Trading Strategies on Trial: A Comprehensive Review of 21 Practical Trading Strategies Over 56 Listed Stocks

Shu-Heng Chen
AI-ECON Research Center
Department of Economics
National Chengchi University
Taipei, Taiwan 11623
E-mail: chchen@nccu.edu.tw

Tzu-Wen Kuo
AI-ECON Research Center
Department of Economics
National Chengchi University
Taipei, Taiwan 11623
E-mail: g7258502@grad.cc.nccu.edu.tw

Abstract

Using a dataset of 56 listed companies in the Taiwan stock market and 21 trading strategies from the practitioners of one major securities company in Taipei, this paper contributes to a follow-up research on the effectiveness of trading strategies. A notion of effective trading strategy based on the winning probability is given. If the criterion for the winning probability is set to "bigger than 0.5" (i.e., better than random guessing), then we find that none of the 21 trading strategies are effective. Hence, to some extent, the result lends support to the efficient market hypothesis.

Keywords: Trading Strategies, Efficient Market Hypothesis, Equity Curve, Winning Probability, Buy and Hold

1 Introduction

This paper provides a comprehensive evaluation on the performance of 21 trading strategies over 56 listed companies in the Taiwan stock market. Trading strategies were under intensive study over the last few decades. Very early results were unable to find evidence of profitability and thus concluded that trading strategies is not useful ([5]). However, more recently, there has been a renewed interest in this topic. Numerous studies examining technical trading strategies, applied to various shares and share market indices, have uncovered evidence of profitability ([1], [6], [8]). There are also studies which fail to find evidence of profitability once reasonable adjustments are made for risk and trading costs ([7], [2], [3]). This paper can be regarded as a continuation of this research line. It, however, differs from the previous studies in its *coverage*.

The conventional study mainly focused on two types of trading strategies, namely, the *moving average rules* and the *filter rules*. As a matter of fact, these two families of rules constitute only the very primitive level of the practical strategies, normally conducted in the financial markets. To some extent, they are only *toy models* or *academic models*. Based on our consultant experience with securities company, we can expect more advanced rules in trading practice. Sometimes, we are told that this trading strategies made a good profit, but a systematic study of them is not available. Therefore, the purpose of this paper is to extend the evaluation from the academic models to the *business models*. Twenty one

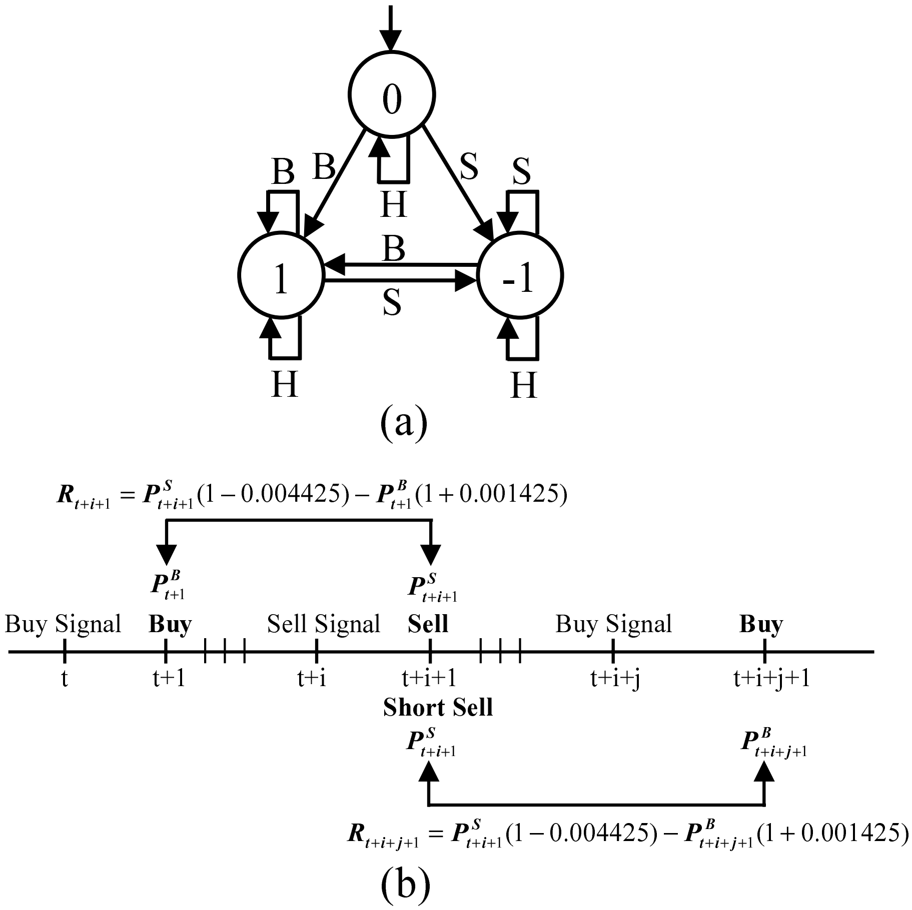

Figure 1. (a) The Three-State Automaton (b) Trade and Accumulated Returns in the Time Flow

trading strategies are selected for evaluation. To our best knowledge, this is probably the largest scale of evaluation ever seen in the literature. Secondly, these 21 trading strategies are applied to 56 listed companies in the Taiwan stock market, which were selected from 19 industries. This also provides us with one of the most robust evaluations.

The rest of the paper is organized as follows. In Section 2, we shall specify the evaluation methodology taken in this paper. Section 3 presents the empirical results, followed by the concluding remarks in Section 4.

2 Evaluation Methodology

2.1 Equity Curves

The evaluation methodology is very similar to [4]. The profit is defined in terms of per-unit basis. So, **BUY** means to buy one unit of stock and **SELL** to sell one unit of stock. However, since short-selling is *allowed* in this paper, **BUY** and **SELL** also implies *to recover short* and *sell short* respectively. In this case, two units of stock are bought or sold at the same time. Finally, **HOLD** means no trade.

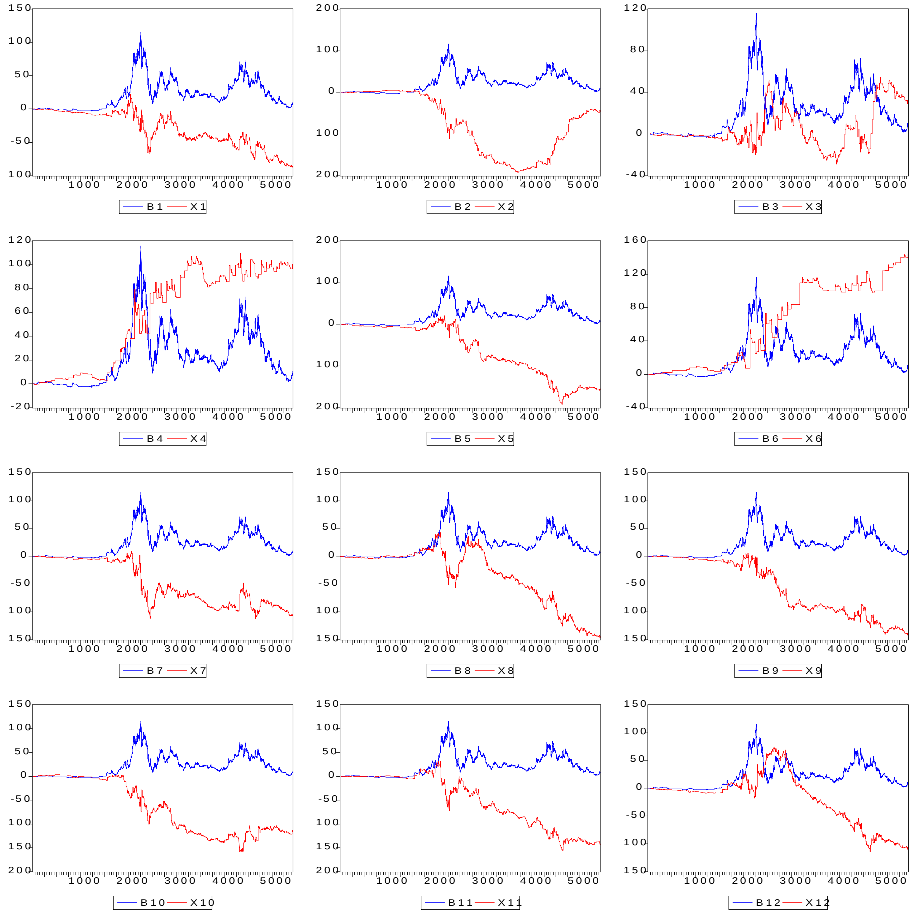

Figure 2. Equity Curves of the 21 Trading Strategies and the Benchmark: Strategies 1-12

The whole rule of game may be better described by a three-state automaton depicted in Figure 1-(a). The three states are denoted by "0", "1" and "-1". "1" refers to being *long* on one unit of stock and "-1" refers to being *short* on one unit of stock. "0" serves as both the *initial* state and the *terminal* state. In addition to these three states, there are three actions which will determine the transition to the next state, namely, "B"(**BUY**), S(**SELL**), and "H"(**HOLD**). As Figure 1-(b) manifests, at any point in time, a trader can only be either *long* or *short* on one unit of stock. Therefore, if a trader is already on the long (short) position, then any "**BUY**" ("**SELL**") action shall be ignored. Finally, the terminal state "0" will not be reached until the clearance date, i.e., the period t.

Based on *this three-state automaton*, one can calculated the sequence of accumulated profits π_τ $(0 \leq \tau < t)$ as follows (See also Figure 1-(b)):

$$\pi_0 = 0, \tag{1}$$

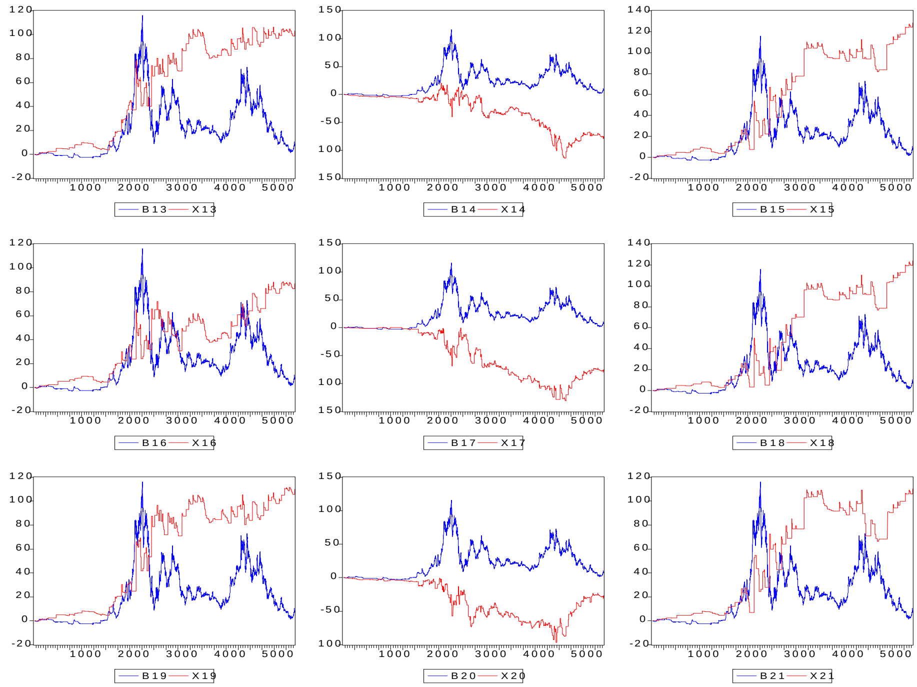

Figure 3. Equity Curves of the 21 Trading Strategies and the Benchmark: Strategies 13-21

and, for $0 < \tau \leq t$,

$$\pi_\tau = \begin{cases} 0, & \text{if } \ I_{\tau-1} = 0, I_\tau = 1, -1, \\ \pi_{\tau-1}, & \text{if } \ I_\tau = I_{\tau-1}, \\ \pi_{\tau-1} + P_{s+\tau}(1 - c_1 - c_2) - P_{s+\lambda_\tau}(1 + c_1), & \text{if } \ I_{\tau-1} = 1, I_\tau = -1, 0 \\ \pi_{\tau-1} + P_{s+\lambda_\tau}(1 - c_1 - c_2) - P_{s+\tau}(1 + c_1), & \text{if } \ I_{\tau-1} = -1, I_\tau = 1, 0 \end{cases} \quad (2)$$

where I_τ is the state at the time period τ. As depicted in Figure 1-(a), $I_\tau \in \{1, 0, -1\}$. c_1 is the tax rate of each transaction, and c_2 the tax rate of securities exchange income. In the case of Taiwan, $c_1 = 0.001425$, and $c_2 = 0.003$. λ_τ is an index function:

$$\lambda_\tau = \min\{\lambda \mid 0 \leq \lambda < \tau, I_\lambda = I_{\tau-1}\} \quad (3)$$

Once π_τ can be depicted as a function of t, which is also called the *equity curve*.

To see how well these 21 trading strategies performs, the accumulated profits of a *benchmark* is also calculated. A natural candidate for the benchmark is the *buy-and-hold* strategy. The accumulated profits of the buy-and-hold strategy is calculated as the following,

$$\pi^*_{\tau,i} = P_\tau(1 - 0.004425) - P_{0(i)}(1 + 0.001425), \quad (4)$$

where $P_{0(i)}$ is the stock price of the first trading time of the associated trading strategy, i, $i = 1, 2, ..., 21$.

2.2 Winning Probability

The accumulated profits of the trading strategies will then be evaluated based on their performance comparison with the benchmark. A simple comparison can be made by just

Table 1. The Empirical Distribution of the Winning Probabilities of 21 Trading Strategies over the 56 Companies

	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	12	8	7	5	4	3	2	2	2
2	27	22	14	9	4	3	2	1	1
3	22	13	11	7	5	3	3	3	1
4	46	42	34	33	28	22	15	11	4
5	18	11	7	6	5	4	3	3	2
6	48	36	35	31	25	17	10	8	5
7	13	7	4	4	4	3	3	3	3
8	20	10	7	7	7	7	6	3	2
9	14	7	5	4	3	2	2	2	1
10	17	8	7	4	4	3	3	3	2
11	30	22	14	10	8	7	4	4	2
12	17	7	6	5	3	2	1	1	1
13	45	41	34	30	27	21	17	12	6
14	22	13	8	6	5	4	4	2	1
15	46	38	36	30	25	20	12	8	5
16	45	43	34	31	25	21	16	8	4
17	24	15	11	7	5	4	3	2	2
18	44	37	34	32	22	15	11	8	6
19	45	39	35	32	27	23	18	12	6
20	24	14	11	6	6	5	5	4	3
21	47	36	35	27	24	16	14	8	7

watching the equity curve of the trading strategies and the benchmark. Examples can be found in Figures 2 and 3. Alternatively, one can calculate the *winning probability*, which is defined as follows.

$$Prob_{win} = \frac{\#\{\tau : \pi_\tau > \pi^*_\tau\}}{t} \tag{5}$$

3 Empirical Results

Figures 2 and 3 presents the equity curve of the 21 trading strategies when applied to *Shinkong Spinning Co., Ltd.* from January 5, 1981 to March 5, 2001. For making a comparison, the equity curve of the buy-and-hold strategy is also drawn along with that of the 21 trading strategies.

Table 1 shows an *empirical distribution function* of the winning probability of each trading strategies. The distribution function is defined as

$$F(x) = Prob(X > x). \tag{6}$$

Since there are totally 56 companies used to test a specific trading strategy, the *empirical distribution function* of the winning probability is simply

$$F(x) = \frac{\#\{i : Prob_{win}(i) > x\}}{56}, \tag{7}$$

where $i = 1, 2, ..., 56$. What is reported in Table 1 is in fact only the numerator of Equation (7). Table 1 enables us to address the a very fundamental issue: *are there any effective trading strategy?* While there is no unique notion of effectiveness, we give one which is closely related to Table 1. A trading strategy is said to be *effective* relatively to the benchmark, if at least in 51% of the population (in our case, 29 out of the 56 companies), its winning probability ($Prob_{win}$) is greater than 0.5.

This notion of effectiveness is easy to justify. Notice that, for a specific company, if the winning probability of a trading strategy is greater than 0.5, then we can say that in this company the trading strategy already outperforms the benchmark. But, since this dominance is not for sure (for other companies), we need a proper statistical criterion. Hence, we ask the trading strategy must dominate the benchmark in at least 51% of the testing samples, which is 29 companies in our case. This feature corresponds to the column "0.5" in Table 1. From that column, we can see that none of any trading strategies can satisfy the above-mentioned criterion. In other words, all trading strategies are ineffective.

4 Concluding Remarks

Are trading strategies effective? The answer from this paper is affirmatively *no*. However, it may be interesting to notice that trading strategies did work very well for come stocks. Taking the last trading strategy as an example. Its winning probability can be greater than 0.9 for 7 stocks. Therefore, given the wide diverse results reflected in Table 1, some cautions have to be taken for the *small sample* experiments, i.e., experiments based on only a few stocks, because, in light of Table 1, they can generate quite different, and hence inconclusive, results.

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