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Variable Moving Average Test on Weekly Stocks of Indian Markets

Dr. Uttam B. Sapate

Professor, MM's Institute of Management Education Research and Training, Pune, India

Abstract:

In the financial literature Efficient Market Hypothesis (EMH) has been one of the dominant topics. An implication of weak-form of efficiency / random walk is that the trading rules will not generate economic profits. The purpose of this study is to analyze results of application of variable moving average (VMA) test on weekly stock prices of Indian Markets, thus investigating its efficiency at the weak form level (Fama,1970). Three different strategies viz. Buy, Sell and Buy-Sell of VMA trading rule have been tested on weekly stock prices on 200 stocks from Indian Stock markets over different time periods to test Weak Form of Efficient Market Hypothesis (WFEMH). The results from the VMA trading rule tests indicated that the technical trading rules do not yield statistically significant forecasting power. It means that forecasting of returns based on trading rules cannot be employed to earn abnormal returns.

Keywords: Indian stock markets, variable moving average, trading rule test, weak form market efficiency

JEL: G1, G11 and G14

1. Introduction

Technical trading systems are composed of sets of trading rules that govern when it is appropriate for a trading to buy or sell their position within an asset. The simple trading strategies that are discussed in this research paper have one or two parameters that offer optimal trade timing by generating buy and sell signals.

According to Fama (1970), in an efficient market, prices “always fully reflect available information”. Therefore, prices could be considered an unbiased estimate of the true value of an investment at any given moment. “If stock prices either overreact or underreact to information, then profitable trading strategies that select stocks based on their past returns will exist.”

The moving average (MA) method is the most widely used methods of technical analysis. As distinct from a diagrammatic technical analysis, the MA method is easy to quantify and apply in investment decision-making or empirical tests. A moving average is an average of observations from several successive time-periods. In order to estimate a moving average sequence, calculation of successive averages of a predetermined number of successive observations is done. The objective of the MA method is to smooth out variations in the data. The method compares the recent market price with the MA of the stock price. If the current price is higher than the MA, a long investment position is taken. Conversely, if the current price is lower than the MA, a short position is taken. In another variation, the current market price is replaced with a short MA, and method compares of the short MA with the long MA. The effectiveness of this method largely depends on how the moving averages are calculated i.e. how many past observations are used to estimate MA and the methodology used to estimate the MA.

The paper is organized as follows; Section 1: Review of literature, Section 2: Data and methodology, Section 3: Analysis and findings, Section 4: Conclusions.

2. Literature Review

Brock, Lakonishok and LeBaron (1992) investigated two simple technical trading rules viz. VMA and trading range breakout (TRB) rule. They showed that the two simple trading rules have significant predictive power for the United States equity index returns. They defined the moving average trading rules as rules that are implemented by comparing two moving averages calculated over different time periods, one long-run period and the other short-run period. In addition, buy and sell signals are generated by the two different moving average periods. This strategy is expressed as buying (selling) when the short-period moving average rises above (falls below) the long period moving average. The trading range breakout rule generates a buy (sell) signal as the stock price penetrates new highs (lows). They considered the technical trading rule with and without one percent band width. For example, a variable moving average rule for weekly stocks for sub-period of 2.5 years is (5,50,0.01) for which the short period is 5 weeks and the long period is 50 weeks and a 1% band filter is applied, which indicates that a buy (sell) signal is only produced when the short-run moving average is at least 1% above (below) the long-run moving average. (Brock *et al.*, 1992).

Trading rules tests of WFEMH based on VMA and TRB were utilized along with other tests by Thomas & Brian (2005). They carried out test for predictability in seven Middle-Eastern North African markets by investigating both the WFEMH and the returns from technical analysis. Starting with tests for the Random Walk Hypothesis (RWH), they used daily data returns and a battery of econometric tests including unit-root analysis, individual and multiple variance ratio, wild bootstrapping and non-parametric tests

based on ranks. Their results suggested that only Israel and Turkey followed a random walk. Technical analysis based on VMA and TRB trade rules constituted further evidence for stock market predictability. Finally, taking into account local trading costs, profit simulations based on the breakeven costs computation methodology established the possibility of raising abnormal positive returns in the region.

3. Data and Methodology

Data: The data comprises of weekly share prices (adjusted for bonus, rights and stock splits) for 200 companies that form part of the Bombay Stock Exchange (BSE) 200 index from 1st April, 2000 to 31st March, 2010 (weekly observations). The sample companies account for more than 83.6% of the market capitalization as well as the trading activity on the Indian market. The sample is hence fairly representative of the market performance.

The weekly share price (Friday closing price) series have been converted into weekly return series for further estimation. The weekly data provide 521 observations for ten-year period. Subsequently, data was split in to the sub-periods of 5 years and 2.5 years as given below;

Total 10Yr	First 5Yr sub-period	Second 5Yr sub-period	First 2.5Yr sub-period	Second 2.5Yr sub-period	Third 2.5Yr sub-period	Fourth 2.5Yr sub-period
Apr. 00 to Mar. 10	Apr. 00 to Mar. 05	Apr. 05 to Mar. 10	Apr. 00 to Oct. 02	Oct. 02 to Mar. 05	Apr. 05 to Oct. 07	Oct. 07 to Mar. 10

Table 1: Sub-periods division for data analysis

Hypothesis: Ho: 'Buy (Sell, Buy-Sell) strategy' based VMA trading rules in the Indian weekly stock markets return series do not provide significantly different returns than 'buy & hold strategy'

All the null hypotheses have been tested at 95% confidence level. Null hypothesis has been rejected if P value is less than 0.05.

Statistical Tools: Initial data processing & refinement has been done using Microsoft EXCEL. The econometric tests of VMA have been applied using MATLAB software of The Math Works, Inc. (2008).

Variable Moving Average Test: Moving average trading rules are implemented by comparing two moving averages calculated over different time periods, one long-run period and the other short-run period. The buy and sell signals are generated by the two different moving average periods. This strategy is expressed as buying (selling) when the short-period moving average rises above (falls below) the long period moving average. A variable moving average rule for weekly stocks can be expressed as (5,50,0.01) wherein the short period is 5 weeks and the long period is 50 weeks and a 1% band filter is applied. It indicates that a buy (sell) signal is produced when the short-run moving average is at least 1% above (below) the long-run moving average. In this study the moving average rules are tested with band of 1% (i.e. 0.01). The trading decisions are assumed to be taken without any delay (trades executed with 0-day lag). In order to avoid adverse impact of the transaction costs on the trading rule returns and thereby biasing the results, the transaction costs only at 0.3% of the trade size have considered based on Indian internet based stock trading companies' transaction charges.

VMA trading rules are applied on stocks' return series wherein the following short and long moving average periods are considered based on maximum number of observations for given type of data set as illustrated.

Sr. No.	Frequency of Data	Period of Data	Maximum No. of Observations	Short Moving Average	Long Moving Average
1	Weekly	10 years	521	16 weeks	80 weeks
2	Weekly	5 years	260	8 weeks	40 weeks
3	Weekly	2.5 years	130	4 weeks	20 weeks

Table 2: Short and Long moving average periods for VMA test

If absolute value of observed statistics is greater than or equal to critical value, then it indicates difference is substantial and rejects that trading rule is not able to generate significant returns than buy and hold strategy in turn rejecting WFEMH.

4. Analysis and Findings

The hypothesis Ho { 'Buy (Sell, Buy-Sell) strategy' based VMA trading rules in the Indian weekly stock markets return series do not provide significantly different returns than 'buy & hold strategy'. } is tested using VMA tests.

Table 3 shows the results of VMA tests for weekly log returns of stocks for total ten-year period for three strategies. Results of all three VMA strategies with weekly return series accept the null hypothesis in turn accepting Weak Form Market Efficiency Hypothesis. It is observed that for the total period i.e. of 10 years there are no exceptions with regards to VMA test in all strategies in hypothesis acceptance.

Period	Parameter	Buy strategy	Sell strategy	Buy-Sell strategy
April 2000 to March 2010	Acceptance %	95.90	98.97	79.49
	Hypothesis Ho	Accepted	Accepted	Accepted

Table 3: Summary of VMA test for weekly log returns of individual stocks

Among the three strategies considered for analysis, the Sell strategy provided highest acceptance at 98.97% and Buy-Sell strategy provided lowest acceptance at 79.49% w. r. t. randomness hypothesis in case of weekly data.

Table 4 shows the results of VMA Buy Strategy tests for weekly log returns of stocks for all sub-periods.

Period	Acceptance %	Hypothesis Ho
Total10Yr	95.90	Accepted
First5Yrsub-period	98.69	Accepted
Second5Yrsub-period	98.97	Accepted
First2.5Yrsub-period	100.00	Accepted
Second2.5Yrsub-period	100.00	Accepted
Third2.5Yrsub-period	100.00	Accepted
Fourth2.5Yrsub-period	100.00	Accepted

Table 4: Sub-period Weekly VMA Buy Strategy test results

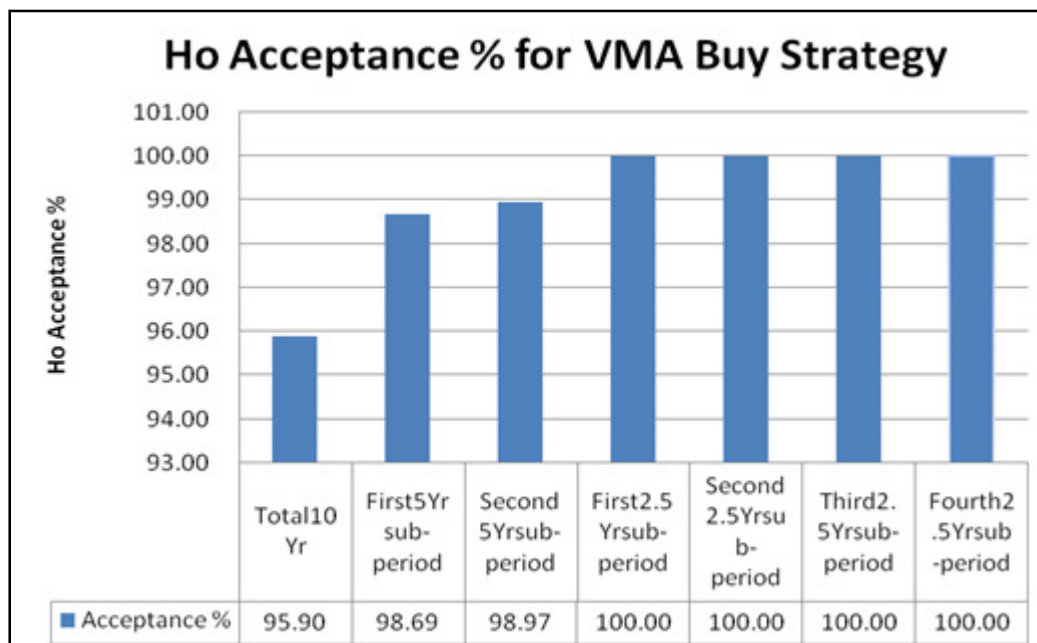


Figure 1: Graphical sub-period Weekly VMA Buy Strategy test results

In case of VMA Buy strategy for all seven sub-periods the null hypothesis of weak form of market efficiency is accepted. The acceptance % is observed to be lowest in case of Total 10-year period.

Table 5 shows the results of VMA Sell strategy tests for weekly log returns of stocks for all sub-periods.

Period	Acceptance %	Hypothesis Ho
Total10Yr	98.97	Accepted
First5Yrsub-period	98.04	Accepted
Second5Yrsub-period	98.97	Accepted
First2.5Yrsub-period	100.00	Accepted
Second2.5Yrsub-period	99.35	Accepted
Third2.5Yrsub-period	99.44	Accepted
Fourth2.5Yrsub-period	100.00	Accepted

Table 5: Sub-period Weekly VMA Sell Strategy test results

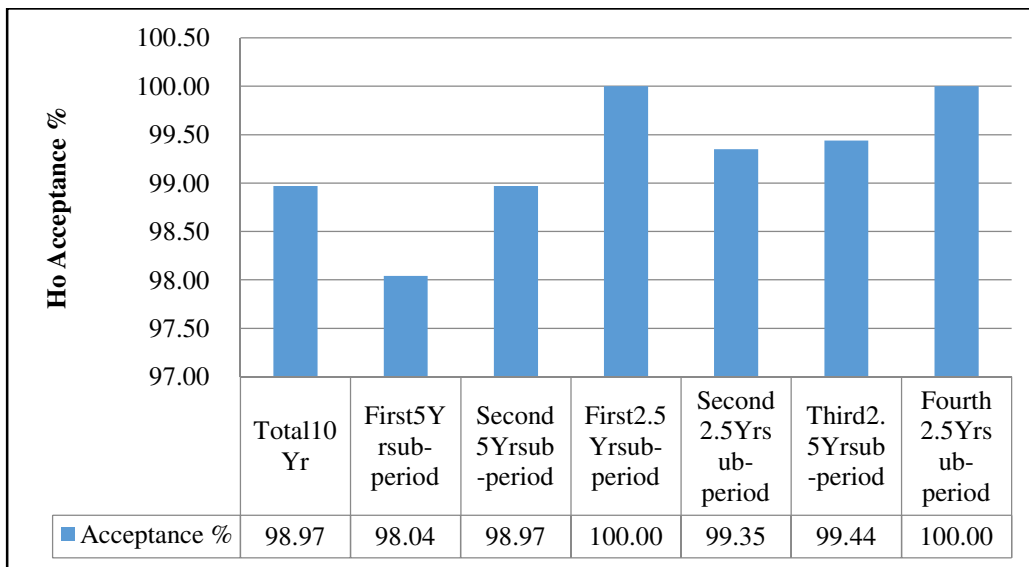


Figure 2: Graphical sub-period Weekly VMA Sell Strategy test results
Ho Acceptance % for VMA Sell Strategy

In case of VMA Sell strategy for all seven sub-periods the null hypothesis of weak form of market efficiency is accepted. The acceptance % is observed to be lowest in case of First 5-year sub-period.

Table 6 shows the results of VMA Buy-Sell strategy tests for weekly log returns of stocks for all sub-periods.

Period	Acceptance %	Hypothesis Ho
Total 10Yr	79.49	Accepted
First 5Yrsub-period	88.24	Accepted
Second 5Yrsub-period	90.77	Accepted
First 2.5Yrsub-period	92.91	Accepted
Second 2.5Yrsub-period	96.08	Accepted
Third 2.5Yrsub-period	93.82	Accepted
Fourth 2.5Yrsub-period	98.97	Accepted

Table 6: Sub-period Weekly VMA Buy-Sell Strategy test results

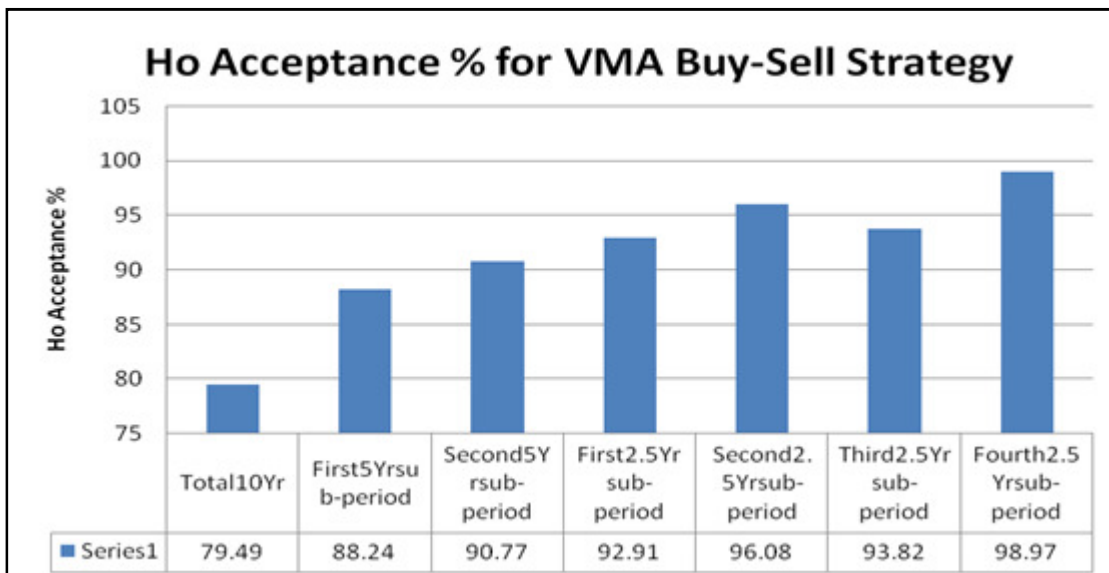


Figure 3: Graphical sub-period Weekly VMA Buy-Sell Strategy test results

In case of VMA Buy-Sell strategy for all seven sub-periods the null hypothesis of weak form of market efficiency is accepted. The acceptance % is observed to be lowest in case of Total 10-year period.

The trading rule VMA test could not reject the null hypothesis Ho indicating the return series is weak-form efficient. It means the weekly log returns of stocks accept hypothesis {Random Walk No. 2 wherein $\epsilon_t \sim \text{INID}$ (independently and not identically distributed

disturbance terms}} for all sub-periods. The results of VMA test with 'Buy' strategy & 'Sell' strategy exhibit lower level of predictability (i.e. more randomness) compared to 'Buy-Sell' strategy in all cases. Sub-period analysis reveals no substantial variation in the results.

The trading rule test of VMA accepts the hypothesis H_0 for all three strategies of Buy, Sell & Buy-Sell. This means trading rules in the Indian stock markets return series do not provide significantly different returns than buy & hold strategy i.e. Indian stock markets return series of stocks is weak-form efficient.

Results are contrary to earlier studies on trading rules viz. Balsara *et al.* (2007), Sundhar and Kakani (2006). The technical trading rules can be profitable to the extent to which the returns are just eliminated by the transaction costs that the trading rules incur under the version of market efficiency which is restated by Fama (1991). The earlier studies on technical analysis (Alexander, 1964, Fama and Blume, 1966) conclude that technical analysis is not profitable when transaction costs are taken into account.

5. Conclusions

The main findings of this study indicate the non-existence of VMA trading rule profitability in the Indian stock markets. The results from the trading rule tests indicated that the technical trading rules do not yield statistically significant forecasting power. It means that forecasting of returns based on trading rules cannot be employed to earn abnormal returns.

The results indicate that none of the trading rules exhibit statistically significant forecast power and trading rules (VMA) cannot produce economically significant returns relative to the buy and hold strategy. In spite of this it is observed that the trading rules normally are found to be appealing to the investors. The explanation for the same can be that these technical rules may be generating economic returns in certain time periods and may be dependent on selected type of stock.

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