Development of Forex Trading Robot with Money Management

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Abstract

There are three important factors to manage in forex trading: trading analysis, risk management, and money management. The previous paper [ABE17] develop some robots that can analyze forex market based on technical analysis and fundamental analysis. Technical analysis works based on indicators and historical data. Fundamental analysis works based on forex-related news and events that affect forex trends, news reports, economic data, and political events. The result from these experiments show that the performance of technical robots are more robust than fundamental robot.

Meta Trader 4 (MT4) is a platform to do online forex trading. In this paper, some robots are built under this platform, based on technical analysis, completed with risk management and money management. The goal is to compare the performance of technical robots that use various types of risk and money management strategies. There are four types of money management strategies used in this paper: Martingale, Anti Martingale, Position Sizing, and Fixed Lot Size. Two types of risk management used in this paper are Pending Order and Trailing Stop. Seven parameters are used to evaluate robot's performance: total nett profit, gross profit, gross loss, maximum drawdown, total trades, maximum consecutive wins, maximum consecutive losses.

In this paper, some experiments were conducted with backtesting strategy, which use historical forex market data. Experiments show that with the same initial deposit, Martingale Strategy make the largest profit, but with quite high maximum drawdown. Anti Martingale Strategy has the lowest maximum drawdown, which is good for the trader. But on the other hand, make less profit than the Martingale Strategy. In average, the robot that uses fixed lot size for every trade, pending order, and trailing stop balance in making profit and protecting capital (maximum drawdown). With fixed lot size for every trade maintain the same risk size per trade: fifty percent possibility of win and and fifty percent of loss.

Keywords: forex robot, money management, risk management, backtesting strategy, MT4

1. Background and Goals

Foreign exchange (forex) is the largest, most liquid market where all the world's currencies are traded. There are eight major currencies in forex market: U. S. Dollar (USD), European Euro (EUR), Japanese Yen (JPY), British Pound (GBP), Swiss Franc (CHF), Canadian Dollar (CAD), Australian/ New Zealand Dollar (AUD/NZD), and South African Rand (ZAR). These currencies are traded in pairs. The most liquid currency pair is EUR/USD. The quotation EUR/USD = 1.1500 means that 1 Euro is exchanged for 1.1500 U.S. Dollars.

Forex trading open 24 hours a day, 5 days a week, and can be accessed online via a software platform called Meta Trader 4. Market price actions are displayed in form of chart. There are some strategies used in forex trading to analyze this chart and then to predict the next action to take. Technical analysis is a strategy to analyze market price direction based on statistical judgements of the historical data. There are many technical indicators that can be used to do market analysis and to predict price movement in Meta Trader 4. Fundamental analysis works based on economic, social, and political news that affect the forex market price.

Forex trading robot automates the process of open and close trading position. It heps traders determine whether to buy or sell a currency pair at any given time based on a set of rules (automatic analysis) without any destructive emotion like greed, fear, or bias. It can operate 24 hours a day/ 5 days a week continuously without break.

One of many forex advantages is a trader can use leverage. It can be used to multiply trader's initial capital up to hundreds of times. It multiplies a trader's profit, but also on the other hand, a trader's lose. It's like a double-edged sword. In fact, every open trade has 50% possibility of win and 50% possibility of losing. Based on these facts, a trader must have strategies to manage initial capital and trading risks.

Some experiments from the previous paper [ABE17] show that there is no 100% accurate indicator to predict the market prices and trends. Because of this reason, traders must protect their capital by manage risk for every open trading position. This paper build some robots that can automate the process to open, modify, and close trade in forex with various types of risk and money managements. The goal is to compare their performance by various evaluation parameters, i.e.: *nett profit, gross profit, gross loss, maximum drawdown, total trades, maximum consecutive wins,* and *maximum consecutive losses*.

2. Market Analysis

There are many strategies and indicators that can be used to analyze market prices movement. This paper build a robot that use resistance and support indicators to make decision to open

buy or sell order. This robot is then modified by some types of money management and risk management.

2.1 Resistance

As can be seen in Fig. 1, Resistance is the level in market price chart where the uptrend price change direction downward. This level happened when the price can't move any higher.

2.2 Support

On the contrary with resistance, support is the level in market price chart where the downtrend price change direction upward. This level happened when the price can't move any lower.

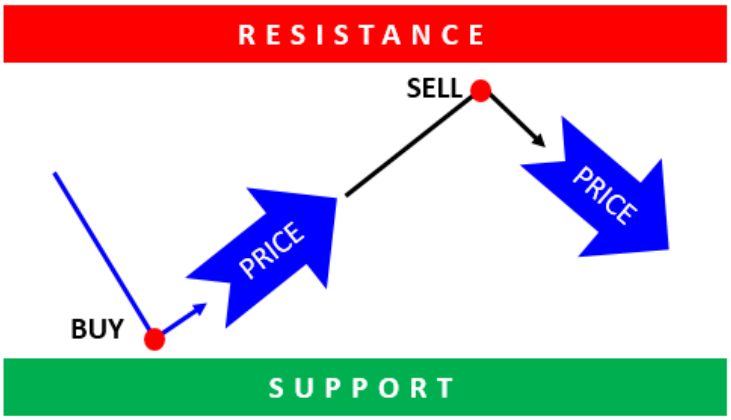

Fig. 1: Resistance and Support

2.3 Breakout Strategy

There are various ways to do market analysis. This paper use resistance and support line to do market analysis. The basic of this strategy is to buy low and to sell high. It waits to enter the market when the market begin to open daily. It begin to make support and resistance level when the market haven't started to fluctuate. When the market price move and breakout resistance level, then the strategy will start to open a buy order. On the contrary, when the market price breakout the support level, it will start to open a sell order. The order will be closed until it reach a certain level of target profit or a certain level of optimum risk defined by the trader.

3. Risk Management

Future forex prices are unknown. Neither by using technical nor fundamental analysis, there's no 100% accurate prediction. No matter how strong the analysis poiting to a particular trend, every open trade is a risk. The risk of forex trading is when the trader open a position and then the market move against this open position. Two scenarios of these possibilities are: (1)

The trader open a buy order, but the market price decline or (2) The trader open a sell order, but the market price increase.

To manage this risk, traders need to limit the risk of every open trades. By doing this, trader ensures to survive when the market go against any open positions. There are various ways to manage forex trading risks. Some strategies that are discussed and experimented in this paper are by using pending order, trailing stop, and control the lot size for every open position.

3.1 Pending Order

Pending order is an order that have not yet become an active trade, but will be triggered to be active after the market price reaches a certain point. By using pending order, traders can determine to open a position just at a certain level of price. It allows traders to buy at low price and to sell at high price.

3.2 Trailing Stop

Stop-loss order is an order that will close trader's open position because it reach certain point of loss. Trader can determine the maximum level of loss risk for every open trades. This level can be determined either statically or dynamically. Statically, traders must adapt this level in a volatile market or in a quiet market. In quiet market, *x* pips can be means a large move. On the contrary, in volatile market, the same *x* pips can be means as only a small move.

Trailing stop is a stop-loss order that will be adjusted dynamically as the trade moves in the trader's favour. It can diminish loss risk and lock trader's profit. This may be quite useful in a fast moving markets.

4. Money Management

To minimize the risk in forex trading, one of the important thing to do by any forex trader is to manage trader's capital. There are some ways to manage trader's capital in forex:
(1) Fixed size of lot size for every open trade,
(2) Position sizing,
(3) Martingale,
(4) Anti Martingale.

4.1 Fixed Size

Forex is a very upredictable market. Many factors can affect market price fluctuation. Not only economic, political issues, historical data, but also market trends at a particular time. There is no a hundred percent accurate tools to predict the next market price movement. That's why, there always risk for every open trade. There always the same possibilities of win

and loss in every open trade. Based on this fact, the basic strategy in forex is by using the same lot size for every open trade.

4.2 Position Sizing

On the contrary with fixed size, position sizing refers to a strategy to calculate the size of an open position or the amount of money that a trader is going to trade. It's another important factor beside strategy to enter and exit trade that determine the success of a trade. It's a double-edged sword. It can make big profits, but it can also lead to big losses as well. If a trader predict that the market trend is going to follow his prediction, the trader open a bigger lot size. Otherwise, it should be smaller size. So in position sizing, the lot size is adjusted based on trader's analysis and prediction.

4.3 Martingale

Martingale is a strategy that doubles the amount of order after every loss. The idea is derived from the same possibilities of win and lose for any open trade. The same way like flipping a coin, it can be head or tail. If a trader choose the same order type over and over (for example buy order), it will eventually be right. It could be very profitable, but also could danger trading account. Theoretically, the first win would recover all the previous losses and turn into a profit. But in fact, it's the riskiest strategies available. It needs a big amount of initial capital to make the trader can keep trade without get any margin call. On the other hand, it's very useful to face the very dynamic and volatile nature of forex market.

4.4 Anti Martingale

Anti-Martingale is the opposite version of Martingale strategy. It's a strategy that doubles the amount of order for every win trade, and halves the size for every loss trade. It's less risky compared with Martingale strategy, because it increases trade size during a winning streak.

5. Online Forex Trading Platform

This paper developed some forex trading robots under Meta Trader 4 (MT4) terminal. It is an online forex trading platform, developed by MetaQuotes Software. It provides many resources to allow traders and also trading robots to enter the online forex market. Traders can analyze the market price using various charts and indicators provided by MT4, or by their own developed indicators. Based on this analysis, traders can open, modify, or close any buy or sell order online at any time. All of this actions can be made fully automatic by using forex trading robot.

Fig. 2 shows the Integrated Development Environment of Meta Trader 4 terminal. From left to right: the first window shows the environment to develop forex trading robot using MQL4

programming language. The main window is showed at the middle. Forex traders watch the forex market through this window. Traders can choose currency pairs that want to trade, watch the market price chart, and use some indicators to analyze the chart. The rightmost window is a window for open, modify, or close a trade.

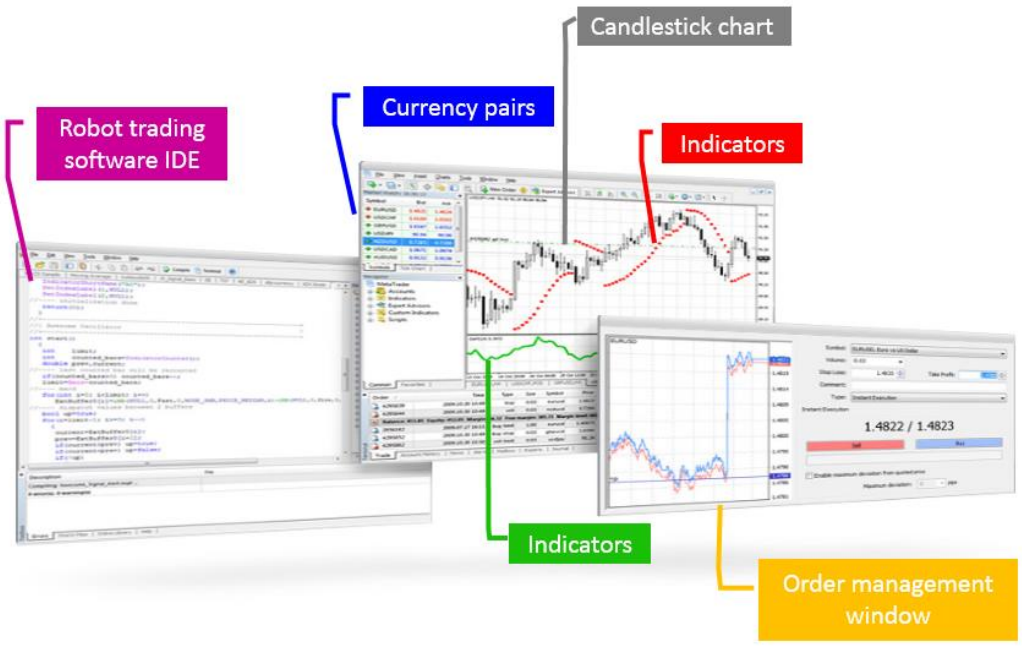

Fig. 2. MetaTrader 4 Trading Terminal

6. Automated Forex Trading Robot

In this paper, some forex trading robot are build under Meta Trader 4 trading platform [YOU10]. They can automate the process of open and close order based on some predefined rules. The rule is defined based on technical analysis, equipped with risk and money management. The goal is to compare the performance of each robot that is and isn't equipped with risk and money management.

6.1 Daily Breakout Robot

In this research, the algorithm of the trading robot works based only on technical analysis. This robot use resistance and support line to open order decision. It works based on this rule:

1. Open buy order if the price crosses above resistance level
2. Exit trade when the price breaks above the open price plus 100 pips
3. Open sell order if the price crosses below support level
4. Exit trade when the price breaks below the open price minus 100 pips.

6.2 Daily Breakout Robot with Money Management

The goal of this research is to compare many types of money management discussed at part 4.

So based on the daily breakout robot rule explained at 6.1, some robot are build with some new modification that equipped this basic robot with many types of money management rules: fixed size, position sizing, martingale, and anti-martingale. And also with risk management rules: pending order and trailing stop.

7. Experimental Setup and Result

Some experiments were conducted to compare the performance of robots that are equipped or not with money management. Table 1-2 show the result. The performance of each robot is evaluated based on the total nett profit, gross profit, gross loss, maximal drawdown, total open trades, maximum consecutive wins, and maximal consecutive losses. The following data is the explanation of each evaluation parameter:

1. *Total net profit*: difference between "gross profit" and "gross loss".
2. *Gross profit*: the sum of all profitable trades.
3. *Gross loss*: the sum of all unprofitable trades.
4. *Maximal drawdown*: the largest loss, in percent of the deposit
5. *Total trades*: total amount of trade positions.
6. *Maximum consecutive wins*: the longest series of profitable trade.
7. *Maximum consecutive losses*: the longest series of unprofitable trade.

These experiments are divided into two different setup time. The first works in 1 hour period for 1 year. The next experiment works in 15 minutes period for 1 year. EUR/USD is chosen for these experiments as it's the most volatile currency pair in forex trade. Figure 3-14 represent the account balance graphs of these experiments.

From each evaluation parameter in these experiments, as can be seen from Table 1 and Table 2, the strategy that gets the highest performance is:

1. Total net profit: Martingale Strategy.
2. Gross profit: Position Sizing Strategy.
3. Gross loss: Anti Martingale Strategy.
4. Maximal drawdown: Anti Martingale Strategy.
5. Total trades: Pending Order - Trailing Stop - Fixed Size Strategy.
6. Maximum consecutive wins: Martingale-Restart After Loss, Anti Martingale, Position Sizing Strategy for the first experiment. Pending Order - Trailing Stop - Fixed Size Strategy for the second experiment.
7. Maximum consecutive losses: Martingale-Restart After Loss, Anti Martingale, Position Sizing Strategy for the first experiment. Pending Order - Trailing Stop - Fixed Size Strategy for the second experiment.

Table 1. The first experimental setup and result

Experiment duration : 1 year
Symbol : EUR/USD
Period : 1 hour (H1)
Bars in test : 7,212
Initial deposit : 10,000.00
Technical Strategy : Daily Breakout
Robot's Types : (1) Martingale,
(2) Martingale – Restart Afer Loss
(3) Martingale – Restart After 5 Consecutive Loss
(4) Anti Martingale
(5) Position Sizing
(6) Pending Order, Trailing Stop, Fixed Size

Robot's Money & Risk Management	Nett Profit	Gross Profit	Gross Loss	Max. Draw down	Total Trades	Max. cons. wins	Max. cons. losses
(1)	**2,701.24**	10,901.35	-8,200.11	27.49%	44	4	6
(2)	438.04	6,773.98	-6,335.94	10.71%	281	**8**	**13**
(3)	-4,251.7	606.62	-4,858.32	59.68%	24	3	6
(4)	170.36	1,574.77	**-1,404.40**	**3.30%**	280	**8**	**13**
(5)	-1,006.26	**67,632.01**	-68,638.27	72.74%	280	**8**	**13**
(6)	1,888.34	10,505.38	-8,617.04	7.98%	**411**	7	9

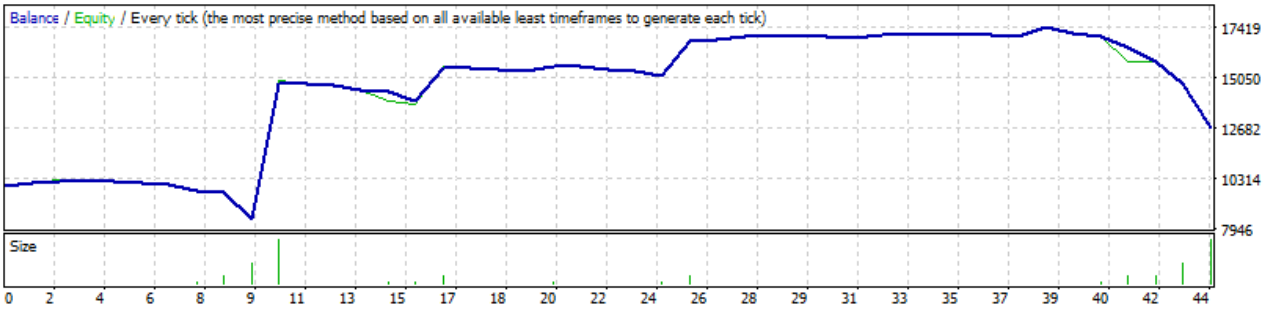

Fig. 3: Daily Breakout Martingale Strategy – H1

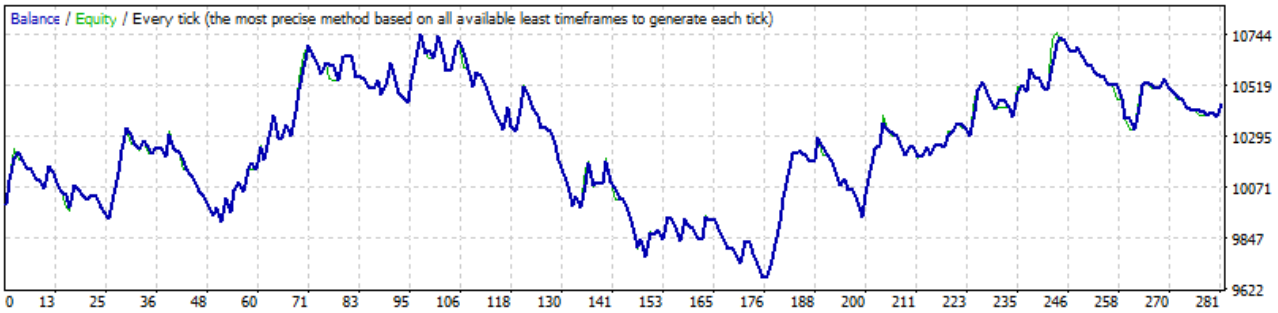

Fig. 4: Daily Breakout Martingale – Restart After Loss Strategy – H1

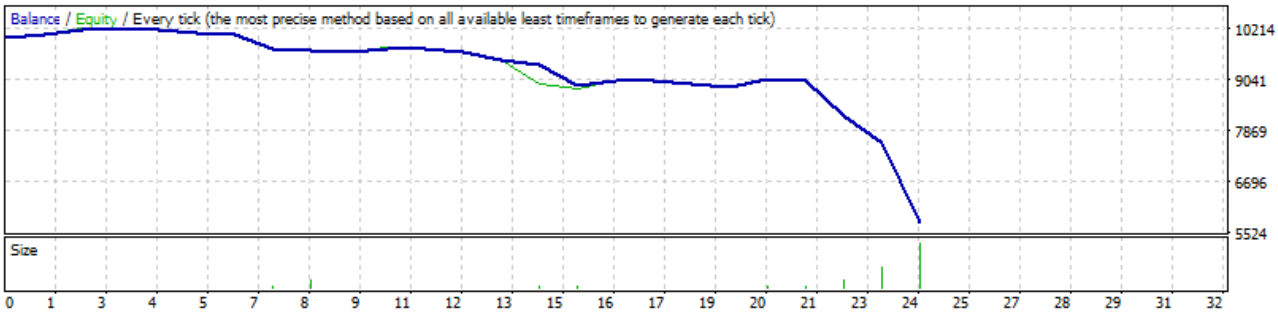

Fig. 5: Daily Breakout Martingale Strategy – Restart After 5 Consecutive Loss – H1

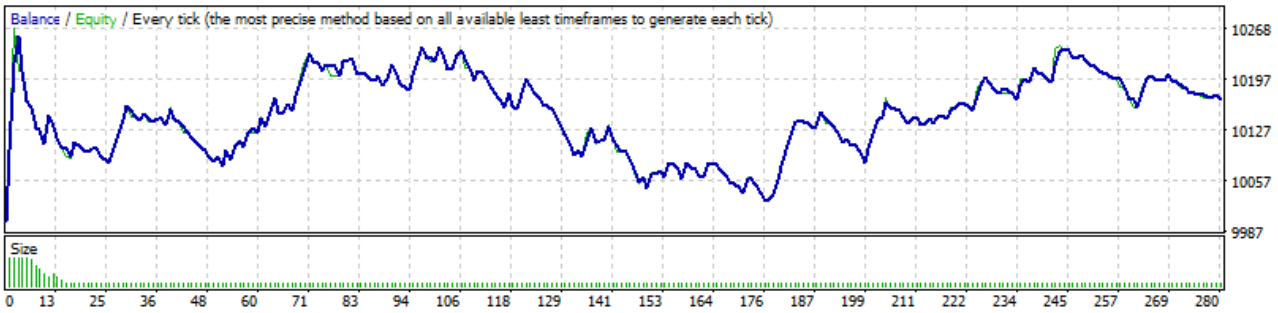

Fig. 6: Daily Breakout Anti-Martingale Strategy – H1

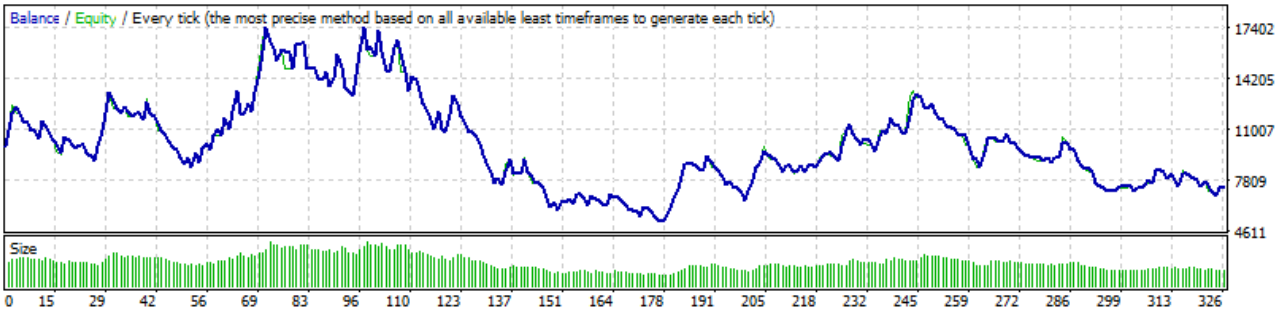

Fig. 7: Daily Breakout Position Sizing Strategy – H1

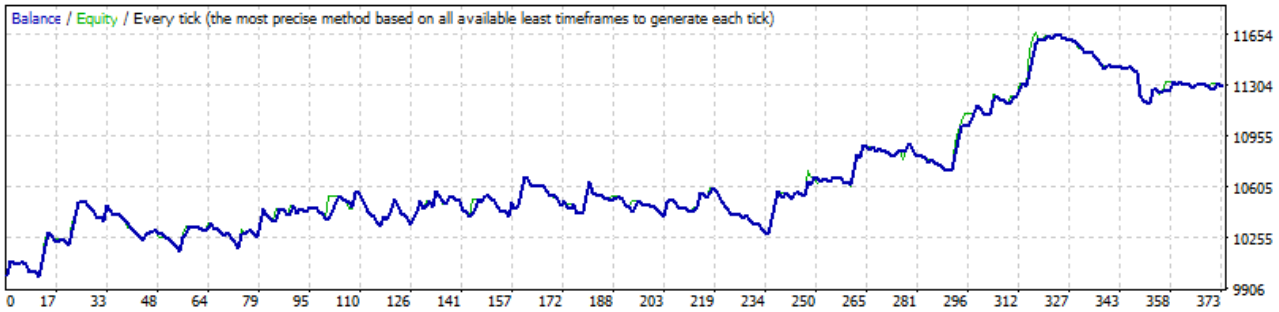

Fig. 8: Daily Breakout with Pending Order, Trailing Stop, Fixed Size – H1

Table 2. The second experimental setup and result

Experiment duration : 1 year
Symbol : EUR/USD
Period : 15 minutes (M15)
Bars in test : 28,845
Initial deposit : 10,000.00
Technical Strategy : Daily Breakout
Robot's Types : (1) Martingale,
(2) Martingale – Restart Afer Loss
(3) Martingale – Restart After 5 Consecutive Loss
(4) Anti Martingale
(5) Position Sizing
(6) Pending Order, Trailing Stop, Fixed Size

Robot's Type	Nett Profit	Gross Profit	Gross Loss	Max. Draw down	Total Trades	Max. cons. wins	Max. cons. losses
(1)	**11,838.56**	33,576.09	-21,737.52	29.77%	171	4	9
(2)	238.97	4,287.09	-4,048.11	5.24%	280	4	9
(3)	1,188.50	3,333.20	-2,144.70	15.36%	12	2	3
(4)	**93.82**	**990.29**	**-896.46**	**1.49%**	280	4	9
(5)	239.44	**38,417.56**	-38,178.12	46.58%	280	4	9
(6)	1,300.54	6,355.54	-5,055.00	4.82%	**373**	**5**	**9**

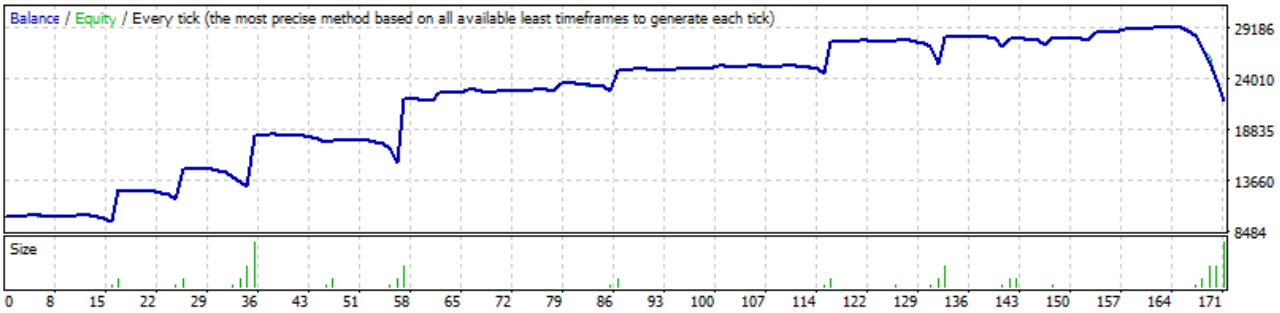

Fig. 9: Daily Breakout Martingale Strategy – M15

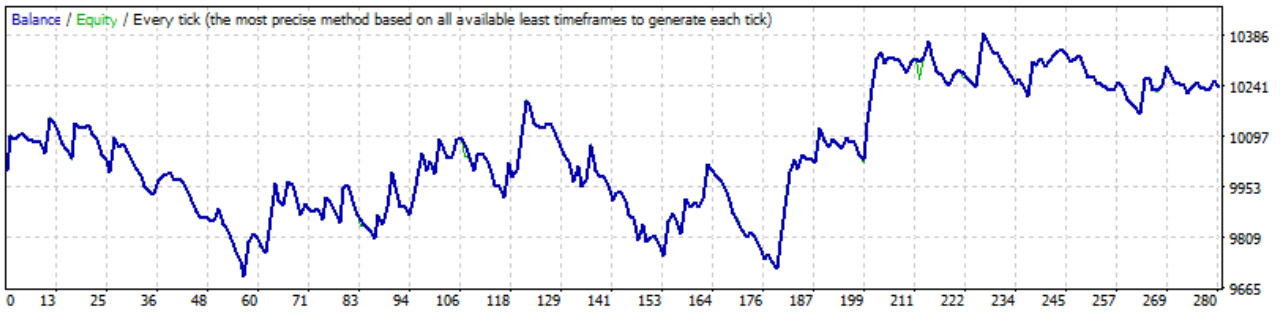

Fig. 10: Daily Breakout Martingale – Restart After Loss Strategy – M15

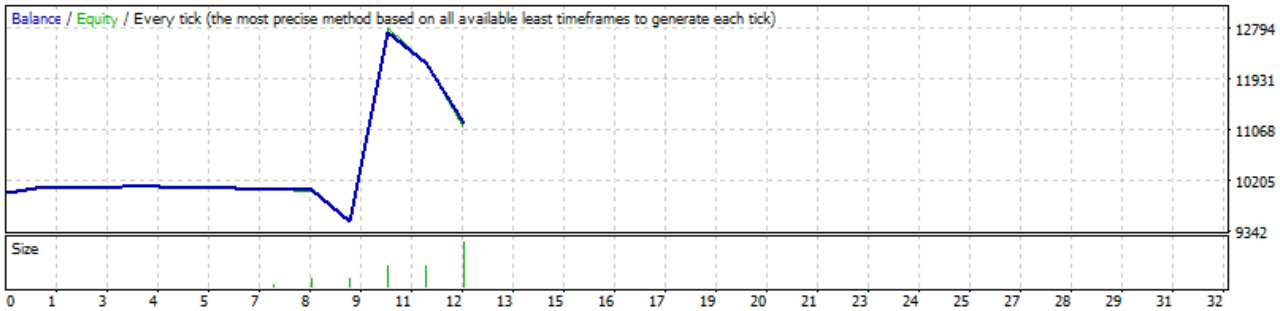

Fig. 11: Daily Breakout Martingale Strategy – Restart After 5 Consecutive Loss – M15

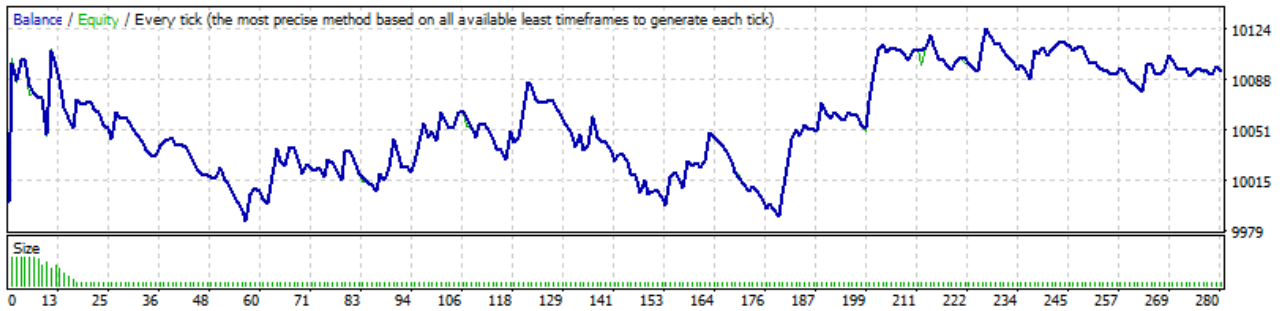

Fig. 12: Daily Breakout Martingale Strategy – Restart After 5 Consecutive Loss – M15

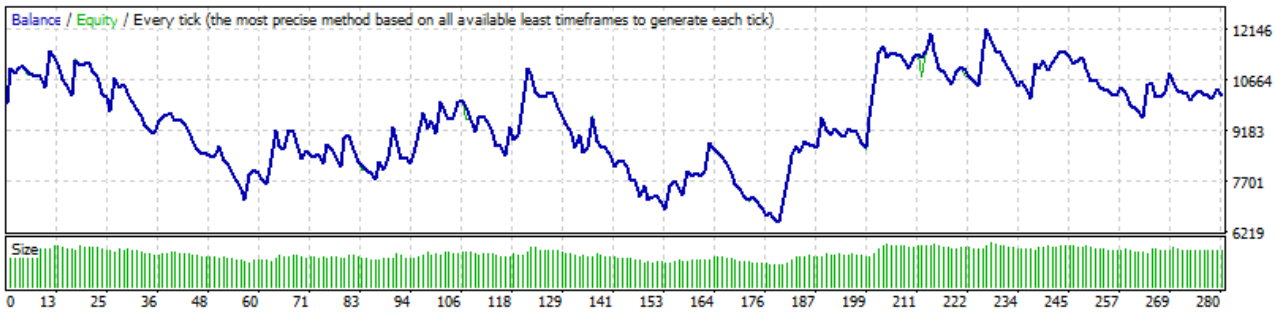

Fig. 13: Daily Breakout Position Sizing – M15

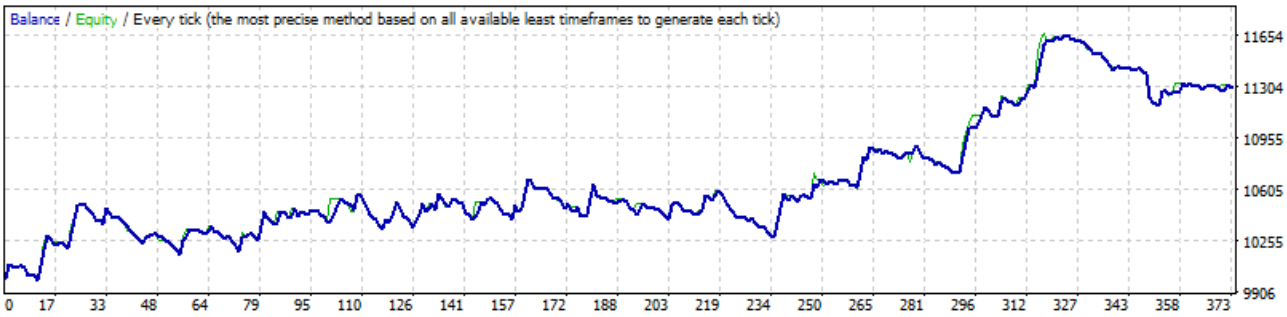

Fig. 14: Daily Breakout with Pending Order, Trailing Stop, Fixed Size – M15

8. Conclusion

Experiments show that Martingale Strategy get the highest total net profit. It has a high potential profit, but also on contrary, quite high maximum drawdown. So a trader needs a huge amount of capital to use this strategy. This strategy double up on a poor decision. It causes a lot of losses, as can be seen from the second experiment it has the highest maximum consecutive losses. Anti Martingale Strategy double up on a good decision. It has the smallest maximum drawdown from both experiments. So it can be concluded that it is the most safety strategy as it follows market trend. But on the other hand, the total net profit gain is not as high as the Martingale Strategy. The most active robot is the robot that use fixed lot size for every open trade. It isn't equipped with any money management. It only use trailing stop to manage the potential risk of every open trade. From the nett profit parameter, it gets the second highest position after Martingale Strategy. And maximum drawdown is quite low. It is the second best after Anti Martingale Strategy. So in average, this robot has a balance in making profit and protecting trader's capital.

9. References

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