A New Analytical Tool for Forex Trading[1]

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Abstract

Predicting currency movement is very important for investors who face exchange rate risks in their investments. Unfortunately, the most of existing tools that are used as a guidance do not contain any information about the future. Most existing tools use past performance in predicting thresholds or support and resistance levels. They do not take into account investors' reviews on economic forecasts or market dealers' sense in predicting market events. To fill this gap, this study try to build an alternative analytical tool to set support and resistance levels that is more consistent with economic and market forecasts or outlooks.

This study use some simulation analyses and comparative studies using several countries (Brazil, India, Indonesia, Malaysia, Philippine, Russia, Thailand and Turkey) data and then combine those data with some market analyst reviews related to those countries to produce a new analytical tool. Using data from 2014 until 2016, the study found that the new analytical tool performs better than existing tools. Therefore, it can be used as a more appropriate guidance for investors for reducing currency risk in their investments.

I.   Introduction

Nowadays, investors are much more smarter than they were in the past. In investing their capital, they will invest in several portfolios in several financial markets in several countries to gain an optimum return. As they can involve in several markets, investors have an ability to arbritage among those markets. Capital can transform from one portfolio to other portfolios and from one currency to other currencies. As a consequence, capital moves very fast from one financial market to another in the form of any currencies. In one day, a huge amount of money and million transactions are involved in financial markets. Along with higher potential return, investing their money in many markets in many countries, investors will also face some risks that lead to a lower return. Even more, their money will shrink if they invest carelessly.

There are many risks in financial markets, such as credit risk, market risk, interest rate risk, liquidity risk, policy risk, operational risk, currency risk and so on. One of the most common risks in investment is currency risk. Fluctuation in currency rates can cause profit or loss when an investor has exposure to foreign currency or in foreign-currency-traded investments although the currency value in which the underlying instrument is registered does not changes. Currency risk itself defined as the potential risk of loss from exchange rate fluctuation. In order to lower currency risk, investors can do hedging or other technique design to offset any currency related gains or loses (Kuepper, 2017). Normally, a combination of forex forwards and options let on investors to fix currency risk within tolerable levels as long as premiums are reasonable. This hedging techniques are not continually powerful, though diversification into many major currencies can help limit this risk.

To avoid loss their money, investors will collect all relevant information to enhance return for their investments. Information is very important to decide how much money should be invested in one portfolio or another. Information also will tell investors which markets are going to be bullish or bearish. In general, information can be devided into two factors, namely sentiment factor (rumours) and fundamental factor. These two factors influence markets frequently and give significant impact on return of investments. However, investors could also be defined into two types, namely long term investors and short term investors. Usually, long or medium investors will concern about fundamental factors of markets and countries where they invest. They does not really concern about sentiment factors because they invest in a long period.

In contrary, short term investors will concern both fundamental and sentiment factors. These types of investors moves their investments from one market to other market quite rapidly. They will come to invest in portfolio usually in a short period which depend mostly on good news in the market. This condition could lead currency movement to one side because of herding behaviour of investors. Also in a short term, they could move to the opposite direction if bad news suddenly appear or the previous good news do not meet their expectations. This situation makes currency swing and also called a high currency volatility.

In order to analyse currency movement, investors have a number of tools for predicting currency movement. In general, as an addition to global market view, investors mostly adopt several techniques which are widely available in financial market for technical method such as Bollinger band, MACD[3] and many others. However, in predicting daily currency movement, most

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[3] MACD = moving average convergence and divergence

of existing tools do not have a capability to do the job. In addition, it is very difficult to build a sophisticated model to support forex trading. Thus, using charts, paterns, simple calculations and other simple tools that are able to be produced quickly are the most preferable.

Almost all analytical tools are able to be a risk guideline for investors who invest using particular currency. For example, when investors invest their money in one country, they can use Bollinger band to measure currency risk of the investment. They also can see how close current currency level to its supporting or resistance level. This information is used to decide whether they have to make portfolio adjustment or not. However, most available tools using past performance in predicting support and resistance level. Those existing tools does not take into account information needed for investors that have been mention above. Furthermore, those existing tools also neglect current condition, fundamental economy, peer countries' currency movement and so on. Most available tools do not cover analyst review or dealer sense in predicting market event. Hence, it needs some adjustment to get the more suitable tools in predicting future event.

Therefore, this paper focus on how to combine historical data with market forecast and information including fundamental and sentiment factors in order to build a new analytical tool. Therefore, this new analytical tool is expected to give a forecast of currency movement. This alternative tool could be similar or different with the existing tools such as Bollinger band or others. It depends on how a market analyst's view about the outlook of markets. If the market is about to consolidate then this new tool could be similar with Bollinger band or others. Hence, this new analytical tool needs to be tested with empirical studies using data set from several countries. In this study, data from some emerging countries are used for several reasons. Apart

from the technical issues such as accessibility of the data, those observed countries showed quite similar reaction to market sentiments in currency movement.

This study will evaluate whether the real currency movement from observed countries are moving inside the new tool. In evaluating those movement, this study will use a set of data from January 2014 to December 2016. Thus, this study will accommodate market view from analyst in believing their currency movement against USD in one probability which covered their view from global and domestic factors.

This study will be divided into several parts. After introduction at the first part, this study will explore some literatures which presented some existing tools for forex trading band at the second part. Third part will explained the methodology used in this empirical study. Fourth part will talk about the data that used in this study. In this part also will discuss about the result of the exercised data. Then, fifth part is a conclusion.
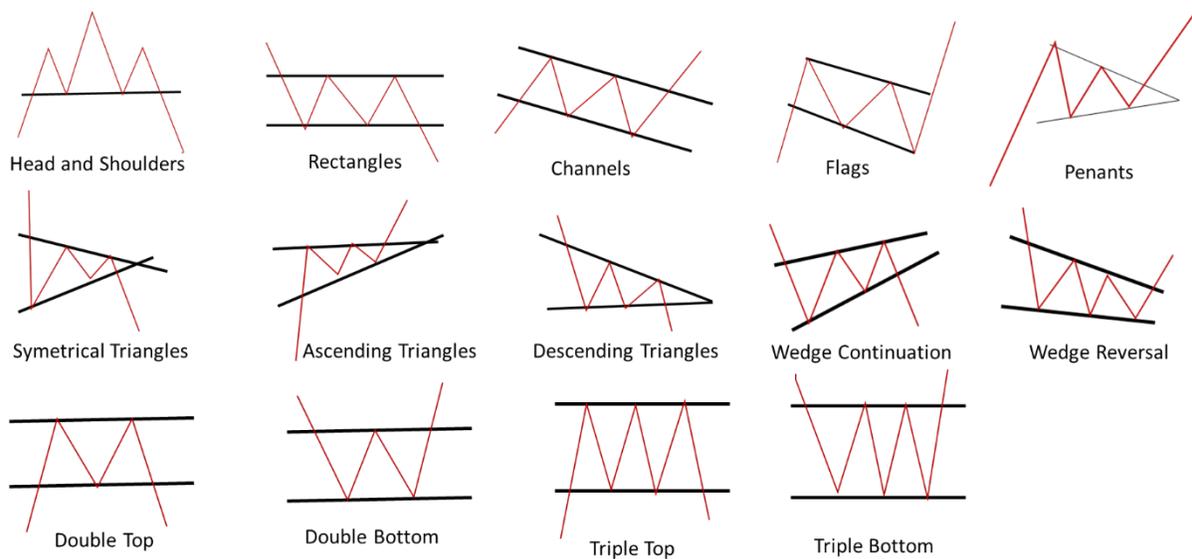
II.   Literature Studies

In the financial market, either stock market or currency market, people commonly mixed a chartist with technical analyst. A chartist analyzes price charts only, while technical analyst studies technical indicators derived from price changes in addition to the price chart.[4] According to that definition, technical analyst scrutinizes the price action of the financial markets instead of the fundamental factors that seem to affect market prices. It is because there is believe that all

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[4] Credit Suisse, Technical Analysis – Explained, Global Technical Research and Behavioral Finance. Zurich: (https://www.credit-suisse.com/pwp/pb/pb_research/technical_tutorial_de.pdf)

the relevant market information is reflected (or discounted) in the price. There are several technical analysis that are commonly used by investors. These technical analyses show some resistance and support levels for historical data. Some of them use pattern (triangles, flags and double bottoms) to determine resistance and support levels (see figure1). The rest of them using econometrics or simply mathematic approach, such as moving average including Bollinger Band and MACD, stochastic, index[5] and others.

Figure 1. Example of Pattern in Technical Analysis

Head and Shoulders	Rectangles	Channels	Flags	Penants
Symetrical Triangles	Ascending Triangles	Descending Triangles	Wedge Continuation	Wedge Reversal
Double Top	Double Bottom	Triple Top	Triple Bottom	

Source : http://www.mrao.cam.ac.uk/~mph/Technical_Analysis.pdf

One of the most popular technical analysis in foreign exchange market is Bollinger band. Basically Bollinger Band provides trading band for investor and answers whether prices are too high or too low on a relative basis. Bollinger (1992) explained that Bollinger band are plotted two standard deviations above and below a simple moving average. Bollinger band shows foreign

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[5] Relative Strength Index.

exchange move within corridor on daily basis. Usually, Bollinger band is used to look at a momentum of currency's movement at one period. Therefore we can predict whether the observed currency has a tendency to continue at current move or it has reached a support or resistance level. In this case, the observers do not have any capability to break the level.

Figure 2. Bollinger Band in Technical Analysis

(source: Bloomberg 2017)

Bollinger (2001) stated that standard Bollinger Band formulas as follows:

$$Upper\ band = Middle\ band + 2 * standard\ deviation$$

$$Middle\ band = 20\ period\ moving\ average$$

$$Lower\ band = Middle\ band - 2 * standard\ deviation$$

According to its calculation base, Bollinger Band sometimes is used to identify period where high volatility or low volatility happened. The width of the bands get narrower during less volatile period and vice versa. Hence, it can identified period when prices are at extreme and possibly unstable levels.

Other popular technical analysis in foreign exchange market is Moving Average Convergence Divergence (MACD). This method was developed in 1970s by Gerald Appel as an indicator of the change in a security's underlying price trend (Grimes, 2012). MACD commonly calculated by the formula as follows;

$$MACD\ Line = 12\ day\ EMA - 26\ day\ EMA$$

$$Signal\ Line = 9\ day\ EMA\ of\ MACD\ Line$$

$$MACD\ Histogram = MACD\ Line - Signal\ Line$$

EMA stands for exponential moving average which are similar to moving average, except that more weight are given to the latest data. Consequently, this type of moving average takes faster to recent price changes that simple moving average. Thus, the interaction, whether crossover or divergence, between MACD line and signal line that technical analyst look for. As suggested by its name, MACD is distressed with the convergence and divergence of the two exponential moving averages. Hence, the main purposes of the analysis is to identify turning points in a trend by focusing on its divergence and convergence.

Figure 3. Moving Average Convergence Divergence (MACD) in Technical Analysis

(source: Bloomberg 2017)

Relative Strength Index (RSI) is an analysis developed by J. Welles Wilder, to identify overbought and oversold conditions by measuring velocity of security's price movement (Hayden, 2004). For technical analysts or traders, using RSI to recognize potential turning points helps them to make entry or exit decision. The values of RSI are calculated from either closing prices or yields. Hayden (2004) described there are only two equation involved in RSI calculation. The first part to obtain is the value of relative strength (RS) which is the ratio of the average up closes to the average down closes over "n" periods as follows,

$$RS = \frac{Average\ of\ 'N'\ days\ closes\ Up}{Average\ of\ 'N'\ days\ closes\ Down}$$

Hence, the RSI calculation can be describe by the equation as follows,

$$RSI = 100 - \frac{100}{1 + RS}$$

Figure 4. Relative Strength Index (RSI) in Technical Analysis

(source: Bloomberg 2017)

Other technical analysis that can be used is candlestick charting. Candlestick charting originally is Japanese technical analysis for rice trader in the 17th century. Many traders belief that candlestick charting technique accurately reflects short-term outlooks. Moreover it blend perfectly with nearly all the traders' common technical analysis methods.

Candlestick is form by putting together opening, high, low and closing price of the day in one vertical line. When the opening price is higher than closing price then a filled candlestick is drawn with dark color, usually black. On the contrary, when the opening price is lower than closing price then a hollow candlestick is formed. The lines, which can be short or long, above or below the candle represents the high or low price range and these lines are known as several names (shadows, tails, wicks). The candle may or may not have shadows, tails or wicks.

Figure 5. Candlestick Graph

(Source: Bloomberg 2017)

A pattern can be formed by one or several candlesticks, but not more than five[6]. Most of the time, candle patterns show reversal patterns but they also help in projecting trends. A

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[6] http://www.optionsuniversity.com/CandlestickSecrets/Book/candlesticksecrets.pdf

reversal pattern shows that the direction of a stock is going to curtail its flow and at times this conveys that an uptrend or downtrend will reverse its course

In candlestick, Darsono et al (2017) explained that Doji was formed in candlestick chart when opening level and closing level are at the price level. Doji is the most famous candlestick among all different kinds of candlesticks and Doji Star is the most famous Doji pattern since its reliability is to show reversal sign. However, some trader belief that Doji candlestick signal and patterns are sometimes tricky, thus adding another tools to the chart can avoid false signal. In combining Doji candlestick and Bollinger Bands, trader looks for Doji candlestick which hit the upper band or lower band as a confirmed reversal sign for the currency or securities movement.

Figure 6. Combination of Doji Candlestick and Bollinger Band Confirming Reversal Trend
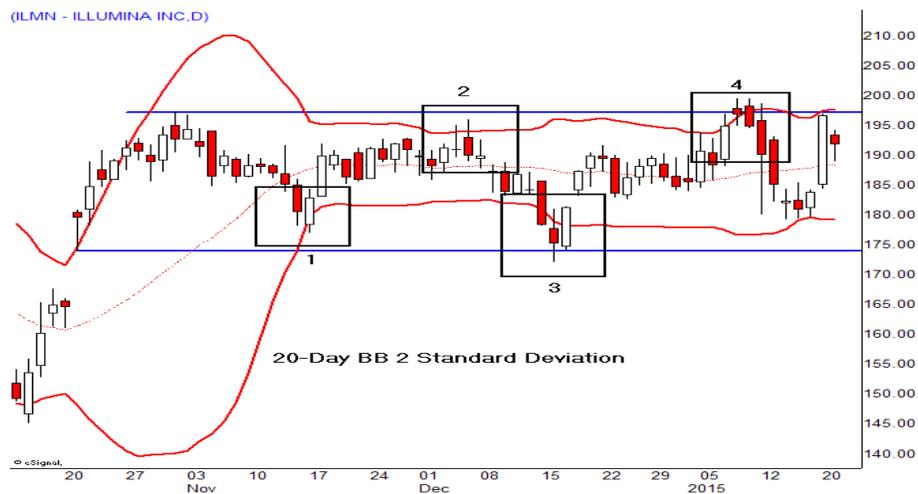
(Source: Investopedia 2017)

III.   Methodology

The approach used in the new method of determining the trading band or exchange rate corridor begins with using the exchange rate of the highest and lowest transaction from the previous period to determine the exchange rate is expected to happen (expected exchange rate). Hence the expected exchange rate would be used as the reference for exchange rate corridor. Expected exchange rate can be described in the following equation.

(1) $X = H.h + L(1 - h)$

Where H is the highest transaction rate of the previous period, L is the lowest transaction rate of the previous period, h represents the probability of currency depreciation against the USD and X represents the expected exchange rate. Since h represents probability, the number of h can be varied from 0 to 1.

Furthermore, this study using the number of expected exchange rate to calculate the width of half trading band. Half the width of the trading band which is denoted by Y is represented from the furthest distance between the expected exchange rate (X) with the value of the highest transaction rate (H) or lowest transaction rate (L). The half width of the corridor can be represented by the following equation.

(2) $Y = \max\{ H - X, \ X - L\}$

The following figure gave the idea of equation (2).

Figure 5. The Explanation of Equation (2)
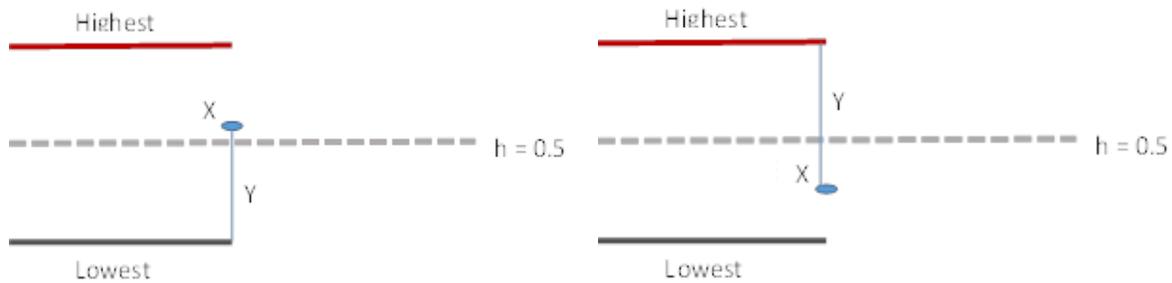
In order to determine upper band and lower band of the trading band, this study used probability of currency depreciation which is believed to the following rules;

• If h> 0.5 range corridor $(X + Y , L)$

• If h≤0.5 corridor range $(H, X - Y)$

Those equations explained the normal condition where no shock happened.

However, there is a condition whose divergence between domestic factor and global factor are high. For example when the domestic factors are good but the global factors are very bad, the bad factors from global can overcome the good domestic factors. Therefore, the good domestic factors can not dampen currency depreciation. On the contrary, there is a condition where the global factors are very good but the domestic factors are very bad. Even though there was a tendency of capital inflow driven by the good global factors, local currency was failed to appreciate because the domestic factor was too bad.

Therefore, there was a need to adjust the value of h from equation (1). In this case, h was determine by two factors, global and domestic. Hence, h might less than zero or even higher than 1. Symbol h^* will represents the new h or adjusted depreciation factor.

In order to capture currency depreciation factor from both domestic side and global side, the depreciation factor is the sum of domestic and global factor. Hence, the depreciation factor can be represented by the following equation.

(3) $$h^* = h_d + h_g$$

Where h^* stands for adjusted depreciation factor, h_d stands for domestic depreciation factor and h_g stands for global depreciation factor. Thus, equation (1) became adjusted as follows

(4) $$X = H.h^* + L(1 - h^*)$$

IV.   Data and Analysis

Data

This study using several set of daily data from emerging countries such as Brazil, Malaysia, Mexico, India, Indonesia, Philippine, Thailand and Turkey from January 2014 to December 2016. Apart from the technical issues such as accessibility of the data, those observed countries showed quite similar reaction to market sentiments in currency movement.

Next, equation (1) needs the value of probability of currency depreciation which represents by h. Instead of using continuous variables, this study used discrete variables to facilitate classification market condition following investor's pattern. This study classified h to five

numbers (0.2; 0.4; 0.6; 0.8; 1.0) based on investor's belief to depreciation of local currency. Where market is expected in consolidation condition, h is set to 0.6. Meanwhile, if exchange rate is expected to appreciate, h is set to 0.2 (highly appreciation) or 0.4 (appreciation). And if exchange rate is expected to depreciate, h is set to 0.8 (depreciation) or 1.0 (highly depreciation).

Prediction	h
Highly appreciation	0.2
Appreciation	0.4
Consolidation	0.6
Depreciation	0.8
Highly depreciation	1.0

Table 1. h based on investor's belief

Then, since h^* might be in negative territory or higher than 1, it required transformation probability of currency depreciation for global and domestic sentiments. Instead of using continuous variables, this study used discrete variables to facilitate classification market condition following investor's pattern. This study classified global sentiments, h_g, to five numbers (0.2; 0.4; 0.6; 0.8; 1.0) based on investor's belief to depreciation of local currency. Where market is expected in consolidation condition, h_g is set to 0.6. Meanwhile, if exchange rate is expected to appreciate, h_g is set to 0.2 (highly appreciation) or 0.4 (appreciation). And if exchange rate is expected to depreciate, h_g is set to 0.8 (depreciation) or 1.0 (highly depreciation).

Prediction	h_g
Highly appreciation	0.2
Appreciation	0.4
Consolidation	0.6
Depreciation	0.8
Highly depreciation	1.0

Table 2. h_g based on investor's belief

Domestic sentiments are influenced by economic factors, politic factors, and other domestic factors. In this empirical study, we used GDP, CPI, and Trade Balance that are available and obtained easily from data provider, such as Bloomberg. Political factors were not used because relatively difficult to obtain. Then, these three economic data are processed to get h_d. First, this study calculated average and standard deviation for GDP, CPI, and Trade balance. This study used 1 and ½ standard deviation. Second, this study classified each data to six categories (1, 2, 3, 4, 5, 6) based on deviation between value of data and their average.

Deviation	GDP	CPI	Trade Balance
Above 1 Std. Dev	6	1	6
+ ½ − 1 Std. Dev	5	2	5
0 − + ½ Std. Dev	4	3	4
0 − -½ Std. Dev	3	4	3
-½ − -1 Std. Dev	2	5	2
Below -1 Std. Dev	1	6	1

Table 3. Value of Deviation

In table 3, we see that there is a difference in determine the value of deviation between CPI and other data (GDP and Trade Balance). It happened because when value of GDP and Trade balance are above average (positive deviation), then it will contributes positive sentiment to exchange rate. In contrary, for CPI, when value of CPI are above average (positive deviation), then it will contributes negative sentiment to exchange rate. Third step, value of deviation are summed based on weight of each data. Specifically, this study weight 50:30:20 for GDP:CPI:Trade Balance. Those weighting is used based on investor's view which see GDP give more impact to exchange rate than CPI and Trade Balance. Then the value that has been weighted are transformed to h_d which is divided as follows:

Weighted Value of deviation	h_d
6	-0,3
5	-0,2
4	-0,1
3	0
2	0,1
1	0,2

Table 4. h_d value

h_d is a correction factor of h_g, as example, if investor predicts exchange rate will depreciate, so the value of h_g is 0.8 while domestic data is improved, so the value of h_d is -0.2. Then, h^*, using equation (3), is 0.6.

Proposed Band

1st Simulation

In order to get proposed band, this study conducting two calculation in all observed countries, using the equation (1) and (2) and using equation (4) and (2). The main difference between these two groups is the type of probability of currency depreciation using in the equation. Group 1 which conducting calculation using equation (1) and (2), using the probability of currency depreciation based on investor's belief which was represented by h. On the other hand, group 2 conducting calculation using equation (4) and (2) using equation (3) as modified currency depreciation factor or h^*. Since, this study would compare the result with simple Bollinger Band, Group 1 and Group 2 used highest-lowest exchange rate in previous moving 20

days. Thus, as a control group the study calculated upper band and lower band using Bollinger Band method with 20 days moving average in all observed countries.

By plotting the upper and lower band of the exchange rate together with the exchange rate happened in the observed period, this study found the number of exchange rate happened outside the proposed band. Hence, according to the results, the proposed band using standard probability of currency depreciation gave the best event of errors among other observations. Only Malaysia and Russia gave best result in proposed band using modified probability of currency depreciation.

Country	Bollinger Band	h*	h
	% of Error	% of Error	% of Error
Brazil	18,01%	11,46%	10,23%
India	17,05%	9,31%	8,17%
Indonesia	18,55%	10,18%	9,34%
Malaysia	18,54%	7,71%	7,98%
Phillipines	19,21%	9,54%	7,57%
Russia	18,96%	9,41%	9,69%
Thailand	19,89%	10,89%	9,27%
Turkey	18,74%	13,11%	9,83%

Table 5. Result from 1st Simulation

2nd Simulation

Second simulation in this study is conducted by the same method with 1st simulation. However, this simulation exercising three different length for moving average for Bollinger Band and moving highest-lowest exchange rate for proposed band. There are three groups of

observation that we used in this study. Group A using highest and lowest exchange rate in the last 30 days in exercising proposed band. Group B using highest and lowest exchange rate in the previous 60 days in exercising proposed band. Lastly, group C using highest and lowest exchange rate in the previous 90 days in exercising proposed band. Thus, as a control group the study calculated upper band and lower band using Bollinger Band method with 30, 60 and 90 days moving average in all observed countries

By plotting the upper and lower band of the exchange rate together with the exchange rate happened in the observed period, this study found the number of exchange rate happened outside the proposed band. Hence, according to the results, the proposed band using standard probability of currency depreciation gave the best event of errors among other observations.

Country	Bollinger Band	h*	h
	% of Error	% of Error	% of Error
Brazil	19,50%	8,02%	7,05%
India	15,70%	7,27%	5,96%
Indonesia	21,92%	7,21%	6,65%
Malaysia	24,04%	5,91%	5,91%
Phillipines	20,63%	7,82%	6,12%
Russia	23,72%	7,63%	8,18%
Thailand	19,07%	8,17%	6,54%
Turkey	18,59%	9,16%	5,71%

Table 6. Exchange Rate Happened Outside Trading Band in 30 days Moving Highest and Lowest Exchange Rate

Country	Bollinger Band	h*	h
	% of Error	% of Error	% of Error
Brazil	14,57%	5,48%	4,33%
India	8,66%	3,04%	2,13%
Indonesia	14,33%	2,22%	2,51%
Malaysia	20,49%	4,30%	4,01%
Phillipines	15,75%	4,46%	3,71%
Russia	17,95%	4,20%	4,92%
Thailand	13,35%	4,83%	3,13%
Turkey	15,21%	7,19%	3,87%

Table 7. Exchange Rate Happened Outside Trading Band in 60 days Moving Highest and Lowest Exchange Rate

Country	Bollinger Band	h*	h
	% of Error	% of Error	% of Error
Brazil	13,12%	5,13%	3,92%
India	7,01%	1,59%	0,64%
Indonesia	12,36%	1,39%	1,55%
Malaysia	18,56%	3,29%	2,84%
Phillipines	13,69%	2,49%	1,87%
Russia	14,07%	4,24%	4,08%
Thailand	9,64%	2,97%	1,63%
Turkey	13,28%	6,49%	3,03%

Table 8. Exchange Rate Happened Outside Trading Band in 90 days Moving Highest and Lowest Exchange Rate

Although proposed band with unadjusted h give best result in event of error in general, there are some countries which give different result. Malaysia and Russia got worse result in

event of error by using 30 days moving highest lowest exchange rate, Indonesia and Russia got worse result in event of error by using 60 days moving highest lowest exchange rate, and Indonesia got worse result in event of error by using 90 days moving highest lowest exchange rate. Moreover, the longer moving highest lowest exchange rate, the better event of error produced by proposed band.

However, there are several points to be considered in this study. Firstly, in implementing this study, intense discussion among experts and comprehensive analysis are needed in order to determine confidence level of currency movement (h). Secondly, since every currency has its own sensitivity to respond event in the market, determination of h need to be improved to make it in line with the countries conditions instead of arbitrary determination. Thirdly, in the event of low and stagnant volatility in the past normal observation period, longer observation period can be applied in order to determine forex trading band.

V. Conclusion

Hence, the exercise in the previous part brings us the conclusion:

a. According to the sample and methodology using by this study, proposed band produces lower percentage of error than existing tool.

b. Existing tool using historic data while proposed band also adds investor's market view component in its calculation. Therefore, proposed band can be used to enhance tools in forecasting currency movement since investor's market view can be accommodated in this method.

c. Economic view of the investor becomes a crucial determinant factor in determining the upper and lower band in proposed band. It is because with the same data the results may differ depending on the value of h.

d. The use of longer period in the calculation produces lower number of error. However, another consequences of longer period is proposed band become wider. Therefore the determination of period used in the calculation become investor's own preference.

e. h^* should give better result in event of error since its components are more details. However, according to the exercise had done in this study, the exercise using h^* does not show better result. It might be happened because this study using simplification and arbitrarily method in determining h_d by simplification in determining components and weight. Thus, the respond given by each countries should be different. While this study using arbitrarily method in determining hg. However, using the proper way of method in determining h^* might be time consuming.

Based on the limitation and conclusion of the study, further research needed to enhance this study in some aspects:

1. In determining the value of h, especially for h, and h_g this study used arbitrarily method instead of sophisticated method. Therefore, there is an opportunity for further research in determining the value of h .

2. In determining the value of h_d, this study used only three economic data as its components, CPI, GDP and Trade Balance. Moreover, this study used arbitrarily method in order to determine weight for those components of h_d. This condition needs to be elaborated in further research.

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