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Comparison between the Expert Systems of SAR and BOLL

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Abstract. This paper presents tests and comparisons between SAR and BOLL, tow security transaction expert systems, through statistical experiments, with the wining rate, annual rate of return and net profit rate as the management objectives, on basis of the mass data generated by the security market; the results suggest a ratio among the wining rate, annual return rate and net profit rate of the two as 0.876, 0.936 and 0.936 respectively, and the yearly numbers of transactions of SAR is 3.7 times more than that of BOLL. The lower rate of SAR is, as believed, a result of the higher transaction cost of it comparing with BOLL.

Introduction

In global financial trade, technical analysis method is an important and more popular method. In technical analysis method, the common software expert system is essential[1-3]. Currently we use the annual rate of return, win rate, and net profit rate as management goal to comparatively analyze two special expert systems SAR and BOLL[4]. SAR (Stop and Reverse), also known as Trajectory Reverse or Reverse Operating Point, created by American technical analysis guru Wells Wilder, is a medium- and short-term technical analysis tool to determine the moving trend of the stock price. SAR focuses on both price and time as well as the moving average, with the points in SAR moved in trajectories, such is the origin where the name of Trajectory Reverse derives from.

SAR is made available by two steps. The first step is to stop loss, which requires the investor to determine a stop price before buying or selling a specific stock to control the investment risk, while such price is rather volatile in its constant repositioning with the fluctuating stock price. Investors are seeking the opportunity of big return with the potential risks put under control, yet the moving trends of different stocks in different period of time are varied under the volatility of the market profile, in which a excessively high stop price may result in missing the opportunity of a big return by a selling operation when the stock price drops back, ensued by a new wave of price soar, whereas the excessively low stop price means nothing in risk control. Therefore the determination of the precise stop price is the focal point of various theories and indexes of technical analysis, which is exactly the goal SAR serves.

The second step is to Reverse, which requires the investor to close out when the stock reaches the predetermined stop price, and to go short at the same time to maximize the profit. Such move is practicable in stock markets with available short mechanisms, in which the investors maintain their profit by either dumping the stock and holding out when price drops down below the stop price, or buying in or holding the stock when the price soars above the threshed indicated by the SAR index.

The formula of the SAR reverse index is as follow[5]:

$$SAR_n = SAR_{n-1} + AF\left[EP_{n-1} - SAR_{n-1}\right] \tag{1}$$

$$0.02 \le AF \le 0.2 \tag{2}$$

$$EP_n = \max C_n \tag{3}$$

or

$$EP_n = \min C_n \tag{4}$$

Fig. 1 SAR Expert System

Fig. 2 BOLL Expert System

Empirical Analysis of SAR and BOLL Expert System (shown in Fig. 1, 2).

Experiments and Results.

(1) The SAR expert system is derived from the following array of rules:

A buy-in signal is triggered when the stock price breaks through the SAR curve from below, indicating the prospect of a possible raising of stock price, marking the window where the investors shall buy in the stock immediately.

The raising of the stock price takes shape when the up-trend movement of the stock is still gaining momentum while the SAR curve moves upward along with, with the latter providing powerful support to the stock price. In such case the investors shall hold the stock steadily or buy in the stock at a low price.

The sell-out signal is triggered when the stock price drops down below the SAR curve from above, predicting the possibility of a new wave of drop, marking the window where the investors shall immediately sell out the stock.

The drop of the stock price takes shape when the down-trend movement of the stock is still gaining momentum while the SAR curve moves downward along with, with the latter posing great pressure on the stock price. In such case the investors shall hold out steadily or reduce their holding at a high price.

Special Standards for Determination of Trajectory Reverse:

The short side is gaining upper hand when the downward trait of the SAR curve pitches over 45°, where the stock price drops drastically in a sustained manner. In such case the investors shall hold out steadily and be cautious about the rebound.

When the SAR curve moves upward for a considerable period of time, with its moving trait pitching upward below 45°, and with drastic soaring of price in short terms, suggesting the possibility of a reverse in stock price at any time due to the overstretch of the long side, the investors shall keep a close look at the trend of the SAR curve, and be determined to make liquidation when any obvious signal of sell-out is triggered by the SAR index.

When the SAR curve starts moving upward with the pitching angle over 45°, suggesting the long-side is gaining momentum and the price is to go upward in a sustained manner, the investors shall hold their stocks steadily for the price raise.

When the SAR curve moves downward for a considerable period of time (3 months at least) with the pitching angle below 45°, and a sudden uptrend surge emerges and punches through the SAR curve from below, signaling the possible end of a medium- or long-term of price drop, the investors shall start buy in the stock at a low price.

When the SAR curve moves upward with the pitch angle below 45°after a considerable period (3 months at least) of downward consolidation, signaling the strength of the short side being drained up and the long side gaining momentum, predicting the prospective of a new wave of price raise taking shape in a sustained manner, the investors shall hold their stocks steadily for the price raise.

SAR expert system source code

The figure of main

```
X1:=(3*C+L+O+H)/6;X2:=(20*X1+19*REF(X1,1)+18*REF(X1,2)+17*REF(X1,3)+16*REF(X1,4)+15*REF(X1,5)+14*REF(X1,6)+13*REF(X1,7)+12*REF(X1,8)+11*REF(X1,9)+10*REF(X1,10)+9*REF(X1,11)+8*REF(X1,12)+7*REF(X1,13)+6*REF(X1,14)+5*REF(X1,15)+4*REF(X1,16)+3*REF(X1,17)+2*REF(X1,18)+REF(X1,20))/210;
AA:MA(X1,3),COLORRED,LINETHICK2;
BB:= SMA(AA,3,1),COLORFFFF00;
L1:=HHV(H ,1 );L2:=FORCAST(L1,3);L3:= (EMA(C,5)*7+EMA(C,5)*3)/10;L4:= MA(C,13);
positions:IF(CLOSE>SAR(4,2,20),SAR(4,2,20),DRAWNULL),CIRCLEDOT,COLORMAGENTA;
Short positions: IF(CLOSE<SAR(4,2,10),SAR(4,2,10),DRAWNULL),CIRCLEDOT, COLORGREEN; {CLOSE,CIRCLEDOT,COLORBLACK;}DKX1:= EMA(C,5);
```

The system of trade

```
N 1 100 10;
STEP 1 100 2;
MAXP 1 100 20;
TURN:=SARTURN(N,STEP,MAXP);
ENTERLONG:TURN=1;
EXITLONG:TURN=-1;
```

(2) Experiment Platform: Great Wisdom Securities Information Platform V5.99 version.

(3) Experimental Parameters: To take a position of all funds by one time or to close all positions when meeting the condition, and the transaction cost is taken as 0.5%.

(4) Experiment Samples: Daily-line data of all A shares (2012.12-2013.5) in Shenzhen Securities Market.

(5) Experiment Process, Time and Results:

Table 1 Test Results of SAR Expert System

The Test Settings for the System

Testing method: the stock selection formula—SAR buy in
Testing time: December 3, 2012—May 30th, 2013 regardless of forced liquidation
Tested stocks: 1522 in total   Initial launching: 40,000 Yuan
Buying condition:
One of the following groups is true:
1. the stock selection formula: SAR buy in (10,2,20) [daily line]
When the condition is met: according to medial rate: closing price to buy in with all the funds
When continuous signals appear: stop buying
Liquidate condition: (close out according to the closing price)
Select stocks by indicators: the stock selection formula: SAR sell out (10,2,20) [daily line]

The Test Report Abstract for the System

The number of Tested stocks: 1,522
Annual rate of return: 31.26%   Annual number of trades: 13,166.40
Win rate: 77.93%   Success rate: 77.93%
Average profit: 1,445.26 Yuan   The annual average number of signals: 27,415.20
The greatest single profit: 18,971,.09 Yuan   The greatest single loss: -10,463.69 Yuan
Number of trades: 5,486   Number of profitable trades: 4,275(account for 77.93%)
Net margin: 7,928,696.00 Yuan   Net margin rate: 13.02%

Comparative Analysis Results(shown in Fig. 3, 4)**.**

Table 2 Comparative Analysis Table

	Winning Percentage	Annual Rate of Return	Net Profit Margin	Annual Transaction Number
SAR Expert System	77.93	31.26	13.02	13,166.40
BOLL Expert System	88.95	33.37	13.90	3,561.60
RSI Expert System	85.57	75.70	31.54	6,837.60
Ratio of SAR Results over BOLL Results	0.876,1	0.936,7	0.936,6	3.696,7

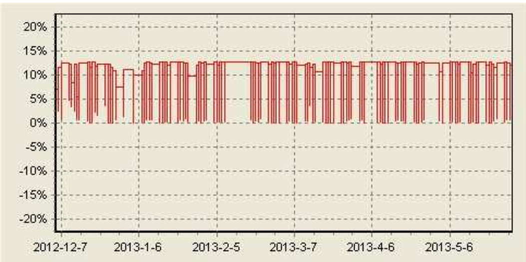

Fig. 3 SAR Yield Curve Chart

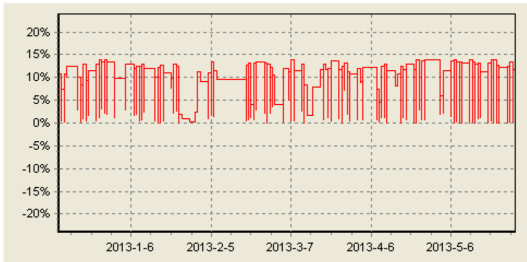

Fig. 4 BOLL Yield Curve Chart

Conclusion.

In this paper, the SAR expert system is analyzed from the perspective of the wining rate, annual rate of return and the net profit rate, as the closest concern of the investors. Comparisons between SAR and BOLL suggest small differences among them between their performance on wining rate, annual rate of return and net profit rate, with the former slightly inferior to the latter; yet SAR dominates absolutely in terms of the number of annual transactions (3.7 times of the BOLL), suggesting the low profiting rate of SAR due to its higher transaction cost, despite of the more transaction opportunities SAR provides. Further comparisons between the expert systems of SAR, BOLL and RSI suggest RSI as the optimal choice for investors.

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