Fibonacci Retracement Pattern Recognition for Forecasting GBP/USD Foreign Exchange Market

By

Mohd Fauzi Ramli
(1632121990)

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LIST OF ABBREVIATIONS

ANN	Artificial Neural Network
ARIMA	Autoregressive Integrated Moving Average
FTS	Fuzzy Times Series
GBP	Great Britain Pound
KNN	K - Nearest Neighbor
LDA	Linear Discriminant Analysis
LS- SVM	Least Squares Support Vector Machine
MA	Moving Average
MACD	Moving Average Convergence Divergence
MAE	Mean Absolute Error
MATLAB	Matrix Laboratory
MFI	Money Flow Index
MSE	Mean Square Error
QDA	Quadratic Discriminant Analysis
RMSE	Root Mean Square Error
RSI	Relative Strength Index
RW	Random Walk
SVM	Support Vector Machine
USD	United State Dollar
UTC	Universal Time Coordinated

LIST OF SYMBOLS

α — Limiting value

Ω — Total number of classes

Π_i — i th class in the dataset

$\hat{\omega}$ — Forecasted class label for test sample

Pengecaman Corak Anjakan Balik Fibonacci untuk Meramal Pasaran Pertukaran Matawang Asing GBP/USD

ABSTRAK

Kajian ini memperkenalkan satu pendekatan anjakan balik Fibonacci yang melibatkan ramalan masa hadapan melalui analisis kearuhan pergerakan sebelumnya bagi pergerakan pertukaran matawang asing (forex). Pasaran matawang asing adalah salah satu daripada pasaran yang rumit merangkumi ciri-ciri turun naik yang tinggi, ketidaklelurusan dan luar aturan. Selain itu, ciri-ciri ini juga menyebabkan pasaran matawang asing amat sukar diramal. Masalah terdiri daripada pengecaman corak, klasifikasi dan peramalan. Objektif kajian adalah untuk mengenalpasti corak menggunakan corak gelombang Elliott, untuk membandingkan klasifikasi pola ketepatan antara K - Jiran Terdekat (KNN) dengan Linear Analisis pembezalayan (LDA) dan untuk meramal pasaran forex jangka masa pendek dengan menggunakan kaedah anjakan balik Fibonacci. Hasil daripada keputusan menunjukkan bahawa terdapat dua jenis corak yang berbeza arah aliran iaitu arah aliran menaik dan arah aliran menurun. Algoritma- algoritma seperti K - Jiran Terdekat (KNN) dan Analisis Beza Layan Lelurus (LDA) adalah kaedah- kaedah yang digunakan untuk pengecaman pola umum tidak lelurus menampilkan perlombongan dari input corak gelombang Elliott yang berdimensi tinggi. Hasil daripada keputusan menunjukkan bahawa LDA adalah lebih baik daripada KNN dari segi ketepatan mengklasifikasikan data iaitu 99.43%. Analisis teknikal yang menggunakan anjakan balik Fibonacci akan dilaksanakan selepas corak arah aliran telah dikenalpasti. Arah aliran menaik atau arah aliran menurun mempunyai gelombang anjakan balik sebelum gelombang dorongan seterusnya mencapai wilayah baru. Anjakan balik Fibonacci ditentukan dari titik rendah ke titik tinggi untuk mengenal pasti tahap sokongan yang mungkin. Anjakan balik juga ditentukan dari titik tinggi ke titik rendah menggunakan nisbah yang sama. Selepas pergerakan harga menaik atau menurun ditentukan, sokongan dan rintangan yang baru akan ditentukan. Tiga tahap anjakan balik Fibonacci iaitu 38.2%, 50.0% dan 61.8% diperbandingkan. Hasil daripada keputusan menunjukkan 38.2% adalah tahap ramalan yang terbaik bagi pasangan matawang Great Britain Pound melawan United State Dollar sebagai pasangan matawang utama dengan menggunakan Ralat Mutlak Min (MAE), Ralat Punca Min Kuasa Dua (RMSE) dan Pekali Sekaitan Pearson (r) sebagai ukuran statistik dengan nilai 0.001884, 0.000019 and 0.992253 bagi arah menaik dan 0.001685, 0.000019 dan 0.998806 bagi arah menurun. Kesimpulannya, 38.2% adalah tahap yang terbaik bagi anjakan balik Fibonacci untuk meramal pasaran matawang asing samada aliran menaik atau aliran menurun.

Fibonacci Retracement Pattern Recognition for Forecasting GBP/USD Foreign Exchange Market

ABSTRACT

This study presents an approach to the Fibonacci retracement implicates a forecast of future movements in foreign exchange rates (forex) of the previous movement inductive analysis. The forex market is one of the utmost intricate markets through the characteristics of high volatility, nonlinearity and irregularity. Meantime, these characteristics also make it very difficult to forecast forex. The problem are contain pattern recognition, classification and forecasting. The research objectives are to recognize the pattern using the Elliott wave pattern, to compare accuracy patterns classification between K - Nearest Neighbor (KNN) and Linear Discriminant Analysis (LDA) and to forecast short term forex market using Fibonacci retracement method. The results show two different type of trend patterns which are uptrend and downtrend. K-Nearest Neighbor (KNN) and Linear Discriminant Analysis (LDA) algorithm are the general pattern recognition method for nonlinearly feature mining from high dimensional input Elliott wave patterns. Results show that LDA is better than KNN in terms of classification accuracy data which are 99.43%. Technical analysis by using Fibonacci retracements for forecasting will be through after the trends of pattern were recognise. The market trend upward or downward will have a retracement wave before the next impulse wave approaches new region. Fibonacci price retracements are determined from a previous low to high swing to identify potential support levels as the market pulls back from a high. Retracements are also run from a previous high to low swing using the same ratios, looking for probable resistance levels as the market reverse from a low. After a significant price movement up or down, the new support and resistance levels are often at or near these retracement lines. Among of three levels of Fibonacci retracement which are 38.2%, 50.0% and 61.8% results, the 38.2% shows the best forecasting for Great Britain Pound pair to US Dollar currency as major pair by using Mean Absolute Error (MAE), Root Mean Square Error (RMSE) and Pearson Correlation Coefficient (r) as the statistical measurements which are 0.001884, 0.000019 and 0.992253 for uptrend and 0.001685, 0.000019 and 0.998806 for downtrend. As conclusion, 38.2% is the best Fibonacci retracement level to forecast forex market for uptrend and downtrend.

CHAPTER 1

INTRODUCTION

1.1   Overview

Fibonacci retracements were employed to recognize the strategic places for transactions to be located. Fibonacci retracements specify the probable retracement levels through a reversal or price correction during a trend (Gaucan, 2010). According to Loginov and Heywood (2015), support and resistance levels are the tool to implement forecasts trend breaks and one of that usually was employed as an indicator market entrance. Support level is a price level below the current market price where a weakening is stopped and prices turn back once more, while resistance level is the opposite of support. After a significant price change up or down, the new support and resistance levels are frequently at or close to these levels as shown in Figure 1.1 (Loginov and Heywood, 2015).
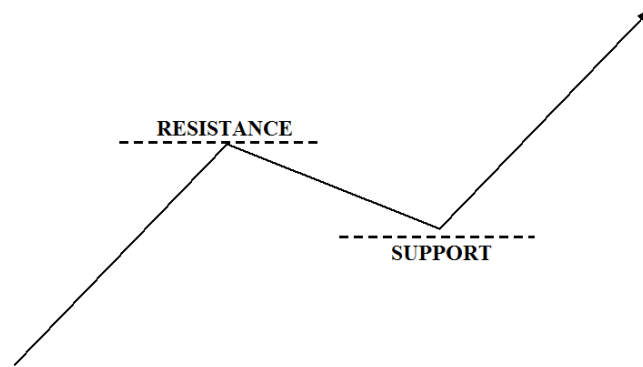
Figure 1.1: Graphical representation of Support and Resistance levels (Loginov and Heywood, 2015).

Figure 1.1 shows a graphical representation of support and resistance levels through a market by an uptrend. If the price starts at the very left of the figure was assume as the first price point. At that moment it moving upward to certain point before reversal, that turning point is specified as resistance level. Support level can be determine after the downward movement that reach the turning point before reversal.

According to Kotyrba et al. (2013), support and resistance levels are definitely characterized as retracement in trending market. Through uptrend, retracement is a support level where short- term downward price move within the uptrend are reversed. Figure 1.2 shows the price levels marked with support would be measured as retracement. Through downtrend, retracement is a resistance level where short- term upward price move within the downtrend is reversed.

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Figure 1.2: Graphical representation of retracement.

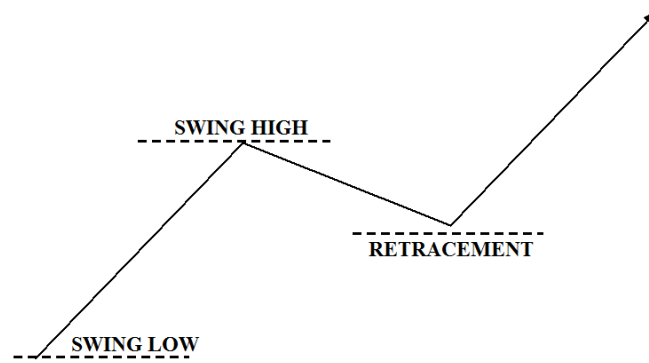A sequence of numbers can be generated by taking ratios of terms in the Fibonacci sequence numbers. It can be employ to forecast future retracement. There are three Fibonacci ratios used to forecast retracement which are 0.382, 0.500 and 0.618. Fibonacci retracement is employed in finding the support and the resistance level (Kumar, 2014). Through this method, high swing and low swing are identified, then it is followed by dividing the vertical distance into 38.2%, 50% and 61.8%.

Fibonacci sequence numbers provide the mathematical basis for the Elliott wave theory. According to Kotyrba et al. (2013), Elliott wave theory is employed to recognize wave pattern including their deformation in the graphs and assist to improve the forecasting of its trend.

The used of Fibonacci ratios are abundant in technical analysis, mainly in the forex market. Practically, in every reference of online platforms in the forex market has design a tool to create prospective Fibonacci retracements as one of the technical analysis. Detail discussion of Fibonacci retracements will be presented in literature review.

1.2   Problem Statement

The forex market is one of the utmost intricate markets through the characteristics of high volatility, nonlinearity and irregularity. Meantime, these characteristics also make it very difficult to forecast forex. As the Bretton Woods System collapsed in 1970's, the fluctuations in the forex market are more volatile than ever (Yu et al. 2007). Additionally, some significant factors, such as economic growth, political, trade development, psychological, interest rates and inflation rates have high impacts on the exchange rate fluctuation (Yao et al. 1999). The collaboration of these factors is in a very intricate style. The problem are contain pattern recognition, classification and forecasting.

The pattern recognition is employed in order to recognize Elliott wave patterns for the purpose of forecast. Elliott wave patterns are not exact, they are marginally different every time they appear (Volna et al. 2013). They can have a different amplitude and different period, although graphically the same pattern can appear different even though actuality the same. Besides, these patterns do not cover every time point in the series, but are optimized so that the advanced classifier would be able to learn their key characteristics and accurately recognize them. One of the significant problem is to recognize the input pattern reliably. Elliott wave patterns can be classified into uptrend and downtrend pattern. Uptrend patterns indicate that the forex market price is going upward while downtrend patterns indicate that the market price will move to downward.

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Among many methods of forex forecasting, there is a growing focus on Fibonacci price retracements which are available in almost all software for technical analysis (Bednarz, 2013). Fibonacci sequence numbers is used to forecast the resistance and support levels. This method of retracement forecast has great accuracy but a set of values which are 38.2%, 50.0% and 61.8%. However this study is focusing on the correlation between three retracements which is never been studied.

1.3   Research Objectives

Knowledge of how deep the impending the forex market price retracement level would be can assist to forecast the forex market trend. Forecasting demands for past market actions with price movement. The exact technical analysis methods the more accurate forecasting. This study is conducted in order to fulfil these following objectives:

i.   to recognize the pattern using the Elliott wave pattern.

ii.   to compare accuracy patterns classification between K - Nearest

        Neighbor (KNN) and Linear Discriminant Analysis (LDA).

iii.   to forecast short term forex market using Fibonacci retracement

        method.

1.4   Scope and Limitation of the study

The scope of this study is limited to technical analysis approach in forex market. Price data is provided by Meta Trader 4 Platform. The data which is used in this study is Great Pound Britain pair to United State Dollar (GBP/USD) as a forex major pair

currency. This study will review the forecasting process based upon only technical analysis for four months period from the 1st March 2016 till 30th June 2016. Scope and limitation of this study can be list out as below:

i.   Price data were collected between 2.00 pm until 5.00 am from Monday to Saturday when the forex market is most active for GBP/USD pair currency.

ii.   Price data were collected for every 5 minutes interval. This interval of time is appropriate because it easy to recognize pattern.

iii.   One pattern for a day to get the short- term forecasting.

1.5   Expected Outcome

When this study complete, the outcome is expected to answer the entire objective stated previously. The expected outcome of this study are tabulated in following Table 1.1.

Table 1.1: The expected outcome for the study

No	Objective	Expected Outcome
1	To recognise the pattern by using the Elliott wave pattern.	Elliott wave pattern has a similar retracement frequency.
2	To compare trend direction between K- Nearest Neighbor compare to Linear Discriminant Analysis.	The efficiency of 2 different types of Elliott wave pattern can be determine.
3	To forecast short term forex market using Fibonacci retracement technique.	There are three level of retracement which are 38.2%, 50.0% and 61.8%. From the literature, 61.8% is the best retracement direction.

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1.6   Dissertation Structure

As usual, dissertation structure are commonly comprises in five chapter by starting from introduction and ended by conclusion and future work.

Chapter 1: Introduction

The first chapter is Introduction where the problem statements are elaborate briefly. From the various technical analysis of forex forecasting, the Fibonacci retracement is chosen as a topic and discusses further. Scope and limitation is stated to justify framework of the research.

Chapter 2: Literature Review

The second chapter is Literature Review where references from specific journals, website, books, thesis, reports and other references are summarised and analysed. From the reference done, methodology for dissertation is finalised. In this chapter, the main topic for the dissertation is thoroughly discussed.

Chapter 3: Methodology

The third chapter is Methodology for detailing the method applied in this dissertation. Briefly, this dissertation has three major steps. Starting from the collection, selection and analysis data, the result will be employed for forex forecasting.

Chapter 4: Result and Discussion

All the results gathered from the analysis are presented in Chapter 4 which are Result and Discussion. Results either in tables or graphs are illustrated in easy form which is understandable even though read by non- technical background peoples.

Chapter 5: Conclusion and Future Work

Final chapter are Conclusion and Future Work where all of the findings in this study are concluded. All the findings must answers the entire objectives stated in Chapter 1. In this chapter also provide some recommendation for future research.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

Hadi et al (2001) define forex is a liberty market that states the prices of currencies based on the supply and demand of a certain exchange. Compared to other financial markets, the forex market has subsequent profits which are 24 hours operation, 5 days a week, over the counter market and no permanent place.

Forex trading are created by buying or selling a quantity of exchange against another (Econ & Gallo, 2014). The major exchanges are USD (U.S. Dollar), EUR (Euro), GBP (British Pound), YEN (Japanese Yen) and CHF (Swiss Franc). As a component of study in the forex markets, the risk is an inevitability countable as technical analysis instruments (Teodor, 2015).

2.2   Technical Analysis

Technical analysis is a foreign exchange (Forex) market analysis technique that explicitly finds to exploit trends in previous prices, whether through graphical analysis or quantitative methods (Mahmoodzadeh et. al., 2007; Penteado, 2013; Roscoe & Howorth, 2009). The technical analysis method focuses on understanding the current market trends and attempt to identify any reversal of this trend and forecast by what method the forex

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market is probable to perform in the future. Technical analysis frequently comprise prices and volumes by employing previous data made by market influences at future exchange price actions (Hadi et al., 2001). Technical analysis is apprehensive with what has actually occurred in the market relatively than what should occur and takes into account the price of instruments and the volume of trading and produces graphs from that data to employ as the primary instrument (Vonko, 2007).

For many years, challenges have been through to characterize forex market according to a set of instructions (Hellal & Gerald, 2014). According to Yao & Tan (2000), forex market has its own trend, cycle, seasonality and rules. Technical analysis is employed to identify patterns of market price actions that have extended been recognized as significant. For numerous given patterns there is a high probability that they will produce the expected results. Correspondingly, there are recognition patterns that repeat themselves on a steady foundation.

Qualitative is principle analytical concept based technical analysis be determined by interpretation of the character of geometric patterns approximating levels of support and resistance (Hadi et al., 2001). According to Gaucan (2011), Fibonacci retracement levels are a significant part of technical analysis employing support and resistance levels.

2.3   Fibonacci

The mathematician of the middle ages from Italy was Leonardo of Pisa, well known by his other name, Fibonacci (1175-1250) (Burton, 2011). While travelling

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looking for business from one place to another in the Mediterranean Sea, he compared the different number of systems and deliberate Arabian mathematic (Benavoli et al., 2009 ; Burton, 2011).

Return back to Pisa in 1202, Fibonacci wrote his legendary Liber Abaci (Manuscript of Counting). Fibonacci's manuscript regulate to the study of linear equations and numerous mathematical subjects (Burton, 2011). They were problems about rates of properties, calculating income, and problems that assisted analyse fluctuations in exchange. The manuscript presented the sequence of numbers which brings his name, Fibonacci sequence numbers (Goetzmann, 2003).

2.3.1   Sequence numbers and golden ratio

The Fibonacci sequence numbers initiated with Fibonacci's legendary deal with the amount of descendants of a pair of rabbit problematic (Burton, 2011). Equation (2.1) shows the Fibonacci sequence numbers.

$$0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144…. \tag{2.1}$$

The following number is set up by accumulation the previous two numbers as shown by Equation (2.2).

$$F_n = \begin{cases} 0 & if \quad n = 0 \\ 1 & if \quad n = 1 \\ F_{(n-1)} + F_{(n-2)} & if \quad n > 1 \end{cases} \qquad (2.2)$$

where n = number of term

F_n = number of sequence

The ratio of consecutive Fibonacci sequence numbers approaches to the golden ratio relatively rapidly as they go to infinity (Han et al., 2012). The golden ratio indicates that a definite length is divided such that the ratio of the whole to the longer part equals the ratio of the longer part to the shorter part (Chen & Lee, 2002). In golden ratio, sum of the two quantities to the larger quantities is approximately 1.6180339887, correspondingly ratio of two consecutive numbers of Fibonacci sequence is approximately 1.618034 (Burton, 2011).

Fibonacci sequence numbers are employed to forecast and evaluate the price action of the forex market. Fibonacci retracement is used in outcome the support and the resistance and also employ to recognize Elliott wave pattern in forex market. Although the Fibonacci ratios have been improved to numerous technical indicators, their utmost employed in technical analysis remains the measurement of correction waves (Kotyrba et al., 2013).

2.3.2   Fibonacci retracement

Fibonacci retracement is an instrument to employ the technical analysis for forecasting the forex market (Gaucan, 2011). Fibonacci retracement is employ to

recognized major swing high and swing low then it is followed by dividing the vertical

distance into 38.2%, 50% and 61.8% (Kumar, 2014). Technically, Fibonacci retracement

in an uptrend and in downtrend direction can also be represented as in the Figure 2.1 and
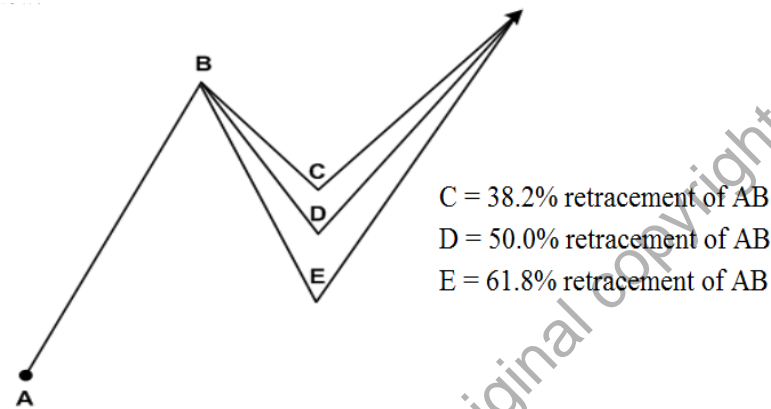
Figure 2.2.

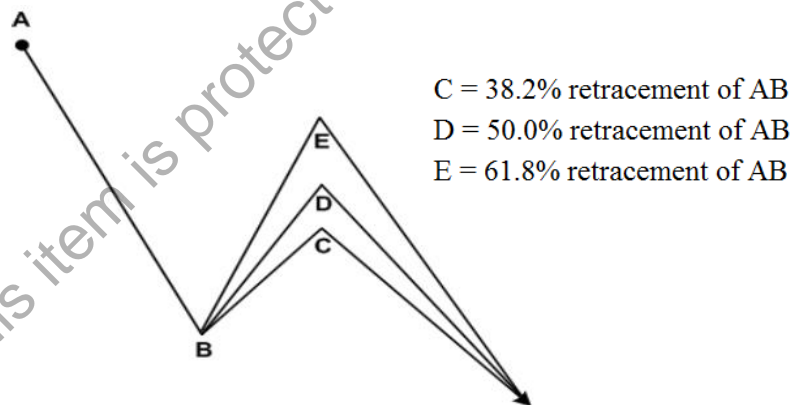Figure 2.1: Fibonacci retracement in uptrend (Gaucan, 2011)

Figure 2.2: Fibonacci retracement in downtrend (Gaucan, 2011)

The practice of Fibonacci retracement levels in forex market are to determine

how far one expects a market to retrace before continuing in the direction of the trend.

The indication is buy on a retracement at a Fibonacci support level when the market is

uptrend, and sell on a retracement at a Fibonacci resistance level when the market is