Price Action and Pattern Trading Course

Subtitle: Theory to Practice with over 85 years of Evidence

Author: Young Ho Seo

Finance Engineer and Quantitative Trader

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About this book

Technical analysis for the financial trading and investment has nearly several hundred years of history. Traders use the technical analysis to collect the scientific evidence to find out the probable market direction and volatility for their trading. When many people spot the same thing in the financial market, I think we should take it very carefully, especially if they are based on the scientific evidence. Price action and pattern trading strategies were extensively used by many successful traders to identify the trading opportunity to profits in the market. Price action and pattern trading strategies concern less on the traditional technical indicators. However, they concern more on raw price patterns. With the recent development of many brilliant trading strategies within the price action and pattern trading, their usefulness are already beyond the expectation of many of us.

As a quantitative developer and trader, my job allows me to explore nearly thousands of different trading strategies to validate and verify. Several price action and pattern trading strategies have shown me that their operating characteristics are much different from the typical momentum and mean reversion strategies. Those price action and pattern trading strategies are powerful. However, the idea behind these powerful trading strategies is poorly understood by many traders. Therefore, I decided to come up with the new concept “Equilibrium Fractal-Wave process” because I was not able to encapsulate many proven trading strategies used by traders last 85 year using the existing theory.

To accomplish the concept “Equilibrium Fractal-Wave process”, I had to create more comprehensive Price Pattern Table to explain those price action and

pattern trading strategies outside the trend and seasonality framework, which are the backbone of the analysis techniques for univariate price series. The main purpose is to communicate with traders for the potential market dynamics for their profitable trading by spotting the existing phenomenon in the financial market.

This book is still geared up for your practical trading. Therefore, just explaining why the strategies work is probably not sufficient for traders. This book covers many working price action and pattern trading strategies in details and with examples. At the end of this book, we have also provided some useful information towards your trading management. Especially we emphasize the importance of the risk management in this book. I tried to offer the digestible information as much as I can even for average traders. In addition, many free tools are available from the website: “http://algotrading-investment.com” for free of charge. Especially, you might need the Peak Trough Analysis tool to follow some of the chapters in this book. You can freely download the Peak Trough Analysis tool from the same website above. Finally, reader should note that this book contains some strong technical language.

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Introduction to Price Action and Pattern Trading

Subtitle: 1st Training in Price Action and Pattern Trading Course

Author: Young Ho Seo

Finance Engineer and Quantitative Trader

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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	• Japanese candlestick patterns • Support & resistance • Pivot point analysis • Volume Spread Analysis

• Median Renko chart • Tick chart • Point & Figure chart • Heiken Ashi • Area • Kagi • Line break • Histogram • Scatter plot	• 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.

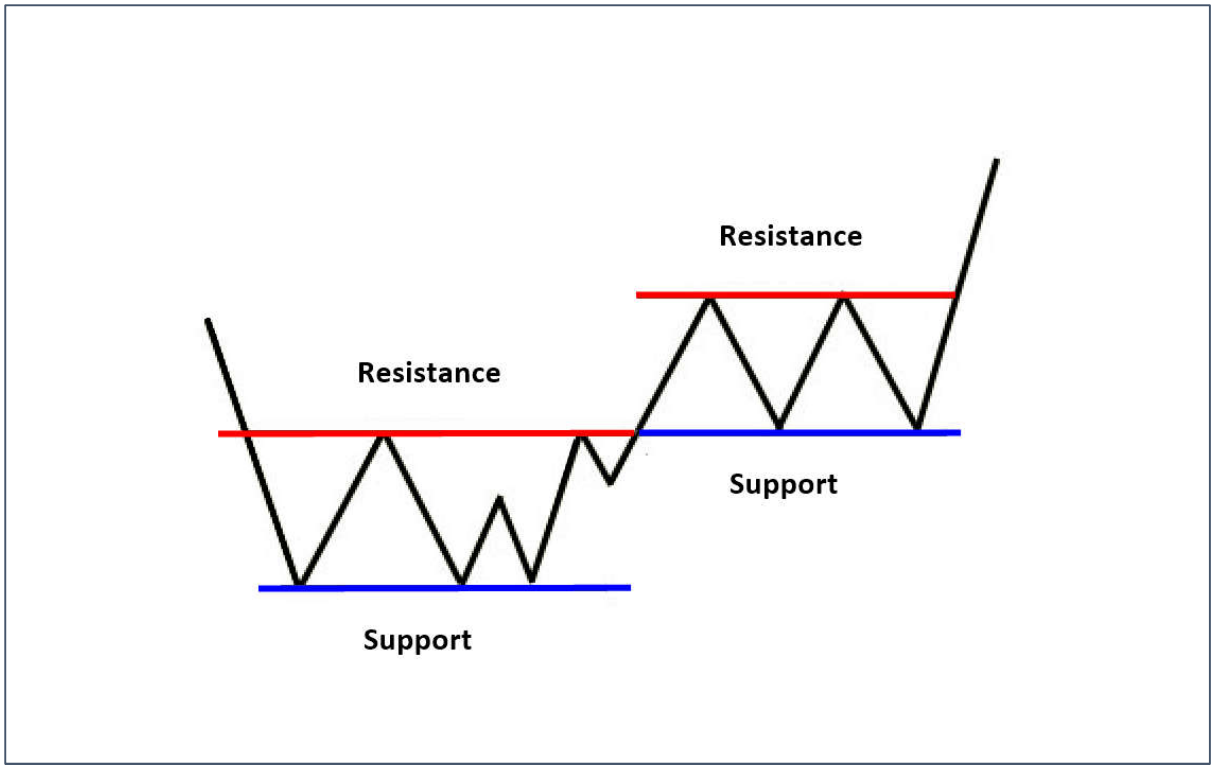


Figure 1-3: Schematic diagram of Support and Resistance for financial trading.

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.

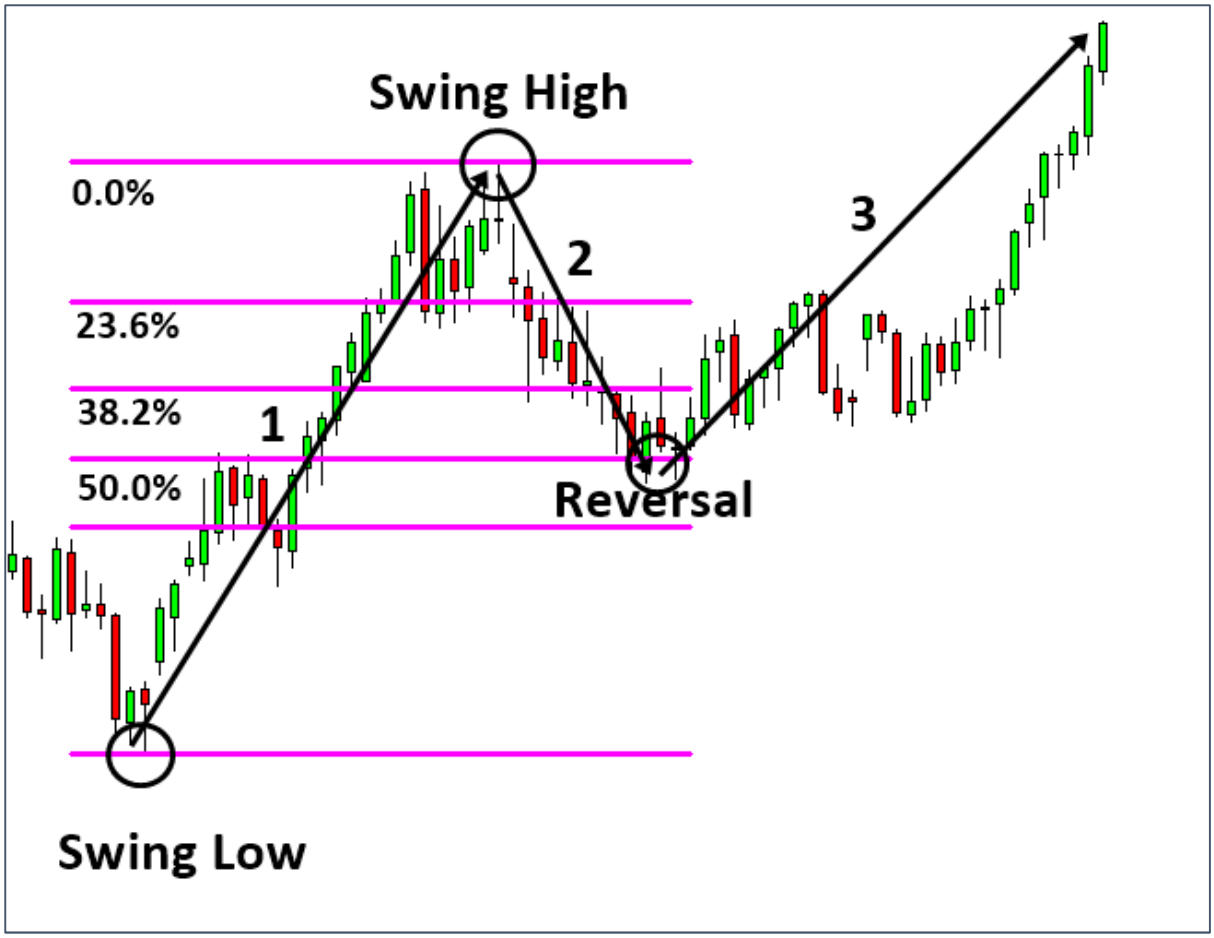


Figure 1-5: Fibonacci Retracement drawn over daily EURUSD candlestick chart for bullish setup.

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.

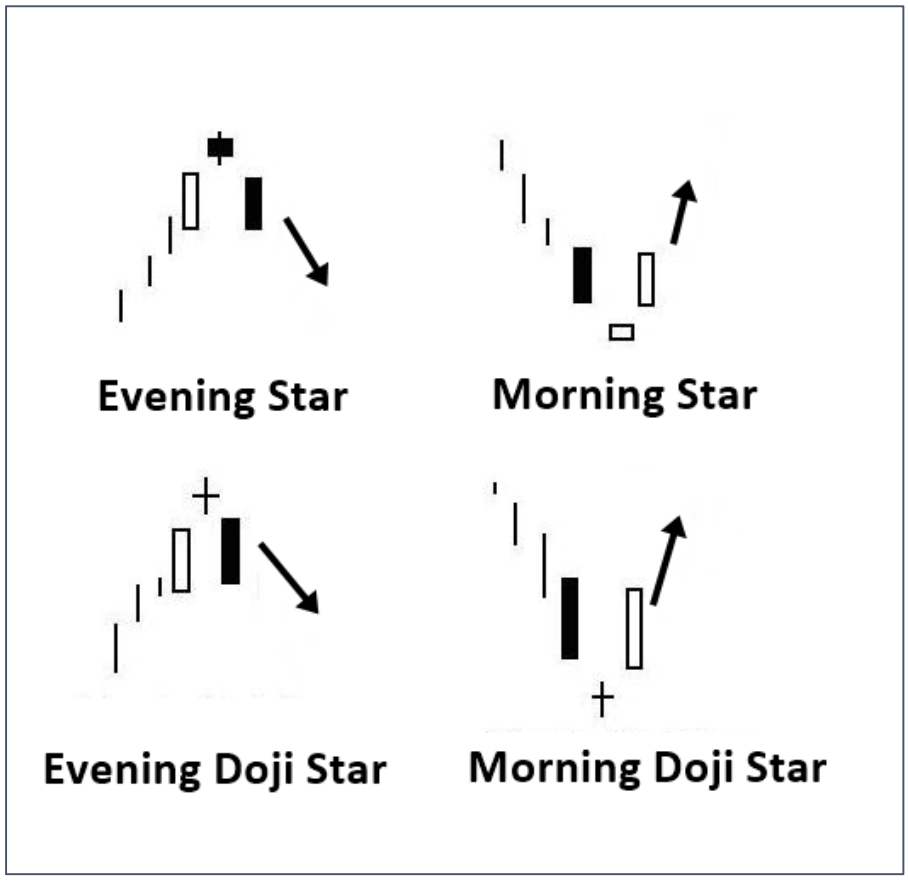


Figure 1- 6: Trend reversal Japanese candlestick patterns.

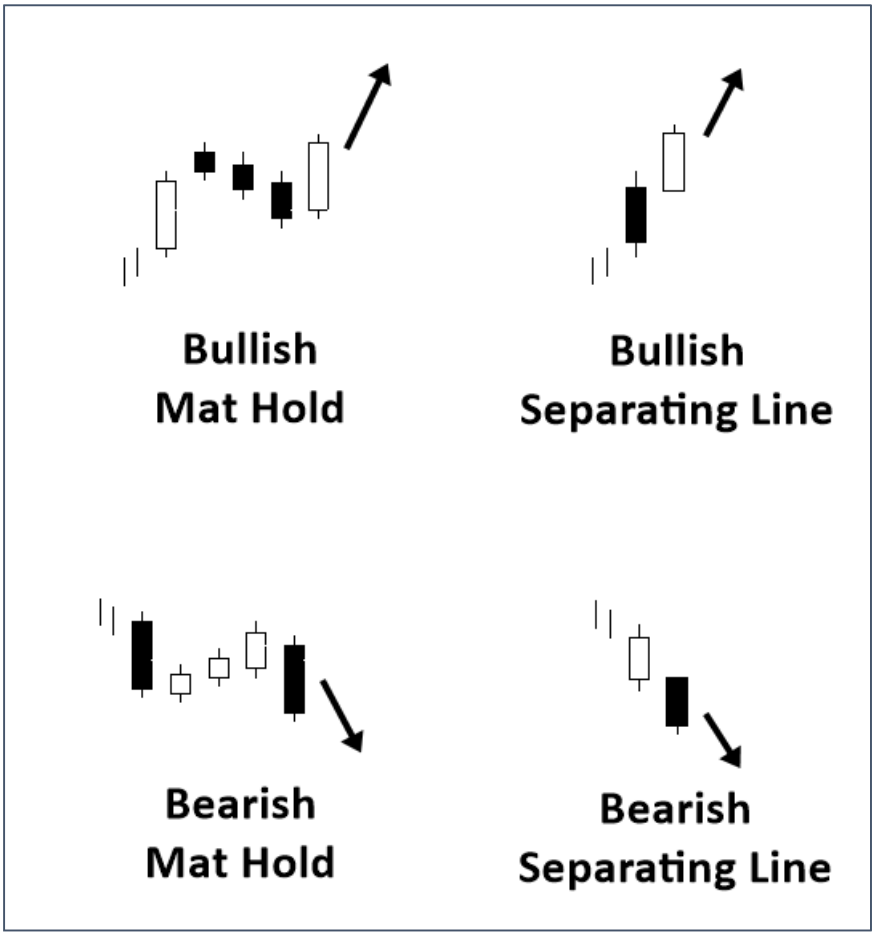


Figure 1- 7: Trend continuation Japanese candlestick patterns.

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.

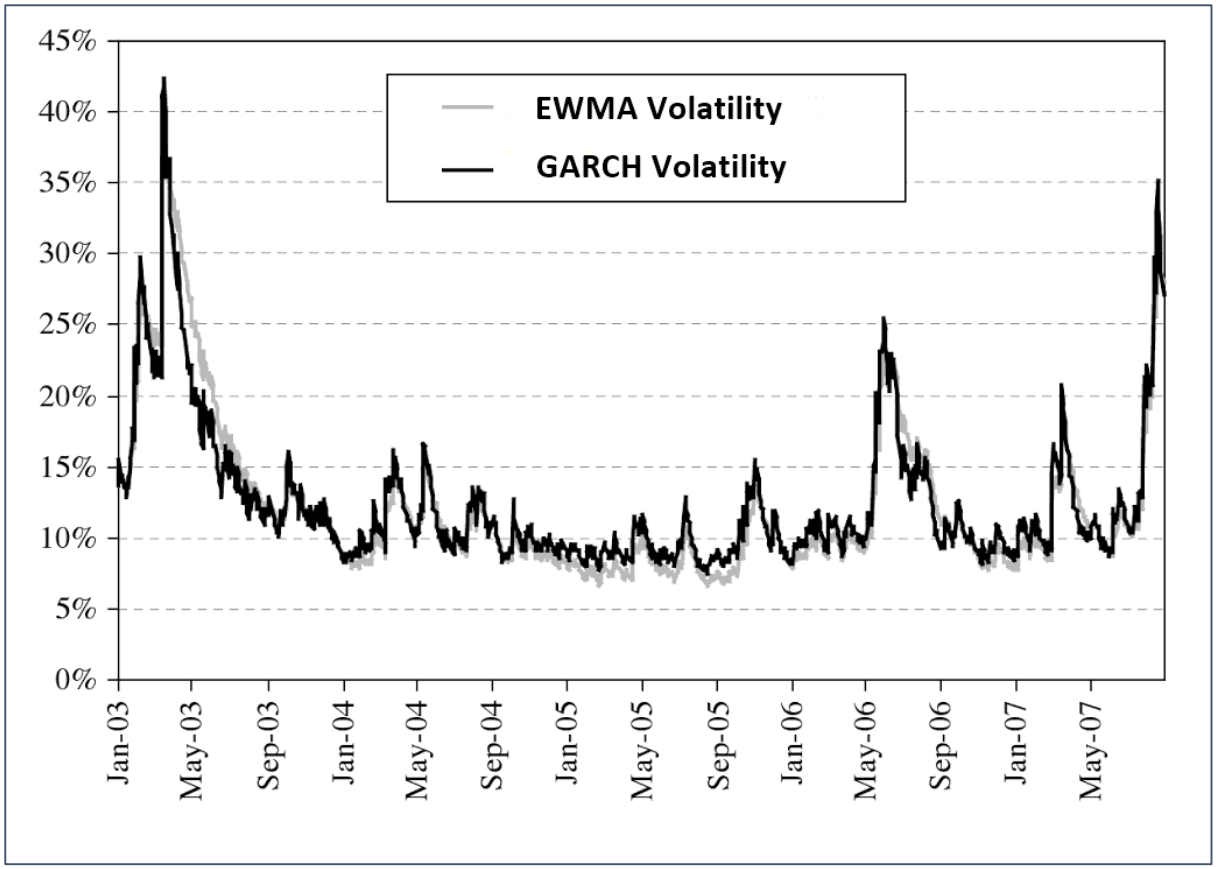


Figure 1-8: GARCH and EWMA Volatility for FTSE 100. (Alexander, 2008)

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.

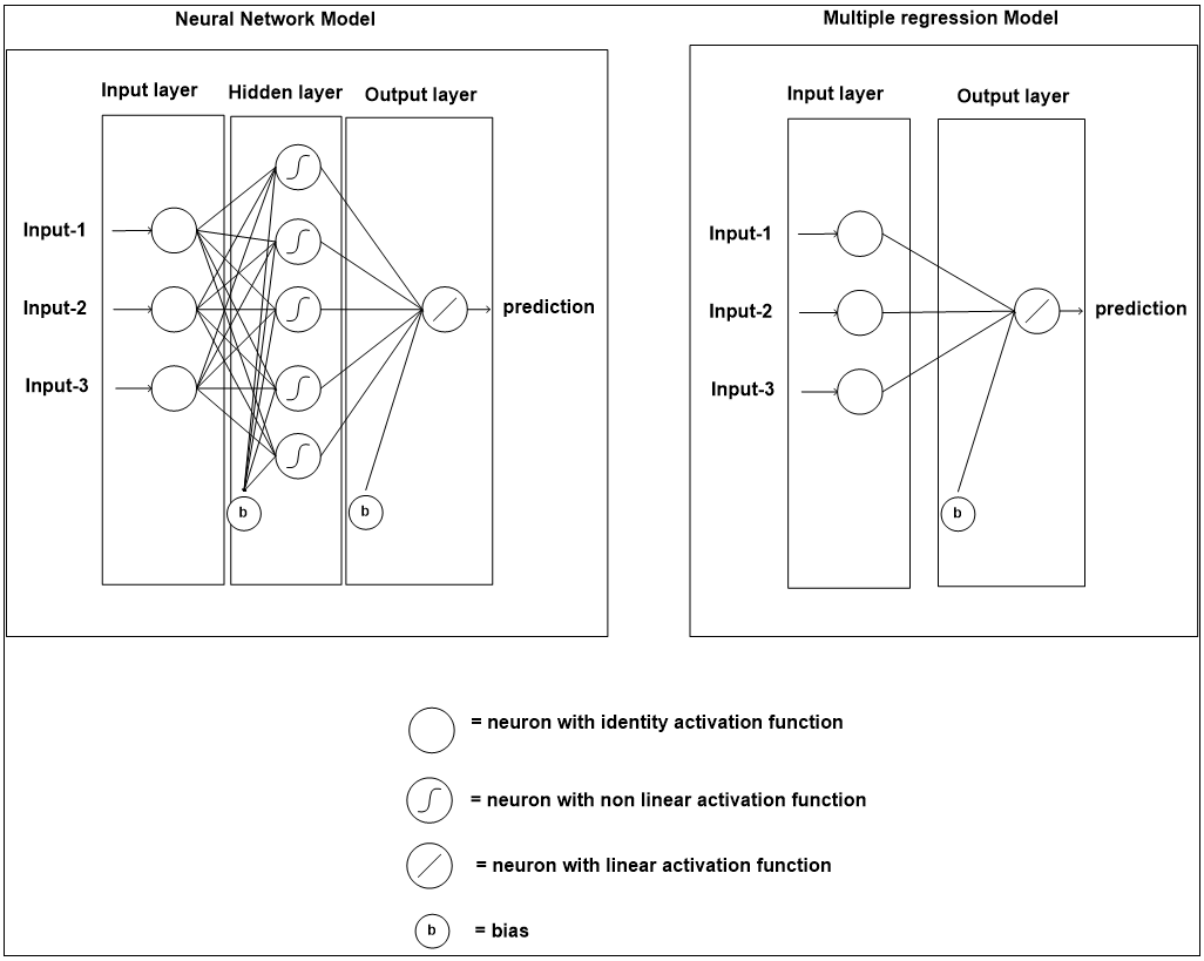


Figure 1-9: Topology of feed forward neural network model with 3 input neurons, 5 hidden neurons and 1 output neuron (Left) and multiple regression model expressed using neural network topology (right).

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.

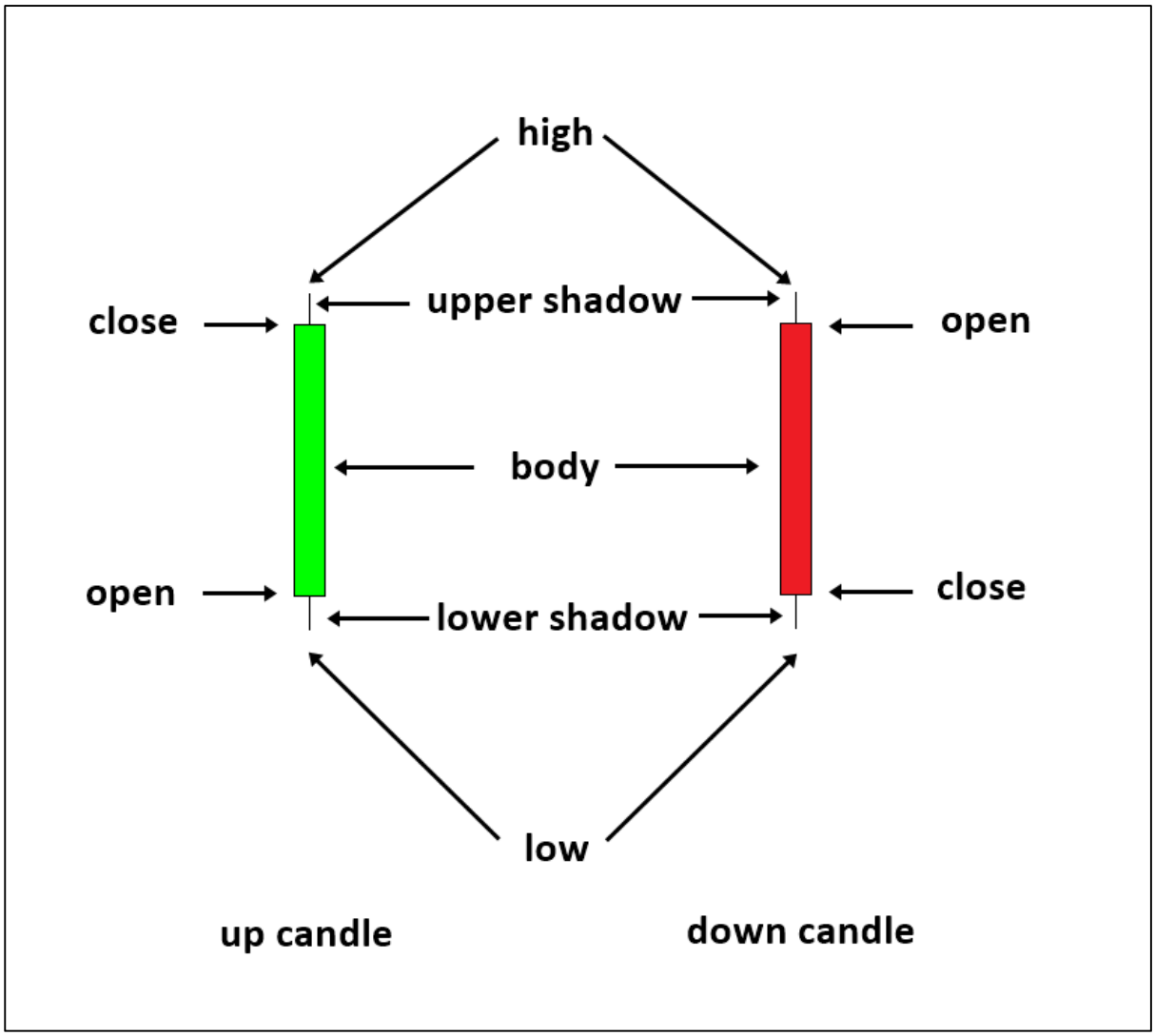


Figure 2-2: Anatomy of the Candlestick chart.

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.

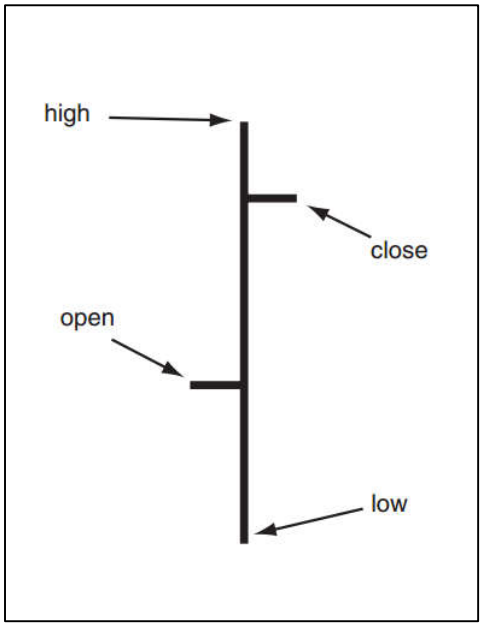


Figure 2-4: Anatomy of the Range Bar.

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.

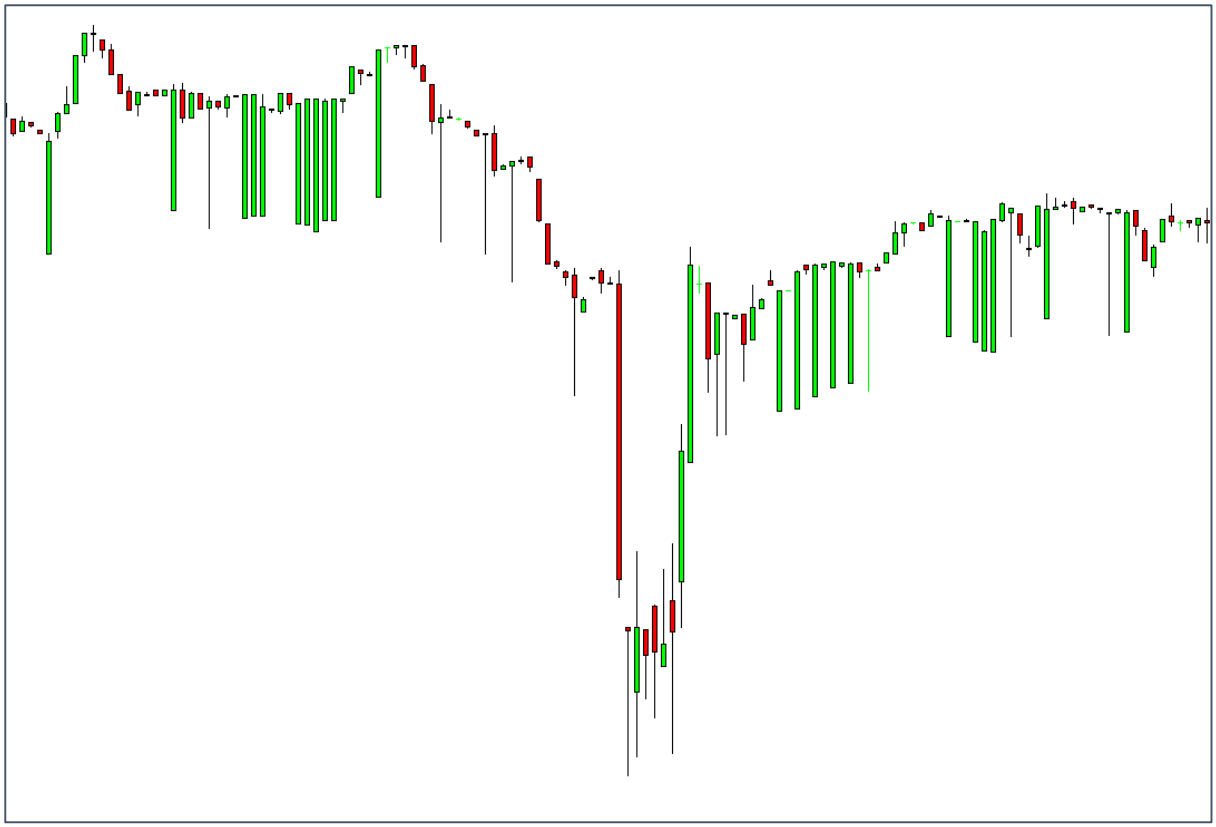


Figure 2-5: Broken candlestick chart for NZDSGD currency pairs in 1-minute timeframe.

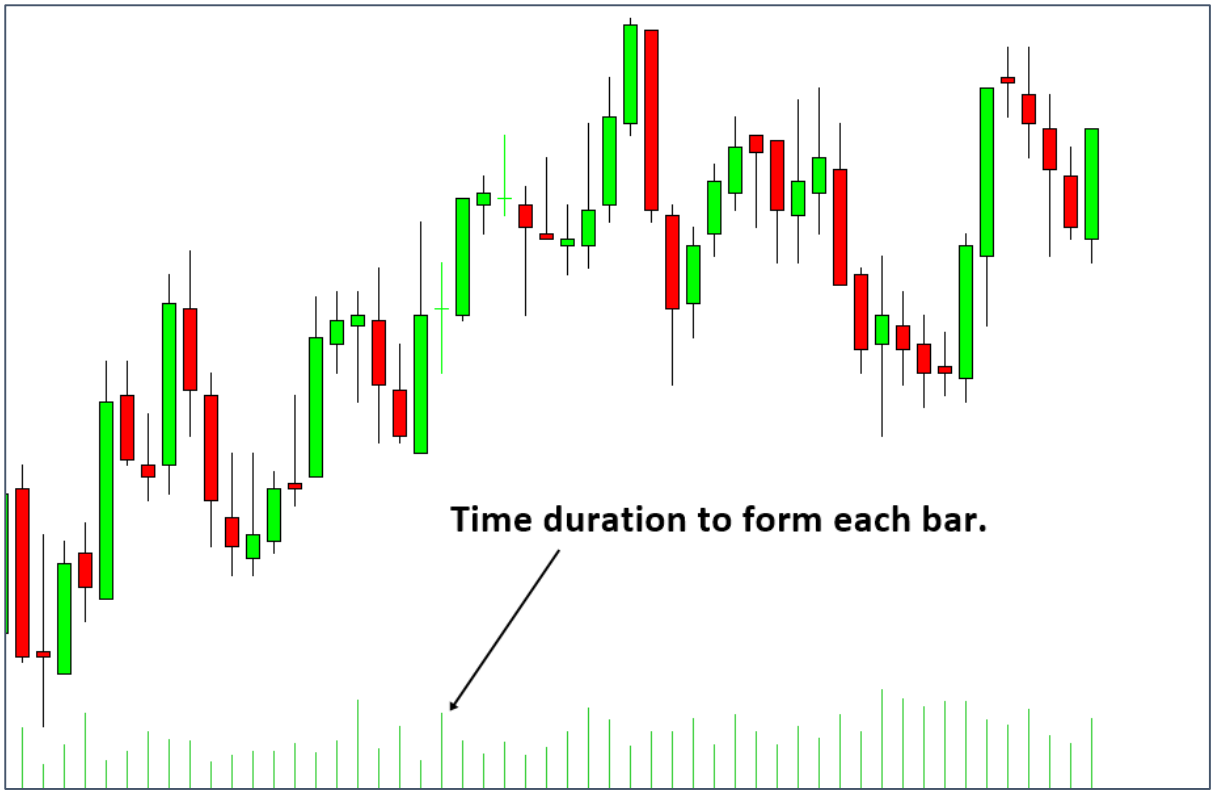


Figure 2-6: EURUSD Tick chat with 100 tick volume. On average, each bar was formed in 182.36 seconds.

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.

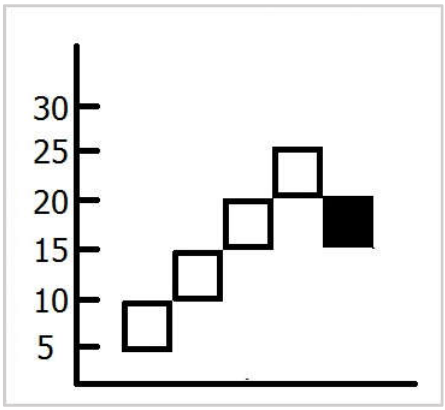


Figure 2-7: Conceptual representation of Renko chart.

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.

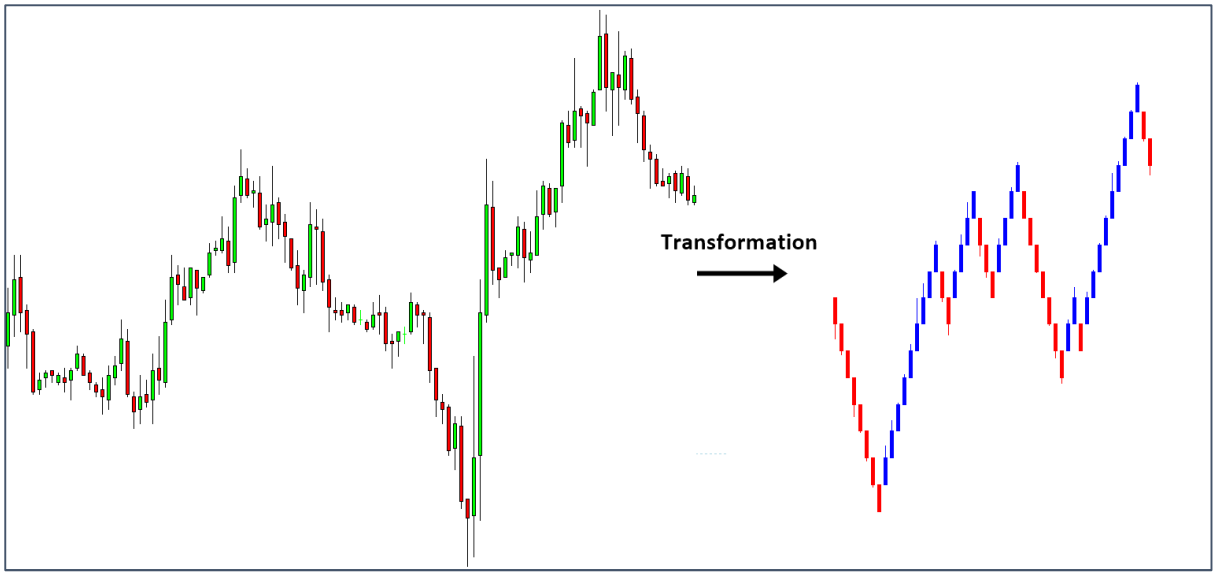


Figure 2-8: Daily EURUSD price series and Renko chart on the same period.

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. Price Patterns 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 trading strategies right 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? Mathematicians 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 ways might be decomposition approach. Decomposition is the techniques that separate or decompose price series into several regular components. Here, different regular components are the different price patterns existing in the financial price series and this concept is represented in Figure 3-1.

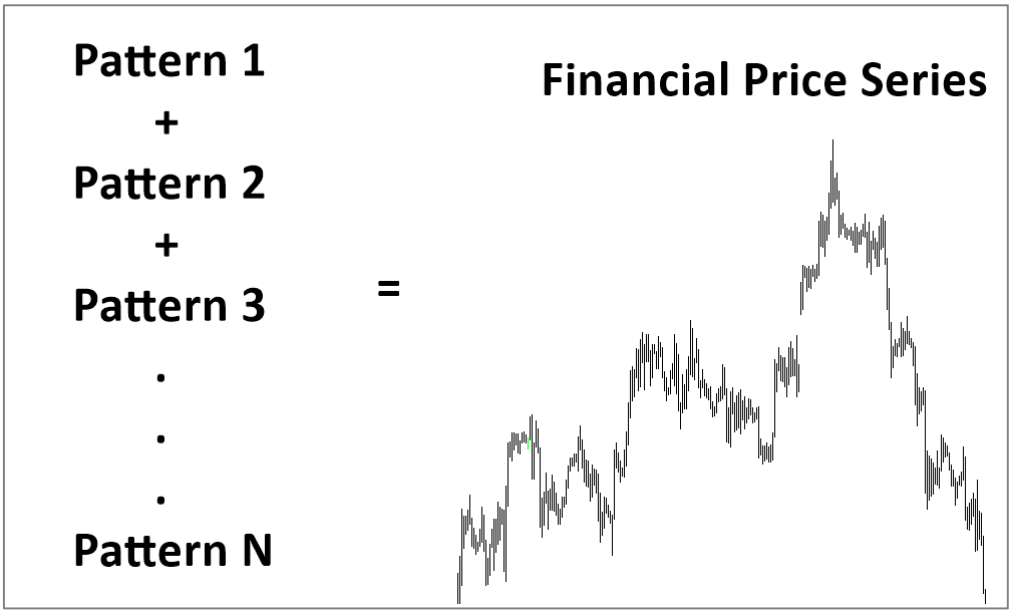


Figure 3-1: The concept of the decomposition for the financial price series.

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 theory exist to describe the price patterns in the financial market. Among them, Gardner's version considers the trend and seasonality as the main underlying patterns of the time 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 component 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 pattern will make up the seasonal fluctuations.

The Gardner's taxonomy is intuitive and easy to understand because trend and seasonality are the backbone of the analysis technique for the univariate price series. Although Gardner's taxonomy does not mention about random process explicitly, his taxonomy already assumed that any price series include some random process. In fact, it is the taxonomy of three components including randomness, trend and seasonality.

If we can decompose the price series into several price patterns, surely we can combine each price patterns to explain many complex price patterns existing in the market. For example, in the Gardner's trend-seasonality taxonomy, we can generate twelve different patterns of the price series by combining the basic trend and seasonal patterns as shown in Figure 3-2. Scientist uses this taxonomy to characterize many real world time series data set. Then, what is the big deal about the decomposition techniques? Each price patterns existing in the price series are basically regularities, which traders can make use for their trading decision. These regularities can 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.

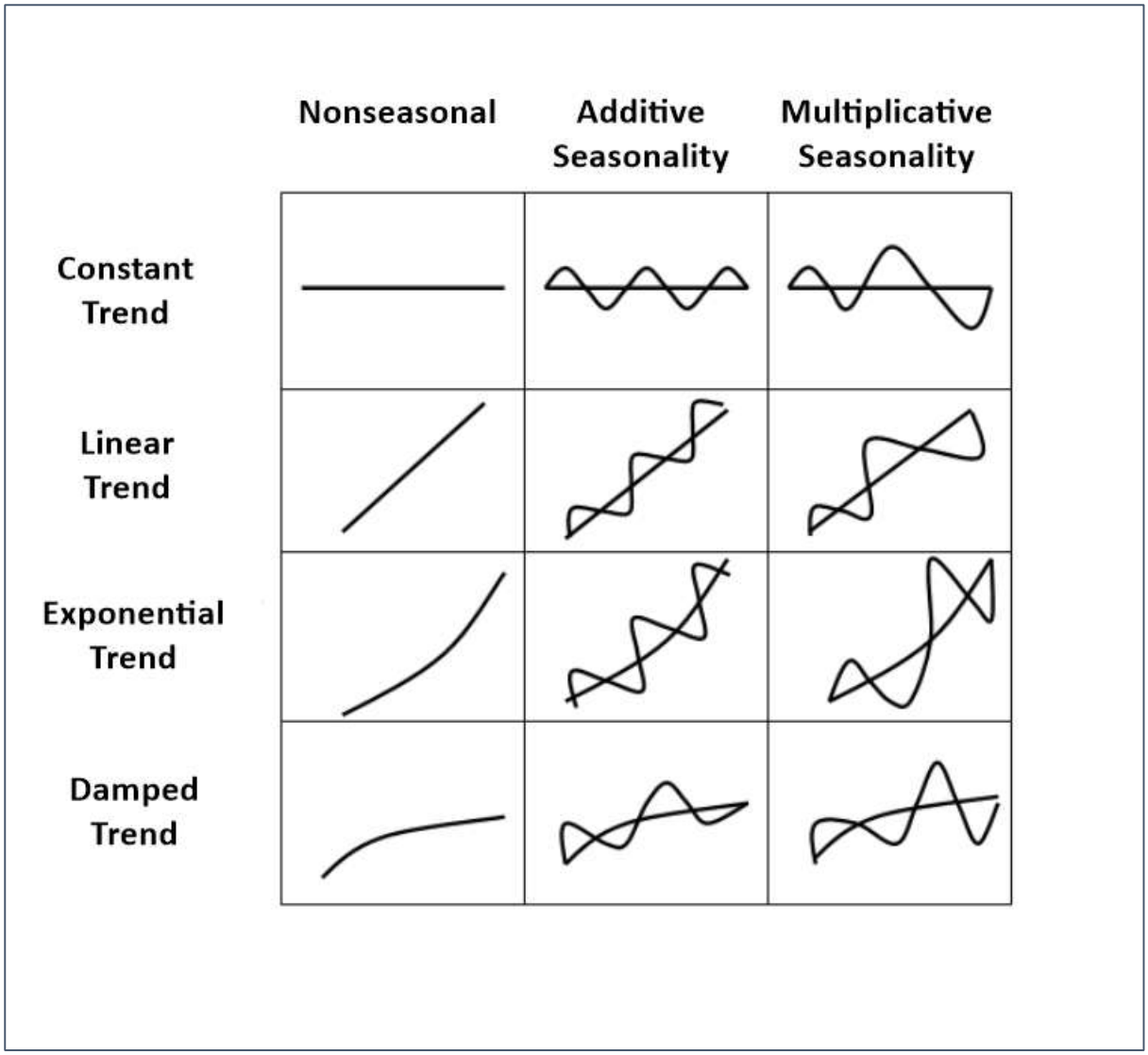


Figure 3-2: The original Gardner's table to visualize the characteristics of different time series data (Gardner, 1987, p175). Gardner assumed the three components including randomness, trend and seasonality in this table.

In spite of the brilliant idea of characterizing the time series behaviour in terms of trend and seasonality, practically the entire financial market will not fit to this trend-seasonality taxonomy 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 often. In general, price will not move in the path suggested by the regularities of trend and seasonality for financial market. In many cases, the trend and seasonality might be the less significant components in the financial price series in the Stock and Forex market in comparison to the data obtained from the business and social studies. Therefore, there is the strong demand for more comprehensive taxonomy suit for many practical trading strategies. The Gardner's trend and seasonal taxonomy 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 taxonomy with trend and seasonality, in this book, we propose the four components taxonomy. The four components include Random process, Equilibrium process, Wave process and Fractal-Wave process. These four components can serve as the basics patterns existing in the financial price series. Just like the trend and seasonal component in the Gardner's taxonomy, these four components are the building blocks to explain 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 four 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 taxonomy. However, it is also not different from the 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. Therefore, wave process is a similar concept to the seasonal fluctuation in the Gardner's model.

Furthermore, Wave process can include other cyclic behaviour, which can be described with the combined functions of sine and cosine waves.

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 the financial prices series. In plain language, Fractal-Wave process refers to the repeating patterns in different scales. For example, trader might remember that the price patterns in S&P 500 before 2008 financial crisis. He can come across nearly similar price patterns in lower timeframe or in other instruments. Because he has already seen that the price pattern leads to the huge bearish movement for S&P500 before 2008 financial crisis, he would take the sell action whenever he recognize the similar patterns from lower timeframe or from other instruments.

In fact, random, equilibrium and wave process in our four taxonomy models are nearly identical to the Gardner's trend and seasonal taxonomy except that wave process include more comprehensive description about cyclic patterns than seasonal component of the Gardner's taxonomy. Only Fractal-Wave process is the new component, which was not described from the Gardner's taxonomy.

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 four components in five columns. In Figure 3-3, first three columns including Equilibrium Process, Additive Seasonality and Multiplicative seasonality are identical to the Gardner's three columns. Fourth column include any simple and complex cyclic patterns, which can be described with the combined functions of sine and cosine waves. Fifth column describes the Fractal-Wave process together with Equilibrium process.

There are many different data in the Stock and Forex Market. 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. Some components among these four can present more in some price series than other price series. For example, some stock market price series can possess much stronger Equilibrium process than currency price series in the Forex market. Practically speaking, the most of the price series in the Stock and Forex market will have either the mixed effects of Random process, Equilibrium process and Wave process or the mixed effects of Random process, Equilibrium process and Fractal-Wave process. The portion of each process presents in the price series will vary most of time.

Once again, the main purpose of this taxonomy is to identify the regularities existing in the price series. Therefore, traders can make more accurate prediction for his trading. In addition, this taxonomy can be used to communicate with traders for the purpose of strategy building. For example, there is no need to apply hammer when the entire house is 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, you should really apply the right trading strategy carefully for your trading. If you are applying wrong tool for your trading, you will be suffering more than enjoying the profits.

From next section, we will describe these four components in more details and with examples. In addition, we need to introduce another term called “stationary process” to explain the market dynamic behind the typical mean reversion and momentum trading strategy. Furthermore, we will also explain

the combined patterns like Equilibrium Wave process or Equilibrium Fractal-Wave process. We do this because the price patterns in the real world financial markets are likely to be one of these combined patterns. We will cover these seven price patterns in terms of both trading and technical point of view in next seven chapters. We will try our best to give you example data sets exhibiting each price patterns best. 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, Equilibrium Fractal-Wave process or random process. Therefore, when we explain the four basic price patterns including Random, Equilibrium, Wave process and Fractal-Wave process, we might use some data set not from the Forex or stock markets. For example, it is very difficult to find Stock or Forex market data showing trend pattern alone. Therefore, in explaining the Equilibrium process, we use UK housing price to show you how the typical Equilibrium process dominated price series look like. Even if we use non-financial market data sets sometimes, it is still important for you to understand these basics patterns to understand the combined price patterns in the later parts of this book. Figure 3-3 is the price patterns for the case of growing trend present. When there is declining trend present, you have to flip the price patterns in Figure 3-3 vertically. For your own convenience, we provide the separate table for the case of the declining trend in Figure 3-4. The price patterns in Figure 3-4 occurs during the bearish market whereas the price patterns in Figure 3-3 occur during the bullish market.

	Equilibrium Process	Wave Process			Fractal-Wave Process
		Additive Seasonalility	Multiplicative Seasonalility	Multiple Cyclic Combination	
Constant Level	(1, 1)	 (1, 2)	 (1, 3)	 (1, 4)	 (1, 5)
Linear Trend	 (2, 1)	 (2, 2)	 (2, 3)	 (2, 4)	 (2, 5)
Exponential Trend	 (3, 1)	 (3, 2)	 (3, 3)	 (3, 4)	 (3, 5)
Damped Trend	 (4, 1)	 (4, 2)	 (4, 3)	 (4, 4)	 (4, 5)

Figure 3-3: Four components Price Pattern Table for the case of growing trend. 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.

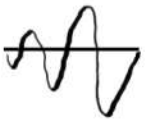
	Equilibrium Process	Wave Process			Fractal-Wave Process
		Additive Seasonalility	Multiplicative Seasonalility	Multiple Cyclic Combination	
Constant Level	(1, 1)	 (1, 2)	 (1, 3)	 (1, 4)	 (1, 5)
Linear Trend	 (2, 1)	 (2, 2)	 (2, 3)	 (2, 4)	 (2, 5)
Exponential Trend	 (3, 1)	 (3, 2)	 (3, 3)	 (3, 4)	 (3, 5)
Damped Trend	 (4, 1)	 (4, 2)	 (4, 3)	 (4, 4)	 (4, 5)

Figure 3-4: Four components Price Pattern Table for the case of declining trend. 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.