International Business Management 6 (2): 140-146, 2012
ISSN: 1993-5250

Technical Trading Systems as Crystal Balls in Reducing Risk: The Malaysian Stock Market

[1]Fred Tham Kut Heng, [2]Noor Azlinna Azizan and [1]Lau Wee Yeap
[1]University of Malaya, Kuala Lumpur, Malaysia
[2]Faculty of Technology, Universiti Malaysia Pahang, Malaysia

Abstract: This study investigates the advantage of technical analysis in reducing risk and generates profits and generates greater return than a passive strategy. Researcher examine the mean returns of 13 technical trading systems against the returns from a buy and hold strategy for the 7 year period from 1996-2009 for Malaysian stocks. The 13 technical trading systems are 1-30 dual simple moving average crossover, 5-20 dual simple moving average crossover, 3-7 exponential moving average crossover, Relative Strength Index (RSI), momentum, stochastic, Moving Average Convergence Divergence (MACD), five Channel Breakout Systems (CBO 20-20, CBO 20-10, CBO 20-5, CBO 10-5 and CBO 15-5) and the Directional Movement Index (DMI). The findings reveal that 12 out of 13 trading systems produced significantly positive gross returns when no transaction costs were involved. These findings refute the assertion that Malaysian stock prices are weak-form efficient suggesting that technical trading systems can be exploited to make abnormal profits.

Key words: Market efficiency, transaction cost, technical trading system, random walk, trading frequency, abnormal profits

INTRODUCTION

Technical analysis is the study of market action (price changes), primarily through the use of charts. The purpose is to forecast future price trends. Technical analysis theory is based on three premises: Market action reflects everything; prices move in trends; history repeats itself. Early studies by Dawson (1985) on the efficacy of technical analysis (Technical analysis is the science of recording usually in graphic form, the actual history of trading (price changes, volumes of transactions, etc.) in a certain stock or in the averages and then deducing from that pictured history the probable future trend (Edwards and Magee, 1948). Technical analysis has a wide range of technical trading systems to assist an investor or analyst to time market entry and exit. They are broadly classified into trend following indicators and trend predicting indicators. Examples of trend following indicators are moving averages, channel breakout, relative strength index, stochastic, momentum, moving average convergence divergence, directional movement index, etc., where the system does not predict the time a stock would achieve a certain price but instead follow the market trends. A buy or sell signal would be triggered mechanically based on each system's prescribed rules. The trend-following indicators are in contrast with another category of systems that attempts to predict the time a stock would take to test a certain price. These time-and-price techniques fall under the category of trend predicting systems, the most popular of which are the W.D. Gann Technique and the Elliot Wave Theory, incorporating Fibonacci ratios on price and time. More recent concepts that are now tested on financial markets include chaos theory, fuzzy logic, genetic algorithms, artificial intelligence and neural networks) as an investment tool in trading Malaysian stocks suggested that technical analysis is not profitable. Dawson found some price patterns but noted that investors often ended up making less returns than the market after deducting transaction costs. Dawson concluded that despite the existence of patterns of price movements, no super-normal profits could be gained consistently from technical analysis. Yong commented that investors could not rely on any set of technical tools to help them in their stock investment but require other attributes like patience and discipline in stock investment. Yet stock players continue to use technical analysis to time the stock markets since, the 1970s. Have they been doing the wrong thing all this while? Is technical analysis of any value to the investor, analyst and fund manager as an investment tool to forecast market direction? These are important and practical research questions because many Malaysian investors, analysts and fund managers are continuing to embrace this tool to predict market direction as evidenced by the growing number of chart and technical commentaries in major daily newspapers, business

Corresponding Author: Fred Tham Kut Heng, University of Malaya, Kuala Lumpur, Malaysia

magazines and periodical financial reports by brokerage houses submitted to their clients (A study by Cheng (1996) found that 27% of the analysts in Malaysian brokerage houses surveyed used technical analysis in their research). In spite of this evidence that industry participants use technical analysis to some extent in their research, sceptics and cynics are quick to denounce its usefulness as an investment tool. A reader in a local newspaper was quoted as saying let us leave the head and shoulders in the bathroom to combat dandruff rather than as an investment tool (New Straits Times, January, 27, 2004, Mailbag Symphony trades on PE ratio of 52 times). In view of this dichotomy of views, the pertinent question to be asked is are technical analysis tools really profitable? This study attempts to shed some light upon this controversy by providing further empirical evidence as to whether technical trading systems can be profitable for Malaysian stocks. The efficient market hypothesis provides a theoretical framework to test if technical trading systems might work.

Literature review: The literature review on technical trading rules is divided into early and modern empirical studies. Early empirical studies (1960-1987) comprised mainly of statistical analyses such as serial correlation runs analysis and spectral analysis. However, serial correlation cannot detect complicated chart patterns while runs tests cannot detect size of price reversals. Statistical analysis also suffers from the difficulty of incorporating elements of risk and transaction cost. Subject to these limitations, early empirical studies on the profitability of technical trading rules by Alexander (1961, 1964), Fama and Blume (1996), Van Horne and Parker (1967) and Benington and Jensen (1970) concluded that technical analysis was not helpful in predicting US stock market prices. These apparent failures were much clearer when transaction cost was included. For example, Alexander concluded that in fact at this point, I should advise any reader who is interested only in practical results and who is not a floor trader and so must pay commissions, to turn to other sources on how to beat buy and hold. However, tests of technical trading rules on futures markets and foreign exchange markets revealed sizeable net profits (e.g., for futures markets, Stevenson and Bear (1970) and Irwin and Uhrig (1984); for foreign exchange markets, Poole (1967), Cornell and Dietrich (1978) and Sweeney (1986)). Thus, the US stock markets appeared to be efficient relative to futures markets and foreign exchange markets during the time periods examined (Park and Irwin, 2004). Modern empirical studies (1988-2006) on technical trading rules began with the study by Lukac *et al.* (1988). Lukac tested twelve technical trading systems across 12 actively trading US commodities from 1978-1984 and found that seven out of the twelve systems had gross returns significantly above zero and four out of the twelve systems produced net returns and significant risk-adjusted returns and concluded that the presence of significant positive profits demonstrated that price adjustments were not instantaneous due to market friction, inferring market inefficiency.

Modern empirical studies improved on early studies by incorporating transaction cost, risk, parameter optimization, out-of-sample tests and statistical tests in their testing procedures. A number of important modern empirical studies suggested that it is possible to make excess profits from technical analysis in futures and foreign exchange markets (e.g., for currency futures, Taylor and Tari (1989), Silber (1994), Szakmary and Mathur (1997); for spot currency, Maillet and Michel (2000), Lee *et al.* (2001a, b) and Martin (2001)). Several studies found economic profits in emerging stock markets (Bessembinder and Chan, 1995; Ito, 1999; Ratner and Leal, 1999) but modern studies indicated that technical trading rules can no longer yield economic profits on US stocks after the late 1980's (Bessembinder and Chan, 1998; Sullivan *et al.*, 1999; Ready, 2002).

Modern empirical studies therefore reconfirm earlier studies that it is difficult for technical trading systems to beat the buy and hold strategy for US stocks but economic profits are still possible in emerging markets. However, studies by Bessembinder and Chan (1995), Ito (1999) and Ratner and Leal (1999) were on Asian indices and not on stocks. This study is the first modern empirical study of technical trading rules on Malaysian stocks. An earlier study on Malaysian stocks by Jingtao *et al.* (1999) revealed that an active strategy using delayed index levels and technical indicators were able to achieve higher returns of 26%, compared to a passive investment and banks savings returns of -14.98 and 7.98%, respectively suggesting that the Malaysian stock market was weak-form inefficient for the period tested between 1990-1991. This study however, adopted an artificial neural network model to test for market efficiency and not via technical trading rules.

MATERIALS AND METHODS

This study uses the filter rule methodology to test the Bursa Malaysia for weak-form market efficiency by applying 13 technical trading systems to 38 index-linked stocks over a period of 7 years on daily data between the periods from 1st January, 1996 to 31st December, 2009. This methodology is similar to the methodology of testing technical trading systems as used by Lukac *et al.* (1988). The Bursa Malaysia would be considered weak-form market efficient if simulated returns from the 13 systems

on a sample portfolio of 38 stocks fail to significantly exceed that of a naive buy and hold strategy. In such an instance of an efficient market, it would be a futile exercise to use technical analysis and trading systems to time the Malaysian stock market. On the other hand if returns from the 13 trading systems can beat the returns from the buy-hold strategy then the Malaysian stock market would be viewed as weak-form inefficient. Under this circumstance, technical analysis could be a useful investment tool in timing Malaysian stocks.

When using the trading rules test, returns must take into account transaction costs and be adjusted for risk. Four important criteria must be met when using the trading rule framework. Firstly, tests must be based only on data that is publicly available, returns must have taken into account transaction cost, returns must be compared against a buy and hold strategy and returns must be risk-adjusted. The performances of the 13 systems on the 38 sample stocks were simulated using the Metastock software, Version 7.0. The 13 technical trading systems tested in this study have pre-specified trading rules which trigger buy and sell signals without regard to market fundamentals or personal judgment. The buy and sell rules used in each of the following 13 systems to test the hypotheses are those that are either commonly used by analysts and investors or are advocated by the developer of the various systems.

The 13 technical trading systems are 1-30 dual simple moving average crossover, 5-20 dual simple moving average crossover, 3-7 exponential moving average crossover, Relative Strength Index (RSI), momentum, stochastic, Moving Average Convergence Divergence (MACD), five Channel Breakout Systems (CBO 20-20, CBO 20-10, CBO 20-5, CBO 10-5 and CBO 15-5) and the Directional Movement Index (DMI).

Data and hypotheses: The population frame that made up the Bursa Malaysia consisted of 907 stocks as at December 31, 2005 of which 598 stocks are from the main board, 277 stocks from the second board and 32 stocks are from Mesdaq (Main board/second board: Listing on the main board/second board either; a) requires a profit track record over a period of 3-5 years; b) a minimum market capitalization of RM250 million and profit for the latest financial year or an infrastructure project as a core business). Minimum paid-up for listing on the main board is RM60 million comprising ordinary shares with a minimum par value of RM0.10 each whilst the minimum paid-up for listing on the second board is RM40 million comprising ordinary shares with a minimum par value of RM0.10 each. Mesdaq or Malaysian Exchange of Securities Dealing and Automated Quotation Bhd was primarily established to cater for the listing of technology and high-growth companies which have not yet achieved a profit track record over a period of time. The Bursa Malaysia computes indices for each of its many sub-sectors but the most widely followed index is the Bursa Malaysia Composite Index, officially known as the Kuala Lumpur Composite Index (KLCI). The KLCI currently comprises 100 stocks and represents a sample of the whole population of 907 stocks.

For the purpose of this study these 100 stocks were further sampled into 38 actively traded stocks in view of the peculiarity of the trading rule test of weak-form market efficiency which requires that selected stocks from the sample must be liquid in order that problems associated with non-synchronous trading as suggested by Lo and MacKinley (1990) are avoided. The three null hypotheses tested in this study are as follows:

Null hypothesis 1 (A test of the random walk model)
H_1: Gross returns (zero transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy and hold strategy.

Null hypothesis 2 (A traditional test of weak-form market efficiency)
H_2: Net returns (after transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy and hold strategy.

Null hypothesis 3 (Jensen's test of weak-form market efficiency)
H_3: Risk-adjusted net returns from trading systems cannot produce returns greater than the returns derived from the buy and hold strategy.

For this study, three levels of transaction costs were tested in order to determine the effect of transaction costs on trading rule returns. The first test was performed with zero transaction cost. The second test was performed with a brokerage fee of 0.70% or a total transaction cost (including brokerage, stamp duty and clearing fee) of 0.84% and the third test was performed with a brokerage fee of 0.30% or a total transaction cost of 0.44%.

RESULTS AND DISCUSSION

Test of the random walk model: Table 1 highlights the mean gross returns from 13 trading systems at zero transaction cost. About 12 out of 13 trading systems generated significantly positive mean gross returns over the buy-and-hold strategy at the 0.01 level of significance, providing strong evidence against the null hypothesis that stock prices are a random walk.

Traditional test of weak-form market efficiency: In a traditional test of efficient markets, no trading systems are expected to produce returns before transaction costs. Table 2 highlights the mean net returns from trading systems after accounting for 0.84% transaction cost. The results showed that four of the 13 trading systems generated significant returns above the buy-and-hold strategy at the 0.10, 0.05 and 0.01 level of significance, providing strong evidence against the null hypothesis that the Malaysian stock market is weak-form efficient. Table 3 highlights the mean net returns of trading systems after accounting for 0.44% transaction cost. Results from Table 3 showed there was a vast improvement in the number of profitable trading systems when transaction cost was reduced from 0.84-0.44%. A total of nine trading systems generated significantly positive mean returns that beat the buy-and-hold strategy at the 0.1, 0.05 and 0.01 level of significance as compared to just four systems at the higher transaction cost of 0.84 %.

Jensen's test of weak-form market efficiency: In modern empirical studies on technical trading rules, any test of weak-form efficiency must account for risk as an efficient market is one that does not yield a profit above a return to risk. Jensen's measure is based on the Capital Asset Pricing Model to account for risk in returns from trading systems. The procedure is to regress the returns from trading systems with that of returns from the buy-hold strategy, after deducting the risk-free rate of return. Two Jensen's regression tests were conducted, the first test after accounting for 0.84% transaction cost and the second, after 0.44% transaction cost. When 0.84% transaction cost was applied in the Jensen test, two out of the 13 systems the Channel Breakout 20-20 and 20-10 systems-produced significant intercepts (A_{ts}), leading to the conclusion that these two trading systems performed better than the buy-and-hold strategy at the 0.01 level of significance. When transaction cost was lowered to 0.44% (Table 4), 6 out of the 13 systems produced returns significantly above a return to risk at the

Table 1: Mean gross returns (Zero transaction cost)

Trading systems	Mean gross return (%)	Calculated p-value (1-tailed)[a]
1-30 SMA	200.44	0.0000***
5-20 SMA	113.86	0.0000***
3-7 EMA	170.23	0.0015***
RSI	200.67	0.0000***
Momentum	107.35	0.0005***
Stochastic	126.39	0.0365***
Channel breakout 20-20	198.50	0.0000***
Channel breakout 10-5	69.82	0.0035***
Channel breakout 15-5	94.87	0.0005***
Channel breakout 20-10	169.26	0.0000***
Channel breakout 20-5	106.07	0.0000***
MACD	8.28	0.2595
DMI	220.43	0.0000***
Buy-and-hold	-16.68	0.0340

[a]Significance level is denoted by ***at the 0.01 level

Table 2: Mean net returns (0.84% transaction cost)

Trading systems	Mean net return (%)	Calculated p-value (1-tailed)[a]
1-30 SMA	-0.68	0.486
5-20 SMA	-4.27	0.366
3-7 EMA	-51.24	0.000
RSI	-13.49	0.234
Momentum	-16.43	0.080*
Stochastic	-90.80	0.000
Channel breakout 20-20	139.62	0.000***
Channel breakout 10-5	-8.07	0.282
Channel breakout 15-5	20.87	0.124
Channel breakout 20-10	99.06	0.000***
Channel breakout 20-5	38.71	0.017**
MACD	-62.78	0.000
DMI	28.10	0.110
Buy-and-hold	-17.38	0.028

Table 3: Mean net returns (0.44% transaction cost)

Trading systems	Mean net return (%)	Calculated p-value (1-tailed)[a]
1-30 SMA	66.72	0.002***
5-20 SMA	38.84	0.002***
3-7 EMA	9.28	0.346
RSI	54.90	0.039**
Momentum	27.33	0.065*
Stochastic	-57.82	0.000
Channel breakout 20-20	162.99	0.000***
Channel breakout 10-5	23.06	0.106
Channel breakout 15-5	51.39	0.012**
Channel breakout 20-10	129.80	0.000***
Channel breakout 20-5	67.40	0.002***
MACD	-38.59	0.000
DMI	96.88	0.003***
Buy-and-hold	-17.05	0.031

[a]Significance level is denoted by *0.10, **0.05 and ***0.01 level

Table 4: Regression coefficients for test of excess returns (0.44% transaction cost) based on the Capital Asset Pricing Model

Trading systems	Intercept coefficient A_{ts}	p-value (1-tailed)[a]	Buy-hold coefficient β_{ts}	p-value (1-tailed)	R^2
1-30 SMA	47.730	0.127	0.259	0.326	0.006
5-20 SMA	42.018	0.035**	0.715	0.014	0.128
3-7 EMA	-27.390	0.197	-0.104	0.406	0.002
RSI	29.371	0.242	0.125	0.414	0.001
Momentum	16.490	0.246	0.427	0.101	0.045
Stochastic	-76.200	0.000	0.272	0.149	0.030
CBO 20-20	187.070	0.001***	1.145	0.052	0.072
CBO 10-5	-2.376	0.462	0.126	0.357	0.004
CBO 15-5	48.730	0.050**	0.595	0.072	0.058
CBO 20-10	140.740	0.001***	0.874	0.055	0.055
CBO 20-5	49.100	0.046**	0.273	0.244	0.013
MACD	-58.380	0.000	0.243	0.043	0.080
DMI	92.680	0.024**	0.563	0.186	0.022

[a]Significance level is denoted by **0.05 and ***0.01 level

Table 5: Ranking of six profitable risk-adjusted trading systems based on jensen's measure, 0.44% transaction cost

Rank	Trading systems*	α_{ts}	β_{ts}	(α_{ts}/β_{ts})
1	CBO 20-5	49.100	0.273	179.85
2	DMI	92.680	0.563	164.62
3	CBO 20-20	187.070	1.145	163.38
4	CBO 20-10	140.740	0.874	161.03
5	CBO 15-5	48.730	0.595	81.90
6	5-20 SMA	42.018	0.715	58.77

*All six systems beat the buy-and-hold strategy at 0.05 and 0.01 significance level

Table 6: Ranking on 13 trading systems based on Sharpe's ratio, 0.44% transaction cost

Systems	R_{ts}	R_f	R_{ts}-R_f	σ_{ts}	Sharpe ratio
CBO 20-20	162.99	30.98	132.01	232.50	0.57
CBO 20-10	129.80	30.98	98.82	181.06	0.55
DMI	96.88	30.98	65.90	205.99	0.32
CBO 20-5	67.40	30.98	36.42	128.18	0.28
1-30 SMA	66.73	30.98	35.75	186.07	0.19
CBO 15-5	51.39	30.98	20.41	134.14	0.15
RSI	54.90	30.98	23.92	186.96	0.13
5-20 SMA	38.84	30.98	7.86	108.76	0.07
Momentum	27.33	30.98	-3.65	109.72	-0.03
CBO 10-5	23.07	30.98	-7.91	111.93	-0.07
3-7 EMA	9.28	30.98	-21.70	142.96	-0.15
Buy/hold	-17.03	30.98	-48.01	54.50	-0.88
Stochastic	-57.82	30.98	-88.80	85.33	-1.04
MACD	-38.59	30.98	-69.57	46.85	-1.48

0.05 and 0.01 level of significance. The number of profitable systems increased from 2-6 when transaction cost was lowered from 0.84-0.44%. Table 5 highlights the Jensen's measure of ranking the performance of six profitable risk-adjusted trading systems at 0.44% transaction cost after adjusting for their β-coefficients. Pitfalls of using the CAPM orientated beta to identify risk. One of the pitfalls of using Jensen's measure to adjust for risk is that this measure is based on the CAPM's equilibrium required return equation: $E(R_p) = R_f + \beta_p (R_m - Rf)$ which assumes an efficient market. This limits its usefulness in tests of EMH because of its joint hypothesis problem. Noting the limitations of Jensen's measure, this study included an alternative measure, the Sharpe ratio to test for robustness and consistency derived from Jensen's measure. A positive Sharpe ratio would mean that the risk-adjusted return from a trading system beats the return from a buy-and-hold strategy. When using 0.84% transaction cost the Sharpe ratio listed 3 systems with positive returns to risk.

When transaction cost was reduced to 0.44%, the Sharpe ratio listed 8 systems with positive returns to risk (Table 6). Table 7 highlights a summary of the number of profitable trading systems returned by the Jensen and Sharpe's performance measure. Results from Table 7 revealed that the Channel Breakout Systems were ranked amongst the top profitable trading systems under two different measures, confirming their robustness and consistency. The number of profitable trading systems returned by the Jensen and Sharpe's performance measures increased to 6 and 8 systems, respectively when transaction cost was reduced from 0.84-0.44%.

Table 7: Number of profitable systems based on Jensen and Sharpe's performance measure

Sharpe	Jensen	Transaction cost (%)
CBO 20-20	CBO 20-20	0.84
CBO 20-10	CBO 20-10	
CBO 20-5	---------	
CBO 20-20	CBO 20-5	0.44
CBO 20-10	DMI	
DMI	CBO 20-20	
CBO 20-5	CBO 20-10	
1-30 SMA	CBO 15-5	
CBO 15-5	5-20 SMA	
RSI	---------	
5-20 SMA	---------	

CONCLUSION

This study examined 13 technical trading systems commonly used by Malaysian analysts, fund managers and investors. The mean returns from a sample of 38 KLCI-linked stocks traded in and out on a technical basis were compared with the returns from a buy-and-hold strategy for a 7 years period from 1996-2009. Three sets of transaction costs were used to test the profitability of these 13 trading systems on 38 stocks over this 7 years period: the first set with zero transaction cost, the second set for retail trades at 0.84% and the third set for online trades at 0.44%. The findings revealed that 12 out of 13 trading systems produced significantly positive gross returns when no transaction cost was used. Four out of the 13 trading systems produced significantly positive net returns above the buy-and-hold strategy at 0.84% transaction cost while nine of the 13 trading systems produced significantly positive net returns at 0.44% transaction cost suggesting that Malaysian stocks were weak-form inefficient for the period studied. The strictest test of weak-form efficiency the Jensen test was applied to account for risk in returns from the 13 trading systems. When 0.84% transaction cost was applied in Jensen's test of weak-form efficiency, 2 out of the 13 trading systems produced significant risk adjusted returns. The number of profitable trading systems increased to 6 out of 13 trading systems when transaction cost was reduced to 0.44%. These findings refute the assertion that Malaysian stock prices are weak-form efficient for the period studied.

IMPLICATIONS

The other important findings and implications of this study are: Market inefficiency of the Malaysian stock market means that technical trading systems that rely on market data and historical information have value and can

be exploited to make abnormal profits. The most robust systems are those that passed both the Jensen and Sharpe's performance tests. After accounting for 0.84% transaction cost two Channel Breakout Systems (CBO 20-20 and 20-10) stood out as the two most profitable trading systems. When transaction cost was reduced to 0.44%, 6 technical trading systems qualified and they are CBO 20-20, 20-10, 20-5 and 15-5, the directional movement index system and the 5-20 dual simple moving average systems.

In an inefficient market, fund managers, analysts, investors and decision makers in commercial enterprises, banks, insurance, national and state-owned funds and public companies who are considering the choice of investment strategies should adopt an active investment strategy over a passive strategy.

In an inefficient market, Malaysian stock prices may not be reasonable estimates of their underlying worth. This means that Malaysian investors may not be paying fair prices for shares. The findings also revealed the importance of transaction costs on profitability. When transaction cost was reduced to the online rate of 0.44% more trading systems performed significantly better than the buy and hold strategy suggesting that lower transaction cost is a factor that contributes to overall profitability.

REFERENCES

Alexander, S.S., 1961. Price movements in speculative markets: Trends or random walks. Ind. Manage. Rev., 2: 7-26.

Alexander, S.S., 1964. Price Movements in Speculative Markets: Trends or Random Walks. In: The Random Character of Stock Market Changes, Cootner, P. (Ed.). MIT Press, Cambridge, MA., USA., pp: 338-372.

Benington, G.A. and M. Jensen, 1970. Random walks and technical theories: Some additional evidence. J. Finance, 25: 469-482.

Bessembinder, H. and K. Chan, 1995. The profitability of trading rules in the Asian stock markets. Pacific Basin Finance J., 3: 257-284.

Bessembinder, H. and K. Chan, 1998. Market efficiency and the returns to technical analysis. Financial Manage., 27: 5-17.

Cheng, Y.D.N., 1996. Using japanese candlesticks for prediction and timing purposes. Master Thesis, Middlesex University, London.

Cornell, W.B. and J.K. Dietrich, 1978. The efficiency of the market for foreign exchange under floating exchange rates. Rev. Econo. Stat., 60: 111-120.

Dawson, S.M., 1985. Share recommendations using technical analysis. Asian Pacific J. Manage., 2: 180-188.

Edwards, R.D. and J. Magee, 1948. Technical Analysis of Stock Trends. 6th Edn., NYIF, New York, Pages: 4.

Fama, E.F. and M.E. Blume, 1996. Filter rules and stock market reading. J. Bus., 39: 226-241.

Irwin, S.H. and J.W. Uhrig, 1984. Does technical analysis have holes in their shoes?. Rev. Res. Futures Markets, 3: 264-277.

Ito, A., 1999. Profits on technical trading rules and time-varying expected returns: Evidence from Pacific-Basin equity markets. Pacific-Basin Finance J., 7: 283-330.

Jingtao, Y., C.L. Tan and H.L. Poh, 1999. Neural networks for technical analysis: A study on KLCI. Int. J. Theor. Applied Finance, 2: 221-241.

Lee, C.I., K.C. Gleason and I. Mathur, 2001a. Trading rule profits in Latin American currency spot rates. Int. Rev. Financial Anal., 10: 135-156.

Lee, C.I., M. Pan and Y.A. Liu, 2001b. On market efficiency of Asian foreign exchange rates: Evidence from a joint variance ratio test and technical trading rules. J. Int. Financial Markets, Institutions Money, 11: 199-214.

Lo, A.W. and A.C. MacKinley, 1990. An econometric analysis of non-synchronous trading. Rev. Financial Stud., 3: 181-211.

Lukac, L.P., B.W. Brorsen and S.H. Irwin, 1988. A test of future market disequilibrium using twelve different trading systems. Applied Econ., 20: 623-639.

Maillet, B. and T. Michel, 2000. Further insights on the puzzle of technical analysis profitability. Eur. J. Finance, 6: 196-224.

Martin, A.D., 2001. Technical trading rules in spot foreign exchange markets of developing countries. J. Multinational Financial Manage., 11: 59-68.

Park, C.H. and S.H. Irwin, 2004. The profitability of technical analysis. AgMAS Project Res.Rep., Vol. 4.,

Poole, W., 1967. Speculative prices as random walks-An analysis of ten time series of flexible exchange rates. Southern Econo. J., 33: 468-478.

Ratner, M. and R.P.C. Leal, 1999. Test of technical trading strategies in the emerging equity markets of Latin America and Asia. J. Bank. Finance, 23: 1887-1905.

Ready, M.J., 2002. Profits from technical trading rules. Financial Manage., 21: 43-61.

Silber, W.L., 1994. Technical trading: When it works and when it doesn't. J. Derivatives, 1: 39-44.

Stevenson, R.A. and R.M. Bear, 1970. Commodity futures: Trends or random walk? J. Finance, 25: 65-81.

Sullivan, R., A. Timmermann and H. White, 1999. Data snooping, technical trading rule performance and the bootstrap. J. Finance, 54: 1647-1691.

Sweeney, R.J., 1986. Beating the foreign exchange market. J. Finance, 41: 163-182.

Szakmary, A.C. and I. Mathur, 1997. Central bank intervention and trading rule profits in foreign exchange markets. J. Int. Money Finance, 16: 513-535.

Taylor, S.J. and A. Tari, 1989. Further Evidence Against the Efficiency of Futures Markets. In: A Reappraisal of the Efficiency of Financial Markets, Guimaraes, R.M.C. *et al*., (Eds.)., Springer-Verlag, Heidelberg, Pages: 804.

Van Horne, J.C. and G.G.C. Parker, 1967. The random-walk theory: An empirical test. Financial Anal. J., 23: 87-92.