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An Empirical Analysis of W&R Based on Listed Companies' Investments in Vocational Education

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Abstract. W&R, an expert system of securities trading software, is tested through statistical and empirical analyses based on true data about vocational education on securities that are publicly available. With annual net profit margin, rate of return and win as management objectives. The non-directional W&R indicators are empirically analyzed based on theories of mathematical statistics. At last, annual rate of return and net profit margin of the W&R are determined to be 61.62 and 61.63% of Shanghai Stock Exchange indexes. Investment solutions with a win rate of 59.72% and an annual rate of return that is 6.6 times as high as annual interest rate of bank deposits are optional for those investors who are crazy about seeking high profits and willing to undertake risks.

Introduction

In the global financial transactions, technical analysis is an important ad more popular method. The software expert system often used in technical analysis method is necessary. Huang et al. studied average line expert system MA and anti trend expert system RSI [1] and concluded that besides annual transaction times, RSI expert system was overall superior to MA expert system in the win rate, annual rate of return and net profit rate. They also studied anti tread expert system RSI, BIAS, KDJ and W&R [2-3] and concluded RSI expert system was the best in the annual rate of return and net profit margin based on test results and W&R was the worst. RSI net profit margin and annual rate of return were approximately 5 times better than W&R. And BIAS expert system reached up to 98.54% in the success rate and W&R reached up to 7,658.40 in annual transaction times. Now we make empirical analysis with annual net profit rate, rate of return and success rate as the management objective, the vocational educational sector of listed companies as the sample, and W&R expert system as the analytical tool.

Williams %R, or abbreviated as W%R, was released on a book titled How I made one million dollars last year trading commodities, which was published by Larry Williams in 1973. It measures whether stocks are over bought or sold as an oscillator based on swing points of stock prices. By measuring the gap between the peak value (i.e. ceiling price) arising from long or short position and daily closing price, and the ratio at which stock prices fluctuate within certain period, this index

may offer signs about trend reversal in stock market.

Mathematically, formulas of Williams Overbought/Oversold, WMS%R) are as follows [4]:

$$\%R = \frac{high_{Ndays} - close_{today}}{high_{Ndays} - low_{Ndays}} \times (-100\%) \quad . \tag{1}$$

$$\begin{aligned} &(close_{today} - low_{Ndays}) - (close_{today} - high_{Ndays}) \\ &= high_{Ndays} - low_{Ndays} \end{aligned} \quad . \tag{2}$$

$$W\%R = \frac{C_n - H_n}{H_n - L_n} \times 100\% \, . \tag{3}$$

Where, n is trading period defined by traders; C_n is closing price within n days; L_n is the minimum price within n days; and H_n is the ceiling price within n days.

Fig. 1 W%R expert system

Fig. 2 Shanghai Stock Exchange Indexes

Empirical Analysis of W%R (Fig. 1)

Experiments and Results

(1) Experimental Procedures

W%R has been designed as an index for measuring if stocks are oversold or overbought according to Oriental philosophy that when a thing reaches its extreme, it reverses its course. It measures overbought and oversold phenomena in stock market based on swing points, in order to predict highs and lows within a cycle [3].

1. When W%R is above 80, the stocks will be oversold and their prices are approaching the valley that investors can consider buying the stocks.

2. When W%R is below 20, the stocks will be overbought and their prices are reaching the peak that investors can consider selling the stocks.

3. Once W%R fluctuates within a range of high values, the stock prices will generally decline, and if not, which deviates from stock market prices, investors shall sell their stocks.

4. Provided that W%R fluctuates within a range of low values, the stock prices will generally rebound, and if not. Instead, it will be not in line with stock market practices.

5. Investors will be suggested to buy or purchase in case that W%R reaches its peaks and valleys for several consecutive times, or double or multiple peaks or valleys are generated in local areas.

Source Codes of W%R

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N 2.00 100.00 14.00
LL 0.00 100.00 20.00
LH 0.00 100.00 80.00
WR=100*(HHV (HIGH, N)-CLOSE)/(HHV(HIGH,N)-LLV(LOW,N));
ENTERLONG: CROSS (WR, LH);
EXITLONG: CROSS (WR, LL);
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(2) Experimental platform: Great Wisdom Software Version 5.99, Guosheng Securities

(3) Experimental parameters: open a position or close out a position just for once for funds that meet pertinent requirements and the trading costs shall be determined as 0.5% of the funds.

(4) Experimental samples: daily data about vocational education from March 2016 to April 2017.

(5) Experimental processes, time and results: dependent upon test results of W%R:

Table 1 Test Results Based on W%R Expert System

Setting of System Test
Test method: technical indicator - W&R
Test time: from 1st March 2016 to 11th April 2017
Number of Tested Compulsorily Closed Stocks: 25 Initial Investments: RMB40,000.00
Requirements for buy:
The stocks shall be bought in any of following cases:
1. All following requirements are met.
1.1. Technical indicator: The average of W&R (10,6), denoted by WR1, is below WR2 (i.e. Day-based moving average)
If the above technical indicator is reached, all funds can be invested in buying stocks at average or closing price.
In case of any continuous signal, investors are not suggested to buy more.

Requirements for selling: none
Requirements for closing position: closed out at closing price
Index-based stock selection: Technical indicator: The average of W&R (10,6), denoted by WR1, is above WR2

Summary of System Test

Quantity of Tested Stocks:	25		
Annual Rate of Return:	11.56%	Trades per Year:	132.92
Win Rate:	59.72%	Success Rate:	58.11%
Average Revenues:	RMB869.97	Signals per Year:	269.54
Maximum Profits from a Trade:	RMB19,613.72		
Maximum Losses from a Trade:	RMB15,294.90		
Number of Trades:	144		
Number of Profit Trades:	86 (59.72%)		
Net Profits:	RMB125,276.00	Net Margin:	12.53%
Net Profits from Simple Stock Holdings:	RMB203,985.03		
Net Margin of Simple Stock Holdings:	20.40%		
Net Profits from Ideal Models:	RMB9,325,434,880.00		
Net Margin of Ideal Models:	932,543.50%		

Report on System Test

Quantity of Tested Stocks	25		
Net Profits:	RMB125,276.00	Net Margin:	12.53%
Total Profits:	RMB251,353.64	Total Losses:	RMB-126,077.05
Number of Trades:	144	Win Rate:	59.72%
Average Number of Trades per Year:	132.92		
Number of Trades with Profits/Losses:	86/58		
Total Amount of Transactions:	RMB5,856,403.00		
Transaction Cost:	RMB5,187.33		
Maximum Profits from a Trade:	RMB19,613.72		
Maximum Losses from a Trade:	RMB-15,294.90		
Average Profits:	RMB1,745.51		
Average Losses:	RMB-875.54		
Average Revenues:	RMB869.97		
Average Profits/Losses:	-199.37		
Max Number of Consecutive Profit Trades:	9		
Max Number of Consecutive Trades with Losses:	4		
Average Period of Trading:	18.56		
Average Period of Profit Trades:	17.66		
Average Period of Trades with Losses:	19.88		
Coefficient of Revenues:	0.33		
Max Fluctuating Revenues:	RMB1,094,549.00		
Max Fluctuating Losses:	RMB0.00		
Difference between Max Fluctuating Revenues and Losses:	RMB1,094,549.00		
Total Investments:	RMB1,000,000.00		

Statistics of Buy Signals
(Statistically record all buy signals without considering signals which are deleted in transaction tet

because of funds and strategies)			
Success Rate:	58.11%	Number of Signals:	148
Average Number of Signals per Year:	136.62		

Analysis of Results

Table 2 Comparative Analysis Sheet

	Win Rate	Annual Rate of Return	Net Margin:	Average Number of Trades per Year
W&R	59.72	11.56	12.53	132.92
Shanghai Stock Exchange Indexes		18.76	20.33	
Ratios between W&R Indexes and Shanghai Stock Exchange Indexes		61.62%	61.63%	

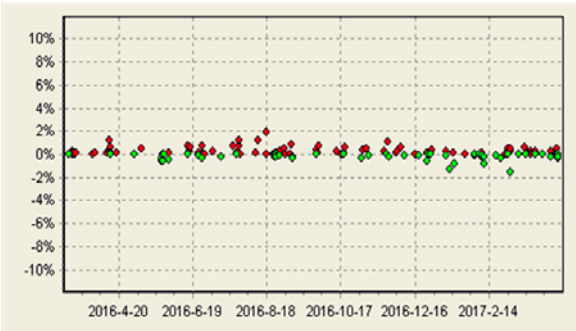

Fig.3 Number of Trades per Year for W&R

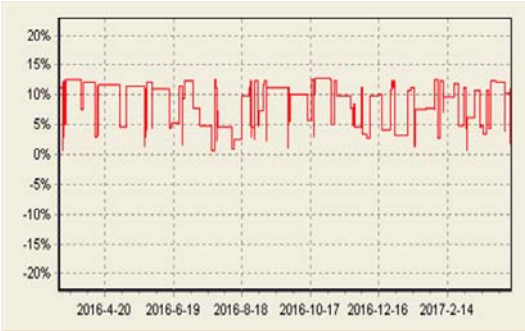

Fig.4 W&R Yield Curves

Conclusions

Based on management objectives such as win rate, annual rate of return and net margin that investors are most concerned about [5], this paper analyzes whether W&R is pragmatic. The experimental results suggest that annual rate of return and net profit margin of the W&R are 61.62 and 61.63% of Shanghai Stock Exchange indexes, which indicates that the it is impossible for W&R indexes of investments in vocational education to increase more drastically than benchmark indexes. The win rate of W&R is 59.72%, which implies that investors are exposed to relatively great risks in this expert system. Thus, this investment option is undoubtedly unpopular among risk-averse investors. The annual rate of return is as high as 11.56, which is 6.6 times of annual interest rate of bank deposits (1.75%), so considerable earnings can be made. Above all, it is a risky option to guide investments about vocational education with W&R. Furthermore, it may be known from Figs 1 and 2 about W&R that frequent trading is a leading cause of risks. In consideration that the annual rate of return on W&R is relatively high, it would be also an optional investment solution for investors who are enthusiastic about seeking high profits and bearing risks.

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