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Early Warning System in Forex Market

Agus Sihabuddin, Dedi Rosadi, Nurdi Dwianto Wibowo

Ilmu Komputer, FMIPA Universitas Gadjah Mada, Yogyakarta
Statistika, FMIPA Universitas Gadjah Mada, Yogyakarta
Ilmu Komputer, FMIPA Universitas Gadjah Mada, Yogyakarta
a_sihabudin@ugm.ac.id, dedirosadi@ugm.ac.id., ka_dinan@yahoo.com

Abstract

In this paper, an early warning system for foreign exchange online trading system is presented. The warning functionality helps the trader's attention on specific situation on foreign exchange market.. This model is developed using combination of four technical indicators those are *Stochastic Oscillator*, *Moving Average Convergence Divergence*, *Relative Strength Index* and *Ease of Movement*, continued by execution of the positions. The system has been tested on EUR/USD and GBP/CHF foreign exchange real data pair in a Meta Trader Expert System.

The value variation and combination of parameter gives different performance. Back testing using EUR/USD gives 20 combinations providing positive profit, one combination providing zero profit and 3 combinations providing negative profit. Back testing using GBP/CHF currency pair gives 12 combinations providing positive profit, one combination providing zero profit and 11 combinations providing negative profit.

Keywords : *early warning, foreign exchange, technical indicator, EUR/USD*

Introduction

The fluctuation of foreign exchange trading is very interesting. This movement is influenced by many factors, such as economic, politic and social factors. These factors are well known as fundamental analysis. For some reason, sometimes this data can not be obtained or distributed evenly among investor or traders. Other approach to predict the fluctuation is by using technical analysis.

Technical analysis is more focused on price behaviour in the past that can be used to predict future price. *Stochastic Oscillator*, *Moving Average Convergence Divergence*, *Relative Strength Index* and *Ease of Movement* are some sample of popular technical indicators used. These indicators sometimes give opposite recommendation to open position thus a combination of these are required.

Because of the 24 hours market open, an expert advisor that enables to open position automatically is required.

Stochastic Oscillator

The Stochastic indicator developed by George Lane is designed to relate the difference between today's closing price and the period low with the trading range of the observation period. The Stochastic quantifies the position of a price within the prevailing price range (Person [4]).

The Stochastic is composed of two (exponential) average lines designated as the %K line and the %D line, which oscillate between 0 and 100. The %K line is calculated as the difference of today's closing price and the period low, divided by the difference of the period high and period low. For better presentation, this quotient is multiplied by 100. The %D line represents a simple moving average of the %K line and therefore reacts less sensitively than the %K line. The formula to calculate component %K (Syamsir [5]) is:

$$\%K = 100x\left(\frac{RecentClose - LowestLow(n)}{HighestHigh(n) - LowestLow(n)}\right) \quad (1)$$

where:

- n = number of periods
- RecentClose* = closing price of current period
- LowestLow* = lowest low during n period of time
- HighestHigh* = highest high during n period of time

A value of 0 indicates that the closing price of the underlying instrument corresponds to the lowest price in the observation period. Analogously, a value of 100 shows the closing price represents the highest value in the observation period. Stochastic values above 80 define an overbought condition, those below 20 an oversold condition.

There are several ways of interpreting the Stochastic Oscillator. Buy when the Oscillator (either %K or %D) falls below a specified level and

then rises above this level. Sell when the Oscillator rises above a specified level and then falls below this level. Buy when the %K line rises above the %D line and sell when %K falls below %D.

MACD

Moving Average Convergent Divergent (MACD) is a further development of moving average. This technical analysis utilises *Exponential Moving Average* (XMA) by subtracting the value of long XMA from short XMA. The formula of MACD is as follows (Syamsir [5]):

$$MACD = XMA(short) - XMA(long) \quad (2)$$

Outputs that can be seen from MACD:

1. MACD line (1)
2. XMA signal from MACD
3. Horizontal line between positive and negative MACD.

The opening of the buying position can be made when the trend is bullish, namely when the MACD line is above the MACD signal line and on the negative area. Meanwhile, the opening of the selling position can be made when the trend is bearish, viz. when MACD line is below the MACD signal line and on the positive area. In order to get a better signal from MACD analysis, a trial and error process to get a short XMA, long period, and trigger line period can be conducted.

Ease of Movement

Ease of Movement (EMV) indicator was developed by Richards Arms, Jr.. this indicator shows relationship among price changing, volume, and volume needed to change the price. Value of EMV can be seen below (Chavarnakul [1]):

$$EMV = \frac{\frac{H + L}{2} - \frac{H_p + L_p}{2}}{\frac{V}{H - L}} \quad (3)$$

With :

- H = present high price
- L = present low price
- H_p = previous high price
- L_p = previous low price
- V = transaction volume

Sell signal is indicated when the value is below 0 and buy when the value above 0.

Relative Strength Index (Rsi)

Relative Strength Index (RSI) was first introduced by J. Welles Wilder in 1978. This

indicator is similar with stocastic oscillator whose purpose is to identify overbought and oversold condition. The value is a range between 0 and 100. The condition to buy and to sell is the same with stocastic oscillator. The value of EMV as computed below (Investopedia [2]).

$$RSI = 100 - \frac{100}{1 + RS_n} \quad (4)$$

With RS = average closing up divide by closing down in the *n* period.

Early Warning System

Early warning system is based on technical analysis to produce signal to buy and to sell. This system combines several technical indicators which is converted first into -1 and 1, then a combination function used to combine the indicators. The function is proposed first by Lipinski and Korczak [3] in the equation (5)

$$e = w_1 f_1 + w_2 f_2 + w_3 f_3 + \dots + w_n f_n \quad (5)$$

Function *e* combines some technical indicators *f₁, f₂, ..., f_N* with weighting value *w_i*. *f₁, ..., f_N* linearly Value is a threshold using to open a position. The decision function takes form in equation (6).

$$h(x) = \begin{cases} -1, & \text{if } x \leq \alpha \\ 0, & \text{if } -\alpha < x < \alpha \\ 1, & \text{if } \alpha \leq x \end{cases} \quad (6)$$

Design

Parameters needed for the applications are *TakeProfit, StopLoss, Lots, Stochastic %K, Stochastic %D, StochSlowing, MACDshort, MACDlong, MACDsignal, wMACD, wSTO, wEMV, wRSI, and a* (as *threshold*).

The main flow of the program is shown in figure 1. Initiation is used to initiate the parameter and constant. Opening position is used to check whether a position can be done. Closing position is used to close the opened position previously in opening position stage.

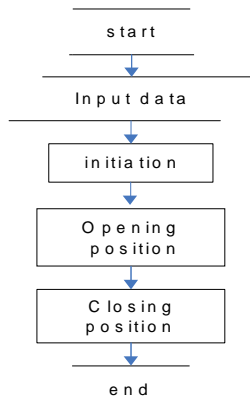


Figure 1. Main flow of application

Opening position as be shown in figure 2 computes the signal to buy or to sell like in equation 5. The value of computation (e) is taken from value of four indicators stochastic oscillator, MACD, EMV and RSI with each weight is 0.25. A threshold a is used to filter e whether the signal is enough or not to open a position. A buy position is opened when the value of e is greater than threshold a and a sell position is opened when the value of e when the value of e is less than $-a$.

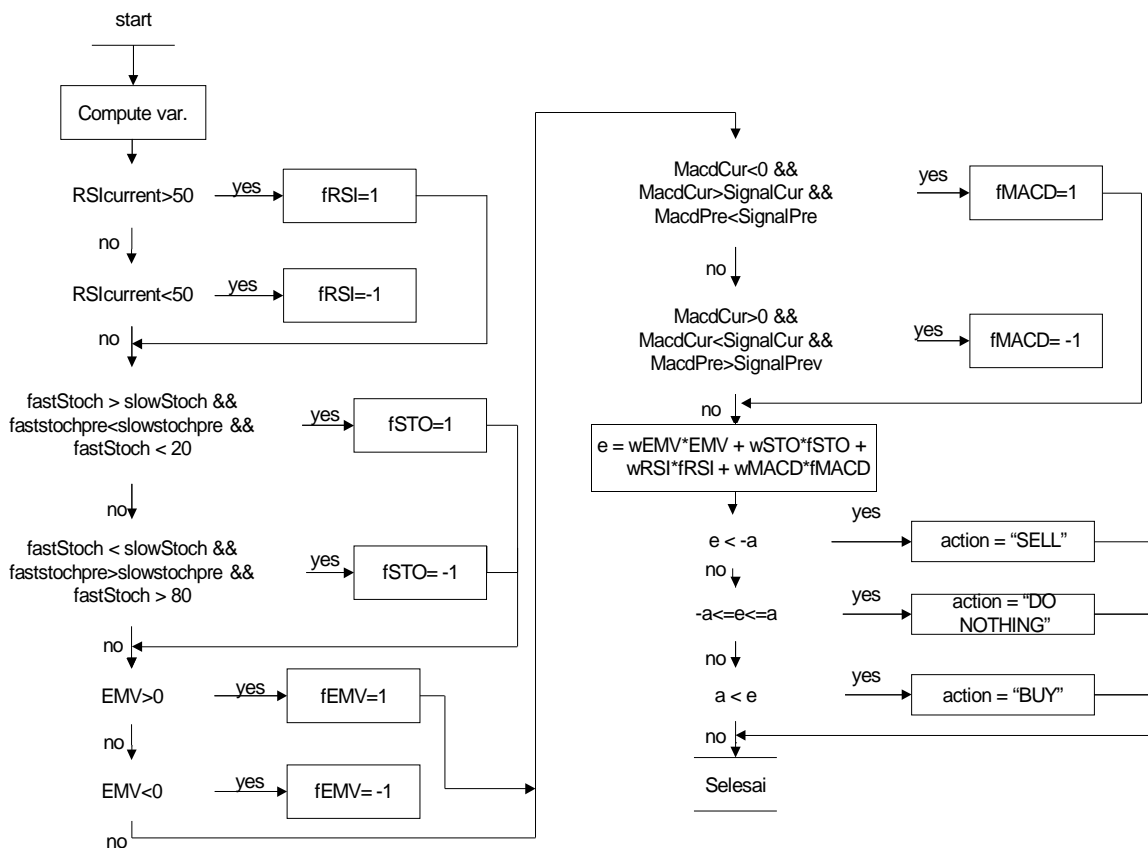
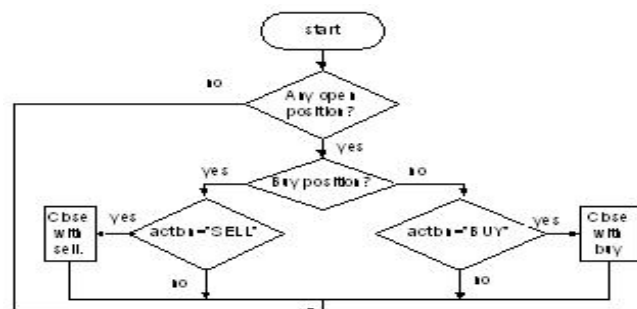


Figure 2. Opening position chart

Closing position part as in figure 3 is used to close the opened position. A buy position is closed by a sell and vice versa. The condition for closing a buy position is if one of these conditions holds: first if the take profit parameter is reached and second if there is a sell signal and the last condition if the stop loss parameter is reached. The sell signal is conditioned the same as in opening position part.



it decrease the account balance.

IMPLEMENTATION

Implementation for the code in design is presented in Meta Quotes Language version 4.0.

This implementation is tested using strategy tester in Meta Trader platform by using expert advisor facility for back testing like in figure 4.

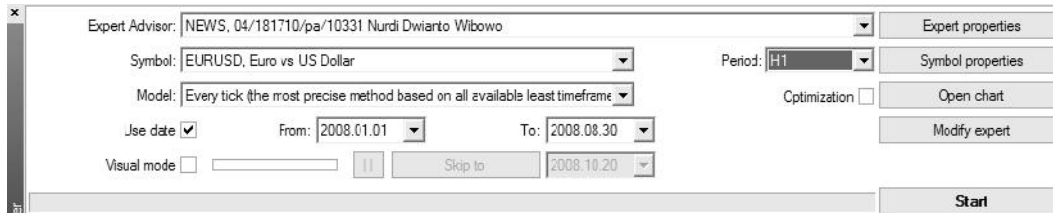


Figure 4 Strategy Tester

The program has been tested on varieties time frame for a EURO/USD currency pair that seems the most liquid currency traded in market. The time frame used is for 15 minutes, one hour, and daily.

Time interval for back testing is from January, 1, 2008 until August, 30, 2008 with every tick model data. The input parameter or period for the technical indicator is the default value.

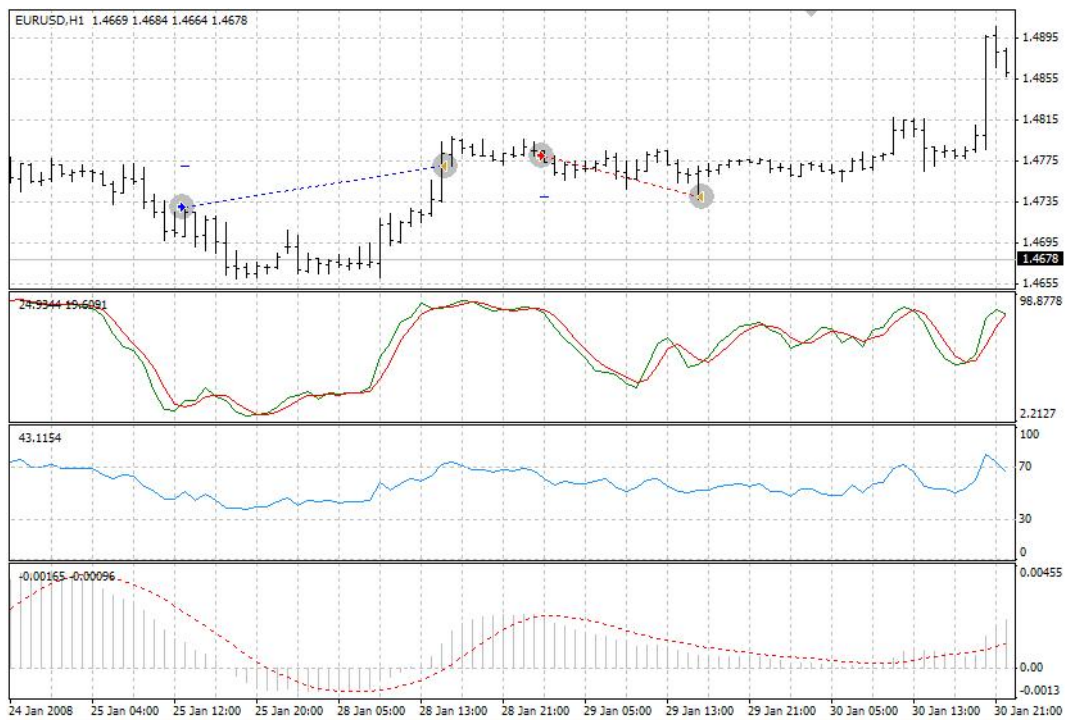


Figure 5. Automatic trading visual

The value of weighting for indicator is 0.25 by default or distributed evenly among indicator and then by trial and error the weighting value changed to get better result. The threshold value a by default is 0.8 and then changed by trial and error. The initial amount of balance is \$ 10.000,00 in demo account and the data provider is FX Clearing Group, Inc, Canada.

The visual of the result is shown in figure 5 that is a snapshot for automatic trading. This is a chart from January 24 until January 30, 2008.

Result and Discussion

The application for early warning system has been backtested using EUR/USD currency pair that is one of major rates (currency pair that involve USD dollar) and GBP/CHF currency pair that is one of cross rate (not major rates).

Tabel 1. Result for EUR/USD with w_i evenly distributed.

No	Time frame	a	# transaction	% succes buy	% succes sell	Profit
1	15 min	0.74	359	50.00%	52.27%	6856
2	H1	0.74	98	75.61%	75.47%	8429
3	daily	0.74	11	100.00%	100.00%	4398

Table 1 shows the back testing of expert advisor with data test EUR/USD for time frame 15 minutes, 1 hour and daily gives positive profit with highest profit in 1 hour time frame. The number of

transaction decrease as the time frame increase. The percentage of buy and sell position opened increases as the time frame increases.

Table 2. Result for GBP/JPY with w_i evenly distributed.

No	Time frame	a	# transaction	% succes buy	% succes sell	Profit
1	15 min	0.74	97	55.10%	52.08%	-9470
2	H1	0.74	97	63.83%	84.00%	1286
3	daily	0.74	13	100.00%	100.00%	4547

Table 2 shows the back testing of expert advisor with data test GBP/CHF for time frame 15 minutes, 1 hour and daily gives positive profit with highest profit in daily time frame. The number of

transaction decrease as the time frame increase. The percentage of buy and sell position opened increases as the time frame increases.

Table 3. Result for EUR/USD 15 minutes time frame with variation in w_i and a

No	wSTO	wMACD	wRSI	wEMV	a	# transaction	% succes buy	% succes sell	Profit
1	0.15	0.35	0.25	0.25	0.69	311	52.35%	52.47%	7553
2	0.25	0.25	0.15	0.35	0.69	358	50.00%	52.27%	6856
3	0.35	0.15	0.25	0.25	0.69	72	70.59%	76.32%	-3418
4	0.15	0.35	0.45	0.05	0.59	369	48.94%	51.93%	6562
5	0.15	0.35	0.45	0.05	0.69	318	51.81%	52.63%	6454
6	0.4	0.35	0.15	0.1	0.54	373	52.11%	53.01%	9476
7	0.15	0.35	0.1	0.4	0.54	333	56.21%	53.66%	-9135

Table 3 shows that the decrease of a not always increase the number of transaction, profit and the percentage of winning trade.

There is a case when the value of $w_{STO}=0.35$, $w_{MACD}=0.15$, $w_{RSI}=0.25$ and $w_{EMV}=0.25$ the number of transaction drop from above 300 to 72

trade. The percentage of winning trade increase from below 60% to above 70% but it gets negative profit or loss at final result.

The highest profit 9476 is when the $w_{STO}=0.4$, $w_{MACD}=0.35$, $w_{RSI}=0.15$ and $w_{EMV}=0.1$ and the value of a is 0.54

Table 4. Result for EUR/USD 1 hour time frame with variation in w_i and a

No	wSTO	wMACD	wRSI	wEMV	A	# transaction	% succes buy	% succes sell	Profit
1	0.15	0.35	0.25	0.25	0.69	82	74.29%	76.60%	6972
2	0.25	0.25	0.15	0.35	0.69	94	75.61%	75.47%	8429
3	0.35	0.15	0.25	0.25	0.69	13	100.00%	83.33%	4187
4	0.15	0.35	0.45	0.05	0.59	96	76.19%	74.07%	8982
5	0.15	0.35	0.45	0.05	0.69	84	75.00%	77.08%	7924
6	0.4	0.35	0.15	0.1	0.54	100	72.09%	75.44%	6411
7	0.15	0.35	0.1	0.4	0.54	40	77.78%	50.00%	-9534

Table 4 shows that variation in w_i value with the same $a=0.69$ value gives different number of transaction, percentage of winning trade and profit. The average of winning trade increase if compared to 15 time frame above. All the combination gives positive profit except for combination of wSTO=0.15, wMACD=0.35, wRSI=0.1 and wEMV=0.4 and the value of a is 0.54.

There is a case when the number of transaction is the lowest but the percentage of winning trade is the highest with combination of wSTO=0.35, wMACD=0.15, wRSI=0.25 and wEMV=0.25 and the value of a is 0.69.

The highest profit 8982 is when the wSTO=0.15, wMACD=0.35, wRSI=0.45 and wEMV=0.05 and the value of a is 0.69

Table 5 Result for EUR/USD daily time frame with variation in w_i and a

No	wSTO	wMACD	wRSI	wEMV	A	# transaction	% succes buy	% succes sell	Profit
1	0.15	0.35	0.25	0.25	0.69	11	100.00%	100.00%	4398
2	0.25	0.25	0.15	0.35	0.69	11	100.00%	100.00%	4398
3	0.35	0.15	0.25	0.25	0.69	0	0.00%	0.00%	0
4	0.15	0.35	0.45	0.05	0.59	12	100.00%	100.00%	4634
5	0.15	0.35	0.45	0.05	0.69	12	100.00%	100.00%	4634
6	0.4	0.35	0.15	0.1	0.54	11	100.00%	100.00%	4398
7	0.15	0.35	0.1	0.4	0.54	20	85.71%	100.00%	5235

Table 4 shows that variation in w_i value and a do not gives different number of transaction but much less transaction than before, percentage of winning trade and profit significantly. The average of winning trade increase if compared to 15 minutes and 1 hour time frame above with almost of all gives 100%. All the combination gives positive profit except for combination of

wSTO=0.35, wMACD=0.15, wRSI=0.25 and wEMV=0.25 and the value of a is 0.69 gives no profit because there is no opened position.

The highest profit 5235 is when the wSTO=0.15, wMACD=0.35, wRSI=0.45 and wEMV=0.05 and the value of a is 0.69 and the other combinations are goes to 4000's.

Table 5 Result for GBP/CHF 15 minutes time frame with variation in w_i and a

No	wSTO	wMACD	wRSI	wEMV	A	# transaction	% succes buy	% succes sell	Profit
1	0.15	0.35	0.25	0.25	0.69	77	55.00%	56.76%	-9468
2	0.25	0.25	0.15	0.35	0.69	97	55.10%	52.08%	-9417
3	0.35	0.15	0.25	0.25	0.69	76	85.37%	80.00%	1886
4	0.15	0.35	0.45	0.05	0.59	63	50.00%	58.06%	-8280
5	0.15	0.35	0.45	0.05	0.69	48	47.83%	64.00%	-9478
6	0.4	0.35	0.15	0.1	0.54	124	59.38%	56.67%	-8825
7	0.15	0.35	0.1	0.4	0.54	130	57.35%	59.68%	-9475

Table 5 shows that variation in w_i value and a do not gives different number of transaction significantly. Compared to EUR USD in the same time frame it gives much less transaction but gives worse performance in profit. Almost of all combinations gives negative profit or loss. The

combination that gives positive profit is combination of wSTO=0.35, wMACD=0.15, wRSI=0.25 and wEMV=0.25 and the value of a is 0.69. It seems that this system is not suitable for this currency pair at 15 minutes time frame.

Table 6 Result for GBP/CHF 1 hour time frame with variation in w_i and a

No	wSTO	wMACD	wRSI	wEMV	A	# transaction	% succes buy	% succes sell	Profit
1	0.15	0.35	0.25	0.25	0.69	92	68.89%	87.23%	3586
2	0.25	0.25	0.15	0.35	0.69	97	63.83%	84.00%	1270
3	0.35	0.15	0.25	0.25	0.69	16	62.50%	87.50%	-1172
4	0.15	0.35	0.45	0.05	0.59	100	65.31%	84.31%	2404
5	0.15	0.35	0.45	0.05	0.69	96	68.75%	87.50%	4516
6	0.4	0.35	0.15	0.1	0.54	102	64.71%	84.31%	-901
7	0.15	0.35	0.1	0.4	0.54	10	33.33%	100.00%	-8586

Table 6 shows that variation in w_i value and a do not gives different number of transaction significantly. Compared to EUR USD in the same time frame it gives as almost the same number of transaction but gives worse performance in profit. Four combinations give positive profit and three combination gives negative profit.

The combination that gives biggest positive profit is combination of wSTO=0.15, wMACD=0.35, wRSI=0.25 and wEMV=0.25 and the value of a is 0.69. It seems that this system is not suitable for this currency pair at 15 minutes and 1 hour time frame.

Table 7 Result for GBP/CHF daily time frame with variation in w_i and a

No	wSTO	wMACD	wRSI	wEMV	A	# transaction	% succes buy	% succes sell	Profit
1	0.15	0.35	0.25	0.25	0.69	13	100.00%	100.00%	4547
2	0.25	0.25	0.15	0.35	0.69	13	100.00%	100.00%	4488
3	0.35	0.15	0.25	0.25	0.69	0	0%	0%	0
4	0.15	0.35	0.45	0.05	0.59	13	100.00%	100.00%	4547
5	0.15	0.35	0.45	0.05	0.69	13	100.00%	100.00%	4547
6	0.4	0.35	0.15	0.1	0.54	13	100.00%	100.00%	4488
7	0.15	0.35	0.1	0.4	0.54	18	71.43%	100.00%	-1569

Table 7 shows that variation in w_i value and a do not gives different number of transaction but much less transaction than before. Compared to EUR/USD as slight the same time frame the number of transaction, percentage of winning trade and profit given is as the same as EUR/USD. The average of winning trade increase if compared to 15 minutes and 1 hour time frame above with almost of all gives 100%.

All the combination gives positive profit except for combination of $wSTO=0.15$, $wMACD=0.35$, $wRSI=0.1$ and $wEMV=0.4$ and the value of a is 0.54 gives negative profit or loss. There is a case when there is no trade opened which is for combination of $wSTO=0.35$, $wMACD=0.15$, $wRSI=0.25$ and $wEMV=0.25$ and the value of a is 0.69.

Conclusion

The value variation and combination of parameter gives different performance. One combination is good for specific case but not always gives the same performance for other case. It would be better if the parameter combination is optimized not just trial and error.

Back testing using EUR/USD gives 20 combinations providing positive profit, one combination providing zero profit and 3 combinations providing negative profit. Back testing using GBP/CHF currency pair gives 12 combinations providing positive profit, one combination providing zero profit and 11 combinations providing negative profit.

It is important too to use fundamental analysis because sometimes it is not necessary to just rely on technical analysis at least if one knows the fundamental analysis, he/she can choose to just buy or sell.

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