touch the concept of Pattern Completion Interval. Previously we have mentioned that pattern matching error and pattern matching accuracy can describe the structural integrity of the harmonic pattern when the measured ratios and the ideal ratios of the patterns are different. Consider that we have the harmonic triangle with 0.382 retracement from our chart as shown in Figure 3-12. Depending on our criteria for pattern matching accuracy, the position of point B can be within the tolerable range or outside the tolerable range. For example, if we set the maximum tolerable pattern matching accuracy to 95%, then we can call it as the harmonic triangle as long as the ratio of AB/XA stays in between 0.401 (=0.382*1.05) and 0.363 (=0.382*0.95). If we extend the same concept to the five point harmonic pattern, we can calculate tolerable range for the final point D. For example, the tolerable ratio of CD/BC for the Cypher pattern can be 1.900 and 2.100. The pattern completion interval is the visual confirmation of this tolerable range for the final point D for harmonic pattern. Since the pattern completion interval defines the maximum and minimum allowable level for the final point D, the pattern completion interval can offer you important information about the harmonic pattern as well as for your trading. Firstly, you know that if the price slips outside the pattern completion interval, then the pattern will not be qualified for your trading. For bullish pattern, if the price slips outside the lower limit, then pattern formation will fail. Likewise, for bearish pattern, if the price slips outside the upper limit, then pattern formation will fail. Since we assume that harmonic pattern will predict the turning point, the tolerance limit corresponding to the pattern formation can naturally become your stop loss level. For example, for bullish pattern, your stop loss level can be the lower limit within the pattern completion interval whereas upper limit is the last trading entry you can make for that pattern. Therefore, the pattern completion interval can become your size of stop loss. Take profit level can be further adjusted using your preferred Reward/Risk ratio for your trading as shown in Figure 3-16.

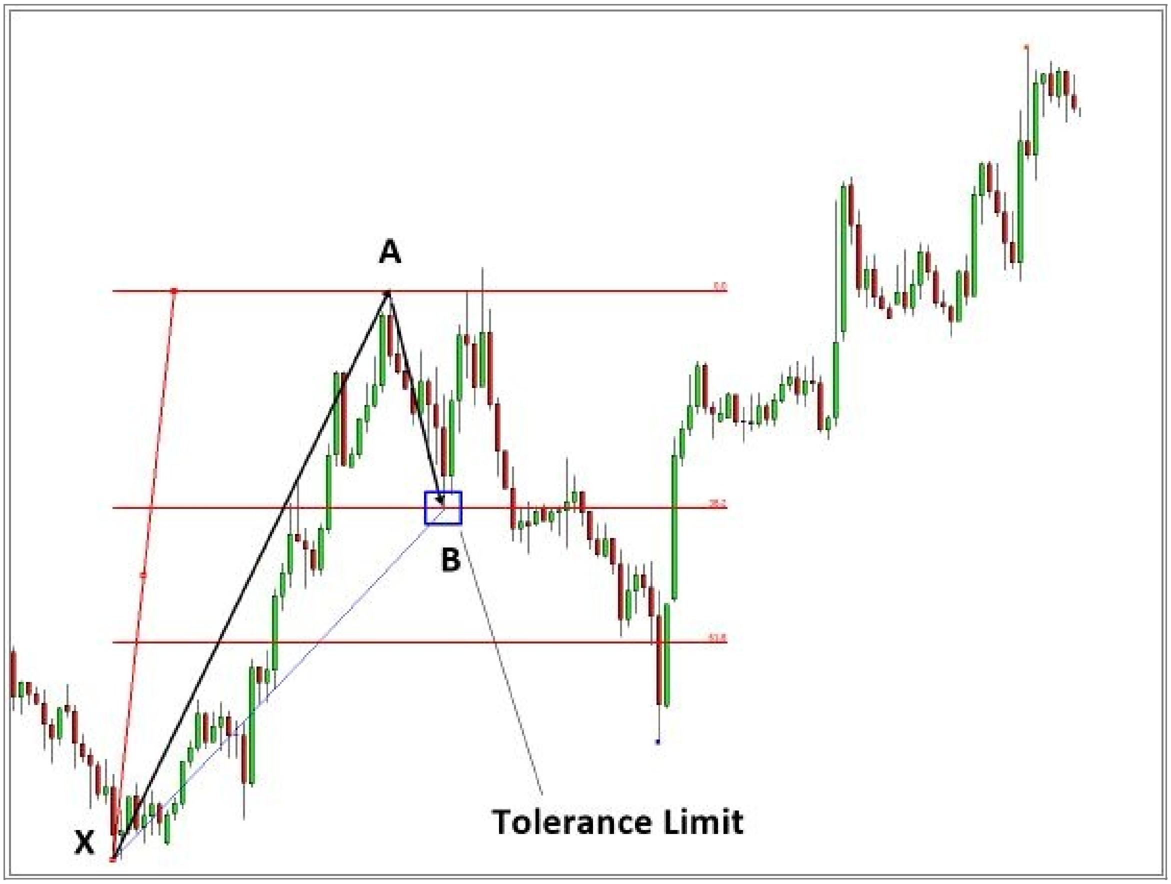

Figure 3-13: Harmonic Triangle made from 3 points. The ratio AB/XA is nearly 0.382.

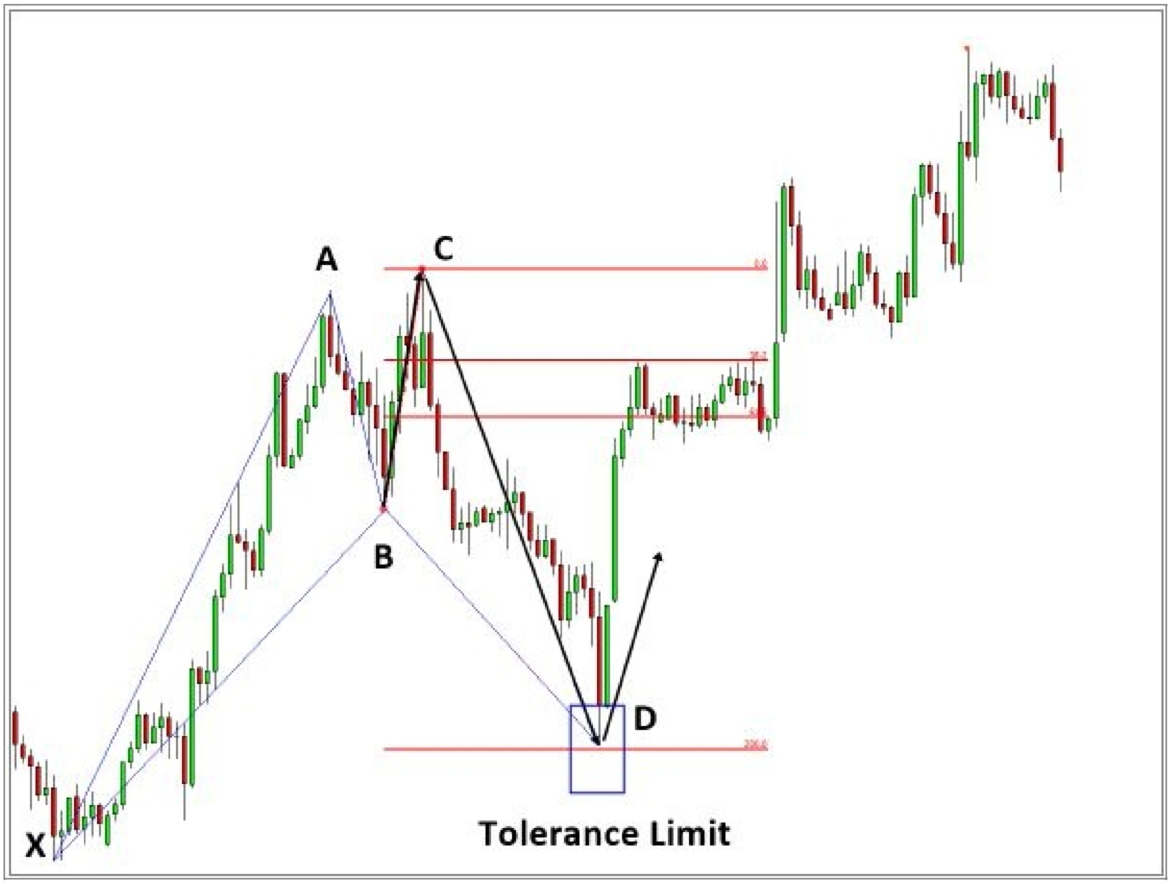

Figure 3-14: Two successive Harmonic Triangles made from XABCD 5 points.

Figure 3-15: Bullish cypher pattern in EURUSD with Pattern Completion Interval.

Figure 3-16: Stop loss and take profit expressed in Pattern Completion Interval ± 10% (i.e. Expected Reward/Risk=3).

3.4 Potential Reversal Zone

Potential Reversal Zone is the fundamental concept behind Harmonic pattern trading. Trader can trade without knowledge of Potential Reversal Zone. However, if traders have good knowledge on Potential Reversal Zone, he can use harmonic pattern with more confidence for his trading. So what is Potential Reversal Zone? Simply speaking potential Reversal zone is the area where three or four Fibonacci levels are converging together. Traders, who believe on natural law behind Fibonacci number, consider this area as the key price level for the future price movement. Is it true really? If you are not convinced, then think this way. There are numerous number of traders using Fibonacci retracement or projection to identify the key price levels every day. If the Potential Reversal Zone are made up from three or four overlapping Fibonacci levels, then roughly three or four times more traders will watch out this price level. From my experience, Potential Reversal Zone is not only logical but they are also practically an important area where high volatile price movement occurs like reversal or breakout. For the average trader, grasping the concept of Potential Reversal Zone can be tricky because they are complex to visualize. So let us best illustrate the concept of Potential Reversal Zone here. There are two types of Potential Reversal Zone. Let us name them as Potential Reversal Zone Type A and Type B respectively. In the five point pattern, Potential Reversal Zone Type A is constructed before the final point D formation using four points X, A, B and C (Figure 3-17). Since price did not hit the point D yet, we use three realized lags XA, AB and BC from point X, A, B and C. Potential Reversal Zone Type A is constructed when we overlap the Fibonacci levels drawn from the lag XA, AB and BC. The whole purpose of constructing Potential Reversal Zone Type A is to detect the location of Point D or to detect reversal area. If the location of point X, A, B and C are correct, the Fibonacci levels drawn from lag XA, AB, BC should be converging to each other. If the location of point X, A, B and C are close to the ideal location, then neighbouring Fibonacci levels will have smaller gap. If points X, A, B and C are inaccurately located, then neighbouring Fibonacci levels will have greater gaps as shown in Figure 3-18.

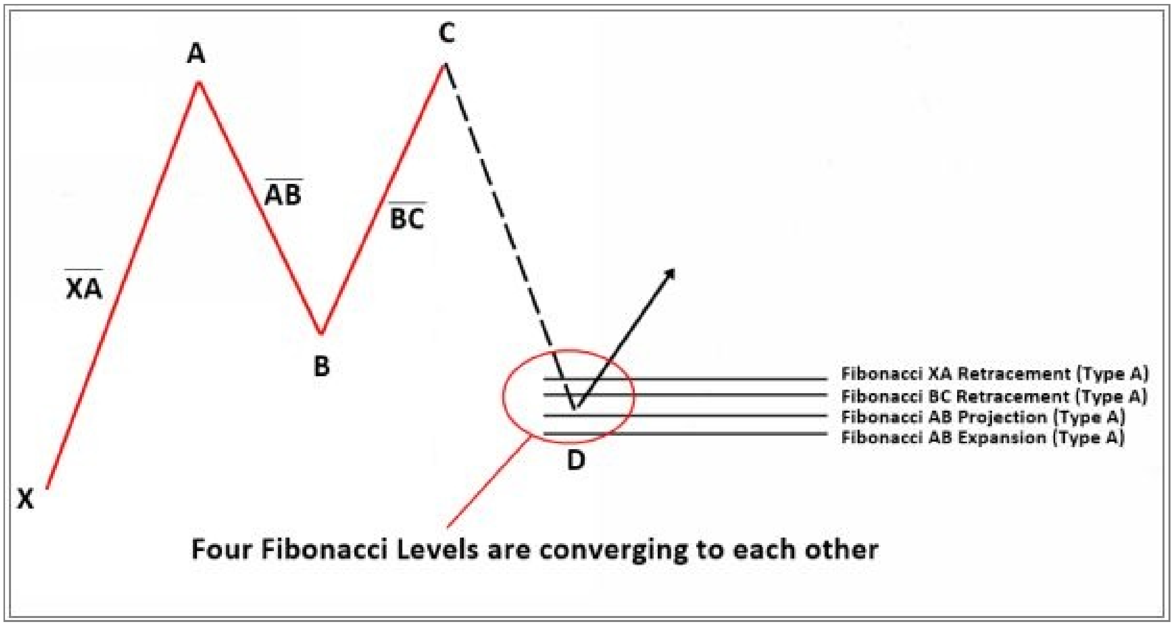

Figure 3-17: Illustration of Potential Reversal Zone Type A.

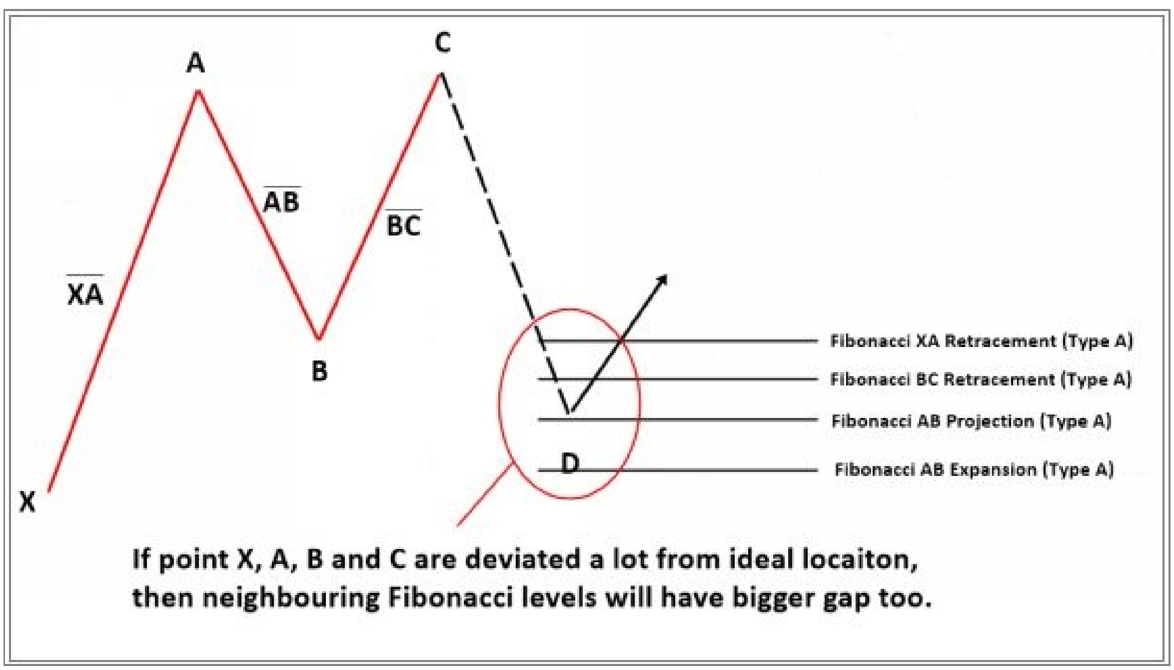

Figure 3-18: Greater gaps in Potential Reversal Zone Type A when point X, A, B and C are located inaccurately in the pattern.

Potential Reversal Zone Type B is constructed after the final point D is formed.

Since we have all five points X, A, B, C and D, we can use all four lag XA, AB, BC and CD to construct Potential Reversal Zone Type B (Figure 3-19). The whole purpose of constructing Potential Reversal Zone Type B is to predict future price movement after harmonic pattern is detected. Price can make reversal or breakout movement around Potential Reversal Zone Type B. Normally you should treat this Potential Reversal Zone Type B as your important support and resistance level after your entry. Trader can use the Potential Reversal Zone Type B for the trailing stop.

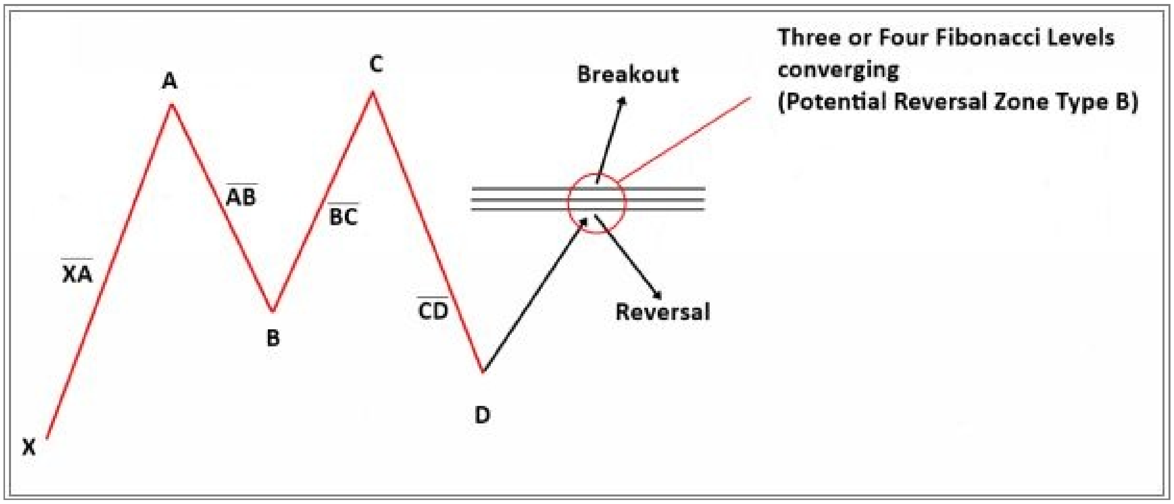

Figure 3-19: Illustration of Potential reversal Zone Type B.

Since Potential Reversal Zone Type A is used to detect the final point D, it is good practice to show all the four Fibonacci levels in the charts even though they are not strictly converge to each other. It is trader's task to analyse the locations of these four Fibonacci levels before he makes his trading decision. Since the distance between Fibonacci levels in Potential Reversal Zone Type A tells the accuracy of the location of Point X, A, B and C, trader should carefully exam the distance of Fibonacci levels. Since we use Potential Reversal Zone Type B as support and resistance level, it is better to show highly converging Fibonacci levels only. Figure 3-20 is an example of Bullish Butterfly pattern showing both

Potential Reversal Zone Type A and Type B. In this example, the price made another reversal at the Potential Reversal Zone Type B. However, sometimes price can penetrate the Potential Reversal Zone Type B as shown in Figure 3-21.

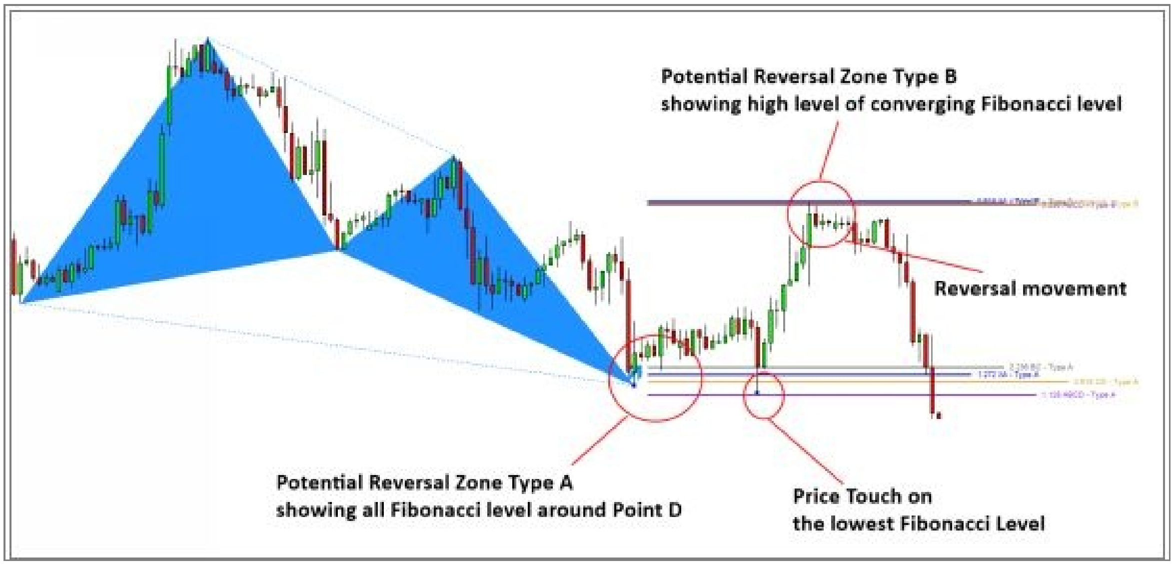

Figure 3-20: Potential Reversal Zone Type A and Type B for Bullish Harmonic Pattern. Note that price bounced off from the Potential Reversal Zone Type B.

Figure 3-21: Potential Reversal Zone Type A and Type B for Bearish Harmonic

Pattern. Note that price penetrated hard at Potential Reversal Zone Type B.

Just like Pattern Completion Interval can be used as the stop loss level for your trading, the upper limit and lower limit of Potential Reversal Zone Type A can be used as the stop loss level for bearish and bullish pattern respectively. You will often find that the stop loss level of both pattern completion interval and Potential Reversal Zone Type A is comparable. Sometimes, Pattern completion interval provides greater stop loss size and sometimes, it can be the other way around. Two things are important to watch out. Firstly, the greater gap in Potential Reversal Zone Type A means that inaccurate position of X, A, B and C point. Secondly, the greater stop loss size means that market have to move longer distance in your prediction to achieve good Reward/Risk ratio. This is statistically harder. In general, it is better to trade when the limit of the Potential Reversal Zone Type A is inside the pattern completion interval unless you have some other reasons to trade. If the difference in stop loss size is small between pattern completion interval and Potential Reversal Zone Type A, then you might ignore the difference. In this case, you can use the greater stop loss size to avoid any stop hunting.

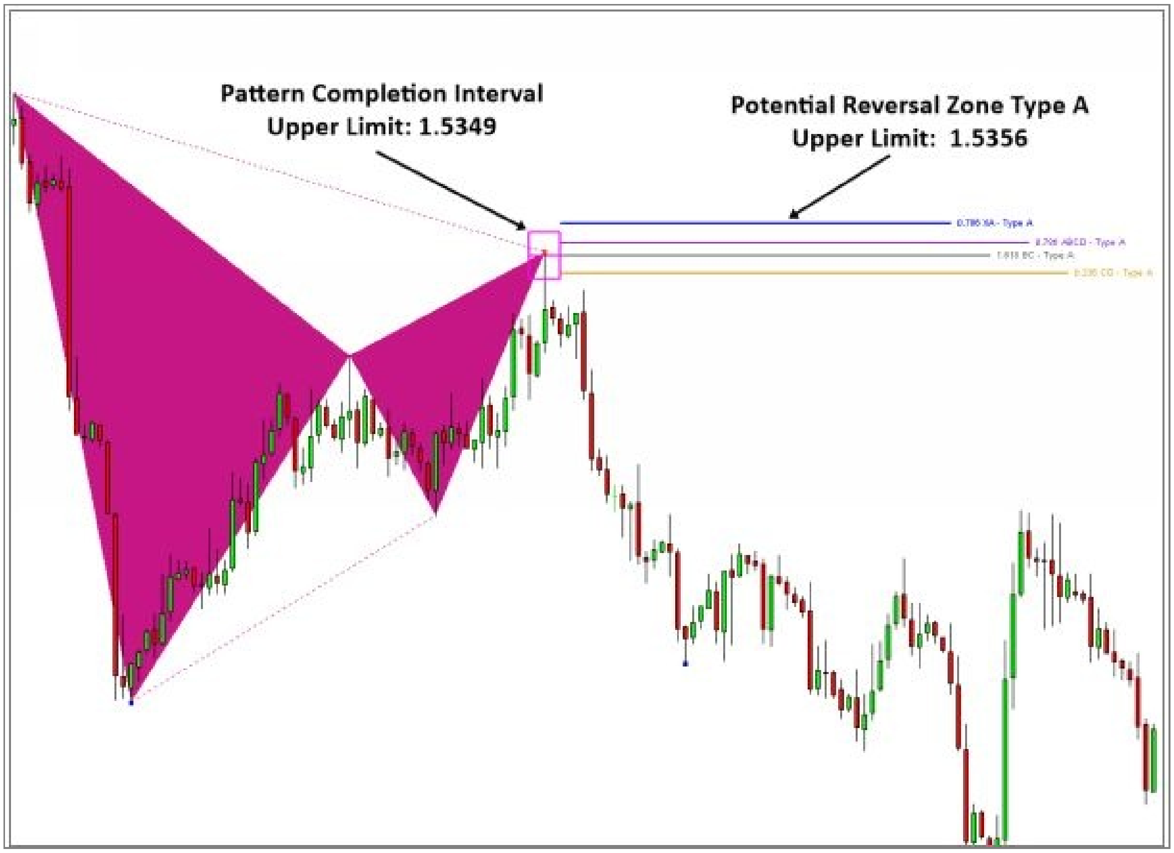

Figure 3-22: Example of greater stop loss size of Potential Reversal Zone Type A in comparison to pattern completion interval on GBPUSD H4 timeframe.

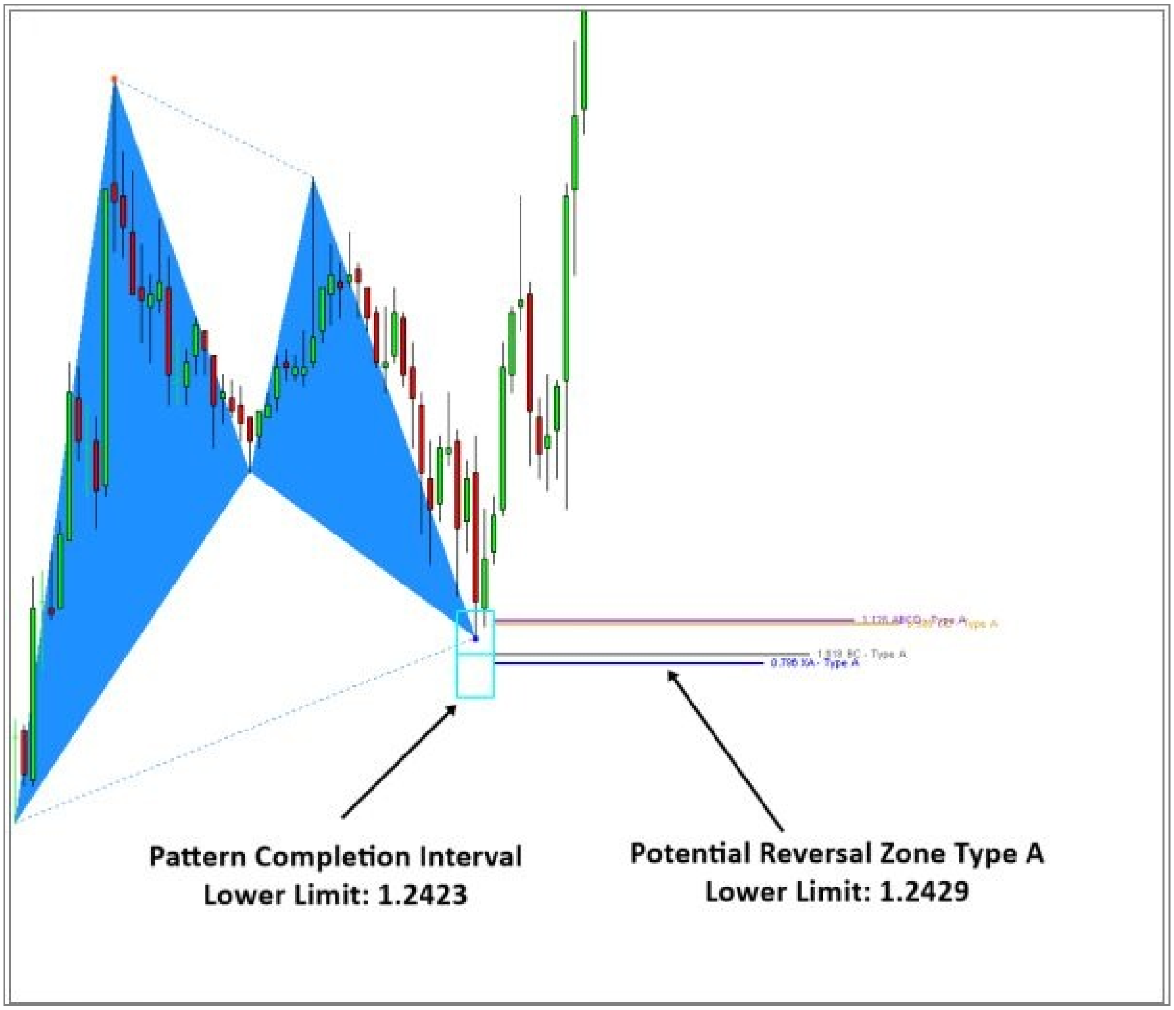

Figure 3-23: Example of smaller stop size of Potential Reversal Zone Type A in comparison to the pattern completion interval on GBPUSD M30 timeframe.

4. Elliott Wave Trading

4.1 Introduction to the Wave Principle

Ralph Nelson Elliott was one of very first person who believed that he could predict the stock market by studying the repeating price patterns in the price series. The Wave Principle from Elliott states that the wave patterns in different scales are repeating and superimposing on each other forming complex wave patterns. If harmonic pattern directly focuses on the short patterns made up from five points, the Wave Principle, developed by Ralph Nelson Elliott, describe how the financial market evolve to meet the equilibrium with the repeating wave patterns, equilibrium fractal waves. The advantage of Elliott Wave theory is that it is comprehensive as the theory provides multiple trading entries on different market conditions. With Elliott Wave theory, traders can perform both momentum trading and mean reversion trading. The disadvantage of Elliott Wave theory is that it is more complex comparing to other trading techniques. In addition, there are still some loose ends in detecting Elliott wave patterns. For this reason, many traders heavily criticize the lack of scientific methods of counting Elliott Waves.

Elliott Wave theory received good attention from many traders and investors for several decades. Elliott Wave theory is a useful technique to deal with the financial market with the dominating Equilibrium Fractal-Wave process. For the financial market with strong Equilibrium Wave process (2^{nd}, 3^{rd} and 4^{th} columns in the Price Pattern Table), traders must use alternative methodology over Elliott Wave techniques because Elliott Wave Theory is not meant to deal with Wave process. Seasonality or other cyclic fluctuations can be dealt better with other techniques. For example, Seasonal Exponential Smoothing, Fourier Transform, Principal Component Analysis or Wavelet Transformation might do better job for such a case. Some literature review and empirical research can yield helpful insight on which market trader can trade better with Elliott Wave Theory. In our Book, we will introduce the fundamentals of the Wave Principle. At the same time, we will introduce the template and pattern approach towards more scientific wave counting for traders.

The Wave Principle states that the crowd or social behaviour follows a certain wave patterns repeating themselves. The Wave Principle identifies two wave patterns. They are impulse and corrective wave. Often, the term impulse wave is interchangeably used with the motive wave. Two terms are identical. Both motive and impulse wave progress during the main trend phase whereas the corrective wave progress during the corrective phase against the main trend. In general, the Impulse Wave has a five-wave structure, while the Corrective Wave have a three-wave structure (Figure 4-1). It is important to understand that these wave structures can override on smaller wave structure to form greater wave cycle (Figure 4-2). Elliott Wave theory is useful in identifying both trend market and correction market. As the Elliott Wave Theory already assumes that price progresses in the Fractal-Wave form, they do not suffer from lagging of price like the smoothing algorithm based technical indicators do.

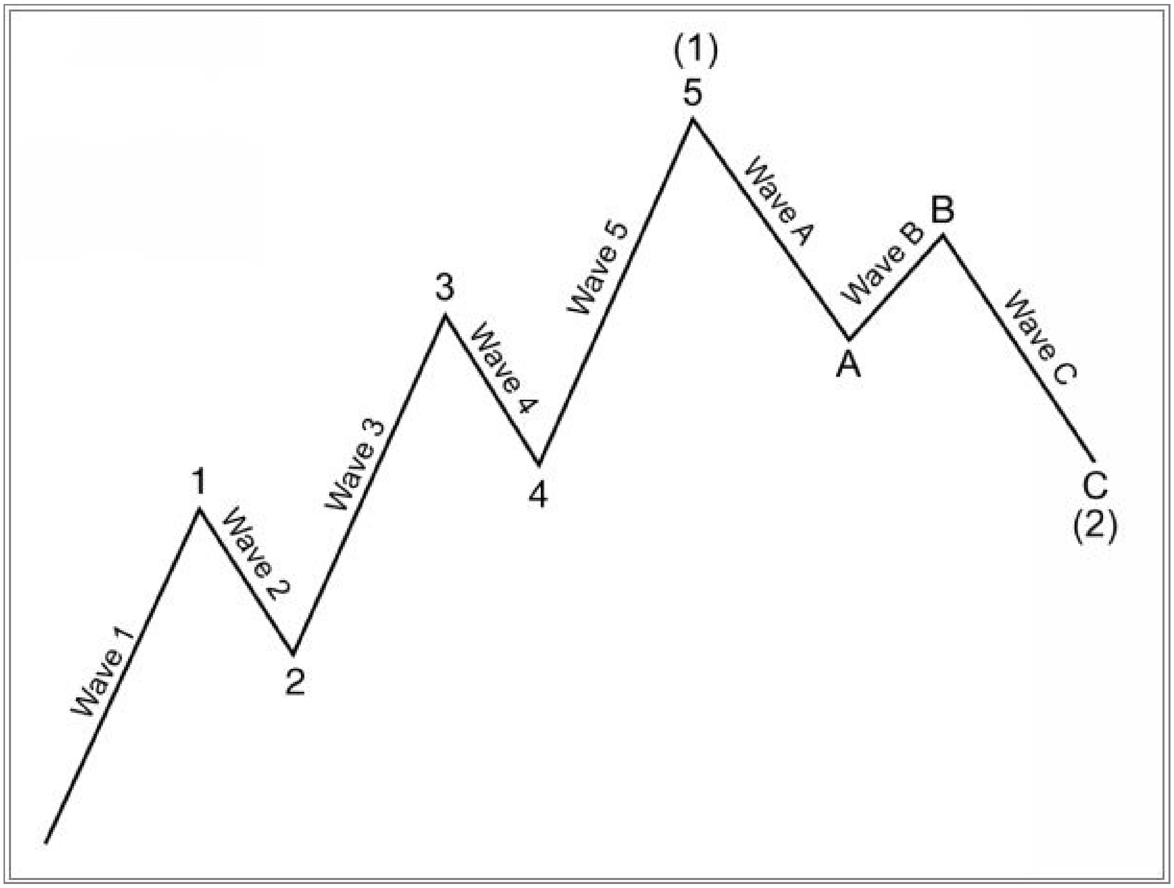

Figure 4-1: Illustrative example of five impulse wave and three corrective wave structure.

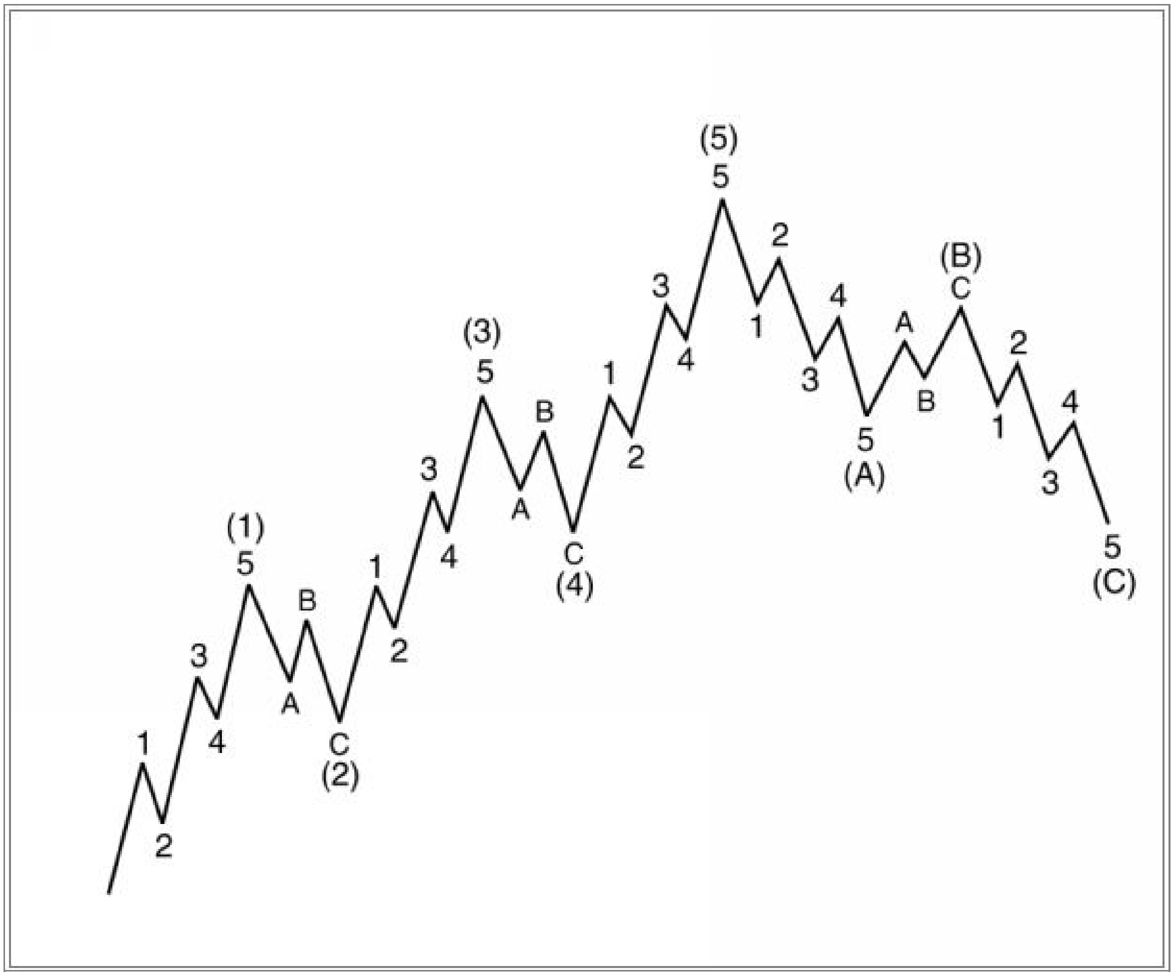

Figure 4-2: Lesser Impulse and corrective wave forming more complex wave patterns.

4.2 Scientific Wave Counting with the Template and Pattern Approach

Elliott Wave theory can be beneficial to predict the market movement if they are used correctly. Junior traders are often fear to use Elliott Wave because their complexity. From my experience, Elliott wave is not a rocket science, anyone can probably learn how to use the technique with some commitment. However, not all the book and educational materials will teach them in the scientific way.
If we are just looking at the three rules from the original Wave principle only, then there are definitely some rooms where subjective judgement can play in our

wave counting. This makes starters to give up the Elliott Wave practice too quickly. Fortunately, there are some additional tools to overcome the subjectivity in our wave counting. First tool but the most important tool is definitely the three wave rules from the original Wave Principle. They can be used as the most important guideline for the wave counting. Below we describe the three rules:

Rule 1: Wave 2 can never retrace more than 100 percent of wave 1.

Rule 2: Wave 4 may never end in the price territory of wave 1.

Rule 3: Out of the three impulse waves (i.e. wave 1, 3 and 5), wave 3 can never the shortest.

Second tool is the Fibonacci ratio. As in the Harmonic pattern detection, Fibonacci ratio can play an important role in our wave counting because they describe the wavelength of each wave in regards to their neighbouring wave. For example, the following relationship is often found among the five wave of the impulse wave. Depending on which wave is extended among wave one, three and five, the Fibonacci ratios are different. Most of time, the extension of wave 3 is most frequently observed in the real world trading.

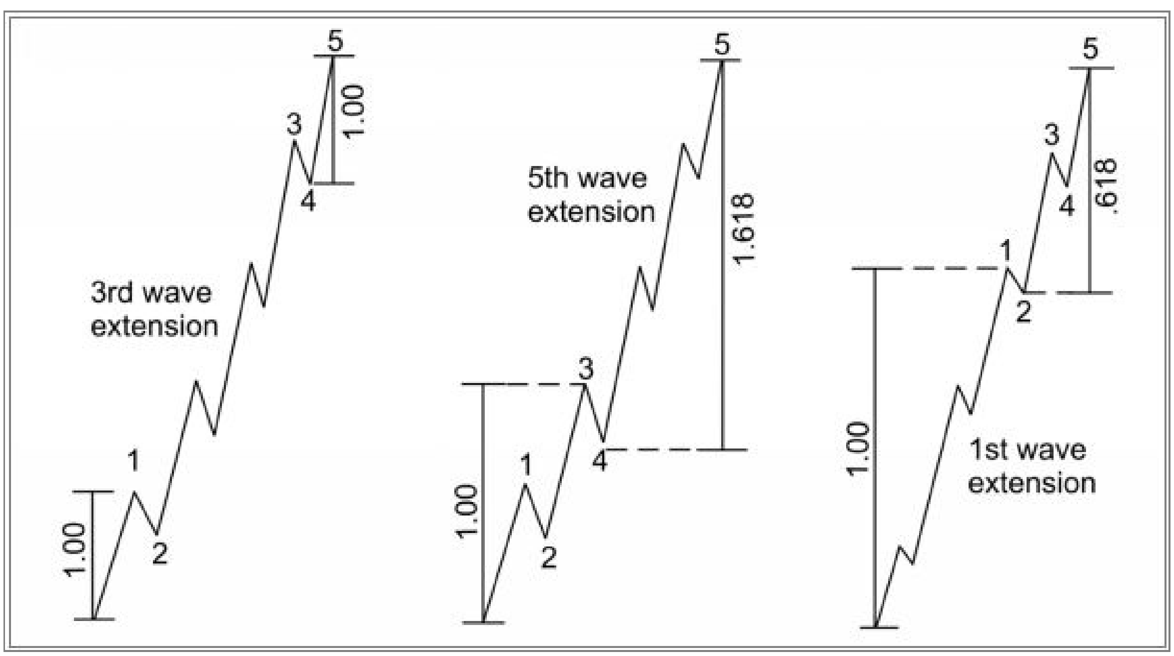

Figure 4-3: Fibonacci relationship of impulse wave structure.

Unless wave 1 is extended, wave 4 often divides five impulse waves into the Golden Section. If the wave 5 is not extended, the price range from the starting point of wave 1 to the ending point of wave 4 make up 61.8% of the overall height of the impulse wave. If wave 5 is extended, then the price range from the starting point of wave 1 to the ending point of wave 4 make up 38.2% of the overall height of the impulse wave. These two rules are rough guideline. Sometime, trader can observe some cases where these two rules are not hold true. Personally, I normally place the Fibonacci ratio relationship in Figure 4-3 before this Golden Section rule. However, the priority between these two rules might depend on the preference of traders.

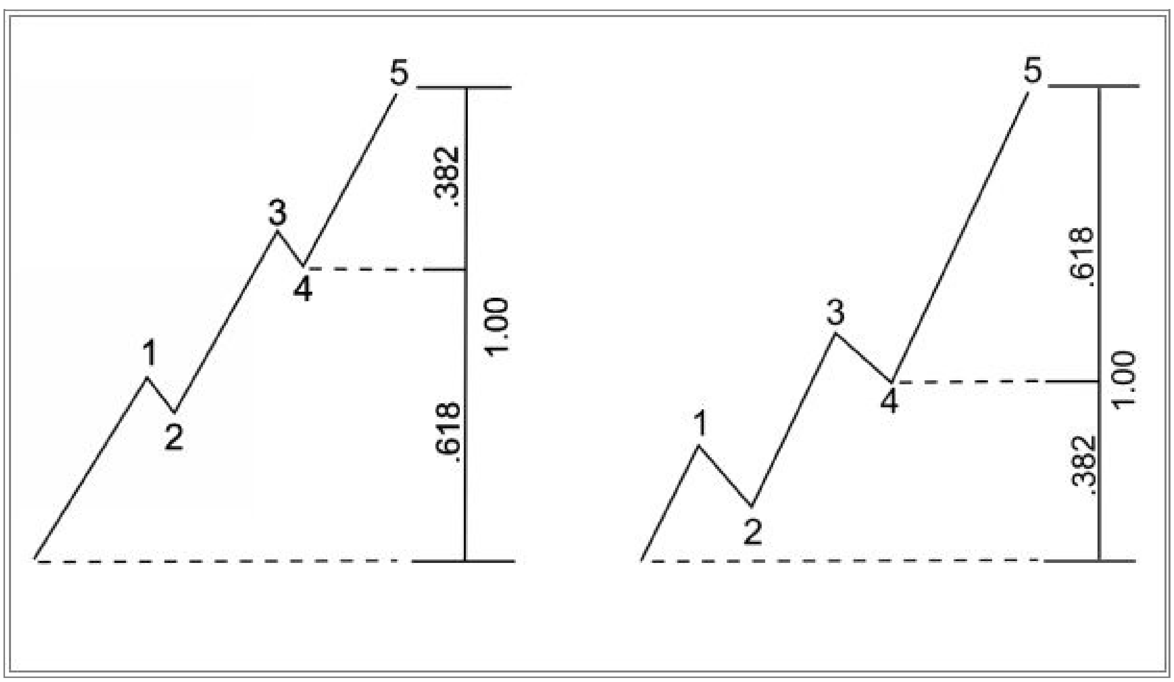

Figure 4-4: Golden Section division rule with wave 4.

For the case of the three waves in the corrective wave, typical Fibonacci ratios are shown in Figure 4-5. The corrective wave is often retrace 61.8% or 32.8% against the size of previous impulse wave. In general, Elliott suggested that corrective wave 2 and wave 4 have the alternating relationship. If wave 2 is simple, then wave 4 is complex. Likewise, if wave 2 is complex, then wave 4 is simple. A “Simple” correction means only one wave structure whereas a “Complex” correction means three corrective wave structures. Furthermore, if wave 2 is sharp correction, then wave 4 can be sideways correction. Likewise, if wave 2 is sideways correction, then wave 4 can be sharp correction.

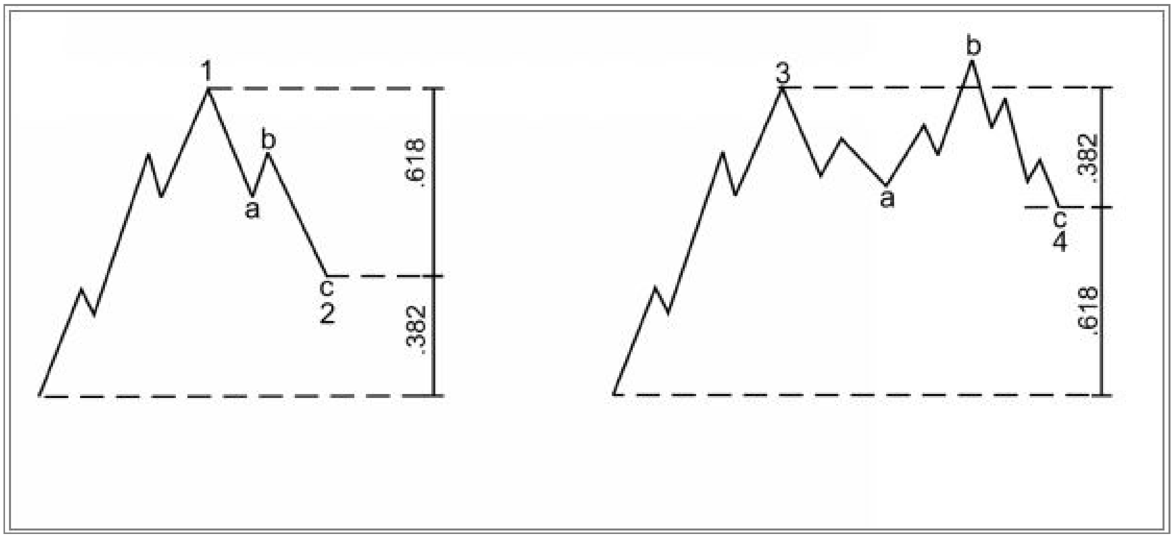

Figure 4-5: Fibonacci relationship for wave 1 and wave 2 (left) and for wave 3 and wave 4 (right).

Third tool, which can be helpful in overcoming the subjectivity, is using template. Template is a rough wave counting drawn in your chart using some sort of very simple automatic algorithm. Even though, the template does not provide you the perfect counting, the template can be helpful in eliminating thousands of alternative possibilities in first place. We found that this makes the wave counting more accurate and easier. The peak-trough analysis is one of the good templates to start with wave counting. You can always create your own alternative version of the template if you wish. However, we will stick with the peak-trough analysis as our basic template in this book. Trader can use both Zig Zag and the modified Fractal indicator for wave counting task. The modified Fractal indicator can show more peaks and troughs for you to work with. However, it is still good approach for your wave counting.

When you combine the three wave rules, Fibonacci ratio and the template, you are not likely to get lost with your counting. Trader can make use of this approach for his daily trading decision too. When you want to count waves, the first thing you need to do is to select the right timeframe showing some countable peaks and troughs. Generally, the peaks and troughs of the larger timeframe must appear in the smaller timeframe. However, the peaks and troughs in the smaller timeframe does not have to appear in the larger timeframe. For example, if you had a peak on daily candle bar with the bar open time 00:00 21 June 2016, this peak must appear in the hourly timeframe or four hourly timeframe. However, the peak of the hourly bar with bar open time 14:00 10 March 2015 does not have to appear in the daily candle bar. In the daily candle bar, it can appear if the peak of the hourly bar with bar open time 14:00 10 March 2015 is the highest high in the day 10 March 2015, otherwise this peak will not appear in the daily candle bar. Larger timeframe tends to reduce the number of the peaks and troughs in your chart making. With long sight of larger timeframe, sometime, counting can be a lot easier. However, larger timeframe might remove some key peaks and troughs from your charts. Therefore, it is important for traders always check both smaller timeframe and larger timeframe. If you are a day trader, then you should at least scan hourly and four hourly and daily charts in your analysis. Sometime, 15 minutes chart can provide valuable trading entry for your day trading too. Adding some odd timeframes like three hourly timeframe in your analysis is optional.

To illustrate the wave counting process, consider the peak-trough analysis in

EURUSD H4 timeframe in Figure 4-6. We have selected H4 timeframe for demonstration purpose only. The peak-trough analysis provide you some template which you can start your wave counting. In spite of the peak-trough analysis reveals the important peaks and troughs for your chart, we can see that it does not provide accurate wave counting. Remember that the template serve you to eliminate thousands of alternative possibility, but you still have to perfect your wave counting by yourself. Next step is to find either wave 123 structure or wave abc structure from our peak trough analysis. By Labelling the wave 1 and 2 first, we can find that wave 2 retraced back between 0.500 and 0.618 of wave 1. Since we know that next peak offer the multiple of price increase against wave 1, it is possible to guess next peak or the peak after the next peak might be wave 3 (Figure 4-7). As you can see, in the real world application, retracement of wave 2 can come near to the ideal Fibonacci ratio of 0.500 and 0.618. However, it will never be dead accurate most of time.

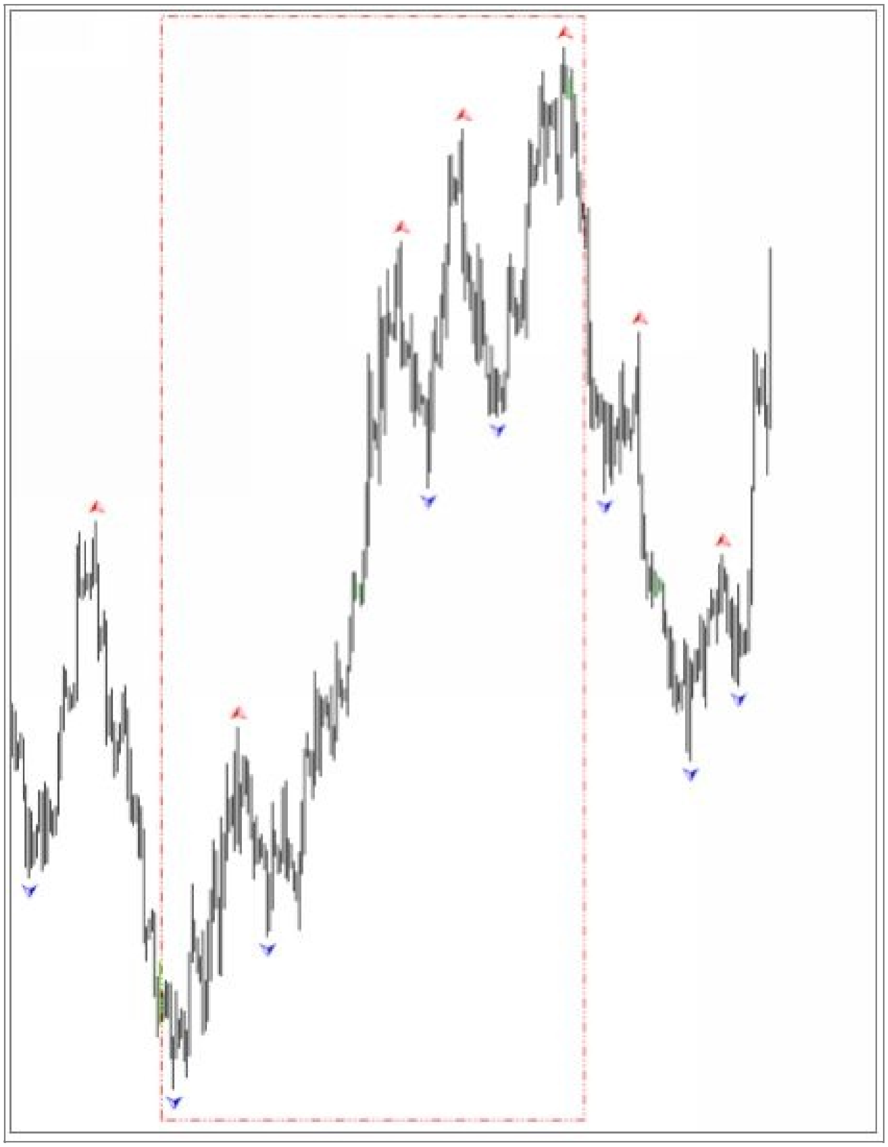

Figure 4-6: EURUSD H4 timeframe with the peak-trough analysis.

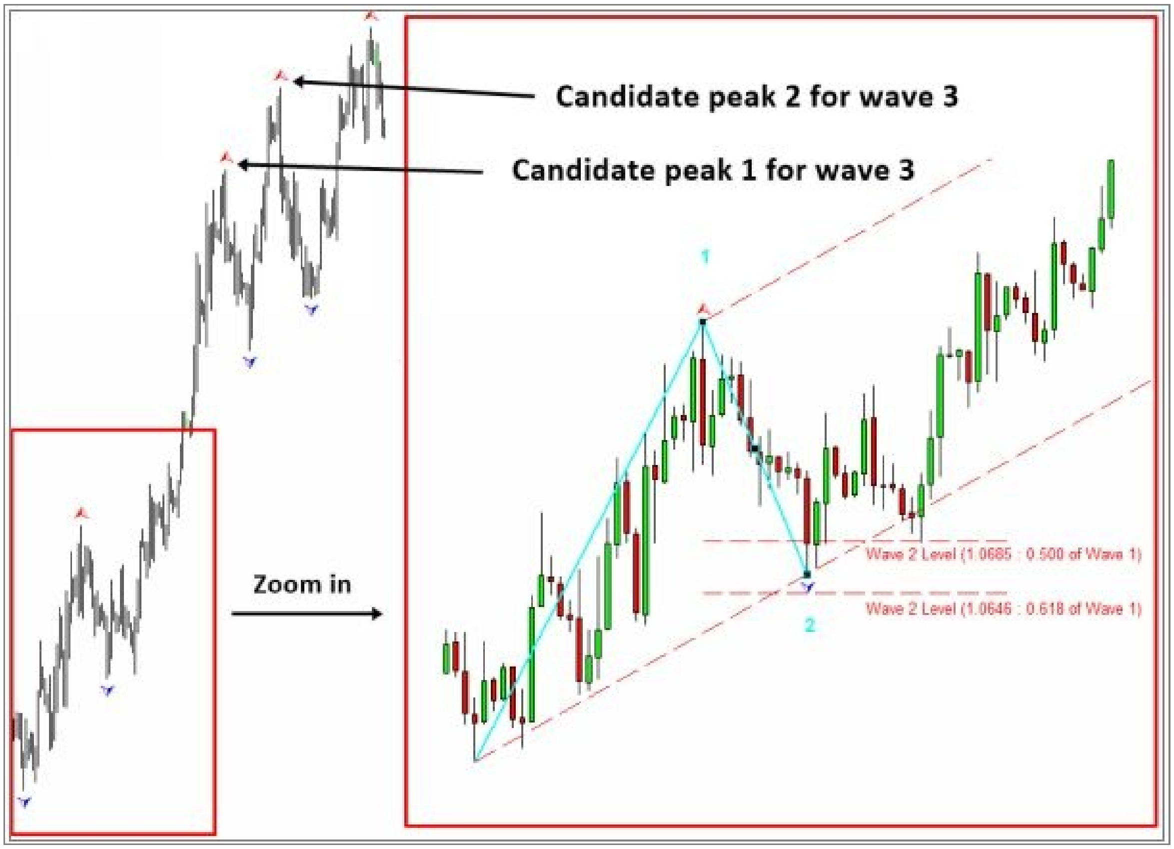

Figure 4-7: Counting wave 1 and 2 on EURUSD H4 timeframe.

To find the wave 3 between the two peaks (Figure 4-7), we have to exam both peaks in this case. When we exam the first candidate peak, we can find that our wave 3 ends near the 1.618 level of wave 1 (Figure 4-8). Our wave 3 ended near the ideal ratio of 1.618 but they are never dead accurate over 1.618. Let us exam the second candidate peak. With second candidate peak, the peak is in fact closer to 2.618 level of wave 1 (Figure 4-9). We cannot determine wave 3 just by comparing the Fibonacci ratios of these two peaks. We can inspect wave 4 and wave 5 in conjunction with wave 3 to support our final decision. With first candidate peak, wave 4 landed very near 0.382 level of wave 3. However, wave 5 is slightly off from 1.000 level of wave 1. With our second candidate peak, wave 4 landed very near to 0.382 level of wave 3. However, wave 5 also landed very close to 1.000 level of Wave 1.

Figure 4-8: Locating wave 3 on first candidate peak on EURUSD H4 timeframe.

Ideal level of wave 4 and wave 5 levels were calculated from candidate peak 1.

Figure 4-9: Locating wave 3 on second candidate peak on EURUSD H4

timeframe. Ideal level of wave 4 and wave 5 levels were calculated from candidate peak 2.

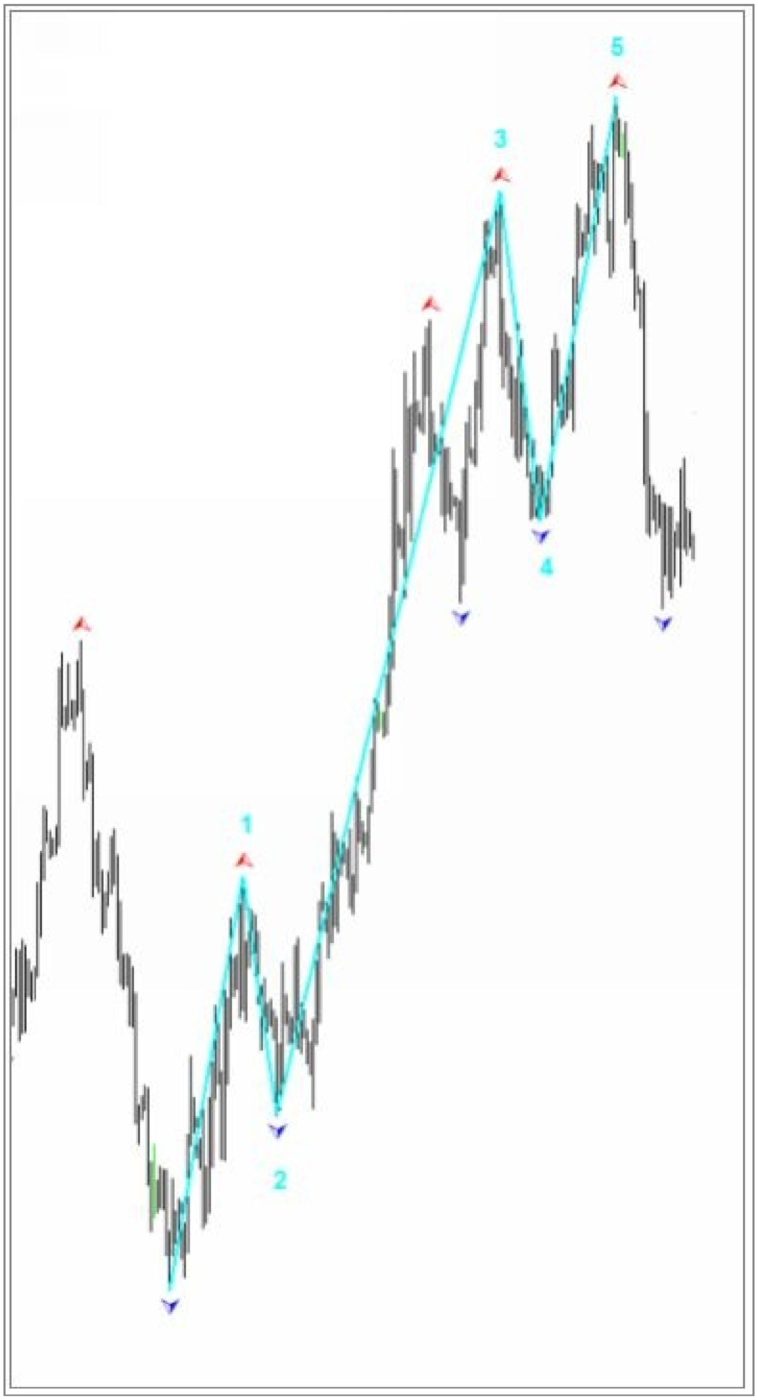

Figure 4-10: Final counting of five-impulse wave on EURUSD H4 timeframe.

Since the second candidate peak provide better evidence for wave 3, we can conclude this wave counting by labelling wave 3 on the second candidate peak. In addition, we can complete our labelling as shown in Figure 4-10. To sum up the process of wave counting, we list the six summary steps here for trader.

1. Apply the template like the peak-trough analysis.
2. Scan through different timeframe to look for key peaks and troughs and define your region of interest in your chart.
3. Look for potential candidate peaks and troughs for either wave 123 structure or wave abc structure from your region of interest in your chart.
4. Confirm wave 123 or wave abc from the evidences using Fibonacci ratio and three wave rules.
5. For wave 123 structure, confirm wave 45 from the evidences using Fibonacci ratio and three wave rules.
6. If your candidate peaks and troughs are not supported by the evidence, then reject the peaks and troughs. Move on to next candidate peak and trough and repeat the steps 4 and 5.

4.3 Impulse Wave Structural Score and Corrective Wave Structural Score

With the three tools including template, Fibonacci retracement and three wave rules, traders can identify the correct patterns to trade from their chart. We have provided six mechanical steps, which anyone can use to count waves in objective manner. Often, there are many traders focus more on fitting the wave counting to their chart. Fitting the wave counting can be useless unless every wave counting is accurate for every single label. For example, Figure 4-11 shows some complex wave labelling. Such a complex labelling can be often attempted by traders. The complex labelling does not results in high accuracy for your trading in general. Often the small error in the wave counting will be amplified later. Therefore, you will likely to override your counting repeatedly when the market does not move according to your wave counting. Complex labelling do not show your intellectual level either. For trading, we should aim to identify accurate pattern and avoid any complexity. Remember that in the financial market, the fractal geometry itself is not strict. In addition, financial market always have decent amount of random process going on. The random fluctuation will always contribute towards some unpredictable portion of the financial market. Therefore, we do not have to attempt labelling the wave for every single candle bar in our chart. Instead, we should try to use the most accurate pattern for our trading.

Figure 4-11: Example of complex wave counting fitted to chart.

Therefore, for better trading practice, we recommend “approach of the pattern detection” rather than “approach of fitting the wave counting”. We strongly emphasize not to use inaccurate wave counting for your decision-making. Instead, you can only rely on the wave patterns meeting certain quality for your trading. The question is how do we differentiate accurate pattern from inaccurate patterns? In order to assess the accuracy of wave patterns, we can revisit the pattern matching accuracy from the Harmonic Pattern. To recap what is the pattern matching accuracy in the case of Harmonic Pattern, it is the metrics showing how close our detected harmonic pattern matches to the perfect pattern made up from the ideal Fibonacci ratios. The concept of the pattern matching accuracy can be extended for the case of Elliott Wave counting too. Since three wave rules and the Fibonacci ratios provide the guideline for the quality of the pattern, we can incorporate such information into these error metrics as we did in the case of harmonic patterns:

$$Mean\ Squred\ Error, MSE = Mean(E_t^2)$$

$$Root\ Mean\ Squred\ Error, RMSE = \sqrt{MSE}$$

$$Mean\ Absolute\ Error, MAE = Mean(|E_t|)$$

$$Mean\ Absolute\ Percent\ Error, MAPE = Mean(|P_t|)$$

Where E_t = measured ratio from chart – reference ratio, P_t = 100 x (measured ratio – reference ratio)/reference ratio.

Figure 4-12: Some possible Error Metrics for Elliott Wave pattern matching.

Once again, we can use the Mean Absolute Percent Error to quantify the pattern matching error for each Elliott Wave pattern.

$$MAPE = \frac{1}{n}\sum_{t=0}^{n}\left|\frac{measured\ ratio_t - reference\ ratio_t}{reference\ ratio_t}\right|$$

Pattern matching accuracy can be calculated simply using the following formula:

Pattern matching accuracy (%) = 100 – Pattern matching error (%).

For both impulse wave and corrective wave, we can name the pattern matching accuracy as the Impulse Wave Structural Score (IWSS) and Corrective Wave Structural Score (CWSS). Since the term “impulse” and “motive” are used interchangeably. One can call the Impulse Wave Structure Score to Motive Wave Structural Score too. Simply speaking, Impulse Wave Structural Score tells you how closely the identified impulse wave pattern matches to the structure of the ideal impulse wave pattern. Likewise, Corrective Wave Structural Score tells you how closely the identified corrective wave pattern matches to the structure of the ideal corrective wave pattern. To give you working example on using the impulse Wave Structural Score and Corrective Wave Structural Score, consider our previous example with two candidate peaks for wave 3. With first candidate peak, our calculation for impulse Wave Structural Score was 83.7%. With second candidate peak, our calculation for impulse Wave Structural Score was 95.5%. This number support our conclusion made from our six steps. From our experience, Wave Structural Score below 80% considered as poor quality. For the decision making for trading, it is advised to use the Wave Structural Score over 80%. If you have two or three alternative scenarios for your wave counting at least satisfying three wave rules, then you can always choose the scenario with maximum Wave Structural Score. What if you never find any wave patterns that meet over 80% of Wave Structural Score at best, then you should not trade. It is always much better not to trade than trading with inaccurate pattern.

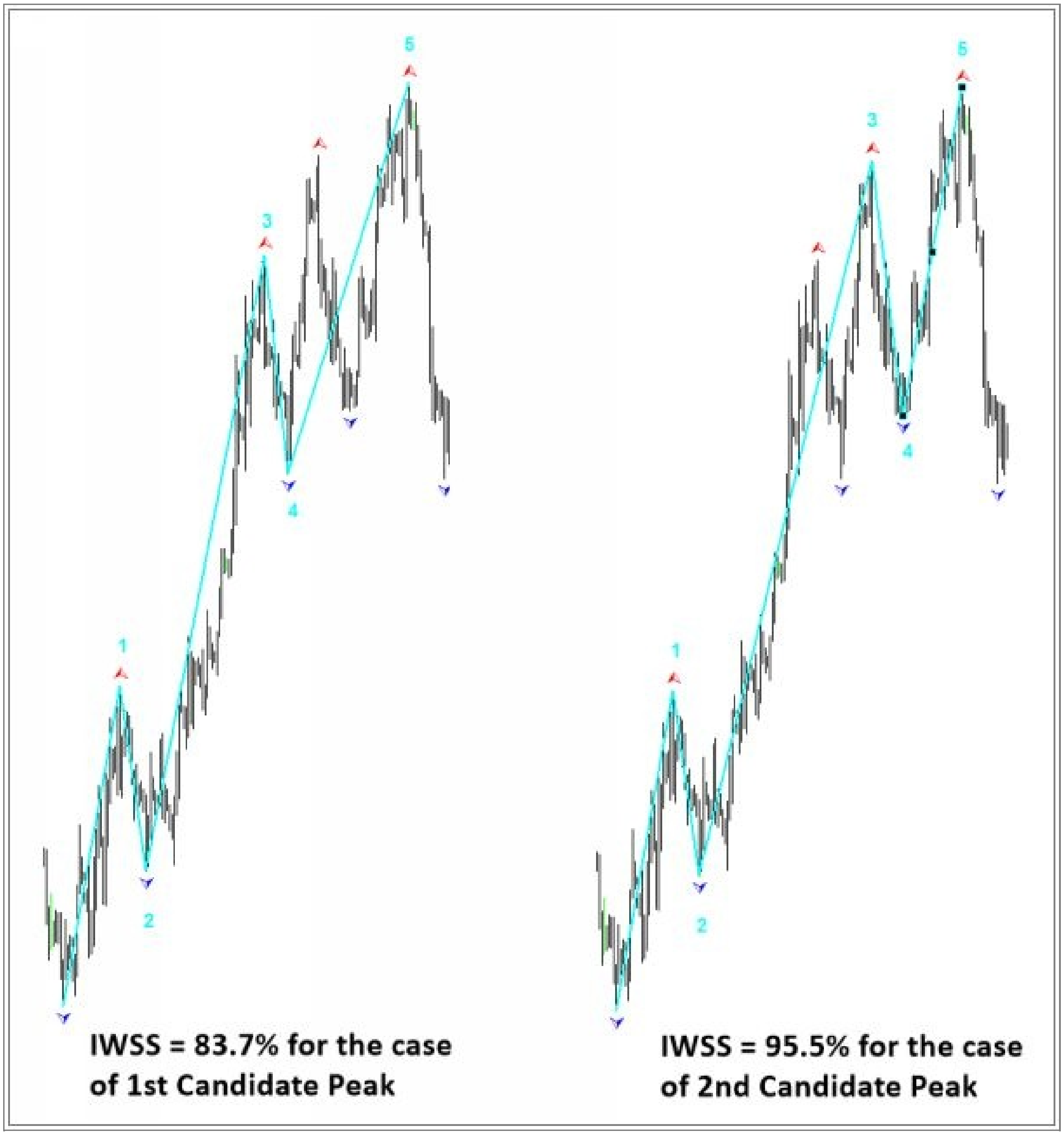

Figure 4-13: Impulse Wave Structural Score comparison. Impulse Wave Structural Score on the left was calculated when the first peak is considered as wave 3. Impulse Wave Structural Score on the right was calculated when the second candidate peak is considered as wave 3.

4.4 Channelling Techniques

During the development of the Wave Principle, Elliott suggested that channelling technique could be useful devise to anticipate the future wave movement. Elliott developed the three channelling techniques when Wave 2, 3 and 4 is completed respectively. We explain the steps of drawing the channels from the case of wave 2 completion to wave 4 completion.

When wave 2 is completed, trader can draw the first upper channel line and base line to anticipate the location of wave 3 (Figure 4-14). Drawing upper channel line is simple. Firstly, draw the base line by connecting the starting point of wave 1 and the ending point of wave 2. Then draw the parallel line to the first base line passing through the ending point of wave 1. Elliott suggested that wave 3 can be completed near the first upper channel line. Practically speaking, this upper channel line provides only the rough guideline for the location of the wave 3. Wave 3 can be completed below or above this upper channel line.

When wave 3 is completed, we can draw second upper channel line and base line to anticipate wave 4 (Figure 4-15). Firstly, draw second upper channel line by connecting the ending point of wave 1 and the starting point of wave 3. Then draw second base line parallel to the new upper channel line passing through the ending point of wave 2. The second base line can be used to anticipate the rough location of wave 4.

When wave 4 is completed, we can draw the final base line and upper channel line to anticipate the rough location of wave 5 (Figure 4-16). Firstly, draw new base line by connecting the ending point of wave 2 and wave 4. Then draw the final upper channel line parallel to the final base line passing through the starting point of wave 3. With the new upper channel line, trader can anticipate the rough location of wave 5.

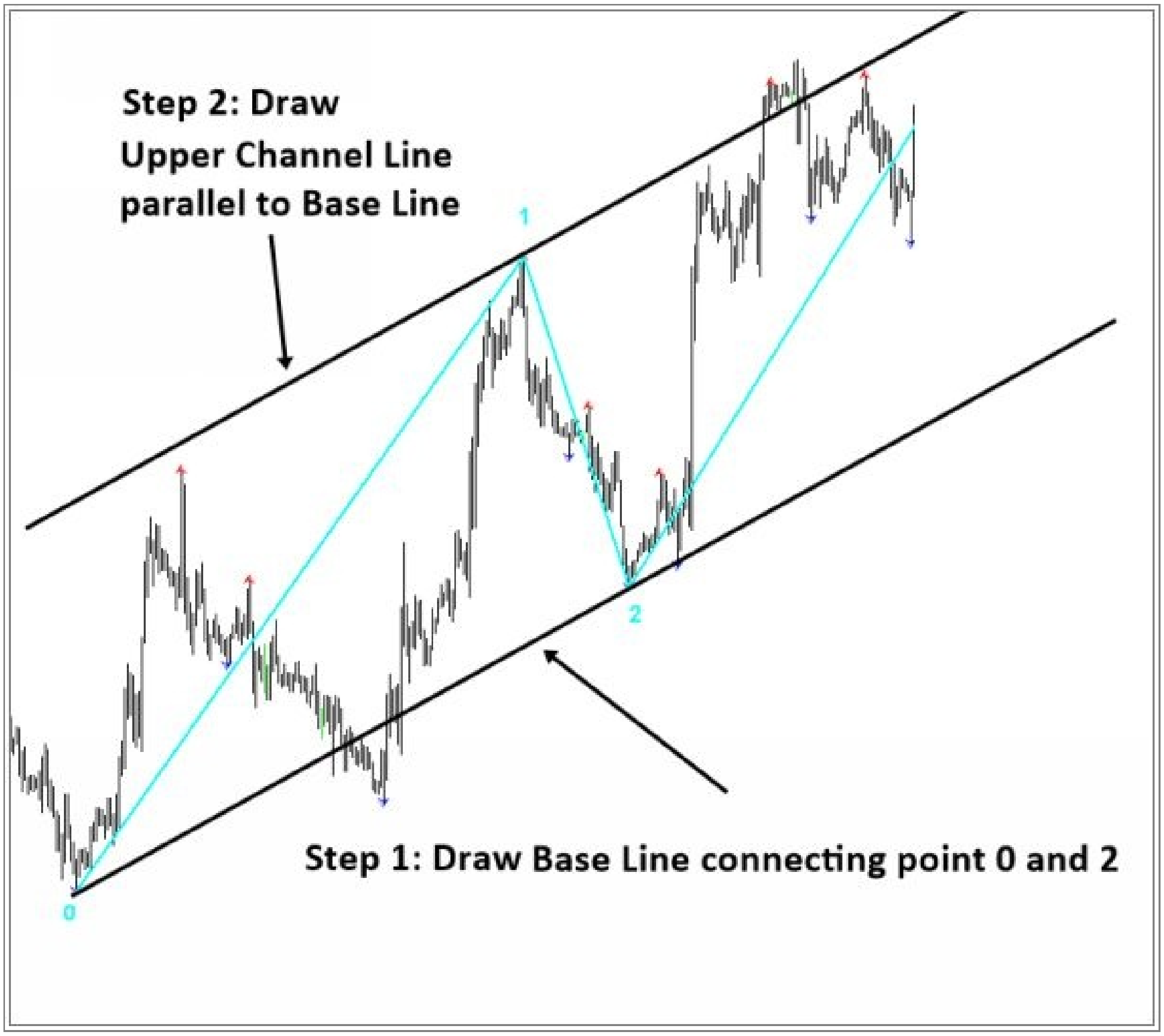

Figure 4-14: Drawing base line and upper channel line when wave 2 is completed.

Figure 4-15: Drawing base line and upper channel line when wave 3 is completed.

Figure 4-16: Drawing base line and upper channel line when wave 4 is completed.

5. Triangle and Wedge Patterns

5.1 Introduction to Triangle and Wedge patterns

When the Equilibrium Fractal-Wave process is dominating over other price patterns, trader can observe repeating price patterns from the financial market. Since the price consistently tests supply and demand of the market in various price level, the price path naturally resembles the Zig Zag shape. When we draw a straight line passing through peaks and troughs in the price path, these envelopes of the peaks and troughs tell us many things about the current state of the financial market. With these envelopes of these peaks and troughs, we can make educated guess about the future movement of the financial market too. Triangle and wedge patterns are the typical patterns made up from these envelopes of the peaks and troughs as shown in Figure 5-2. The history of Triangle and Wedge patterns are as old as Harmonic Pattern or Elliott Wave theory. Triangle and wedge patterns were described comprehensively in the work done by Schabacker (1932) and Gartley (1935). Triangle and wedge patterns are one of the most popular patterns traded by traders today. Some popular triangle and wedge patterns are shown in in Figure 5-2. Triangle pattern can be further divided into ascending, descending and symmetrical triangles. Wedge pattern can be further divided into falling wedge and rising wedge. Detection of triangle and wedge patterns are simpler than harmonic pattern and Elliott wave pattern. Triangle and wedge patterns have less strict rules in identifying the patterns. For example, triangle and wedge patterns do not concern the number of points inside the patterns whereas 5 points and 13 points are predefined to identify both Harmonic pattern and Elliott wave patterns. There are at least three important perspectives using triangle and wedge patterns for your trading. First perspective is about the classic perspective of triangle and wedge pattern. Our classic perspective generally follows what Schabacker (1932) and Gartley (1935) described in their book. Second perspective is about the diagonal support and resistance point of view. This perspective is somewhat based on our own experience and empirical research. One might view the second perspective as the improvement made from the works by Schabacker (1932) and Gartley (1935). Third perspective is about Elliott Wave theory point of view. Note that Elliott was not necessarily the creator of the triangle and wedge patterns. However, he wanted to explain the logic behind the triangle and wedge pattern using his Wave Principle. Therefore, we will explain the Elliott view about triangle and wedge pattern in our third perspective. All three perspectives can be helpful for your trading. You can learn all of them for your trading or you can use one of the perspectives only for your trading if you wish. Personally, I prefer the second perspective for trading because they are simple and effective. Reader can make their own choice after they have read all three perspectives from this book.

Figure 5-1: Example triangle pattern constructed from the peak-trough analysis

on EURUSD H1 timeframe.

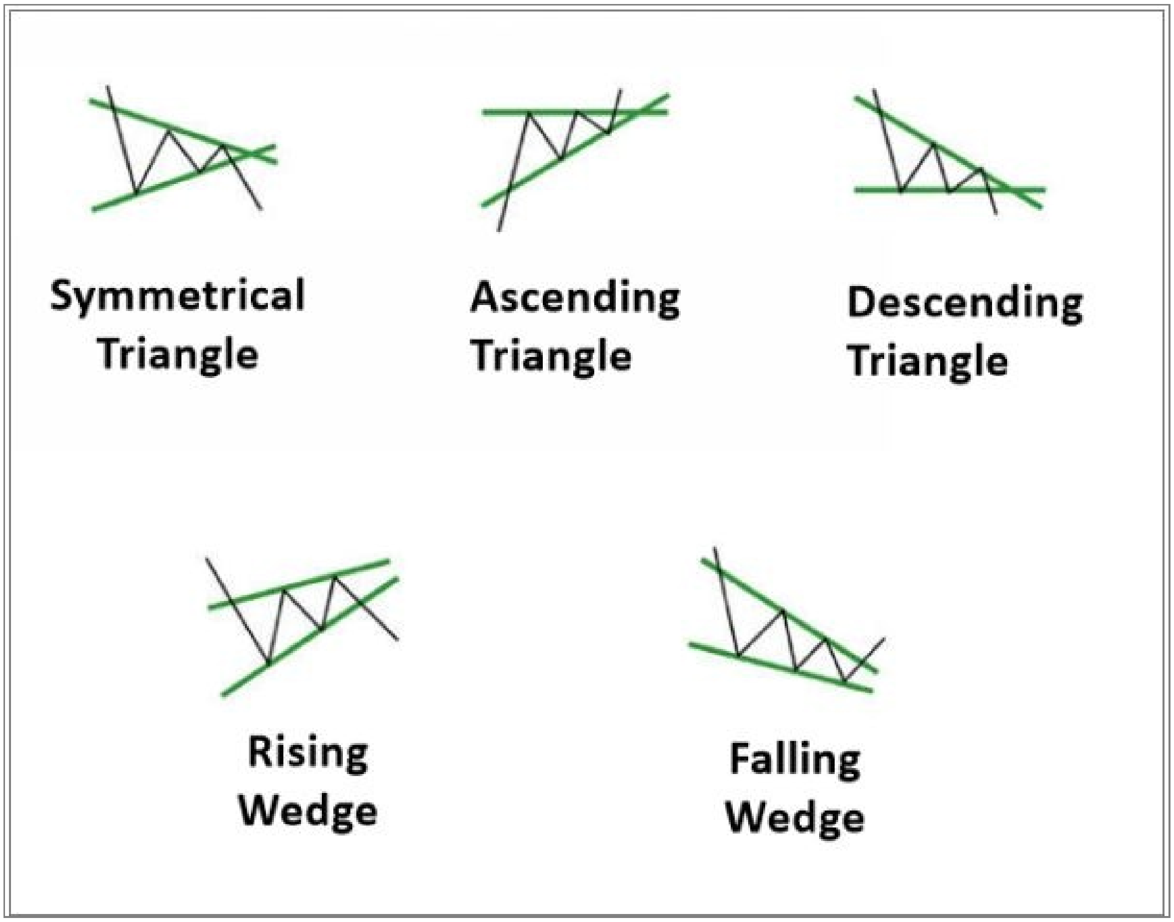

Figure 5-2: List of triangle and wedge patterns.

5.2 Classic Perspective of Triangle and Wedge Patterns

Triangle and wedge patterns occurs when the volatility of the market are gradually reduced (Figure 5-3). Normally before some important news like Non-Farm Payroll or Unemployment Rate release, you can observe triangle and wedge patterns frequently. Triangle and wedge patterns are the sign of the high volatility in the future. At the same time, triangle and wedge patterns indicates the increase in natural orders in the market. For example, Triangle and wedge pattern often appears before some good trendy movement in the financial market.

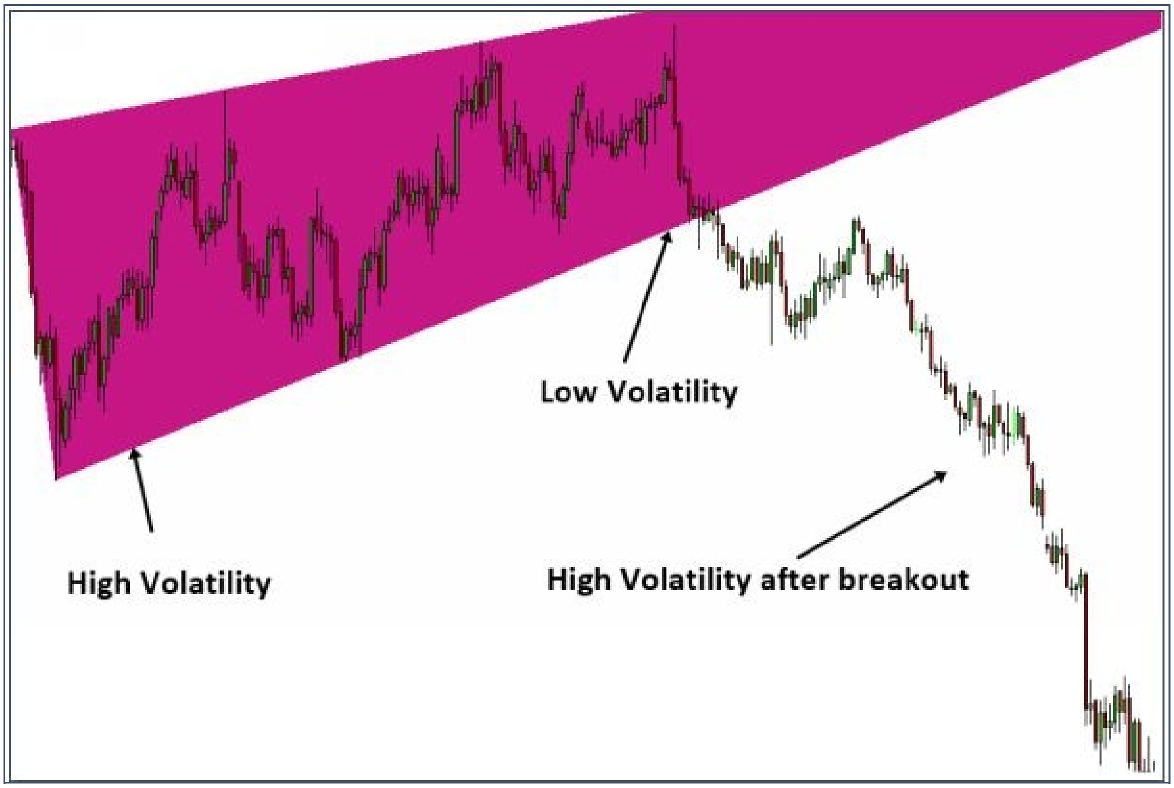

Figure 5-3: Example rising wedge pattern on EURUSD H1 timeframe.

Triangle and wedge patterns can predict the direction of the market up to certain degree. Under the classic wisdom by traders, triangle patterns like ascending and descending triangle pattern supposed to have the pre-defined direction for breakout. Under the classic wisdom, the ascending triangle predict for the potential upwards breakout for buy opportunity. For ascending triangle pattern, the top of the triangle must be flat or at least near flat. In practice, it is very difficult to find the ascending triangle with the perfect flat top. The bottom of the triangle must have the sharp rise. The idea behind this upwards price move should be quite clear to traders. When the price hit the same level multiple times, the level becomes the important resistance level. When the price tries to penetrate this level, the added momentum can accelerate the price movement.

The results would be the breakout (Figure 5-4). The breakout normally happens when the price converges near the right vertex of the triangle. The descending triangle pattern is just the opposite pattern for breakout in downwards (Figure 5-5).

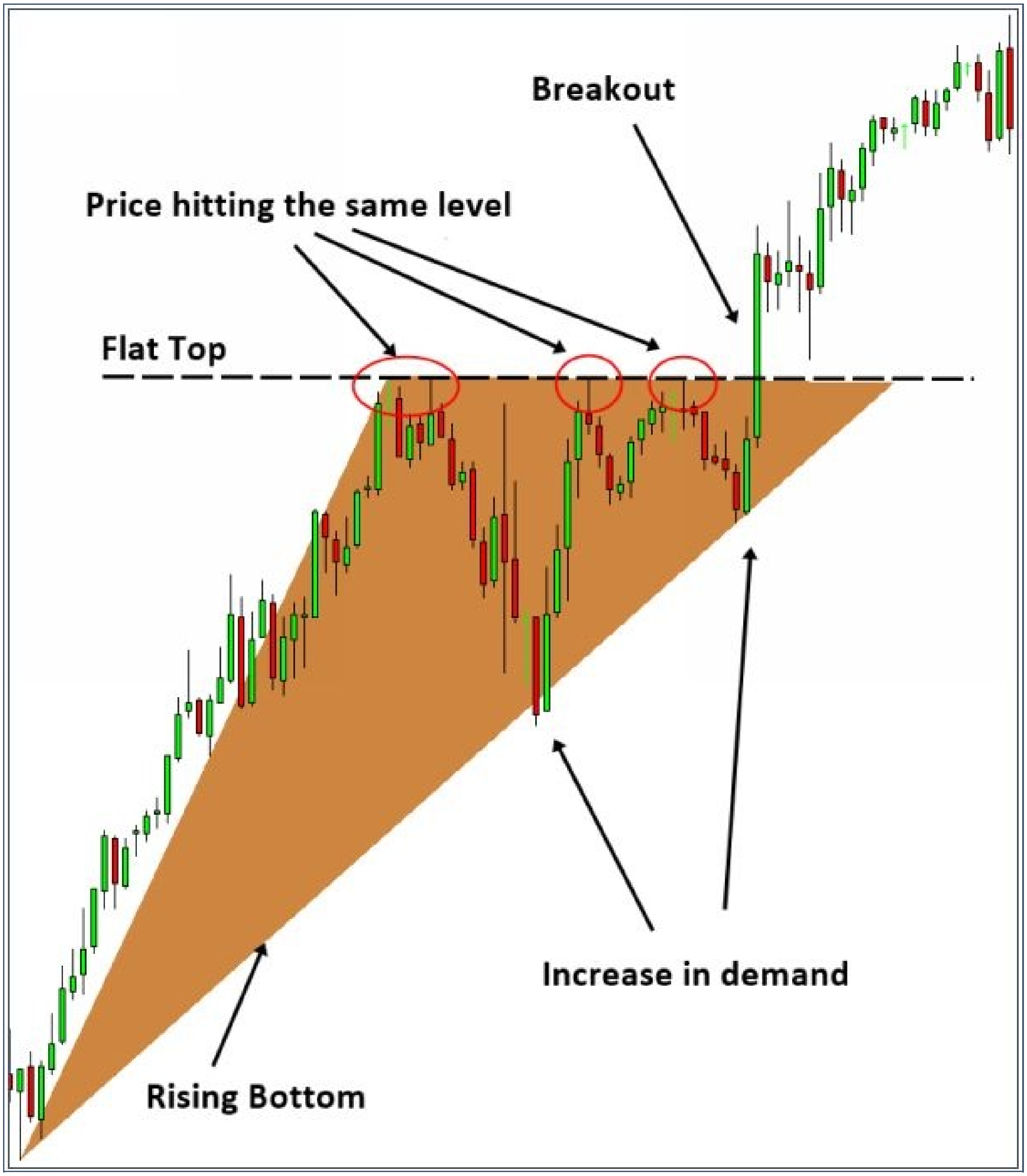

Figure 5-4: Ascending Triangle pattern found in USDCAD in H1 chart.

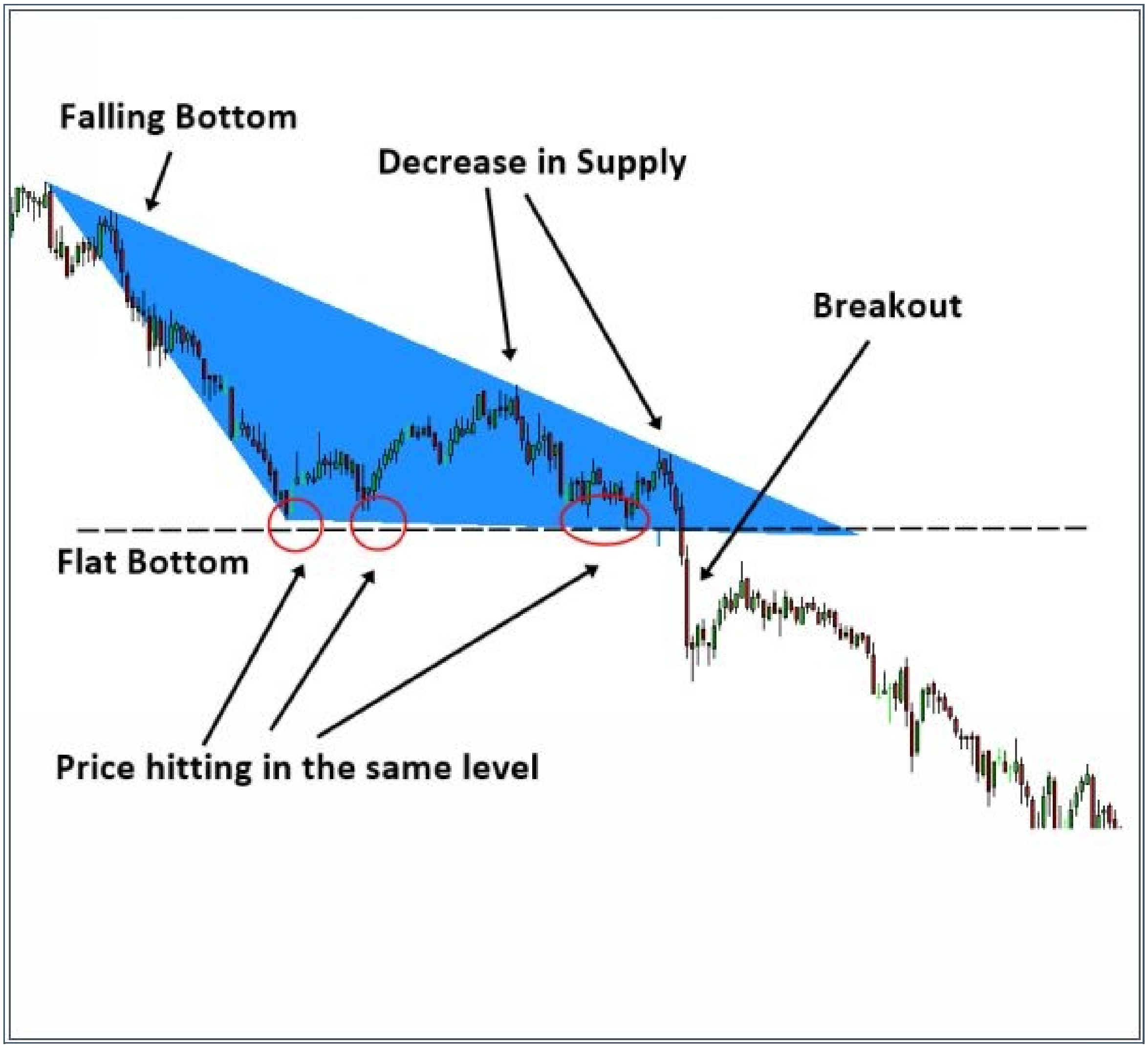

Figure 5-5: Descending Triangle pattern found in M15 Chart for EURJPY.

Wedge patterns are another common pattern used by many traders. Falling Wedge pattern occurs during the extended sell market. Falling wedge pattern have the falling top and falling bottom. The top and bottom are converging towards South East direction in your chart. The right vertex of the triangle can be located inside your chart but the right vertex can be located outside your chart if the convergence is too slow. The falling wedge pattern can appear before big buy trend starts (Figure 5-6). The rising wedge pattern is the opposite pattern occurs during the extended buy market (Figure 5-7). Its usage is more or less the same as falling wedge pattern.

Figure 5-6: Falling wedge example in EURUSD H1 chart.

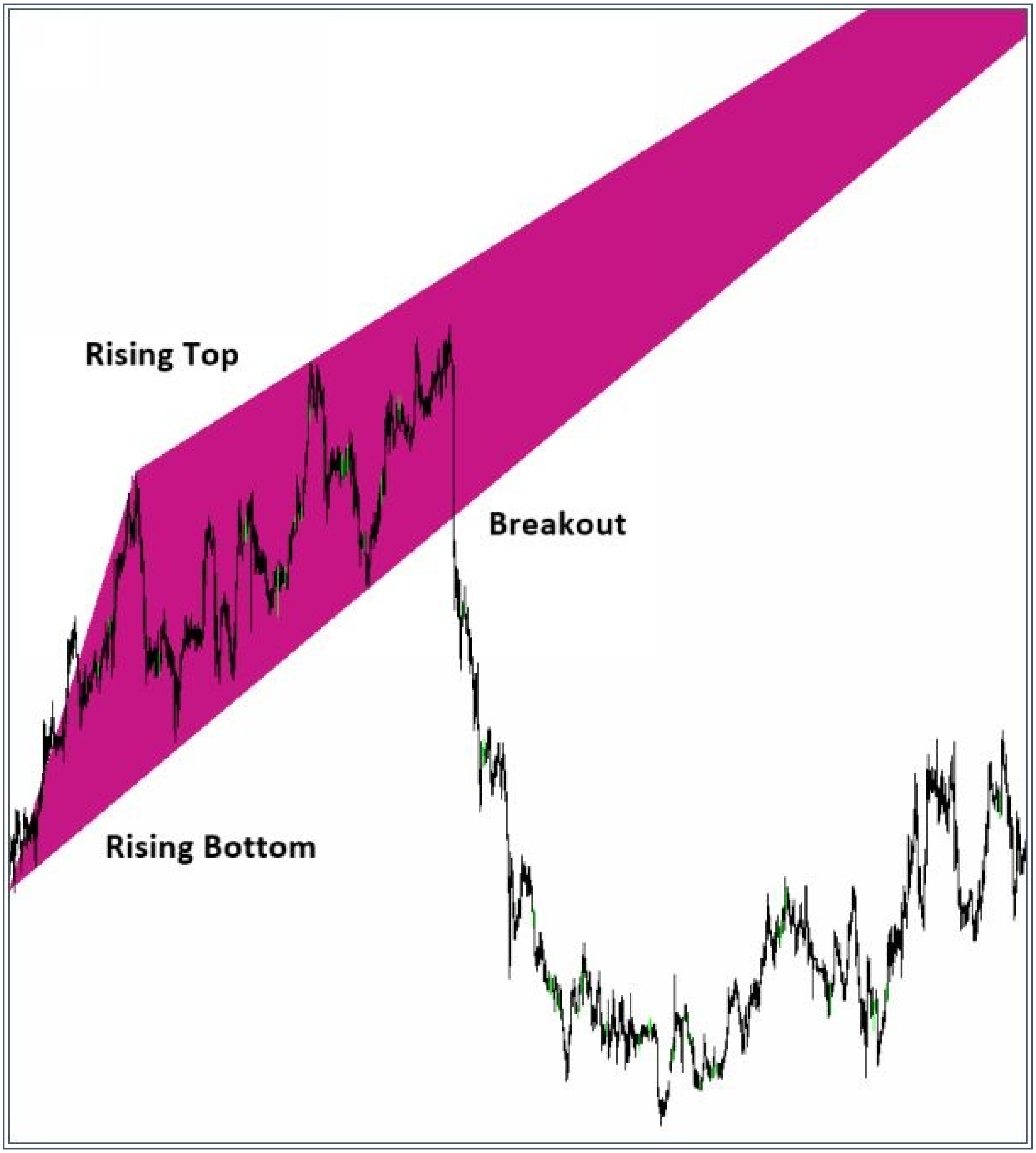

Figure 5-7: Rising wedge example in EURUSD H1 chart.

Since the angle of top and bottom of the Triangle pattern helps us to identify the direction of the price movement for ascending and descending triangle, one might attempt to identify the breakout direction of symmetric triangle pattern using the same logic. In practice, this is not quite helpful for the case of symmetric triangle pattern. Personally, I much prefer to use the symmetric triangle pattern as non-directional breakout trading like the straddle setup. In the straddle setup, trader places both buy stop and sell stop respectively on the top and the bottom of the symmetric triangle. This type of trading setup is useful when the market is just about to release some big news or some important fundamental data. In addition, when the readings of Oscillators like Relative Strength Index are near the extreme level, you might perform the straddle trading setup. It is important to note that larger the symmetric triangle patterns in size requires more market volatility to have the effective breakout. Therefore, your educated guess in market volatility will be helpful for the trading setup like this.

Figure 5-8: Symmetric triangle pattern on EURUSD H1 chart.

There is obviously some disadvantage in using triangle and wedge pattern in your trading. For example, triangle and wedge pattern alone does not answer the question of when to breakout. Therefore, when you are using the classic perspective for your trading, it is important to use Secondary confirmation techniques to gauge the right timing. For example, some common overbought and oversold indicators like RSI, MACD, CCI, MFI and Divergence Indicator are usable together with triangle and wedge patterns. To make some educated guess on future volatility, it is helpful to watch out the Economic calendar and fundamental news for your trading. This often increases the accuracy of your trading.

5.3 Diagonal Support and Resistance Perspective of Triangle and Wedge Pattern

To explain the resulting breakout of triangle and wedge pattern, the top and the bottom of the triangle and wedge pattern can be treated as support and resistance. The thing is that the top and the bottom of the triangle and wedge patterns are angled lines and not the horizontal line. Therefore, they are more of diagonal support and resistance. Many textbook might teach you that support and resistance level are reversal area. However, in this book, we emphasize that support and resistance are where both reversal and breakout movement can occurs. For example, we treat support and resistance area as the price level where the price can penetrate hard or bounce back hard with high trading volume.

With diagonal support resistance lines, the effective support and resistance level changes with time. For example, the support and resistance levels move along the bottom and top of the triangle and wedge patterns as time goes. In addition, diagonal trend channels are another good example of the diagonal support resistance lines. With horizontal support and resistance line, the effective support and resistance levels are constant over time. The simplest horizontal support resistance example is the daily pivot point used by many traders. The price levels of the daily pivots are constant for one day. Next day, new daily pivot are calculated. Likewise, Fibonacci retracement levels or round numbers are another example of horizontal support resistance levels. In addition, Potential Reversal Zone Type A and Type B from Harmonic pattern are another good example of horizontal support and resistance too.

What is the significant point about the perspective of diagonal support and resistance with triangle and wedge pattern? As we have mentioned before, triangle and wedge pattern does not answer the question of when to breakout. However, when they are combined together with horizontal support and resistance level, they are likely to provide better answer on the question. The typical good example of combining diagonal support resistance with horizontal support resistance can be illustrated combined usage of triangle and wedge pattern with Harmonic Pattern. For example, Figure 5-9 shows the breakout in buy direction where the D point of ABCD pattern meet the bottom of the falling wedge pattern. Since the classic entry for Wedge pattern is often taken outside the wedge pattern, our entry near the D point of ABCD pattern is much faster than the classic entry. At the same time, our size of stop loss become smaller too making our Reward/Risk profile much more attractive.

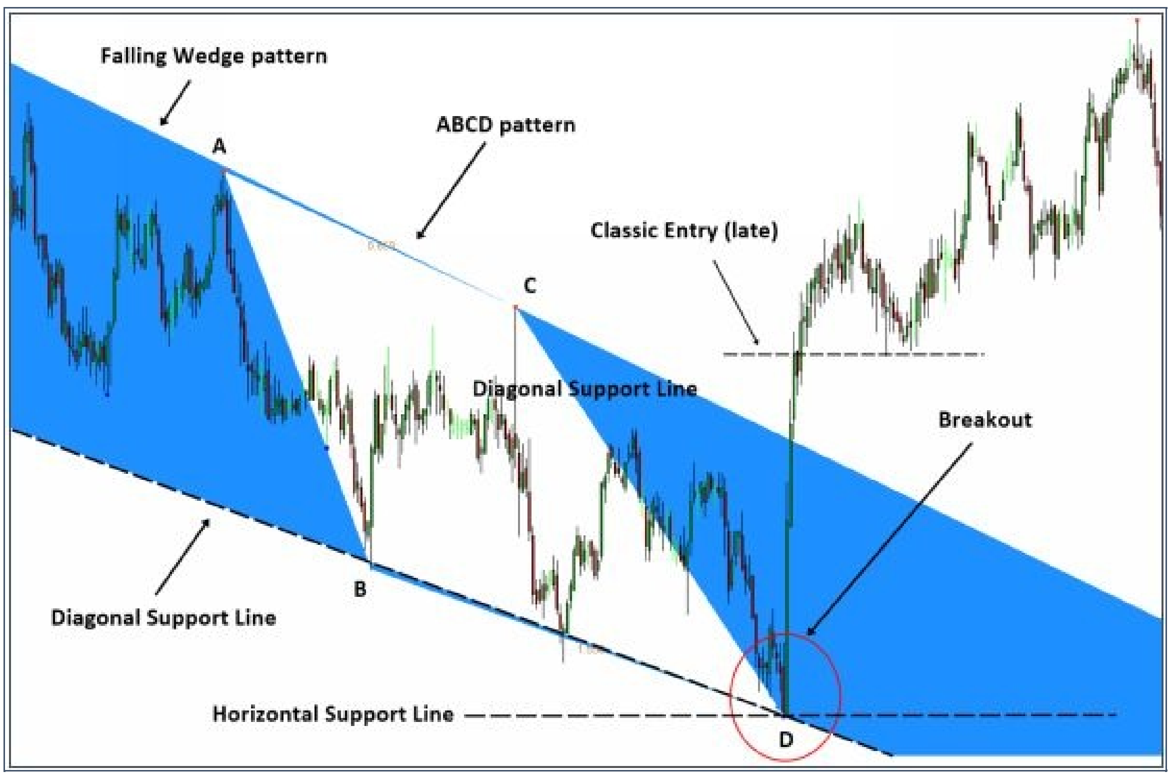

Figure 5-9: AB=CD pattern formation along the bottom of the falling wedge pattern on EURUSD H1 chart.

Another significant point of using diagonal support and resistance come from using the multiple timeframe pattern Analysis. When we say multiple timeframe pattern analysis, we are not talking about watching many charts. We are talking about placing the triangle and wedge patterns detected from the higher timeframe and the lower timeframe in the single chart. If one can place the important diagonal support and resistance line from hourly, daily, weekly and monthly chart on the signal chart, traders can benefited from this rich information. Combing diagonal support and resistance line with horizontal support resistance line can be even more effective with multiple timeframe pattern analysis. For example, Figure 5-10 shows the trading signal combined with daily falling wedge pattern with harmonic pattern found on H1 timeframe.

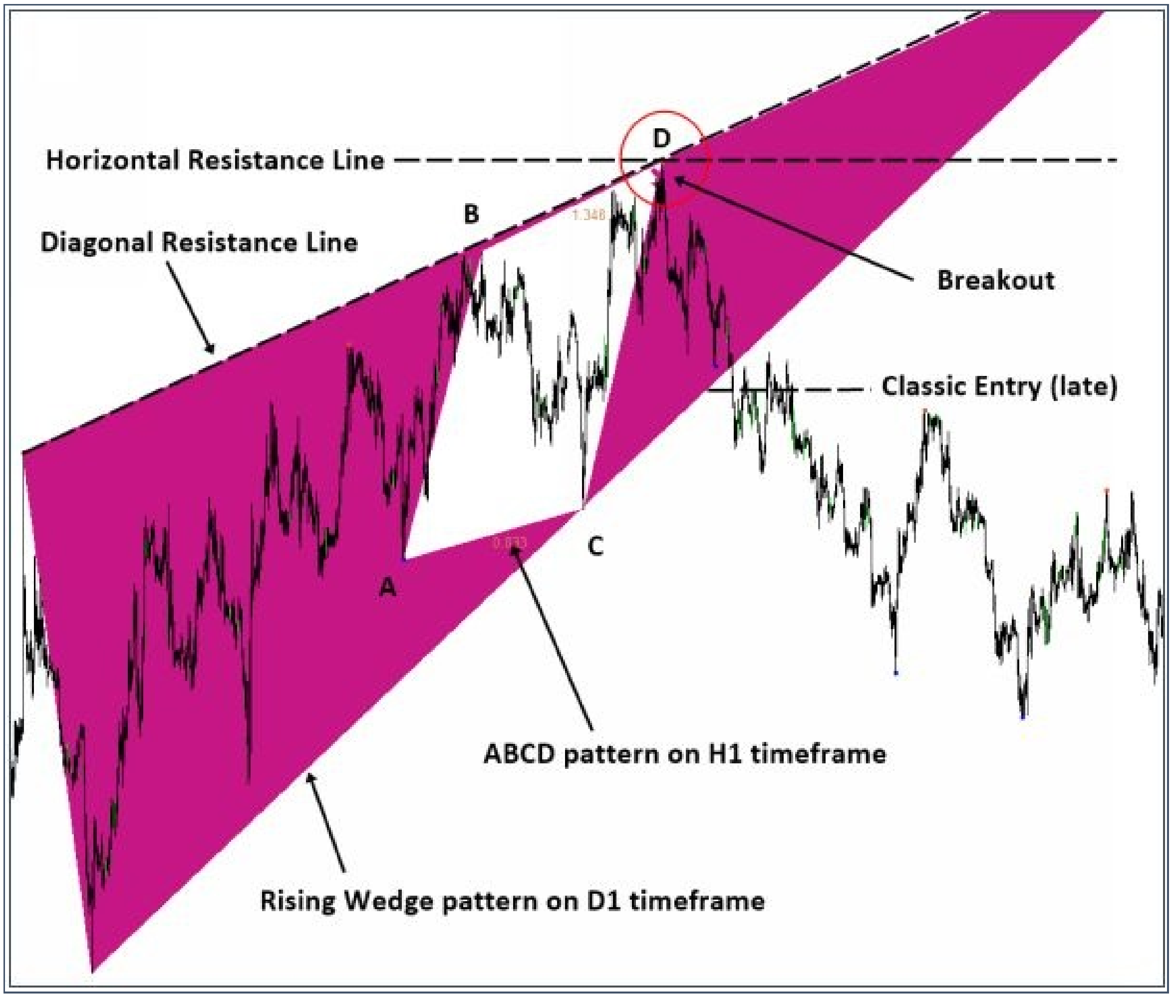

Figure 5-10: Rising wedge pattern on D1 timeframe was placed together with AB=CD pattern found on H1 timeframe.

5.4 Elliott Wave Perspective of Triangle and Wedge Pattern

Triangle and wedge pattern appeared before the Elliott's work on his wave principle in the work by Schabacker (1932) and Gartley (1935). We never know if the triangle and wedge patterns might offered him some inspiration on his work or not. Somehow, Elliott showed triangle and wedge patterns extensively in his first publication in The Wave principle (1948). In his work, he has described them as horizontal and diagonal triangle respectively. The horizontal triangles include ascending, descending, symmetrical and reverse symmetrical triangles (Figure 5-11). Under the Wave principle, the horizontal triangle patterns occur as second and fourth wave position of the main trend. Since the horizontal triangles are formed in the second and fourth corrective wave position, the price movement after the triangle pattern will follow the main trend direction. Occasionally it is possible to see the wave b of the triangle may exceed the start of wave a as shown in Figure 5-12. Diagonal triangles include upwards and downwards wedge patterns. Diagonal triangle occurs mainly at the fifth wave position of the main trend as shown in Figure 5-13. Therefore, the completion of the diagonal triangle represents the end of the main trend. In spite of the fact that the diagonal triangle have the five-wave structures in the direction of the main trend, wave four within the diagonal triangle moves into the territory of wave one most of time.

In the Elliott's work, he defined that both horizontal and diagonal triangle are strictly made up from five sub waves and each sub wave should not have more than three lesser waves. However, he also mentioned that some triangle pattern may not meet this definition. If they do not meet the definition, then they are just triangle and wedge patterns outside the law of the Wave Principle. Therefore, you are likely to find that some triangle and wedge patterns independent from the Wave Principle too. The first and second perspective of triangle and wedge patterns can be used together with third perspective. However, they can be used as the completely independent strategy without understanding third perspective too.

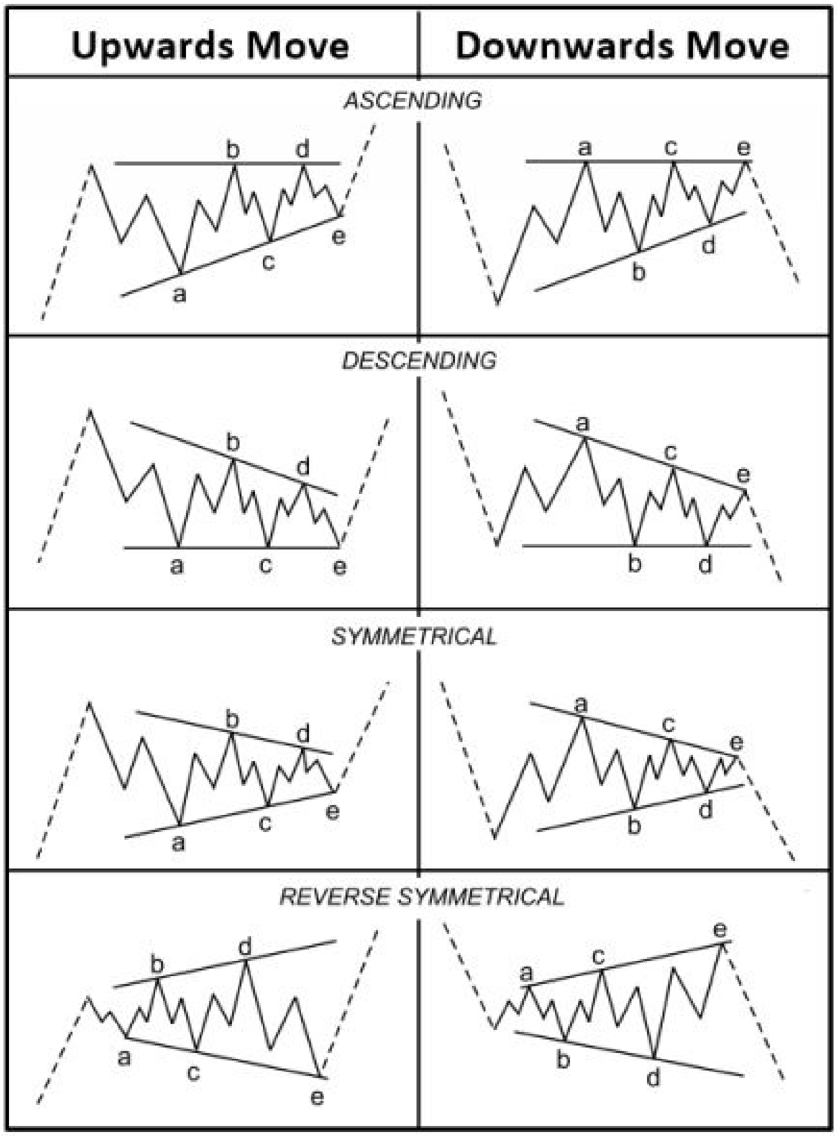

Figure 5-11: Triangle patterns described in terms of corrective wave by Elliott in 1948.

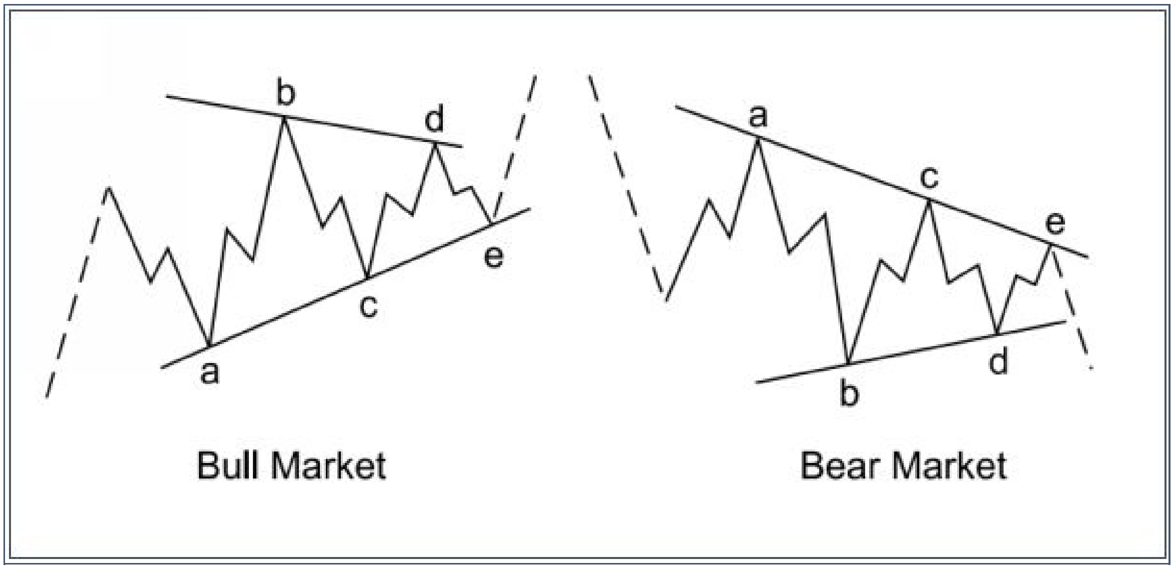

Figure 5-12: Horizontal triangle where wave b exceeding the starting point of wave a.

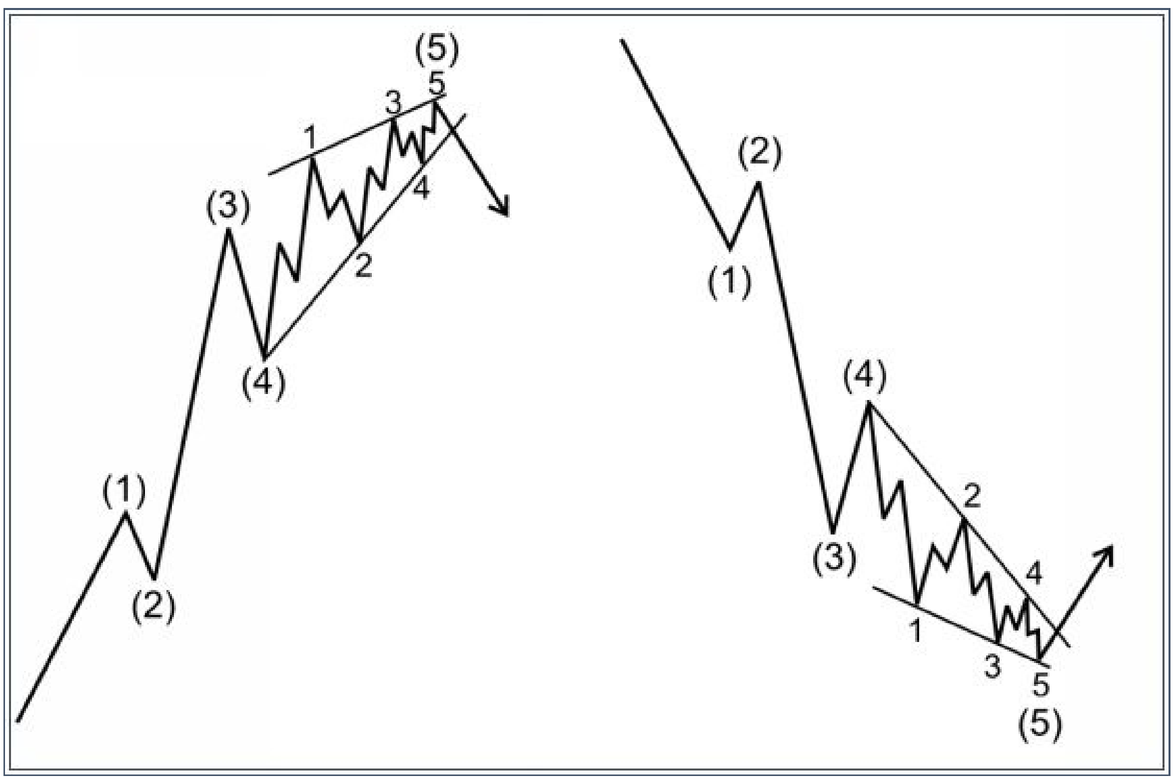

Figure 5-13: Wedge patterns described in terms of impulse wave by Elliott in 1948.

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Trading Management

Subtitle: 3rd Training in Price Action and Pattern Trading Course

Author: Young Ho Seo

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1. Risk Management

1.1 Various Risks in Trading and Investment

Trading and investment carry risk. The opportunities in trading and investment without risk rarely exits except some arbitrage opportunities, which will not be discussed in this book. In theory, you could develop several classes of risks for trading and investment. For example, risk in trading and investment can be classified as Macro and Micro risks depending on where they are originated. Macro and Micro risks can be subdivided further into smaller categories like the market risk, operational risk, liquidity risk, credit risk, political risk, etc. Since this book is not the theoretical textbook, we only describe some examples of Macro and Micro risks in Table 1-1 for your trading. However, this list is definitely not the exhausted one.

Risk Factors	**Description**	**Examples**	**Exposure on Trader/broker**	**Nature**
Market Risk	Risk of changing the fundamentals of the underlying security due to the	Microsoft Window is losing its market share due to the wide popularity of android	Trader: Yes Broker: No	Marco

	competitive market environment.	OS developed by Google.		
Political risk	Risk associated with the possibility of unfavourable government action or social changes resulting in a loss of the security value.	Large change in the currency value and stock prices after the presidential election.	Trader: Yes Broker: Yes	Macro
Interest rate risk	Risk that an investment's value will change due to a change in the absolute level of interest rate.	If interest rate increase, bond prices fall. When interest rates fall, then bon price rise. In addition, interest rate change cause huge spikes on Forex market too.	Trader: Yes Broker: Yes	Macro
Operational Risk	Risk that originates from the mistake of the operator or the company during its trading and investment process.	You have executed your order with wrong stop loss size or wrong contract size.	Trader: Yes Broker: Yes	Micro
Liquidity risk	Risk that refers to the difficulty of converting the assets to cash at the fair value.	You want to sell your 10 million shares of Google but your broker cannot find buyer of your shares because of the large volume.	Trader: Yes Broker: Yes	Micro
Credit risk	Risk or possibility that the operator or company can go bankrupt.	Your broker gone bankrupt so your trading account is suspended from trading.	Trader: Yes Broker: Yes	Micro

Table 1-1: Common risks for your trading and investment.

Trader and investor are exposed on both Marco risks and Micro risks every day. Macro risks like the market risk, political risk and interest rate risk are caused by the external factors outside your trading operation. Most of time, these external factors are not controllable by us. In fact, some of the technical and fundamental analysis might be used to protect traders from these Macro risks. However, some of the risky event can not be warned at all even using any technical or fundamental analysis. For example, trader can make some educated guess on the possible depreciation or appreciation of the currency by looking at some Macro-economic data and technical analysis. Likewise, by studying the company balance sheets and by applying many technical analyses, we can guess that if the company is increasing their market share from its competitors. On the other hands, guessing when the government will increase or decrease the corporation tax is impossible with any technical or fundamental analysis. Macro risks can contribute to the predictable and non-predictable parts of the market. In fact, many technical and fundamental analyses are there for you to reduce the Macro risks for your trading. Charting techniques and technical indicators can help you to identify the short-term or long-term price movement up to some degree. Besides the technical analysis, monitoring the important news can reduce the market risks too. For example, trader need to watch out any news about the taxes or labour laws, trade tariff change, environmental regulation or reformation in the national economy because they can change the entire market dynamics.

Some Micro risks like operational risk and credit risk can be originated from trader or from broker internally. In 2009, trader at UBS, the Swiss banking giant, placed a $22 billion of Capcom bonds in mistake while trying to buy just £220,000. In 2012, Knight Capital lost nearly $440 million in just 30 minutes because their trading software sent erroneous orders. These types of fat finger mistakes are the typical operational risk in trading. Operational risk can be made by anyone or by any algorithm. Sometimes, some trading platforms have many protective systems to prevent some common operational risk but not all of them can be prevented. You can still send wrong contract size or wrong stop loss size to your broker anytime. Especially the erroneous automated trading system can send the erroneous orders at high speed. The penalty from the mistake is always 100% yours. If a book was accidentally dropped on your keyboard and hit the enter key sending the market order with 10 million contracts to your forex broker, you will lose a lot of money on commission even if you close the order immediately. You can not blame other people for this accident. To prevent the operational risk, trader needs to be highly cautious in their trading. It is better to avoid trading when you are not set for the trading. If you are working in a team, it is important to monitor each other to prevent such silly mistake. If you have to build the automated trading algorithm, the operation of the algorithm must be fully tested in the paper account first.

Credit risk is another Micro risk, on which both trader and broker are heavily exposed. Simply speaking, credit risk is the chance of experiencing the bankruptcy for the business organization. Any business organization can go bankrupt. Trader, broker or any liquidity provider can face the bankruptcy. The insolvency of the Alpari UK, currency broker, due to the Swiss franc turmoil in 2015 was a good example of the credit risk exposed by the currency brokers. From the trader's point of view, trader can always lose their entire capital or nearly entire capital from their trading. If the operational risk can be considered as a mistake, credit risk often happens because traders are not educated or not experienced. Except that your account blowing was experimentally carried out on the small account for some educational purpose, this experience can cause serious damage to your finance. For traders, the credit risk is normally originated from the lack of understanding on the market volatility and position sizing.

Consider the aggressive trading example in Table 1-2, where the credit risk is amplified to blow your account. Your starting balance is 10,000 US dollar and pip value for EURUSD is 10 dollar per pip in this example. In this trading example, a trader used the aggressive trading volume for each trade. Luckily, he got the two winning trades increasing his account to 30,000 US dollar initially. Then his luck was run out losing all his account in next three trades. Can you imagine how he would feel in his first two trades? Can you imagine how he would feel after he lost all his account? In this trading example, his obvious mistake is to use the excessively large trading volume. This sort of mistake typically happens to starters who ignore to learn how the pip value and contract size relate the market movement to the profit and loss on his holding positions.

Order ID	**Symbol**	**Entry**	**Volume in Lots**	**Take Profit in pips**	**Stop Loss in pips**	**Trading Results**	**Profit/Loss in Dollar per trade**	**Total Profit/Loss in Dollar**
1	EURUSD	Buy	20	50	50	Win	10000	20000
2	EURUSD	Buy	20	50	50	Win	10000	30000

3	EURUSD	Buy	20	50	50	Loss	-10000	20000
4	EURUSD	Buy	20	50	50	Loss	-10000	10000
5	EURUSD	Buy	20	50	50	Loss	-10000	0

Table 1-2: Aggressive trading example for trader A.

Now consider another trading example in Table 1-3. Starting balance and pip value is identical to the first trading example. In this trading example, the trader started with two lots. Unfortunately, the first two trading gone badly and he lost 2000 US dollar. He is definitely new to the game of trading. Therefore, he decided to chase the loss and increased his trading volume to 10 lots. Another bad trade comes and he lost another 5000 US dollar. Now his broker does not allow him to open the trading volume greater than 2 lots due to the margin requirement set for his account. Therefore, he cannot continue the gambling anymore. He is financially and psychologically exhausted only after four bad trades.

Order ID	**Symbol**	**Entry**	**Volume in Lots**	**Take Profit in pips**	**Stop Loss in pips**	**Trading Results**	**Profit/Loss in Dollar per trade**	**Total Profit/Loss in Dollar**
1	EURUSD	Buy	2	50	50	Loss	-1000	9000
2	EURUSD	Buy	2	50	50	Loss	-1000	8000
3	EURUSD	Buy	10	50	50	Loss	-5000	3000
4	EURUSD	Buy	2	50	50	Loss	-1000	2000
5	EURUSD	Buy	1	50	50	Win	500	2500

Table 1-3: Aggressive trading example for trader B.

The first and second trading example can happen to starters when they are trading on the leveraged products. In the first trading example, trader did not know how the fluctuation in the market affects the profit and loss of his holding position. Such information is summarized in the single quantity, the pip value for the leveraged products like Forex and Future. For example, if one pip value were 10 US dollar, then he would experience ± 10 US dollar in his position per 1 lot trading volume per 1 pip movement in the market. If his stop loss is 50 pips, then he could experience up to -50 US dollar loss per 1 lot trading volume. In addition, he could experience up to -500 US dollar loss for 10 lot trading volume. In the second trading example, it was the psychology triggered the aggressive trading volume later. If a trader is continuously exposed on the psychological bias like this, simply he can not win in the financial market.

1.2 Position Sizing Techniques

If you are trying to borrow money to buy the house or car from your bank, you are the subject of the credit risk to the bank. This means that the bank have to concern that you might not able to pay back the money. When you do not pay back the money, it would change your credit rating from good to bad. At the same time, the bank will make a loss. What the bank can do to limit their credit risk when they lend money to you? Well, the first thing they can do is limiting the amount of lending so you can definitely pay back the interest and principal amount each month. For example, they can lend money to you in a way that your interest and principal payment each month is not exceeding 30% of your monthly income. Setting limit is the key to prevent the credit risk. We can apply the same idea to our trading. We can set the limit on our loss per each trade to maintain the healthy growth of our capital. That way we can reduce the credit risk we are exposed on our trading. Such a technique is called Position Sizing in trading. It is the first risk management tool when you trade on the leveraged products. We list several different position sizing techniques. They include:

- Fixed position sizing, when stop loss size is not available
- Fixed fractional position sizing, when stop loss size is known

- And Position sizing using Kelly's criterion.

In the Fixed position sizing, we simply use the fixed lot size per your trading capital. For example, you might set to use 0.1 Lot per 10,000 US dollar capital to trade on EURUSD symbol. You will revise your lot size when your account reaches 15,000 or 20,000 US dollar later. With the Fixed position size, it is not easy to give the definite trading volume sometimes because the fixed position size can heavily depend on your trading strategy and the market volatility. For example, if you are using trading strategy based on averaging or grid or pairs trading strategies, then you might have some idea of the appropriate trading volume from your backtesting or forwards testing results. Then why we introduce the fixed position sizing? Because the fixed position sizing is useful when the trading strategy does not use the stop loss and it controls the risk by other means like Drawdown or Sharpe ratio, etc. In such a case, you can not use the fixed fractional position sizing.

Most of time, we recommend to use the fixed fractional position sizing if the stop loss size is always known for your trading. In addition, we prefer to tell our traders to use stop loss every time. In the fixed fractional position sizing, we are only risking the certain percentage of our trading capital per each trade. For example, you can risk 1%, 2% or 3% of your trading capital for each trade. Sometimes, it is common to use the value smaller than 1% in some fund management company like 0.5% per trade because they are running large capital. The choice of the value is depending on your risk preferences, your trading experience and your capital size. For starters, we recommend to use less than 2% most of time. To use the fixed fractional position sizing, you must know the size of stop loss for your trading. If your trading strategy does not have stop loss size, then you may have the problem of calculating the fixed fractional position sizing. Then you have to use the fixed position size. The formula to calculate the fixed fractional position size is like this:

Position Size (Lot) = Account Risk in dollar / (Stop Loss Size in pips * pip value) where the Account Risk in dollar = the risk % x your trading capital (US dollar).

The steps to calculate the fixed fractional position sizing is like this:

- Determine Stop Loss Place and calculate the stop Loss Size in your chart
- Determine the Risk % of your trading capital
- Evaluate pip cost and calculate lot size for the given Risk %.

We illustrate a live trading example for better visualization of the process. Consider that we want to trade on AB=CD pattern at the median open price on EURUSD. We will place our stop at the lower pattern completion interval. This gives us 25 pips for our stop loss size. If we want to take 1% risk for our 10,000 US dollar trading capital, we can calculate our lot size for the 1% trading risk assuming the pip value is 10 US dollar like this:

0.4 Lot = 100 / (25 * 10) where Account risk 100 US dollar = 1% x 10,000 US dollar.

For your live trading, it is much wiser to use the automatic calculator to get the exact trading volume efficiently.

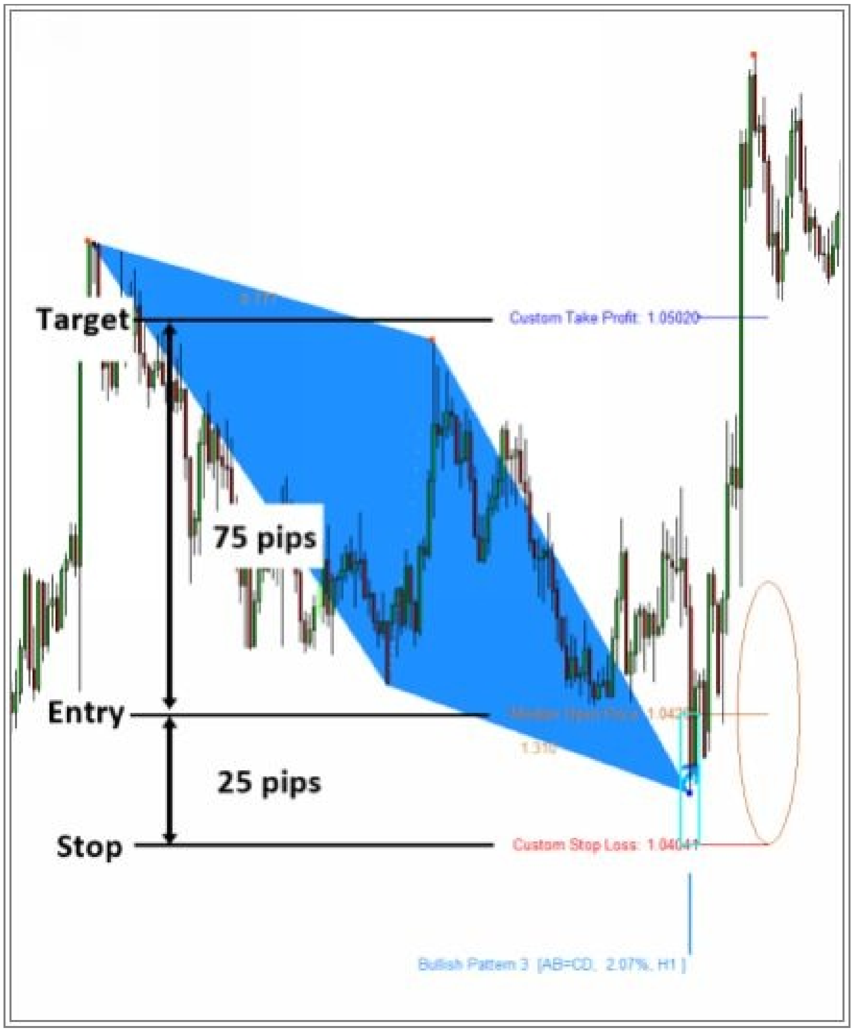

Figure 1-1: Example trading on AB=CD pattern on EURUSD.

Trader can use the position sizing using the Kelly's Criterion. If the fixed position sizing and the fixed fractional position sizing uses the constant risk criteria throughout your trading, the risk is not constant any more in the Kelly's Criterion. In the Kelly's Criterion, the risk is depending on the Win rate and Rewards/Risk ratio of your trading strategy. With Kelly's criterion, your risk % will increase if you get better trading performance. Your risk % will decrease if you get worse trading performance. One important caution about Kelly's criterion is that the Risk % calculated with this formula might be too aggressive for your trading. Therefore, you might use the half or a quarter of the risk %

calculated from the Kelly's Criterion. With Kelly's Criterion, you do not need the stop loss size but you just need to measure the size of average profit and loss from your historical trading.

Kelly's Risk % = W-[(1-W)/R] where W = Win rate and R =Reward/Risk ratio.

1.3 Reward/Risk Ratio in your trading

In any trading and investment, you need to know what your potential Reward and Risk are. Trading and investment involves many form of risks. With these risk factors, your winning rate will be subject to probabilistic nature. The Reward/Risk ratio is the single most important quantity to deal with the probabilistic nature of our trading outcome. The ratio is simply calculated by dividing the average profit by average loss. If your trading strategies have the stop loss always, then you can calculate the Reward/Risk ratio straight away from dividing the take profit size by the stop loss size. If your trading strategy does not have the stop loss, then you need to find your average loss and profit from the historical trading results. In any case, you should calculate Reward/Risk Ratio. Some trader might use the Risk/Reward Ratio instead of Reward/Risk ratio. Both are identical except the position of numerator and denominator is reversed. I personally prefer to use Reward/Risk ratio because I have to work less with decimal places. It is also easier to communicate with the Reward/Risk ratio with other traders for the same reason. For example, we recommend using Reward/Risk ratio greater than 3 for the Harmonic Pattern trading. The number 3 is intuitive and it is informative too. It simply means that your take profit size is three times bigger than your stop loss size. Instead, consider the cases where Risk/Reward ratio is used. Now you have to tell other traders that your Risk/Reward ratio is 0.333. Although Risk/Reward Ratio 0.333 carries exactly same meaning with Reward/Risk ratio 3, 0.333 is much harder to be interpreted every time in our trading.

In this section we assume that your trading strategy have the predefined stop loss and take profit size before your entry. In fact, this is recommended practice to average trader although this is not compulsory because there are a lot of trading strategies controlling risk by other means. Along with the Reward/Risk ratio, you need to be able to derive some other useful information frequently for your trading. Firstly, you should be able to calculate your profit and loss quickly based on your Reward/Risk ratio and your Risk %. It is important because trader should have a feel about the number in their trading. If you risk 1% of your trading capital for each trade with the Reward/Risk = 3, you will be making 3% on your win and you will lose 1% on your loss. If you risk 2% of your trading capital for each trade with the Reward/Risk = 3, you will be making 6% on your win and you will lose 2% on your loss.

1.4 Breakeven Success Rate

From your Reward/Risk ratio, you should be able to calculate the breakeven win rate. Breakeven win rate is the ratio of your winning trades to your entire trades in order to break even in your trading account. Breakeven win rate can be calculated using the formula below.

Breakeven win rate (%) = 100 * (Stop Loss Size/(Take Profit Size + Stop Loss Size)).

For example, if you have 30 and 30 pips respectively for your stop loss and take profit, then your breakeven win rate is 50%. The breakeven win rate 50% means that you need to win 5 out of 10 trades for you to break even in your account. For the Reward/Risk ratio = 1, any excessive wins after your 5^{th} win will contribute to your profits. Figure 1-2 show the corresponding breakeven win rate for the given Reward/Risk ratio. When you have the Reward/Risk ratio = 3, your breakeven rate is 25%. This means that you can breakeven in your trading if you can win 25 times out of 100 trades or 2.5 time out of 10 trades. For the Reward/Risk ratio = 3, any wins after 3^{rd} win will be your profits.

Risk	Reward	Breakeven Win Rate %
100	1	99%
50	1	98%
20	1	95%
10	1	91%
5	1	83%
4	1	80%
3	1	75%
2	1	67%
1	1	50%
1	2	33%
1	3	25%
1	4	20%
1	5	17%
1	10	9%
1	20	5%
1	50	2%
1	100	1%

Table 1-4: Breakeven win rate for various Reward/Risk ratio.

Often I met many starters who believe that they need the win rate of 70% or over to be successful for their trading. Now you can tell that this idea is definitely wrong. How many of you have pursued the trading strategy with high win rate like 90% or 95% and blown up your account? If your reward is exceptionally small comparing to your risk, then you can always manufacture such a high winning rate system. Those systems will produce the exceptionally smooth balance curve upwards at the beginning until it start to lose its edge. Such system is normally not profitable in the long term. If the Reward/Risk ratio <= 0.1 (i.e. Reward =1 and Risk=10), you will typically need to achieve over 90% of winning rate to just breakeven. When you make one loss in your trading, you will need high trading frequency to breakeven after the loss. This will definitely add a lot more work on your trading. In the human trader point of view, it is better to stick with Reward/Risk ratio >= 1.

1.5 Know your profit goal before your trading

Calculating your profit target before your trading is very important task if you want to become a successful trader. Calculating your profit target helps you to see what factors can influence your profitability. Once you have identified important factors for your profit calculation, you can have a realistic view on your profit. This helps trader to stop gambling with your trading. Practically I have found that the trader, who trades without knowing their profit goal prior to their trading, often fails miserably.

Especially when you apply new trading strategies, it is difficult to know its potential profitability. For this reason, it is easy for traders to give up the trading strategy after they are hit with few bad trading. However, if you can calculate the potential profit from the strategy before using them, you are likely to stick with the trading strategy until you will achieve the profit goals. With the set profit goal, you can improve your discipline much faster. To project the future profit in advance, you can use the hypothetical profits formula I have created. I often use this hypothetical profit formula to get some idea about the profitability before trading. With this calculation, you will see why knowing your reward/risk ratio is important.

Hypothetical profit for N trades = Hypothetical profit per trade x N trades.

Where Hypothetical profit per trade (US dollar) = Reward per trade (US dollar) x Win rate – Risk per trade (US dollar) x (1-Win rate).

Before using this formula, trader must know that this formula is accurate for the fixed position sizing. If you are using this formula for the case of the fixed position sizing, the calculation will lead to the statistically expected profit for N trades. For the fixed fractional position sizing, the dollar value of risk per trade varies with our trading capital. Therefore, this formula is less accurate for the fixed fractional position sizing. This calculation will not lead do to the expected profit for the fixed fractional position sizing but only hypothetical profit.

Your actual future profit can be more or less than the hypothetical profit after N trades. However, the calculation is still useful because you can set the short-term profit goal with simple calculation without needing any complex simulation. We still recommend using above calculation to get the quick approximation of our future profit because you can perform much better when you have the profit goal for your trading. We will illustrate how you can set your profit goal for the fixed fractional position sizing. Consider that you have the trading strategy with 35% win rate and Reward/Risk ratio = 3 for the 10,000 US dollar trading capital and 1% Risk. We get:

Hypothetical profit per trade (US dollar) = 40 US dollar = 300 x 0.35 – 100 x 0.65.

Now let us assume that you can manage 50 trades each month, your profit goal can be calculated like this:

Hypothetical profit after 50 trades = 2000 US dollar = 40 x 50.

The 2000 US dollar profit is corresponding to 20% growth for your account. Of course, 20% growth per month is good achievement for trader with 10,000 US dollar account size. From this formula, you can find that the main driver of your account growth is your win rate. If your win rate is 30% for your trading strategy, then your profit goal can be calculated like this:

Hypothetical profit per trade (US dollar) = 20 US dollar = 300 x 0.3 – 100 x 0.7.

Hypothetical profit after 50 trades = 1000 US dollar = 20 x 50.

If your win rate is below 25% for the trading strategy, then there is no reason for you to trade because your profit goal from this trading strategy is zero:

Hypothetical profit per trade (US dollar) = 0 US dollar = 300 x 0.25 – 100 x 0.75.

Hypothetical profit after 50 trades = 0 US dollar = 0 x 50.

From above calculation, you can tell that you can scale up your profit by increasing number of trades. In general, when you can achieve the ideal win rate and ideal number of trades, you will experience stiff increase in your profits. Even if your win rate is low, you can always scale up your profit by increasing number of trades as long as your win rate is above the breakeven rate. One important thing you should consider is that human gets tired after many trading. For this reason, too many trades can reduce your win rate. In return, your profit can be reduced too. Therefore, you should not attempt to overstay in your trading desk. In addition, you have to control your trading psychology without losing your focus.

In spite of the fact that profit calculation requires a calculator or spreadsheet, it is worth to calculate your profit prior to your trading. From the trader’s point of view, it is always more productive to trade with some tangible profit goal. In addition, I have met many junior traders who are nervous for their first trading or trading with new trading strategy. Especially when they got with one or two bad trading, they normally start to feel the pressure. When you have calculated your profit goal before your trading, one or two times losses hardly matter because it is only the part of process in the course of your trading.

1.6 Compounding Profits

Trader should remember that your profit would be compounded if you were using the fixed factional position sizing and if you do not withdraw the profit. Understanding compounding profit is not difficult. Every time you make profit from your trading, you can keep the profit in your account for your next trading. At the beginning, your 2% profit is 200 us dollar from your 10,000 US dollar account. As your account size increased with accumulated profit, your 2% profit can become 300 US dollar from 15,000 US dollar assuming that you made 5000 US dollar profit. This process will go on every time you make profit and the profit stays in your account. In fact, with profitable trading strategy, your account will grow faster than above Hypothetical profit calculated. Therefore, when you are using this hypothetical profit calculation, use it for short-term goal only like a month or two. If you are using the fixed position sizing, it is important to increase your lot size to get the same compounding effect when you have reached your profit goal every time.

1.7 Trading Performance and Cost Metrics

Trading performance and cost metrics are useful for our trading because we can grab all the essential information about our trading with one single number. Especially, annual return, profit factor, Sharpe ratio and Calmar ratio and are often used to compare the performance of traders, fund managers and trading algorithm in the absolute terms. You will not measure the trading performance every day but at least you should measure them once a month. If trading performance metric concerns our profit in our trading, the cost metrics concerns the transactional cost we have to pay for while we are trading. For example, commission and spread are the typical transactional cost we have to pay for while we are trading for currency or stock shares. We have listed several performance metrics and cost metrics in Table 1-5 and Table 1-6.

There are several reasons that performance metrics is important for your day trading. Firstly, we need to measure the performance to compare many trading and investment opportunities. Without a commonly applicable metrics, it is not possible to compare different trading and investment opportunities. Although the performance metrics are not the absolute predictor of the future performance, you are still much better to use this metrics to avoid many bad opportunities. To measure some professionally accepted trading metrics like the Sharpe ratio and Calmar ratio you will need at least 3 years of trading records. Most of time, when you are experimenting with new strategy, you will not have such a long trading history unless you are building the backtesting algorithm for your strategy. To identify the usefulness of the new trading strategy you can use profit factor because it can be calculated with much shorter trading history than Sharpe and Calmar ratio. Along with profit factor, you need to know the winning rate, average profit and loss from your trading.

Secondly, we can measure the performance of trading system to cross-compare different instruments when we develop our own trading strategy. Whether you are applying one trading system across many different instruments or applying several trading system across many different instruments, performance metrics are important. Especially if we want to compare the many different trading systems, then it is important to use the right trading metrics applicable across different instrument and different trading strategies. For example, profit factor, CAGR %, Sharpe and Calmar ratio can be used for this purpose. Especially Sharpe and Calmar ratio provide the risk adjusted return characteristics of the trading strategy. For example, Sharpe ratio or Calmar ratio over 1 represents that your expected return is greater than your risk. Trading system with higher Sharpe ratio and Calmar ratios is desired for traders and investors.

Metrics	Description
Risk free rate %	Rate of return of an investment with zero risk. The risk free rate typically represents the annual interest rate an investor would expect from their typical saving account. The interest rate of the national saving account is a good example of risk free rate.
Annual Return %	The profit an investment generates over a year as a percentage of the amount of capital invested.
Gross Profit	the total sum of all winning trades
Gross Loss	total sum of all losing trades
Average Profit	average of all winning trades
Average Loss	average of all losing trades
Total Net Profit	the total profit based on the difference between gross profit and gross loss
Profit Factor	a ratio of gross profit over the absolute sum of the gross loss (=Gross Profit/|Gross Loss|)
Winning rate (or Winning Percent)	the number of winning trades over the total number of trades
Losing rate (or losing percent)	the number of losing trades over the total number of trades
Maximum consecutive wins	the greatest number of winning trades that occurred in a row
Maximum consecutive losses	the greatest number of losing trades that occurred in a row
Maximum Drawdown %	the largest retracement relative to a previous equity high in the entire trading period
CAGR % (Compounded Annual Growth Rate)	Annual percentage rate at which an account must continually grow over the period, in order to attain the end value from the starting values of your balance.
Sharpe Ratio	Excessive annual return divided by the standard deviation of the annual returns = (Return % - risk free rate %)/standard deviation %
Calmar Ratio	Excessive annual return divided by the maximum drawdown % = (Return % - risk free rate %)/maximum drawdown %

Table 1-5: Essential performance metrics for trading and investment.

To check if we are trading with reasonable operational cost, we need to measure the cost metrics. Operational costs have the direct impact on your trading profits. Such operational cost can be measured readily in the modern trading platform. While you are back-testing or forward-testing, you will notice that high operational cost can wipe out all the profit generated from your trading system. Likewise, many trading systems are profitable in the laboratory condition where operational cost is zero. Trader should monitor the average spread and commission always. Slippage is the absolute value of the difference between the order open price you have sent to your broker and the open price that your broker executed. If your slippage is counted towards your loss, then it is called negative slippage. If your slippage is counted towards your profit, then it is called positive slippage. In theory, you should get more or less similar amount of positive slippage and negative slippage in your trading. If your average negative slippage is much greater than average positive slippage, you need to investigate the reason why you are getting bad deals every time.

Metrics	Description
Average slippage	Average of the price difference between your desired open price and the actual open price
Average positive slippage	Average of the price difference between your desired open price and the actual open price, resulted in your profit
Average negative slippage	Average of the price difference between your desired open price and the actual open price, resulted in your loss
Average Spread	Average of the spread (ask – bid) at your order execution time
Average Commission	Average commission paid for each order execution

Table 1-6: Essential cost metrics for trading and investment.

2. Portfolio Management

2.1 Combining different trading strategy

Many professional traders recommend combining different technical analysis to confirm your trading entry. To give you some idea on why, let us consider the concept of the perfect information in the context of decision-making. The price of the perfect information is priceless. For example, if we know that tomorrow the share price of Google will rise by 8%, say that this perfect information arrived from the future somehow. How much this information worth for you? With this information, you can invest your entire cash on Google today. Well, if you are smart, then you will even borrow money from your friends and family or even from bank to invest on Google share today because the information is perfect. If you are even smarter, then you will not only trade on the Google share but you will trade on the leveraged derivative products of Google share for even bigger jackpots. At the end of tomorrow, you will close all your positions from your trading. Even if you pay back the borrowed money to your family, friend and banks, you will be still making profits of 1 million US dollar from your investment in just one day.

The value of the perfect information is worthless in the financial market. However, such perfect information is not available to anyone in this world except God. In very few cases, we might encounter the near perfect information in the human world. That is insider trading. However, insider trading is illegal and therefore we will not discuss here. Generally, it is better to assume that the perfect information is not available to us. When we do not have the perfect information on our hands, what can we do for our trading? Well, we have to collect pieces of evidence to form the solid but imperfect information for our decision-making. With imperfect information, outcome of our decision will be subject to probability. Our decision can be correct but sometimes it can be wrong too. Each evidence would add some value towards our decision-making but one piece of evidence will not necessarily reveal the entire market dynamics for your trading. For this reason, we have to collect the multiple of evidences from many different angles for our trading. Technical or fundamental analyses are the evidence-collecting tool for traders. We have to remember that each technical analysis are designed to provide the evidence on the presence of the specific price patterns in the Price Table in Figure 3-4 and Figure 3-5 in the 1st training course.

For this reason, we have to be careful at how we mix and match these evidences to form the solid but imperfect information for our trading. For example, if you want to collect the evidence for the price patterns on the equilibrium process, then you should collect the evidences from the technical analysis designed to detect the price patterns on equilibrium process. Likewise, if you want to collect evidence for the price pattern on the equilibrium Fractal-Wave process, then you should collect the evidences from the technical analysis designed to detect the price patterns on the equilibrium Fractal-Wave process. If you blindly mix two different types of technical analysis, then they will provide you conflicting evidences only. Since this book focus on dealing with the price patterns made up from the equilibrium Fractal-Wave process, we provide some examples of combining different technical analysis to collect the evidence for the equilibrium Fractal-Wave process. In Table 2-1, we provide the list of some possible combination of technical analysis. Since Harmonic Pattern, Price Pattern, Supply Demand Zone and Elliott Wave theory are all designed to deal with the price patterns of Equilibrium Fractal-Wave process, these techniques are relatively easy to combine. The possible combinations are not limited to the list on Table 2-1 only. Trader can even combine three or more analysis together if they are highly confident on the individual techniques.

No. of Combinations	Technical Analysis Combined

2	Supply Demand Zone + Harmonic Pattern
2	Price pattern + Harmonic Pattern
2	Elliott Wave Theory + Harmonic Pattern
2	Price pattern + Elliott Wave Theory
2	Supply Demand Zone + Elliott Wave Theory

Table 2-1: List of the possible combination of different technical analysis where price patterns include Triangle, Wedge, Head and Shoulder, Double Top, Triple Top patterns.

We provide some trading examples of the combined analysis on Table 2-1 (Figure 2-1 to Figure 2-6). For the combined analysis, two or three techniques should agree on the trading direction but they should also provide roughly same entry level. If the recommended entries from each technique are deviated too far, then we do not recommend taking the entry. Most of time, the combination are straightforward when you have mastered the individual trading techniques correctly. Therefore, it is better to stick with the technical analysis you are confident to use. From practical point of view, the combined analysis will increase your trading performance in general.

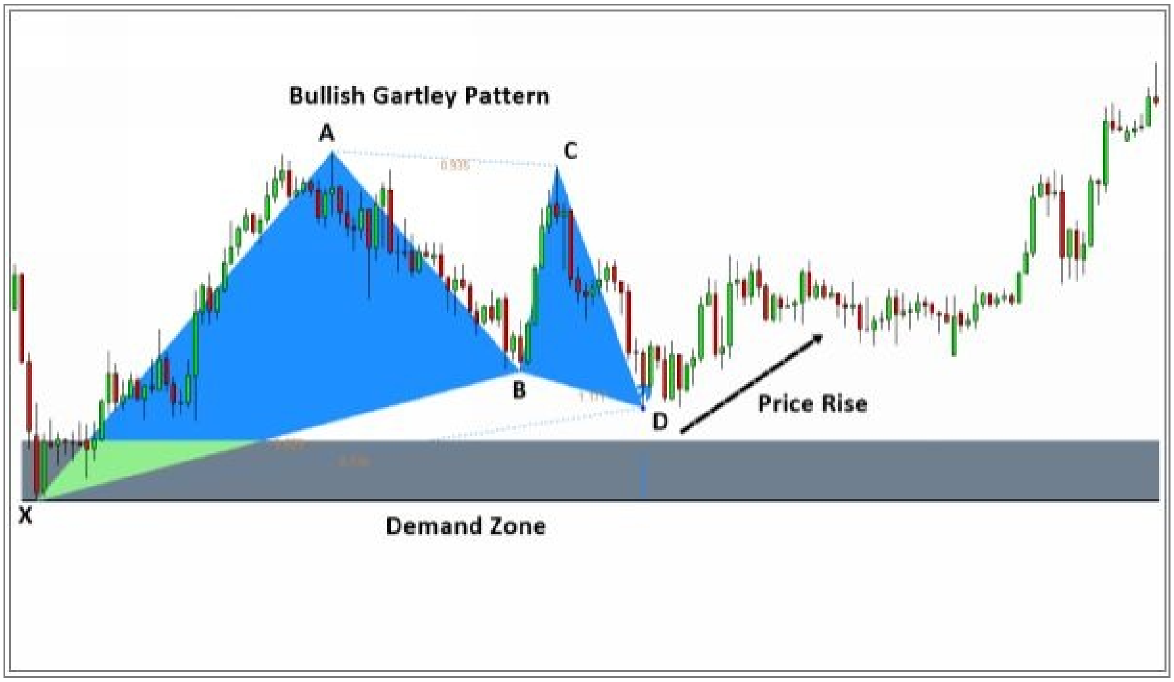

Figure 2-1: Example of combining the Demand Zone with Harmonic Pattern on EURUSD D1 Timeframe.

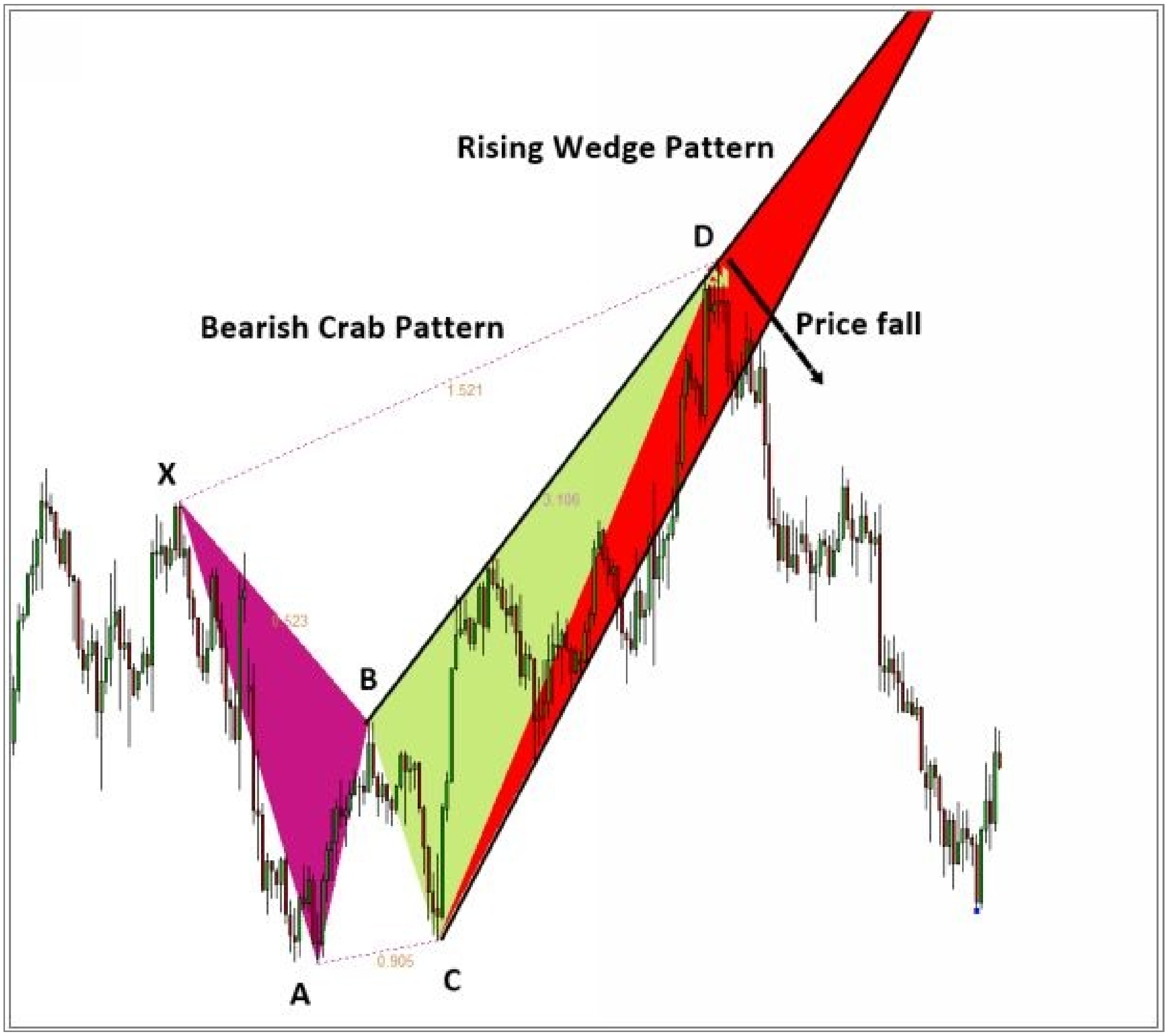

Figure 2-2: Example of combining the Rising Wedge Pattern with Harmonic Pattern on USDJPY H1 Timeframe.

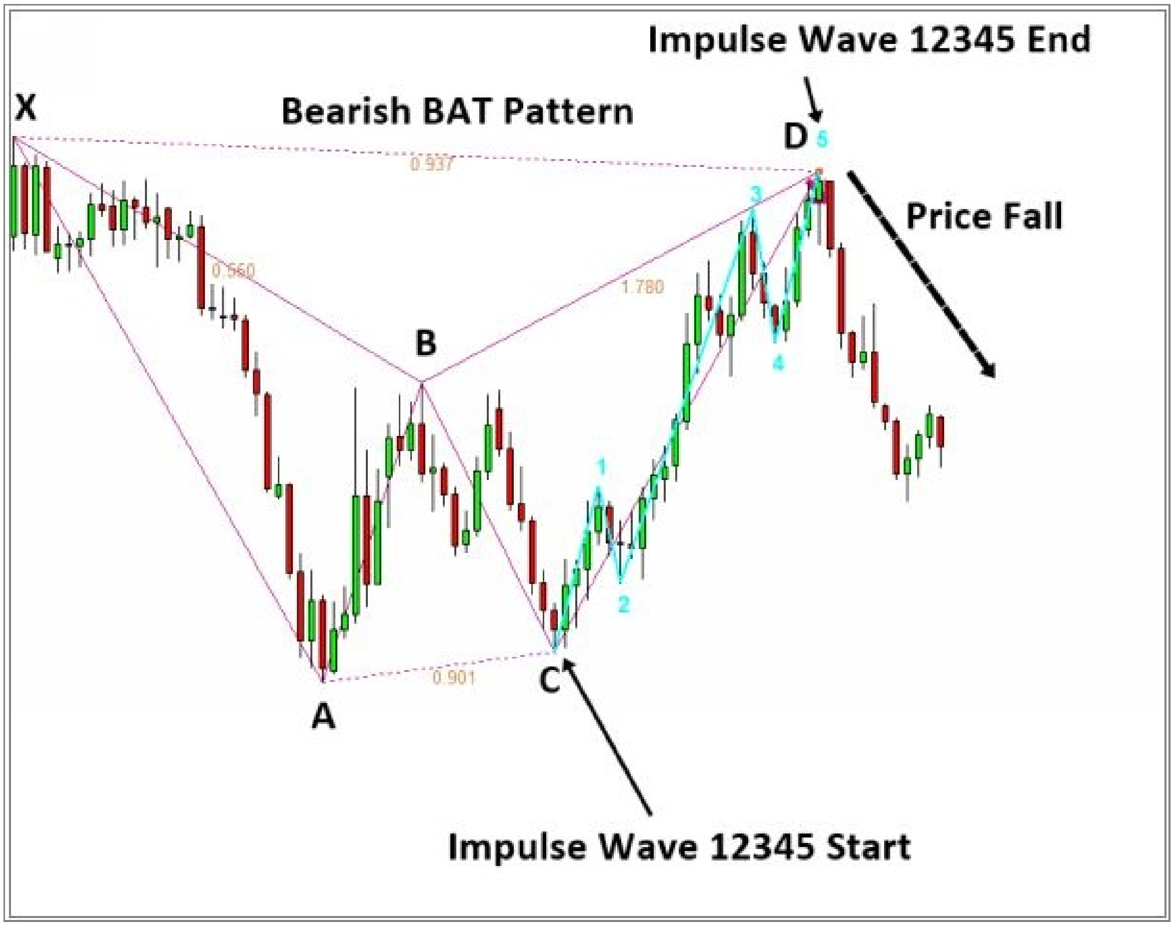

Figure 2-3: Example of combining the Impulse Wave pattern with Harmonic Pattern on EURUSD D1 Timeframe.

Figure 2-4: Example of combining Rising Wedge Pattern with Elliott Wave Pattern on EURUSD H4 Timeframe.

Figure 2-5: Example of combining Demand Zone with the Corrective ABCDE Wave on EURUSD H4 timeframe.

Figure 2-6: Example of combining the Supply Zone with the Corrective ABC Wave on GBPUSD D1 timeframe.

2.2 Hedging

Hedging can help traders to neutralize some or all of the directional risk associates with a position or an entire portfolio. Trader and investor can reduce substantial amount of risk by using various hedging techniques. In theory, the perfect hedging can be achieved through the perfect negative correlation, which is the correlation -1, between two trading systems. Sometimes, we can not achieve the perfect negative correlation. However, if we can achieve the negative correlation near -1, we can still get good hedging effects between the two systems. There are several ways of achieving the negative correlation. Simply holding one long and one equal sized short position of the same security, you can achieve the negative correlation of -1. If you are holding one long position in EURUSD and one short position of GBPUSD, this can be considered as the negative correlation if EURUSD and GBPUSD are highly positively correlated. You can also achieve hedging when you trade two or more securities at the same when they are nearly zero correlated. This is in fact the basis of the popular modern portfolio theory by Harry Markowitz, the Nobel Prize Winner in 1990. To get you better understanding on the hedging principle, we list several hedging techniques you can utilize for your trading here:

- By entering the equally sized opposite positions for full hedging on the same instrument (e.g. holding one long position with an equally sized short position)
- By entering the unequally size opposite positions for a partial hedging on the same instrument (e.g. holding two long position with one short position)
- By entering equally sized opposite positions for near full hedging on the two highly correlated instrument pair (e.g. holding one long position on EURUSD and the equally sized short position on GBPUSD if they are highly correlated)
- By entering the long and short call option while you are having position in the underlying securities

- By entering the long and short position in future contracts while you are having positions in the underlying securities
- By entering long and short positions in the two highly correlated securities (e.g. Buy 1.0 lot on EURUSD and Sell 1.0 lot on GBPUSD)
- Trade on more than two securities, which have nearly zero correlation between them

2.3 Portfolio Diversification

Portfolio means to trade on the combination of different assets. The main concept behind portfolio trading is diversification. Theoretically and practically diversification have proven to reduce the specific risk presents on the individual instrument. Even for the time being, many fund managers are spending over ten thousands hours to select the strong portfolio for their fund management. As we have explained earlier on our Hedging section, the key concept of portfolio diversification is to trade on more than two securities, which have nearly zero correlation. When each security within our portfolio has nearly zero correlation, our risk can be distributed evenly over our portfolio. We will be less influenced by the performance of one instrument. For example, when you are trading on one instrument only, you can not do much for the bad drawdown. If you are trading on multiple of instruments, you will not suffer too much on the same drawdown on that instrument because profits in other instruments in your portfolio can offset the drawdown. There are several ways of building your portfolio. Firstly, you can diversify your portfolio by investing on different markets. For example, you can build your portfolio across Forex, stock and bond, etc. Secondly, you can diversify your portfolio by creating variety within the market. For example, you can trade on several different currency pairs instead of trading only one-currency pair. Thirdly, you can diversify your portfolio by using multiple trading strategies within the instruments. If the different trading strategies are highly uncorrelated, then each strategy can offset the weakness of the other strategy.

In terms of trading capital allocation across your portfolio, there are also several different techniques available. Firstly, you can use the equal weighted allocation. In the equal weighted allocation, literally you are allocating the trading capital equally across all your instruments on your portfolio. For example, if you trade on the five currency pairs including EURUSD, GBPUSD, USDJPY, USDCAD and EURGBP with 50,000 us dollar. You can allocate 10,000 US dollar on each currency pairs. The equal weighted allocation is simple and effective for many of cases. However, there are more fancy way of allocating your capital over your portfolio. The second method is using the mean variance portfolio optimization devised by Harry Markowitz. In the mean variance portfolio optimization, we allocate our trading capital across the portfolio by evaluating the correlation, expected return and variance characteristics of each instrument. The mean variance portfolio optimization is the typical iterative mathematical algorithm, which requires some sophisticated tools to perform. It is even possible to perform the mean variance portfolio optimization using MS-Excel with its Solver add-In or MatLab with some code lines. However, we will not go through the details of applying this because we do not aim to introduce any quantitative topics in this book.

Now let us consider some practical aspect of the portfolio construction. In theory, diversification is the wonderful concept. I have no doubt on that. However, in practice the benefit might be not as great as we think. Especially when we apply them wrong, there can be more harm than good. Not every trader is the fund manager investing 100 million dollars for their customers. Not every trader is a math geek who got the PhD degree in Math. However, we know that the portfolio can reduce our risk much greater than trading on the single instrument. It is even intuitive. Therefore, many traders are using the concept for better performance. To maximize our benefits with our portfolio, there are two important considerations on the portfolio construction. The two important considerations are your trading experience and account size. When you are relatively inexperienced in trading, it is not right for you to trade over 20 or 30 different instruments. Before doing this, you need to consider to master the trading strategy first. As we have shown in our Price Pattern Table (Figure 3-3 and Figure 3-4 in the 1st training course), the price series of different instruments are made up from different combination of the price patterns. You can not expect to achieve the same performance over the different instruments using one trading strategy. For example, the trend-based strategy can work well on the several instruments. However, the same trend-based strategy will not work well with some other instruments with strong presence of the equilibrium Fractal-Wave process or the equilibrium Wave process. Remember that for diversification to work, your trading strategy need to have at least some profits above the breakeven. Really losing strategy is the losing strategy. Even after the diversification, losing strategy will not be turned into the winning strategy. Remember that the core concept of the diversification is to reduce the specific risk presents in the individual instrument. It is not to say that we can reduce all the risks presents on our portfolio using diversification. Diversification is not the bulletproof protection for your trading and investment. If you are relatively inexperienced, then it is recommended to focus on mastering the trading strategy first. You might limit number of instruments to few until you are confident with the trading strategy.

Prior to the diversification, it is also important to consider your account size. With more diversification, the operational cost might increase too. For example, in stock trading, you might have to pay more commission if you want to buy shares over 100 different instruments than just buying shares over five different instruments. Not only the operational cost but also you have to do more work on the management side of it. For forex or future trading, to diversify more, you might have to use some authentic currency pairs, which is higher in the spread and commission. Remember that some authentic currency pairs the spread and commission can be much higher than the popular instruments. It is questionable to diversify more if we have to touch those instruments with higher spread and commission. Diversification is definitely important for your trading. However, for the practical trading application, pleases be sure that your degree of diversification meets the reasonable operational cost and the reasonable amount of management work.

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