

# Enhancing Technical Analysis in the Forex Market Using Neural Networks

Jackie Chong Cheong Sin

*International Institute of Applied Science of Swiss School of Management,  
Switzerland  
jackie@unies.my*

## **Abstract**

*Copious test by countless professionals have proven Technical Analysis to be, at best, break-even tools, even with the finest money management techniques. Those who use only Technical Analysis in actual trades find out very painfully what whipsaws, and false breakouts are. The simple mathematical explanation for this is that Technical Analysis, as introduced by Wilder, Lane, e&., are linear, monovarietal computation routines. This means that Technical Analysis is not designed to deal with non-uniform periodic, and discontinuous functions. To manage these inadequacies, one employs a neural network. The simple network described in this paper predicts technical indicators, and generates trading signals before regular technical indicators do. This gives one the opportunity to enter, and exit trades before the crowd. Tests, and actual trades, have shown that most of the time, one or two days, is all the advantage one needs.*

**Keywords:** Foreign Exchange, Technical Analysis, Forex Market, Neural Networks.

## **1. Introduction**

Technical analysis is the study of historical price action in order to identify patterns and determine probabilities of future movements in the market through the use of technical studies, indicators, and other analysis tools.

Technical analysis boils down to two things [1]:

1. Identifying trend
2. Identifying support/resistance through the use of price charts and/or timeframes

Markets can only do three things: move up, down, or sideways. Prices typically move in a zigzag fashion, and as a result, price action has only two states [2]:

1. Range – when prices zigzag sideways
2. Trend – prices either zigzag higher (up trend, or bull trend), or prices zigzag lower (down trend, or bear trend).

Technical analysis of a market can help you determine not only when and where to enter a market, but much more importantly, when and where to get out, see Figure 1 [3].



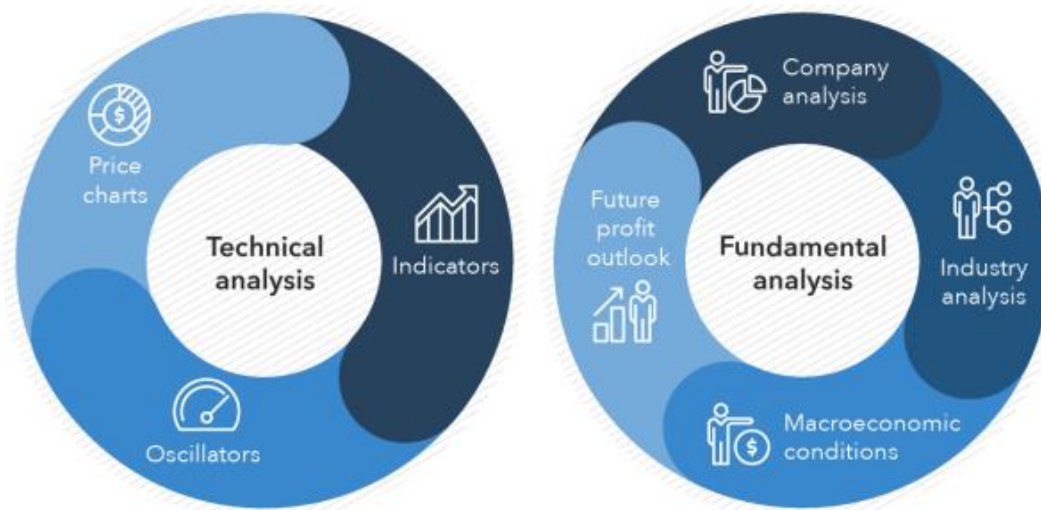
**Figure 1 Forex Range and Trend**

Technical analysis is based on the theory that the markets are chaotic (no one knows for sure what will happen next), but at the same time, price action is not completely random. In other words, mathematical Chaos Theory proves that within a state of chaos there are identifiable patterns that tend to repeat [4]. This type of chaotic behaviour is observed in nature in the form of weather forecasts. For example, most traders will admit that there are no certainties when it comes to predicting exact price movements. As a result, successful trading is not about being right or wrong: it's all about determining probabilities and taking trades when the odds are in your favour [5]. Part of determining probabilities involves forecasting market direction and when/where to enter into a position, but equally important is determining your risk-to-reward ratio. Remember, there is no magical combination of technical indicators that will unlock some sort of secret trading strategy. The secret of successful trading is good risk management, discipline, and the ability to control your emotions. Anyone can guess right and win every once in a while, but without risk management it is virtually impossible to remain profitable over time [6]. Neural networks can be applied gainfully by all kinds of traders, so if you're a trader and you haven't yet been introduced to neural networks, we'll take you through this method of technical analysis and show you how to apply it to your trading style. This paper reports empirical evidence that a neural networks model is applicable to the statistically reliable prediction of foreign exchange rates [7]. Time series data and technical indicators such as moving average, are fed to neural nets to capture the underlying "rules" of the movement in currency exchange rates.

## **2. Technical analysis: four basic principles**

We have all seen so many lists of trading rules that we sort of become numb to them. Even if they contain good advice ("always respect your stops"), they are so omnipresent in the trading literature and on Internet forums that we probably don't pay as much

attention to them as we should. I want to share a very different kind of list today. This is a list of what I believe are the basic principles of market behaviour [8]. This list is, in some sense, a list of what makes technical analysis work. We will encounter these ideas in future blogs and discussions, but today I just want to put them out there for you to start thinking about them, see Figure 2 [9].



**Figure 2 Technical Analysis Basics in General**

I also should acknowledge my debt to the people who taught me. Over the years I had several mentors, and, frankly, I owe them a lot. This list is compiled from the teaching of several of these people, and I know they borrowed these ideas from the people who came before them. This really is one of those fields where, if we can see a little farther than everyone else, see Figure 3 [10], it is only because we stand on the shoulders of giants. Or, another way I like to think of this is that I have many great ideas, but very few of them are actually my ideas!



Figure 3 Technical Analysis Chart

### 2.1 Markets alternate between range expansion and range contraction:

Markets tend to exist in one of two phases: either trending or chopping back and forth in ranges. The problem is that trading tools that will work in one environment are exactly wrong in the other. Applying a strategy that is appropriate in a trading range (selling resistance or buying support) will get you killed in a trend. This is why the first step in any real market analysis is to quantify the most likely emerging volatility environment. (Read that last sentence over several times.) [11].

### 2.2 Trend continuation is more likely than reversal:

Countertrend trading can be seductive. We all love to catch the exact high or low of a move, and while it certainly is possible to make money this way, it is the hard money. Traders who focus on countertrend trading often get an emotional charge from “being right” and from “catching the turn”, but this approach often causes us to miss the really easy money in trends. Given a market in a trend, your best bet is always to bet on continuation of the trend [12].

### 2.3 Trends end in one of two ways: climax or rollover:

There are predictable patterns to the ways trends end. Either the market just runs out of steam, resistance starts to hold, and the market rolls over. (This is the cause of the “rounding top” formation that some people are so fond of.) The other common way trends end is in a buying climax. The market goes parabolic as the last buyers are willing to pay practically any price to get in. Once that last buyer buys, a vacuum is created on the other side and the market collapses. As a funny aside, one of my very first trades were buying wheat futures in late April 1996 when I was sure it was going to the moon. (Check the charts if you don’t know that little piece of market history; we learn best from our painful mistakes!)

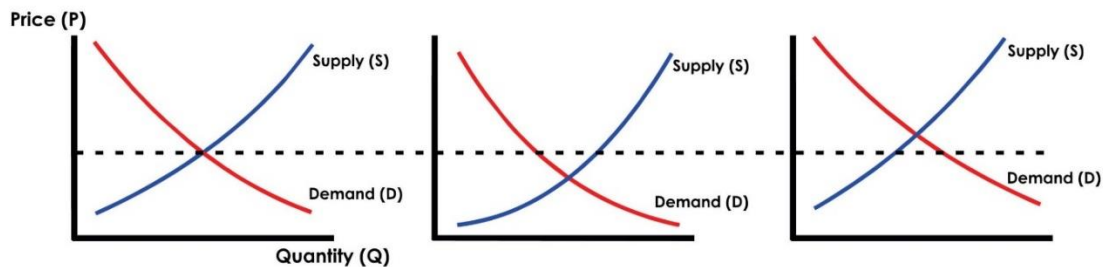
### 2.4 Momentum precedes price:

This one is maybe the most important of the four. The basic unit of market movement is a move in one direction, a pause and smaller move in the opposite direction, and then another move in the original direction. This pattern repeats over and over in all time frames. This meaning of this rule is that when a market makes a sharp move (an “impulse” or “momentum” move), price is likely to continue further in the same direction. (Note that this doesn’t refer to indicators that measure momentum lead price; there are truly no leading indicators because all standard indicators are derivatives of price.)

Think about these rules and how they apply to the patterns you see and the trades you make. Whether you are establishing positions to hold for many months or scalping a few cents off the order flow in the tape, if you’re making money then you almost certainly are aligned with these principles [13]. If you are not making money, then it might be helpful to rethink your strategies in light of these basic principles of price behavior.

### 3. Technical analysis effectiveness in the forex market

If you are considering currency trading in the Forex market, or you are already involved in Forex currency trading, here's a money-making lesson that we can borrow from investors who use technical analysis to help them make investment decisions in the stock market [14]. The goal of performing technical analysis when currency trading is to predict profitable currency pair movements by analysing price trends. The principles of technical analysis in the equity markets are the same as those in the Forex currency trading markets. In fact, the only real difference between the two is that the Forex market is open 24 hours a day while the equity markets are not, Figure 4 shows the basic technical analysis in forex market, see Figure 4 [15].



**Figure 4 Basic Technical Analysis in Forex Market**

This means that certain analytics that take time periods in consideration will need to be adjusted for Forex currency trading. Other than that, any of these common forms of equity technical analysis methodologies can be used when currency trading [16], [17]:

**Elliott Waves:** Developed by Ralph Nelson Elliott, this methodology is based upon the theory that market performance can be predicted by studying wave patterns that develop over a period of time.

**Fibonacci Studies:** Developed by 12th century mathematician Leonardo Fibonacci, this methodology is based upon the theory that changes in trends can be predicted based upon prices interacting with lines based upon certain sequences of numbers.

**Parabolic SAR:** Developed by J. Wells Wilder, this methodology is based upon the examination of prices in comparison to "stop and reversal" (SAR) numbers that indicate entry and exit points for a trade.

**Pivot Points:** A mathematical formula used to determine when to exit a trade based upon the numerical average of the high, low and closing prices.

As I mentioned earlier in this article, the key difference between technical analysis in the equities market, and technical analysis in the Forex currency trading market, is the fact that it is possible to participate in Forex trading 24 hours a day, seven days a week. That key difference is also the primary reason that technical analysis works so well in currency trading. In order for technical analysis techniques to deliver maximum results, there needs to be extended periods of time available for patterns to develop and repeat. Because the Forex market never closes, and currency pairs are traded around the clock, definable patterns develop more quickly and the technical analyst has a plethora of Forex currency trading data available to work with [18]. Because more data means more accurate forecasting results, technical analysts can see better results, in quicker time, when combining technical analysis and Forex currency trading.

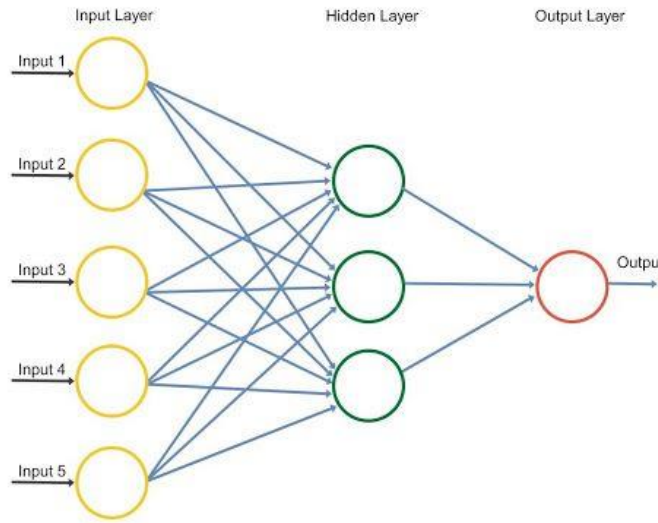
#### **4. Neural networks in foreign exchange**

Cognitive computing is focusing on how information is represented, processed, and transformed [19]. Artificial intelligence is a branch of Cognitive Science that involves the study of cognitive phenomena in machines. This involves three level of analysis: the computational theory, the algorithmic representation, and the hardware or software implementation. Artificial intelligence has been applied in almost every discipline. The last decade it has been noticed an increase in the utilization of such technique in Business and Finance. One of the applications of models such as Neural Networks is time series prediction in different markets such as the Foreign Exchange (FOREX) market. According to the Bank of International Settlements, FOREX is a fast-growing market that at the moment is estimated at \$3.98 trillion. The time series of different currency rates are described as chaotic, extremely noisy, and non-stationary [20]. Almost every research paper that presents a prediction model starts with a reference to the Efficient Market Hypothesis (EMH). According to Fama [21], a random walk-efficient market is big enough to be manipulated by an existing large number of profit-maximizers who are competing with each other trying to predict future market values. This statement implies that the price of an asset reflects all the information that can be obtained at that time and that due to conflicting incentives of the participants the price will reach its equilibrium despite temporal disturbances due to market noise. While the theory seems to be correct for the time it was published, with the passing of time and due to future developments, especially in the area of communication and its impact on a globalized market, there is always the possibility that some areas or instances of the markets may be inefficient, see Figure 5 [22].



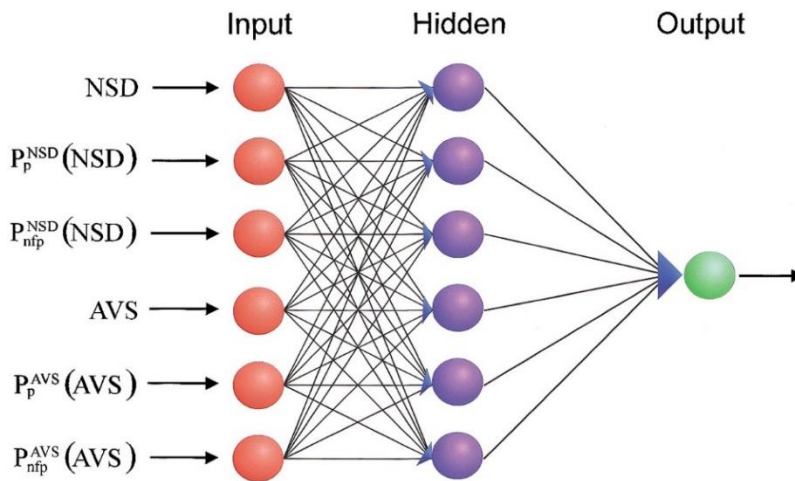
**Figure 5 Neural network - Indicators and Signals - Forex Market**

Today the world is highly interconnected and it takes a fraction of a second to transmit financial news around the globe. The reaction by the markets to market news tends to have an impact on the financial time series. The sequence of those reactions creates patterns that some practitioners believe that, as history repeats itself, so the market reaction does [23]. For instance, Azon [24] provided evidence that there are cases where markets appear to be inefficient. Furthermore, Scabar [25] developed a hybrid prediction model based on an ANN and a Genetic Algorithm (GA) which gives evidence that financial time series are not entirely random. Future market forecasting techniques can be classified into two major categories: fundamental analysis, and technical analysis. Fundamental analysis is based on macro-economic data such as Purchasing Power Parity (PPP), Gross Domestic Product (GDP), Balance of Payments (BOP), Purchasing Manager Index (PMI), Central Bank outcomes, etc. It is obvious that this kind of analysis has a more long-term prediction spectrum and it is not the case for this paper [26]. On the other hand, technical analysis focuses on past data and potential repeated patterns within those data. The major point here is that the history tends to repeat itself, see Figure 6 [27]. As opposed to fundamental analysis, technical analysis makes short term predictions such as weekly, daily, or even hourly predictions.



**Figure 6 Neural Network Analysis**

There is a conglomeration of available tools suitable for technical analysis such as ANN, GA, Genetic Programming (GP), Econometrics tools, technical indicators, etc. Hirabayashi [28] introduces a forecasting optimization model that is based on a genetic algorithm that automatically generates trading rules based on technical indexes such as Moving Average (MA), and Relative Strength Index (RSI). Tulson [29] utilizes wavelet analysis to feed an ANN that predicts FTSE 100 index time series. Butler [30] developed an Evolutionary ANN (EANN) that makes future predictions based on macro-economic data, as illustrate in Figure 7. Tay [31] proposes a Support Vector Machine (SVM) regression approximation model.



**Figure 7 Prediction of Protein Functional Domains from Sequences Using Artificial Neural Networks**

The literature has revealed that there are cases where the combination of two or more techniques offers a better result. Yu [32] introduced an online learning algorithm to





Analysis can seem like an ambiguous concept to a new forex trader. But it actually falls into three basic types [37].

### **5.1.1 Fundamental Analysis**

Fundamental analysis is often used to analyse changes in the forex market by monitoring figures, such as interest rates, unemployment rates, gross domestic product (GDP), and other types of economic data that come out of countries. For example, a trader conducting a fundamental analysis of the EUR/USD currency pair would find information on the interest rates in the Eurozone more useful than those in the U.S. Those traders would also want to be on top of any significant news releases coming out of each Eurozone country to gauge the relation to the health of their economies.

### **5.1.2 Technical Analysis**

The technical analysis comes in the form of both manual and automated systems. A manual system typically means a trader is analysing technical indicators and interpreting that data into a buy or sell decision. An automated trading analysis means that the trader is "teaching" the software to look for certain signals and interpret them into executing buy or sell decisions. Where automated analysis could have an advantage over its manual counterpart is that it is intended to take the behavioural economics out of trading decisions. Forex systems use past price movements to determine where a given currency may be headed.

### **5.1.3 Weekend Analysis**

There are two basic reasons for doing a weekend analysis. The first reason is that you want to establish a "big picture" view of a particular market in which you are interested. Since the markets are closed and not in dynamic flux over the weekend, you don't need to react to situations as they are unfolding, but can survey the landscape, so to speak. Secondly, the weekend analysis will help you to set up your trading plans for the coming week, and establish the necessary mindset. A weekend analysis is akin to an architect preparing a blueprint to construct a building to ensure a smoother execution. Tempted to trade without a plan? Bad idea: Shooting from the hip can leave a hole in your pocket.

## **5.2 Applying Forex Market Analysis**

It's important to think critically about the tenets of forex market analysis. Here is a four-step outline [38].

### **5.2.1 Understand the Drivers**

The art of successful trading is partly due to an understanding of the current relationships between markets and the reasons that these relationships exist. It is important to get a sense of causation, remembering that these relationships can and do change over time. For example, a stock market recovery could be explained by investors who are anticipating an economic recovery. These investors believe that companies will have improved earnings and, therefore, greater valuations in the future and so it is a good time to buy. However, speculation, based on a flood of liquidity, could be fuelling momentum and good old greed is pushing prices higher until larger

players are on board so that the selling can begin. Therefore, the first questions to ask are: Why are these things happening? What are the drivers behind the market actions?

### **5.2.2 Chart the Indexes**

It is helpful for a trader to chart the important indexes for each market for a longer time frame. This exercise can help a trader to determine relationships between markets and whether a movement in one market is inverse or in concert with the other. For example, in 2009, gold was being driven to record highs. Was this move in response to the perception that paper money was decreasing in value so rapidly that there was a need to return to the hard metal or was this the result of cheap dollars fuelling a commodities boom? The answer is that it could have been both, or as we discussed above, market movements driven by speculation.

### **5.2.3 Look for a Consensus in Other Markets**

We can gain a perspective of whether or not the markets are reaching a turning point consensus by charting other instruments on the same weekly or monthly basis. From there, we can take advantage of the consensus to enter a trade in an instrument that will be affected by the turn. For example, if the USD/JPY currency pair indicates an oversold position and that the Bank of Japan (BOJ) could intervene to weaken the yen, Japanese exports could be affected. However, a Japanese recovery is likely to be impaired without any weakening of the yen.

### **5.2.4 Time the Trades**

There is a much higher chance of a successful trade if one can find turning points on the longer timeframes, then switch down to a shorter time period to fine-tune an entry. The first trade can be at the exact Fibonacci level or double bottom as indicated on the longer-term chart, and if this fails then a second opportunity will often occur on a pullback or test of the support level. Patience, discipline, and preparation will set you apart from traders who simply trade on the fly without any preparation or analysis of multiple forex indicators.

## **5.3 Acquiring Forex Trading Systems and Strategies**

A day trader's currency trading system may be manually applied, or the trader may make use of automated forex trading strategies that incorporate technical and fundamental analysis. These are available for free, for a fee, or can be developed by more tech-savvy traders [39]. Both automated technical analysis and manual trading strategies are available for purchase through the internet. However, it is important to note that there is no such thing as the "holy grail" of trading systems in terms of success. If the system was a fail-proof money maker, then the seller would not want to share it [40]. This is evidenced in how big financial firms keep their "black box" trading programs under lock and key.

## **6. Forex trading - types of market analysis**

Fundamental Analysis and Technical Analysis (FA and TA) go hand-in-hand in guiding the forex trader through the way the market (prices) may go under the ever-changing market conditions [41].

## **6.1 Fundamental Analysis**

Fundamental analysis is analysing the currency price forming, basic economical and other factors influencing the exchange rate of foreign currency. It is the analysis of economic and political information with the hope of predicting future currency price movements. Fundamental analysis helps in forecasting future prices of various foreign currencies. Forecasting of prices is based on a number of key economic factors and indicators that determine the strength of a country's economy. The factors may also include various geopolitical aspects that may impact the price movement of a currency pair [42]. This analysis is not used to get the specific numbers for the exchange rates of various currencies. Instead, it helps in determining the trend of the forex spot market over a certain period. If the fundamental analysis hints at a positive outlook for a particular currency pair, it indicates that the price of that pair would experience an upward trajectory movement in the near future. A negative outlook indicates a declining price movement of currency pair in coming future. A neutral instance on currency pair indicates a flat (not much +ve or - ve side movement) movement in the near future [43].

## **6.2 Using the fundamental analysis in the forex market**

Whenever a forex trader receives information about the state of a country, he conducts a fundamental analysis to gauge the impact of this on various currency pairs. Forex traders and investors always look into reports (fundamental analysis reports) based on critical economic data before trading (particular currency pair) on forex market. These reports (FA) also enable them to minimize the risk factors involved in executing forex transactions. The Fundamental Analysis report for any market (equity, commodity, FX etc.) helps in decision-making over medium to long term exchange rate prediction (in case of FX market) [44]. On the other hand, Technical Analysis provides information for short-term predictions. The market's momentum can easily reverse or an extreme volatility can be seen in a matter of minutes after an important announcement or press release is made by the central bank. Information related to the status of the local and global economies can have huge impact on the direction in which the forex market trends.

## **6.3 Key factors influencing fundamental analysis**

Let us now learn about the key factors that influence fundamental analysis. The factors are described below in brief [45]. [46]:

### **6.3.1 Interest Rates**

The interest rates set by the central bank is one of the most important factors in deciding the price movement of currency pairs. A high interest rate increases the attractiveness of a country's currency and also attracts forex investors towards buying.

### **6.3.2 GDP Growth**

A high GDP growth rate signifies an increase in the total wealth of the country. This points towards the strengthening of the country's currency and its value rises relative to other foreign currencies.

### **6.3.3 Industrial Production**

A high industrial growth in any country signifies a robust country economy. A country with robust economy encourages forex traders to invest in country forex currency.

### **6.3.4 Consumer Price Index (CPI)**

The Consumer Price Index (CPI) is directly proportional to the prices of goods and services in the country. If the CPI index is too high (above the central bank benchmark of CPI), there is a high probability that central bank is most likely to lower interest rates to bring down the rate of inflation and stabilize the growth rate for the country's economy.

### **6.3.5 Retail Sales**

A country's retail sales data gives an accurate picture of how people are spending (people income level) and the health of its economy at the lowest level. A strong retail sales figure shows that the domestic economy of a country is in strong shape; it points towards positive growth rates in the future. Apart from these above points, the traders and investors also look into other factors of fundamental analysis like employment statistics, national debt levels, supply and demand balance, monetary policy, political situation, trade deficit, commodity prices, housing prices and capital market growth.

### **6.3.6 Technical Analysis**

Technical analysis helps in the prediction of future market movements (that is, changing in currencies prices, volumes and open interests) based on the information obtained from the past. There are different kinds of charts that help as tools for technical analysis. These charts represent the price movements of currencies over a certain period preceding exchange deal, as well as technical indicators. The technical indicators are obtained through mathematical processing of averaged and other characteristics of price movements. Technical Analysis (TA) is based on the concept that a person can look at historical price movements (for example currency) and determine the current trading conditions and potential price movement [47].

## **6.4 Dow Theory for Technical Analysis**

The fundamental principles of technical analysis are based on the Dow Theory with the following main assumptions [48], [49]:

### **6.4.1 Price discounts everything**

Price is a comprehensive reflection of all the market forces. At any point of time, all market information and forces are reflected in the currency price ("The Market knows everything").

### **6.4.2 Prices usually move in the direction of the trend**

Price movements are usually trend followers. There is a very common saying among traders "Trend is your friend". Trends are classified as [50]:

- Up trends (Bullish pattern)

- Down trends (Bearish pattern)
- Flat trends (sideways pattern)

Price movements are historically repetitive. This results in similar behaviour of patterns on the charts.

#### **6.4.3 Sentimental Analysis**

The participants in every market, the traders and the investors have their own opinion of why the market is acting the way it does and whether to trade in the direction of market (towards market trends) or go against it (taking contrary bet) [51]. The traders and investors come with their own thoughts and opinions on the market. These thoughts and opinions depend on the position of the traders and investors. This further helps in the overall sentiment of the market regardless of what information is out there. Because the retail traders are very small participants in the overall forex market, so no matter how strongly you feel about a certain trade (belief), you cannot move the forex markets in your favour. Even if you (retail trader) truly believe that the Dollar is going to go up, but everyone else (big players) is bearish on it, there is nothing much you can do about it (unless you are one of the big investment banks like – Goldman Sachs or some ultra-rich individual like Warren Buffet). It is the trader's view on how he is feeling about the market, whether it is bullish or bearish. Depending on this, a trader further decides how to play the perception of market sentiment into trading strategy.

#### **6.5 The best types of analysis in Forex**

Forex trading is all about trading based on a strategy. Forex trading strategies help you gain an insight of the market movements and make moves accordingly. We have already studied that there are three types of analysis methods [52].

- Technical analysis
- Fundamental analysis
- Sentiment analysis

Each strategy holds equal importance and neither can be singled out. Many traders and investors prefer the use of a single analysis method to evaluate long-term investments or to gain short-term profit. A combination of fundamental, technical and sentimental analysis is the most beneficial. Each analysis technique requires the support of another to give us sufficient data on the Forex market. These three strategies go hand-in-hand to help you come up with good forex trade ideas. All the historical price action (for technical analysis) and economic figures (for fundamental analysis) are there – all you have to do is put on your thinking cap (for sentimental analysis) and put those analytical skills to the test. In order to become a professional forex trader, you will need to know how to effectively use these three types of forex market analysis methods.

### **7. Technical analysis for professional traders**

Saying which type of analysis is "better" varies from person to person. There are some well-renowned names such as Warren Buffet who has not used technical analysis at all but yet became one of the most successful traders. Some might argue he's more

of an investor than a trader since he only takes on long term positions. While this is true it doesn't change the fact, he's very successful without doing any form of technical analysis. Another great source for this topic is the books written by Jack Schwager. He wrote "Market Wizards" in 1989 and later on "The New Market Wizards" in 2008" and "Hedge Fund Market Wizards" in 2012 [53]. In all his books he interviews professional traders about their trading strategies and their career. When you read these books, you might notice that most of those professional traders struggled at the beginning of their careers and that most of them lost a lot of money. It took them years of practice, dedication, and hard work to become successful and make consistent profits. While the majority of the traders interviewed by Schwager rely on technical analysis, there are some who use fundamental analysis [54]. There is one thing that we can pick-up from Schwager's book and that is technical analysis is more preferred among traders. There may be some exceptions to it, but if most seasoned traders are using technical analysis, then it is without a doubt that there may be something more to this than meets the eye. So, let's first start by exploring how technical analysis works and what are the main principles behind it. In technical analysis, we only look at the current and past price & volume of an asset. For this, we mostly use some sort of chart which displays the price & volume. Based on the chart analysis we then make decisions on when & where to buy or sell the asset (or stay out of the market). Technical analysis focusses on finding repeating patterns in price & volume, recognizing them, and trading them when we see them reoccurring in today's price and volume action. Most trading platforms offer a wide variety of options to perform technical analysis. Examples of these tools are indicators, geometry tools, trend channels, Fibonacci, Elliot Wave, and Gann tools All these tools have one thing in common. They simply ignore all news and other details about the underlying asset and markets and just use price and volume. Technical analysts believe that the market is not random but moves in cycles and patterns. By recognizing these cycles and patterns they can develop their edge to become successful in trading. One of the biggest advantages of technical analysis is that it enables traders to time their entries and exits. Since all trading decisions are based on specific patterns technical traders are defined as clear rules when and where they will enter the market. This is probably one of the reasons why most professional traders like it. Another advantage is that, because technical analysis ignores all fundamental details about the underlying asset, you can use it to trade any asset. For a technical trader, it does not matter whether he looks at a price chart from apple or a price chart from Home Depot. They all trade the same! According to other numerous surveys conducted by brokerage firms, on average 70% of traders prefer to use technical analysis over fundamental analysis, and some use both, see Figure 8 [55]. This can further be verified from Schwager's book, as among all the traders he interviewed, fundamental analysis was only used by about 20% of them.



**Figure 9 Example of A Chart with Some Technical Analysis**

In fundamental analysis, we place a big emphasis on understanding the market conditions. This means having a good understanding of the global markets. For example, a fundamental trader will need to know everything about the recent trade war between the US and China. They will use this information to see which markets might be vulnerable and which might flourish from this and use this to either buy or sell particular stock in particular markets. They will read the reports any unemployment rates, consumer confidence, FOMC reports, financial news statements, read the earning reports, and many more. They try to gather as much information they can find about each asset, market, and global market situation. Because of all this knowledge, most fundamental traders will have a great understanding of the markets and the assets they trade. This allows them to use this information to spot opportunities. In terms of trading results, all these reports may or may not be a big of a difference. Technical traders will argue that the outcome of the reports is already priced in since most reports are based on at least 2-3 weeks of old data. Then again, we do see huge spikes sometimes during the times these news events are released. Whether or not the reports are useful depends on the trader using them. Clearly some professional traders are doing very well using just fundamental analysis. You may have come across the name Jim Rogers. Jim Rogers had an illustrious trading career and he did not believe in technical analysis at all and solely relied on fundamental analysis. In fact, he was one of the few traders featured in Schwager's book who relied and based his decisions on fundamental data. While the technical analysis may have shown amazing results for a vast majority of the traders, Jim Rogers really believed that it was completely useless. His main reasoning behind this was that technical analysis does not provide you with any valuable information as



it doesn't help in predicting asset prices. For many traders out there, the approach Jim Rogers used is rather an eye-opener. He has shown that there is more than one way to succeed in the world of trading, and you do not always have to follow the conventional methods. One of the main reasons why fundamental analysis is not used by many traders is because it can be difficult for the general public to access get all to all the news. By the time you do get access to the fundamental data, it is already outdated and this significantly affects your overall trading options. Another problem might be the sheer amount of data released. In today's age of we see massive amounts of news released every day about the markets, companies, global markets etc. It will be very hard for an individual trader to keep up with all this news and digest it so he can base his trading decisions on it. Last but not least many professional traders who use technical analysis reason that knowing all this news is useless since its already priced in. Now after reading this, you might be wondering which discipline is best for you. Whether you should go for technical analysis or fundamental analysis. Regardless of what you choose, in the end, it all depends on your level of patience and discipline. Market Wizards has shown us that even the best traders in the world had to work hard for years before they became profitable. So, ask yourself if you are up to that. Trading is not for everyone and it can be frustrating. You should accept the fact that you will be losing money, especially during the start of your trading career. Luckily you can practice with a simulator nowadays but still, nothing beats live-trading. At the end of the day, knowing what's "best" in trading is subjective. There are professional traders on both sides so clearly both types of analysis work. Then there are a lot of traders who use both. They use fundamental analysis to get a broader view of where the market might be heading in the next couple of weeks/months and use technical analysis to make short term trading decisions. However, beginners are always recommended to start with technical analysis due to the vast number of professionals recommending and using it. Also, most information freely available on the internet will be based on some sort of technical analysis. On the other hand, traders such as Warren Buffet and Jim Rogers have been overwhelmingly successful by adapting fundamental analysis. It can still be a bit difficult to grasp for beginners, but to say that it does not work in trading is certainly a false belief. The more you dive into the world of trading, the more you are going to learn. So, consider it as a never-ending source of knowledge and proceed with the utmost discipline and patience to get the financial gains you are looking for.

## 8. Conclusion

The statistically best results have been obtained by the model, where logarithmic returns and moving average were taken as inputs. Comparing the results, obtained from this model, to others ones it should be noted that:

1. Model with two added technical indicators: in general, the forecast quality became worse than the initial model (R2 is increased on CHF only, on the others currencies it decreased). It turned out that the probability of correctly predicted increments sign is also lower. Apparently, the information that contains in indicators is excess and makes the problem of forecast more complicated. We could increase, of course, the number of hidden neurons, but it would lead to unwarranted increasing of the learning time.

2. Model with only RSI and %R in input: statistically the forecast quality fell down even more than in other models we studied. This indicates, that the mentioned above prevalent belief about information content of technical indicators is irrelevant to the neural network forecasting.

3. Model with RSI, %R and moving average in input: comparing to previous models the forecast quality has been improved, but it still remained not the best. It looks like the presence of moving average in input of the network is the positive factor at least due to the smoothing of the data.

4. Model with indicators, returns and exponential moving average: results, obtained from this model are analogous to results obtained by basic model. Apparently, there is we have found no essential difference between ordinary moving average and exponential moving average for the problem in question.

5. Embedding method: the particular property of this model is that the results of forecasting of different currencies are much more analogous, than in other models. Nevertheless, the forecast quality is worse than in basic model. Apparently, it is possible to obtain better results from this model by increasing the number of inputs and hidden neurons, but it would lead again to unjustified long learning time.

It should be noted, that CHF and JPY are usually better predicted than GBP and EURO. It seemingly means that regularities, that contain CHF and JPY time series are more complicated than regularities, containing in GBP and EURO time series. In EURO case comparatively lower quality of forecast could be explained by insufficient amount of data.

Thus, in this study neural net forecast of four main currencies on Forex market was carried out. Finally let us conclude that statistical estimates of Forex forecast indicate, that neural network can predict the increments sign with relatively high probability.

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