

The Usefulness of a New Technical Indicator, Rate of Change – Alpha (ROC- α) on Stock Markets: A Study of Malaysian Top Capitalization Stocks

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Abstract

This study examines the usefulness of technical analysis indicators, in particular a new technical indicator named Rate of Change–Alpha (ROC- α) in Malaysian stock market. The aim of this study is to test and validate how ROC- α outperforms the passive threshold buy and hold as well as the best trading systems in Bloomberg in terms of profit performance for the Malaysian stock market by significant margins. The backtest dates back to 2005 and covers a period of 9 years on the Malaysian stock market benchmark index, FBMKLCI30 and its 30 component stocks. An out-of-sample live test conducted for a period of the first 9 months of 2013 is used to valid the findings. The results indicates that technical indicators do outperform the buy-and-hold and that ROC- α outperforms the Accumulation/Distribution Oscillator (ADO) and Directional Moving Index (DMI) which are ranked second and third best trading systems as well as the conventional ROC for the FBMKLCI30 and most of its component stocks. The results of this study show that ROC- α is a useful technical analysis tool that can be used by practitioners in Malaysia, and it is worthwhile to test its usefulness in other stock, futures and foreign exchange markets. The findings of this study are of particular interest and importance to academicians and practitioners; for academicians, this study shows that stock market prices trend and do not move randomly and for practitioners, ROC- α can be used in their technical analysis, trading strategies and portfolio management to improve and enhance their profit performances.

Key words: Algorithmic trading, rate of change momentum, rate of change –alpha, stock market characteristics, technical analysis indicator, technical trading rules, trading system, trading time series, volatility

JEL Classification: C19, C53, C61, G10, G17

1. Introduction

With technical analysis trading rules continue to prove its ability to outperform the simple buy-and-hold strategies in most cases (Park and Irwin (2007)), it is worthwhile to explore and innovate existing technical trading rule such as Rate of Change (ROC) that is used practitioners around the world to test it and the innovated Rate-of-Change-Alpha (ROC- α) in Malaysia stock market. Thus, this study attempt to innovate ROC that has limited validation done in past literature and use the innovated ROC- α in current Malaysian stock market condition to see if it generates abnormal returns.

Malaysia stock market is an emerging stock market, similar like other stock markets in Southeast Asia. One of the important indexes in Malaysia is FTSE Bursa Malaysia KLCI (FBMKLCI) index. It comprises the largest 30 companies listed on the Malaysian main market by full market capitalization. Over the past 10 years, it has a growth rate of 130% since 2003 till 2012. For the past 5 years, FBMKLCI30 has been growing an average 8.6% of per annum. It is definitely a stock market that cannot be missed in South East Asia.

With reports of technical analysis indicators outperforming the simple buy and hold strategy (Yung-Ho *et al.* 2006 and Yu *et al.*, 2013), it is worthwhile to explore and innovate existing technical trading rule such as ROC and test the innovated ROC- α in and on the Malaysian stock market. Thus, this study attempts to innovate the existing technical indicator, ROC that has limited validation done in the past literature, and test it in the current Malaysian stock market condition, to see if it is able to generate abnormal returns above the buy-and-hold strategy as well as the best known trading systems in Bloomberg in terms of profits, namely Accumulation Distribution Oscillator (ADO) and Directional Market Indicator (DMI).

ROC is a momentum indicator that shows the speed of the price movement (Nemavathi and Nedunchezian, 2012). It normally compares the most recent closing price to previous closing price. Practitioners use the movement of this indicator to interpret whether the price is in certain trend, either in an upward or downward trend. ROC is one of the momentum indicators, which looks at the speed at which a variable changes over a specific period of time. In practice, practitioners would monitor closely to the speed at which one variable changes relative to another. In short, ROC determines the momentum behind price movements; it measures the percent change. For most parts, current price and ROC should move together. When the current price and ROC diverge, the technician looks to ROC for a clearer indication of the underlying trend.

The formula of ROC is to take the current price and minus the price on N days ago and then divide it with the price N days ago. The formula for ROC is reflected in Equation 1.1.

$$\text{ROC} = (C - C_N) / C_N \dots\dots\dots \text{Equation 1.1}$$

where C = Close and N = Number of periods ago

In this study, ROC- α , the contribution of this study to the range of technical indicators, is an innovation of the conventional ROC by altering the original base period to an optimized based period that is more suitable to the time series. The formula of ROC- α is innovated to take the current price and minus the price on N days ago and then dividing it with the price on M days. The original based period is optimized to price on M days ago from the conventional price on N days ago. The formula for ROC- α is reflected in Equation 1.2.

$$\text{ROC-}\alpha = (C - C_N) / C_M \dots\dots\dots \text{Equation 1.2}$$

where C = Close and N = Number of periods ago, M = Base number of periods ago

The problem in the research area of technical analysis is to prove it has predictive power and practitioners are able to use it to consistently make positive profits that are higher than the simple buy and hold strategy, especially when hefty transaction costs are taken into account. With inclusion of transaction costs, mixed results are reported in some markets (Park and Irwin (2007).

Therefore, this re-investigation is vital and necessary to test if there are abnormal profits after taking into account the institutional rate of transaction costs for both back-tests of in-sample data and live test for out-of-sample data. Moreover, the previous research studies (Sweeney, 1986, Lukac *et al.*, 1988 and Brock *et al.*, 1992) focus mainly on moving average technical trading rules and there are not many studies performed to test on other technical indicators intensively or specifically. Given to this oversight, this research explores other technical analysis indicators that are rarely tested such as ROC. To do this, ROC should be innovated in order to make it more suitable and adaptive to the current stock market condition in Malaysia. Therefore, the objectives of this study are to innovate a new indicator called Rate Of Change-Alpha (ROC- α) from the conventional ROC indicator that can outperform the buy and hold strategy in Malaysia stock market; and to compare if the innovated technical indicator, Rate of Change - Alpha (ROC- α) can outperform the other technical indicators that are ranked amongst the best in the Bloomberg trading systems, namely, ADO and DMI which are ranked second and third in terms of profits as well as the conventional ROC. The findings of this study confirm that the innovated ROC- α is a particular useful technical analysis tool to time trading entry and exit, and can be programmed into an adaptive technical trading system to automatically generating abnormal trading profits.

Section 2 discusses the importance of technical trading rules in the literature and Section 3 describes the data analysis and methodology. Session 4 discusses the results and their significance. Finally, section 5 draws conclusion and recommendations.

2. Literature Review

Empirical studies (Sweeney, 1986, Lukac *et al.*, 1988, Brock *et al.*, 1992, Bessimbiner and Chan, 1995, Lai and Lau, 2006, Park and Irwin, 2007, Millionis and Papanagiotou, 2011, Chien Ping *et al.*, 2011 and Metghalchi and Garza-Gomez, 2013) support the validity of trends in price and the use of technical analysis tools in profitable trading systems. This research joins the stream of technical analysis researches by contributing some findings of the usefulness of technical indicators, Rate of Change (ROC), Accumulation/Distribution Oscillator (ADO) and Directional Movement Index (DMI) to the Malaysian stock market index, FBMKLCI30, and its 30 index-linked stocks. Studies by Sweeney, 1986, Lukac *et al.*, 1988 and Brock *et al.*, 1992, show most of the tests done are on different types of moving average but there are very limited studies done on other technical analysis indicator such as ROC.

Sweeney (1986) focuses on testing foreign exchange markets by contrasting a test of significance of trading rules profit that explicitly assumes constant risk. Return trade-offs due to constant risk premium which conclude there exist excess return by using trading rules and prove market to be inefficient. Lukac *et al.* (1988) conducts tests on 12 commodities from 1978 till 1984 using 12 technical systems. Of the 12, 7 systems produce significant gross returns, 4 systems produces good net and risk adjusted returns. These result showed that disequilibrium models are better in explaining the short run future prices movements than the random walk. Brock *et al.* (1992) performs tests on moving average and trading range break out on Dow Jones Index from 1897 to 1986 and verify the results using bootstrap techniques for standard statistical analysis. Bessembinder and Chan (1995) test the same technical trading rules on Asian markets and find significant abnormal returns for Malaysia, Thailand and Taiwan. Moreover, studies done by Lai and Lau (2006) affirm that technical indicators like moving averages are able to make significant profits in China, Thailand, Taiwan, Malaysian, Hong Kong and Indonesia.

Similarly, Millionis and Papanagiotou (2011) on 3 stock exchanges namely New York Stock Exchange (NYSE), Athens Stock Exchange (ASE) and Vienna Stock Exchange (VSE), Chien Ping *et al.* (2011) on Danish Stock Exchange, and Metghalchi and Garza-Gomez (2013) on Irish Stock Exchange also show that technical analysis can be used to generate abnormal returns that outperform the buy and hold strategy. Hao *et al.* (2013) shows empirical results that technical analysis indicators are useful tools to generate abnormal profits in emerging stock markets like Malaysia, Thailand, Indonesia and the Philippines.

In summary, Park and Irwin (2007) reports out of 95 studies, 56 studies find positive results with technical trading strategies, 20 obtain negative results and 19 studies indicate mixed results.

3. Methodology

3.1 Research Questions

The research objectives are to test if ROC- α can outperform the buy and hold strategy, and to test if it has the ability to outperform two of the technical indicators that are ranked amongst the best trading systems in Bloomberg, namely, Accumulation/Distribution Oscillator (ADO) and Directional Moving Index (DMI) which ranked second and third respectively as well as the conventional ROC which ranked sixth.

In order to answer the research questions, we use mean long return to gauge the performance of each technical indicator. The mean long return used Kish and Kown (2002) is calculated by using total returns divided by total days of observation (non-trading days are excluded). We define ROC- α mean long return as $X_{roc-\alpha}$, mean B&H return as X_{b_h} , the ADO mean long return as X_{ado} , the DMI mean long return as X_{dmi} and the conventional ROC as X_{roc} .

$$X_{roc-\alpha} = \frac{1}{N_{roc-\alpha}} \times R_{roc-\alpha} \dots\dots\dots \text{Equation 2.1}$$

$$X_{b_h} = \frac{1}{N_{b_h}} \times R_{b_h} \dots\dots\dots \text{Equation 2.2}$$

$$X_{ado} = \frac{1}{N_{ado}} \times R_{ado} \dots\dots\dots \text{Equation 2.3}$$

$$X_{dmi} = \frac{1}{N_{dmi}} \times R_{dmi} \dots\dots\dots \text{Equation 2.4}$$

$$X_{roc} = \frac{1}{N_{roc}} \times R_{roc} \dots\dots\dots \text{Equation 2.5}$$

where $N_{roc-\alpha}, N_{b_h}, N_{ado}, N_{dmi}, N_{roc}$ are the total observation days,

$R_{roc-\alpha}, R_{b_h}, R_{ado}, R_{dmi}, R_{roc}$ are the returns for ROC- α , buy and hold strategy, ADO, DMI and ROC.

The tests are to determine if the mean long returns of each of the above trading system is greater than the mean return of the B&H strategy; and if the mean long returns of ROC- α would be greater than ADO, DMI and ROC.

All hypotheses are written in the form of alternative hypotheses.

- H₁: $X_{roc-\alpha} - X_{b,h} > 0$
 H₂: $X_{roc-\alpha} - X_{2do} > 0$
 H₃: $X_{roc-\alpha} - X_{dmi} > 0$
 H₄: $X_{roc-\alpha} - X_{roc} > 0$

The results will be tested for significance using paired T-tests.

3.2 Modeling

3.2.1. Rate of Change (ROC) and Rate of Change – Alpha (ROC- α)

ROC is a momentum indicator that compares the speed at which it changes over a specific period of time. The formula for ROC is reflected in Equation 1.1.

$$ROC = (C - C_N) / C_N \dots\dots\dots \text{Equation 1.1}$$

where C = Close and N = Number of periods ago

As an innovation of the conventional ROC, ROC- α alters the original base period to an optimized based period that is more suitable to the time series. As part of our research, a series of optimization simulations was performed using Bloomberg to find the most optimized base period.

$$ROC-\alpha = (C - C_N) / C_M \dots\dots\dots \text{Equation 1.2}$$

where C = Close and N = Number of periods ago , M =Base number of periods ago

As can be seen in Equation 1.2, the division of the M period allows more flexible optimization to be conducted to see if such optimization can outperform the conventional ROC and also the other best performing trading systems, ADO and DMI. As the findings on the optimization simulations suggest, N is set to 1 day ago and M is set to 2 days ago.

The trading rule is to enter a long position at the next open when the closing price of the stock crosses above the ROC- α . When the closing price of the stock crosses below the ROC- α , it would exit the long position.

3.2.2. Accumulation/Distribution Oscillator (ADO)

Accumulation/Distribution Oscillator (ADO) is developed by Marc Chaikin (Chaikin, 2014). ADO is a volume-based indicator designed to measure the cumulative flow of money into and out of a security. Chaikin originally refer to the indicator as the Cumulative Money Flow Line. As with cumulative indicators, the Accumulation Distribution Line is a running total of each period's Money Flow Volume. First, Equation 3.1 shows that multiplier is calculated based on the relationship of the close to the high-low range. Second, Equation 3.2 shows the Money Flow Multiplier is multiplied by the period's volume to come up with a Money Flow Volume. A running total of the Money Flow Volume forms the Accumulation Distribution Line which is represented in Equation 3.3.

Money Flow Multiplier = [(C - L) - (H - C)] / (H - L).....Equation 3.1

where C = Close, L = Low and H = High

Money Flow Volume = MFM x V_N.....Equation 3.2

where MFM = Money Flow Multiplier, V_N = Volume in a period of N days

ADL = ADL_{N-1} + MFV_N.....Equation 3.3

where ADL = Accumulation Distribution Line, ADL_{N-1}= Previous Accumulation Distribution Line and MFV_N = Current Money Flow Volume

Using this indicator, practitioners can assert a stock underlying trend or potential reversals when the indicator oscillates away from the stock price. To interpret, ADL is a cumulative measure of each period’s volume flow, or money flow. A high positive multiplier combined with high volume shows strong buying pressure that pushes that pushes the indicator higher. In contrast, a low negative combined with high volume reflects strong selling pressure that pushes the indicator lower. Money Flow Volume aggregate to form a line that either confirms or contradicts the underlying price trend. Thus, practitioners can use this to confirm the trend. For instance, an uptrend in prices with a downtrend in the ADL advocates selling pressure (divergence) that signals the practitioners to sell the stock. On the other hand, a downtrend in prices with an uptrend in the ADL would indicate a buying signal for practitioners that could foreshadow a bearish reversal on the price chart. A downtrend in prices with an uptrend in the Accumulation Distribution Line indicate underlying buying pressure (accumulation) that could foreshadow a bullish reversal in prices. The trading strategy used for ADO would be system would enter the long position when the closing price is moving above the ADL and exit the long position when the closing price is moving below the ADL.

3.2.3. Directional Movement Index (DMI)

Another technical indicator would be tested would be Directional Movement Index (DMI). DMI is invented by J Welles Wilder (1978). It allows practitioners to see the directional movement of a security using today high and low prices relative to the previous day’s high and low prices. DMI can be used to determine whether a stock is in a valid trend, or if it is range bound. In addition, the ADX value is a measure of the strength of the trend regardless of the trend direction; the higher the value of ADX, the stronger the trend. An ADX value greater than 25 generally suggests that the market is trending, and a value less than 20 indicates no trending.

+DMI = 100 * (N Period Smoothed MA of +DM) / ATREquation 4.1

-DMI = 100 * (N Period Smoothed MA of -DM) / ATREquation 4.2

ADX = 100 * (N Period Smoothed MA of DX)Equation 4.3

$$\text{ADX}[i] = (\text{ADX}[i] + \text{ADX}[i - N]) / 2 \dots\dots\dots \text{Equation 4.4}$$

where

Average True Range, ATR= N Period Smoothed Moving Average of True Range;

* True Range = Max (Today's High, Previous Close) – Min (Today's Low, Previous Close)

Directional Index, $\text{DX} = 100 * \text{ABS} ((+\text{DMI}) - (-\text{DMI})) / ((+\text{DMI}) + (-\text{DMI}))$

Positive Directional Movement: +DM = if UpMove > DownMove and UpMove > 0,
 then +DM = UpMove, else +DM = 0

Negative Directional Movement: -DM = if DownMove > UpMove and DownMove > 0,
 then -DM = DownMove, else -DM = 0

UpMove = Today's High - Yesterday's High

DownMove = Yesterday's Low - Today's Low

DMI Period: N Period = For daily, N=day (default to 14 days and omit non trading days)

Smoothed Moving Average of a value V of period N is defined as:

$$\text{SmoothMA}[i] = (V[i] + (N-1) * \text{Sum}(V,N)[i - 1]) / N$$

where Sum(V,N) is the running sum of N values of V.

In Bloomberg, the number of period set is at 14 days and the positive DMI, negative DMI and ADX DMI are all set to the value of 1. The trading strategy used for DMI is enter into a long position when the current closing stock price is above ADXR[i] and to exit the long position when the current closing stock price is below ADXR[i].

We buy 1 lot which is equivalent to 100 shares at each long signal. We do not take into account dividend yields at all as we are strictly testing for abnormal returns above the Buy and Hold which did not take into consideration dividends. Draper and Paudyal (1997) finds that any bias in the results due to dividend exclusion are minimal.

3.3 Data

In this study, we use the daily closing prices of FBMKLCI30 index as well as its 30 component stocks from 1/2/2005 to 9/30/2013. First, back tests are conducted for the first 8 years from 1/2/2005 to 12/31/2012 to find the best trading systems in terms of profit performances. Then, optimization simulations are performed to find the best optimized parameters for ROC- α . To valid these findings by live testing, an out-of-sample period of 9 months from 1/2/2013 to 9/30/2013 is used. The live test aims to validate the applicability of using ROC- α in real life trading.

All the data and the best trading systems are sourced from Bloomberg. For the purpose of testing simulations, 1 lot equivalent of 100 shares per trade is used.

Transaction cost of 0.125% (the institutional rate for institutional investors to invest in the stock market in Malaysia stock market) is chosen because the results of any technical trading tests are only valid if realistic transaction costs are included. In order to validate if the

innovated ROC- α can outperform the buy and hold as well as other technical indicators, back tests are done on the benchmark index, FBMKLCI30 index from 1/2/2005 to 12/31/2012 against those technical indicators available in Bloomberg. Table 1 shows the top 20 technical indicators in terms of profits. In terms of profits, ROC- α rank first while Accumulation/Distribution Oscillator (ADO) and Directional Movement Index (DMI) ranked second and third while the conventional ROC ranked sixth. It is noted that these abnormal returns are generated regardless of the turbulences experienced by the market.

Table 1: Ranking of Best Trading Systems in Bloomberg using FBMKLCI30 Index

Ranking	Strategy	Total Return	Total Return (%)
1	ROC- α	116032.00	116.032
2	Accumulation/Distribution Oscillator (ADO)	112726.00	112.726
3	Directional Movement Index (DMI)	111969.00	111.969
4	Fear & Greed	107808.00	107.808
5	Ichimoku	107059.00	107.059
6	ROC	104801.00	104.801
7	Weighted MA	103913.00	103.913
8	Simple MA	92925.00	92.925
9	Parabolic	90409.00	90.409
10	Triangular MA	86071.00	86.071
11	Buy & Hold	78827.00	78.827
12	MACD	70938.00	70.938
13	Rex Oscillator	49708.00	49.708
14	MA Oscillator	34438.00	34.438
15	RSI	28577.00	28.577
16	Bollinger Bands	28394.00	28.394
17	William's %R	16714.00	16.714
18	Commodity Channel Index	14723.00	14.723
19	Trading Envelopes	8439.00	8.439
20	Stochastic	4532.00	4.532

Source: Bloomberg

We test these 4 trading systems, namely ROC- α , ADO, DMI and ROC on the FBMKLCI30 and compare them to the passive buy-and-hold (BH).

4. Results and Discussion

The results for backtest on FBMKLCI30 and its 30 stocks (inclusive of transaction cost of 0.125%) from 2/1/2005 to 12/31/2012, displayed in Table 2, show that the mean return for ROC- α is the highest, followed by buy-and-hold (B_H), ROC, DMI and ADO in that order. This shows that ROC- α outperforms the B_H and the other three trading strategies for this period. However, it is noted that it is with hindsight that ROC- α had been optimized to suit the particular market, in this particular period; so we have to perform a livetest to check if ROC- α can outperform B_H and the other three trading strategies in real life trading.

Table 2: Backtest results for the period 2/1/2005 to 12/31/2012

Trading Strategies	Mean Return
1. ROC- α	0.4258
2. B_H	0.3432
3. ROC	0.3356
4. DMI	0.2764
5. ADO	0.2620

The significance test results for the difference of the mean returns of ROC- α and B_H as well as the mean returns of ROC- α and the other trading strategies during the backtest period are displayed in Table 3 in the paired t-test. As all the mean differences between the paired strategies are all statistically significant, all the alternative hypotheses, H₁, H₂, H₃ and H₄ are accepted for the backtest period from 2/1/2005 to 12/31/2012.

Table 3: Paired t –test results for the period 2/1/2005 to 12/31/2012

Paired Trading Strategies	Mean Returns	Significance at 5% Level	Acceptance of Alternative Hypothesis
ROC- α & B_H	0.0826	0.022	H ₁ is accepted
ROC- α & ADO	0.1638	0.002	H ₂ is accepted
ROC- α & DMI	0.1494	0.003	H ₃ is accepted
ROC- α & ROC	0.0902	0.003	H ₄ is accepted

To check the validity of the backtest results, a livetest (inclusive of transaction cost of 0.125%) is performed on the FBMKLCI30 and its 30 stocks from 2/1/2013 to 9/30/2013 and the results are displayed in Table 4. The ranking of the trading systems are the same with

ROC- α ranking first and B_H second, followed by ADO, DMI and ROC in that order. ROC- α continues to outperform B_H and the other three trading systems and all the known trading systems in Bloomberg. Thus, it can be deduced that ROC- α is a profitable trading system during this period, regardless of whether the market is efficient or inefficient. It is noted that structural breaks in time series do not affect the performances of these technical indicators.

Table 4: Livetest results from 2/1/2013 to 9/30/2013

Trading Strategies	Mean Return
1. ROC- α	0.6515
2. ADO	0.5255
3. B_H	0.4559
4. ROC	0.3643
5. DMI	0.1834

The significance test results for the difference of the mean returns of ROC- α and B_H as well as the mean returns of ROC- α and the other trading strategies during the livetest for the period 2/1/2013 to 12/31/2013 are displayed in Table 5. It is seen that except for ROC- α minus ADO pair, all the other mean differences between the paired strategies are all statistically significant, therefore alternative hypotheses, H₁, H₃ and H₄ can be accepted for the livetest period from 2/1/2013 to 12/31/2013. For the live test, even though the mean return for ROC- α is higher than the mean return for ADO, H₂ cannot be accepted as the mean difference is not statistically significant.

Table 5: Paired t –test results for the period 2/1/2013 to 12/31/2013

Paired Trading Strategies	Mean Returns	Significance at 5% Level	Acceptance of Alternative Hypothesis
ROC- α & B_H	0.1956	0.070	H1 is accepted
ROC- α & ADO	0.1260	0.129	H2 can not be accepted
ROC- α & DMI	0.4681	0.003	H3 is accepted
ROC- α & ROC	0.2872	0.004	H4 is accepted

5. Conclusions and Recommendations

It can be concluded that for this period of study from 2/1/2005 to 9/30/2013, with the cutoff date of 12/31/2012 for the backtest and thereafter for real life testing, the first hypothesis, H_1 developed to test for objective 1 cannot be rejected. The mean returns of ROC- α for both the backtest and live test outperform the simple buy and hold strategy. As for the second objective, which is to show that ROC- α can outperform the other best trading systems in Bloomberg, namely ADO and DMI as well as the conventional ROC, the results show that for the backtest, all the alternative hypotheses are accepted. For the backtest, ROC- α outperforms ADO, DMI and ROC by statistically significant margins. However, going forward, for the live test, ROC- α outperforms all three trading systems but only statistically so for DMI and ROC. Although for the live test, the mean return of ROC- α is higher than the mean return of ADO, the difference is not statistically significant in the paired t test. A longer out-of-sample period is thus required to determine if the ROC- α can stand the test of time.

The results from this study are consistent with those of Brock *et al.* (1992), Gencay (1996), Kwon and Kish (2002), Wong *et al.* (2003), Yung-Ho *et al.* (2006), Lai *et al.* (2007), Li and Wang (2007), Terrence and Wing (2008), Balsara *et al.* (2009), Metghalchi *et al.* (2009), Lento (2009), Terrence *et al.* (2011), Chien-Ping (2011) and Yu *et al.* (2013). The findings of this research support the hypothesized ability of the technical indicators to make excessive return higher than the buy and hold strategy, even after transaction costs are taken into account (Brock *et al.* (1992), Kwon and Kish (2002), Yung-Ho (2006), Terrence & Wing (2008), Lento (2009)). This finding is consistent with Lai (2007) and Yu *et al.* (2013) studies that emerging stock market like Malaysia is a good ground to use technical analysis for equities investment.

The findings here also support the tests that newly innovated ROC- α can outperform the best performing conventional trading systems in Bloomberg, namely ADO, DMI and ROC. This is consistent with the findings by Balsara *et al.* (2009) and Coutts (2010) that the excessive returns of yesteryears from conventional technical trading rules like moving average tend to diminish over time, especially as the financial markets mature.

The results of abnormal returns for all the trading systems, including ROC- α are net of transaction costs as we take into consider the issue highlighted by Park and Irwin (2007) that transaction costs hinder technical trading rules in making excess profits that is higher than the buy and hold strategy.

Thus, in conclusion, this study introduces a new technical indicator, ROC- α that is extremely useful to Malaysian stock market. The stock market practitioners in Malaysia has a new technical indicator, ROC- α that outperforms the passive buy and hold, and is better than

the best conventional trading systems in Bloomberg for the last 9 years. Going forward, ROC- α needs to be adjusted, either for N or/and M to suit the most current market. Thus, ROC- α is very robust as it can be applied to any financial market across the world in any time frame. The significance of this study lies in the underlying fact that ROC- α can be a very useful and powerful technical indicator instrument to decipher trends and generate excessive abnormal profits in all markets and in all time frames because it can be adaptive and adjustable.

It should be noted that the duration of this study is relatively short, 9 years, compared to 100 years in the case of Brock *et al.* (1992); this is partly because Malaysian stock market and FBMKLCI30 are relatively young market and index. As it is pointed out earlier, the top 30 stocks represent about 70% of total market capitalization of the Malaysian stock market and thus it does not represent the entire Malaysian stock market.

Although the findings show positive results, even after taking into account the institutional transaction costs rate, on the usage and applicability of technical trading rules especially the innovated adaptive trading system like ROC- α on equities market, more and future research can be done to extend the period of study, the coverage of other stock markets in the world, especially those for emerging economies, and on other financial markets like futures, and foreign exchange currencies. The following research is done on ROC- α to automatically adjust the variables N and M, that is the previous period and the base period, using artificial networks to suit the particular market in that particular time frame, that is to be adaptive to current market condition.

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