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Trading with tigers: a technical analysis of Southeast Asian stock index futures

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Our paper examines the profitability of technical trading rules in Southeast Asian (SEA) 'tiger cub' stock index futures markets during and after the global financial crisis (GFC) of 2007/08. Using daily closing price data from 2007 to 2012, we explore technical trading rules such as exponential moving averages (EMA (20), EMA (100), EMA (20,100)) and moving average convergence divergence (MACD) in Indonesia, Malaysia, the Philippines and Thailand. The findings reveal that after applying trading rules that account for transaction costs and risk, abnormal profits cannot be achieved above a naïve 'buy-and-hold' strategy (with the exception of EMA (100) and EMA (20,100) in Indonesia, and EMA(20,100) in both the Philippines and Thailand). There appears to be some degree of success with application of longer-term trading rules, however, unless transaction costs can be reduced, investors are best advised to pursue passive investment approaches. Despite the economic uncertainty associated with the GFC and ongoing market volatility, it appears that SEA tiger cub stock index futures markets are weak-form efficient.

Keywords: Index futures, Southeast Asia, stock markets, technical trading rules, tiger cub, weak-form efficiency

JEL classification: G11; G14; G15

1. Introduction

Southeast Asian (SEA) 'tiger cub' stock markets (Indonesia, Malaysia, the Philippines and Thailand) have grown rapidly in recent times. The Asian Development Bank (2013) shows that the percentage of stock market capitalisation to gross domestic product (GDP) in Malaysia and Indonesia exceeded 100% at the end of 2011, while for Thailand and the Philippines, stock market capitalisation represented approximately 80% of their GDP. Moreover, SEA tiger cub stock markets have captivated the investment community with their swift recovery since the global financial crisis (GFC) of 2007/08. Investors' zeal for higher returns and opportunities for risk diversification in the aftermath of the GFC have seen the emerging SEA tiger cub stock markets driven substantially higher (Asian Development Bank, 2013). This growth has further been acknowledged by the Association of Southeast Asian Nations (ASEAN), who seeks to

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attain increased regional economic cooperation and financial market integration in the SEA region by 2015 (ASEAN Secretariat, 2012).

The question remains however, are SEA stock market returns unpredictable? In other words, do stock prices quickly and rationally reflect new information (including *all* past and present information)? Fama's (1998) efficient market hypothesis (EMH) claims that prices move randomly due to the unpredictability of information. As such, past data or trends cannot consistently be relied upon to generate abnormal returns, particularly after transaction costs and risk are taken into consideration. While the developed market literature has mostly confirmed this hypothesis, uncertainty surrounding the return predictability of emerging stock markets has inspired researchers to examine whether they are informationally or 'weak-form' efficient.

Most researchers who have conducted weak-form efficiency studies in Asian markets to date appear to be interested in more established stock markets, such as China, Singapore, Taiwan, South Korea, Japan and Hong Kong, with limited attention provided to the emerging SEA tiger cub stock markets. Some studies (Füss, 2005; Guidi and Gupta, 2013; Hamid et al., 2010; Hoque, Kim and Pyun, 2007; Islam, Watanapalachaikul and Clark, 2007; Kim and Shamsuddin, 2008; Lim, Brooks and Kim, 2008) have collectively incorporated SEA tiger cub stock markets into their weak-form efficiency investigations; however, they have seemingly omitted trading rule profitability tests at the expense of completeness.

The limited scope of weak-form efficiency studies conducted on SEA tiger cub stock markets is indeed concering, particularly given the region's appeal to international investors, rapid economic development and lofty financial integration goals (e.g., the formation of ASEAN economic community by 2015). To the best of our knowledge, there has only been one study which focuses solely on weak-form SEA tiger cub stock market efficiency using simple technical trading rules; namely Yu et al. (2013). However, while Yu et al.'s study ran from 1991 to 2008, it only provides limited acknowledgement of the GFC and subsequent economic events. Further, transaction costs per trade have actually decreased over time as a result of increased derivative trading, greater competition and the introduction of sophisticated online trading technologies and platforms. Yu et al. (2013) used stock index prices and round-trip transaction fees of 2.1% for Malaysia, 2.4% for Indonesia, 1% for Thailand and 6.5% for the Philippines across their sample; nevertheless, this seems quite high compared to recent costs associated with index futures trading (OCBC Securities, 2014).

Therefore, our study builds on Yu et al.'s (2013) work by addressing the weak-form efficiency status of stock index futures markets in Indonesia, Malaysia, the Philippines and Thailand during a period of considerable global economic uncertainty. Using daily stock index futures price data, we attempt to establish whether technical trading rules generate abnormal returns (after transaction costs and risk) above a naïve buy-and-hold approach from 2007 to 2012. Specifically, we use simple technical trading rules (e.g., 20- and 100-day exponential moving averages (EMAs)) plus more definitive (and practitioner preferred) rules such as EMA cross-overs and moving average convergence divergence (MACD). The appropriate theoretical framework for this study is the weak-form EMH and empirical testing is defined by the following hypothesis:

H_1: Technical trading rules do *not* outperform a naïve 'buy-and-hold' approach (after transaction costs and risk) during periods of global economic uncertainty and market volatility.

The remainder of this paper is organised as follows: Section 2 briefly highlights the technical trading rule literature. Section 3 outlines the data and methods required to carry out the investigation. Empirical results are presented in Section 4. The study is concluded, along with contributions, implications and recommendations for further research, in Section 5.

2. Literature Review

Weak-form efficiency has been of interest to researchers in global stock markets for several decades, mainly as a result of Fama's (1998) EMH. Fama asserts that no historical trading data can be used to predict stock market returns. Along with traditional tests of the random walk, studies have also employed numerous technical trading strategies to confirm weak-form efficiency. Specifically, these studies examine whether investors are able to generate abnormal profits by exploiting apparent trends in historical share prices after risk and transaction costs.

The literature (Brock, Lakonishok and LeBaron, 1992; Hudson, Dempsey and Keasey, 1996; Bessembinder and Chan, 1995; Fifield, Power and Donald Sinclair, 2005) generally asserts that investors cannot rely on technical analysis to gain abnormal profits using historical prices in informationally efficient markets, especially those in developed countries. However, the informational efficiency status of emerging markets is less certain. As such, the focus of weak-form efficient studies using technical trading analysis has shifted to emerging markets over the last thirty years, with particular attention being paid to high growth Asian economies.

Bessembinder and Chan (1995) investigate the predictive abilities of technical trading strategies (namely moving average and trading range breakout rules) in six Asian countries using daily prices from 1976 to 1989. They discover strong return predictability in the stock markets of Malaysia, Thailand and Taiwan but find the rules less effective in the more established markets of Japan, Hong Kong and South Korea. However, any profits gained from the trading rules were eliminated after incorporating round-trip transaction costs. Raj and Thuston (1996) apply moving average oscillator and trading range breakout rules to discover stock market return patterns in Hong Kong using daily prices from 1989 to 1993. They show that the use of moving averages cannot predict returns, but trading range breakout rules can be useful in generating buy signals.

Ito (1999) adapts technical trading rules, such as variable and fixed length moving averages and trading range break rules, to study daily stock return predictability in Japan, Canada, Mexico, Taiwan and Indonesia from 1980 to 1996. Ito reveals that technical trading rules have considerable predictive power for Indonesia, as well as Japan, Canada, Mexico and Taiwan, and that any profits gained from such rules can be explained by the risk-return relationship (as suggested by asset pricing theory). Similarly, Chang, Lima and Tabak (2004) employ variable moving average and trading range breaks to examine daily prices in Asian countries (including the four SEA tiger cub stock markets) from 1992 to 2000. Like Bessembinder and Chan (1995) and Ito (1999), they conclude that technical trading strategies are more effective in emerging stock markets, as the degree of weak-form efficiency seems to be less than well-established stock markets.

Loh (2007) examine daily prices of five countries (including Australia, Japan, South Korea, Hong Kong and Singapore) from 1990 to 2005 using a number of well-known technical trading rules, such as short- and long-run moving averages, momentum indicators and breakeven cost techniques. Loh's findings indicate that the trading strategies utilised can predict the future directional movements in prices accurately up to 50%. Momentum indicators lead to significantly higher returns on buy days when investors are long the asset. On the other hand, significantly lower returns are experienced on sell days when investors are short the asset. Notably, over 75% of the trading signals accurately predicted future upward and downward movements in prices.

Also, Chen, Huang and Lai (2009) employ reality check, moving average, support and resistance, channel breakout and on-balance volume average rules to examine daily prices and volumes of eight Asian countries (Hong Kong, Indonesia, South Korea, Malaysia, Singapore, Taiwan, Thailand and Japan) from 1975 to 2006. Their findings show that without considering non-synchronous trading bias and transaction costs, short-term moving average strategies offer the best predictive abilities for generating excessive profit in the investigated markets (with the exception of South Korea). However, once accounting for transaction costs, long-term moving averages offer better profit maximisation chances for investors.

Finally, Yu et al. (2013) examine daily and monthly data of seven Asian stock markets (Indonesia, Malaysia, the Philippines, Thailand, Singapore, Hong Kong and Japan) in a consecutive trading period from 1991 to 2008 using technical rules, such as fixed and variable moving averages and trading range breakouts. The study indicated that the trading rules employed were successful in forecasting future movements in SEA tiger cub stock markets but abnormal returns disappeared after transaction costs were taken into account (with the exception of Thailand). Yu et al. (2013) concluded that SEA tiger cub stock markets are weak-form efficient and are becoming more efficient over time.

3. Data and Methods

3.1 Data

The theoretical relation between the price of a stock index futures contract and the price level of the underlying index is:

$$F_t = S_t e^{(r-d)(T-t)}, \quad (1)$$

where F_t is the stock index futures price at time t, S_t is the stock index price at time t, and $r - d$ is the net cost of carrying the underlying stocks in the index (i.e., the rate of interest cost r less the rate at which the dividend yield accrues to the stock index portfolio holder d). T is the expiration date of the futures contract, so $T - t$ is the time remaining in the futures contract life (Stoll and Whaley, 1990). In efficient futures and stock markets (absent of transaction costs), riskless arbitrage profits should not eventuate, so the cost-of-carry relationship in (1) should be met at every instant t during the futures contract life. Thus, the instantaneous rate of price change in the stock index should equal the net cost-of-carry of the stock portfolio plus the instantaneous relative price change of the futures contract:

$$R_{S,t} = (r - d) + R_{F,t}, \quad (2)$$

where $R_{S,t} = Ln(S_t / S_{t-1})$ and $R_{F,t} = Ln(F_t / F_{t-1})$.

However, this study is not concerned with the relationship between spot and futures pricing. Specifically, we focus on stock index futures price series and whether technical trading rules can generate abnormal returns after risk and transaction costs. The data sample employed in this study includes 1,565 price observations of four SEA tiger cub stock market futures indices: Indonesia (*JKSE*), Malaysia (*KLSE*), the Philippines (*PSI*) and Thailand (*SETI*). The sample period under consideration is from 1 January 2007 to 28 December 2012. The data were obtained from SIRCA.

The respective stock index futures are on a monthly expiration cycle (i.e., January, February, March, etc). Since we require the most frequent return observations possible, only the data for the nearby monthly futures contract are used.[2] Also, as none of the stock index futures price series transactions have price observations uniformly spaced in time, it is necessary to convert the price series to returns over a fixed time interval (Stoll and Whaley, 1990). While intra-daily intervals are possible, a daily interval was chosen in order to reduce the effects of transaction costs and risk. The closing price at the end of each trading day (i.e., close of the Indonesian (4:15pm), Thai (4:30pm), Malaysian (5:15pm) and Philippine (5:15pm) Stock Exchanges) is therefore treated as one (1) transaction interval. The daily price series are then used to generate the time series of instantaneous rates of return. The returns for the stock index futures contracts are defined as:

$$R_{F,t} = 100 * Ln(F_t / F_{t-1}) \quad (3)$$

[2] Stoll and Whaley (1990) show that nearby contracts are always the most active in terms of trading volume.

Because returns are computed at the end of each trading day, non-trading day or overnight returns are not included in any of the series. Further, Yu et al.'s (2013) sample period of 1991 to 2008 is not re-tested, as the period of interest is the GFC of 2007/08 and how it affected emerging SEA stock index futures markets in subsequent trading. Malaysian, Thai, Philippine and Indonesian stock markets were chosen exclusively as they represent emerging tiger cub economies. The emerging market literature (Guidi and Gupta, 2013; Hamid et al., 2010; Hoque, Kim and Pyun, 2007; Lim, Brooks and Kim, 2008) indicate that young markets are prone to market inefficiencies and can experience return predictabilities; hence, making tiger cub stock markets prime candidates for the proposed technical analyses. While the more developed Asian markets of Japan, Singapore and Hong Kong were investigated by Yu et al. (2013), they are not classified as tiger cub markets; and therefore, not considered appropriate for inclusion in this study.

3.2 Technical trading rules

Technical trading rule strategies are inherently designed to take advantage of changes in stock prices (i.e., bullish and bearish breakouts indicated by buy and sell signals, respectively) (Pavlov and Hurn, 2012). Recent studies (Chen, Huang and Lai, 2009; Loh, 2007; Pavlov and Hurn, 2012; Yu et al., 2013; Zhu and Zhou, 2009) have documented evidence of abnormal profit generation by employing such rules. Hence, it is appropriate for this study of SEA tiger cub stock index futures markets to utilise technical trading rules during a period of heightened market volatility and economic uncertainty. If the market in question is weak-form efficient, then technical trading rules should *not* generate profits (net of transaction costs and risk) larger than those of a 'buy-and-hold' approach (Fama, 1998). In this study, exponential moving averages (EMAs) (i.e., 20- and 100-day), EMA crossovers, and moving average convergence divergence (MACD) are utilised.

Pavlov and Hurn (2012) suggest that the main advantages of using moving average trading rules is that they are: (1) one of the earliest documented rules for conducting technical analysis; (2) simple in application; and (3) popular in practice. EMAs are employed as an alternative to simple moving averages to assign more weight to recent prices for the purpose of making the prices more responsive to the information at hand. The EMA formula is represented by:

$$EMA_t = \frac{2}{n} \times P_t + \left(1 - \frac{2}{n}\right) EMA_{t-1}, \tag{4}$$

where EMA_t is the exponential moving average at time *t*, *n* is the window bandwidth and P_t is the closing price on day *t*.

Essentially, the EMA is an attempt to reduce the lag of the simple moving average trend line; thus, responding more quickly to changing prices. EMA assumes that a buy/sell signal is produced when the price rises above or falls below a nominated moving average parameter (Murphy, 1999). The selection of moving average parameters requires subjective judgement however, particularly when considering short- and long-term price trends. Since the selection process exposes the EMA to potential 'data snooping' bias (Pavlov and Hurn, 2012), we carry out a robustness test for significant return differences between the selected 20- and 100-day moving average parameters (Ellman, 2011) and all other possible parameters (i.e., ranging from 10 to 50 days (in increments of 10) for shorter-term trends, and from 60 to 200 days (in increments of 20) for longer-term trends), but find none.

Crossovers between two or more EMAs are a practical method of generating buy/sell signals. Specifically, the 20- and 100-day EMA crossover is applied to trading patterns of stock price movements in an attempt to estimate the strength of identified trends (McNew, 2005). Thus, buy/sell signals are triggered when:

1) the 20-day EMA crosses up through the 100-day EMA, indicating a buy signal (20-day > 100-day); or

2) the 20-day EMA crosses down through the 100-day EMA, indicating a sell signal (20-day < 100-day).

MACD levels can be calculated by subtracting a longer-term exponential moving average and a shorter-term exponential moving average. A signal line that is obtained from this calculation generates buy/sell signals in accordance with the crossovers of the two lines. This study employs the most commonly used EMAs for the MACD, applying 12- and 26-day parameters (Ellman, 2011):

$$MACD_t = EMA_t^{12-day} - EMA_t^{26-day} \quad (5)$$

Signal lines can then be obtained via the 9-day EMA of the MACD (Ellman, 2011). A buy signal is triggered when the MACD crosses the signal line from below, whereas a sell signal is triggered when the MACD crosses the signal line from above. Interpretation of the MACD lines is presented as follows:

Buy signal: $MACD\ (t-1) < EMA_{MACD}^{9-day}(t-1)\ and\ MACD(t) > EMA_{MACD}^{9-day}(t)$ (6)

Sell signal: $MACD\ (t-1) > EMA_{MACD}^{9-day}(t-1)\ and\ MACD(t) < EMA_{MACD}^{9-day}(t)$ (7)

For comparative purposes, a naïve 'buy-and-hold' (BH) strategy is also examined. Fama (1998) defines the BH strategy as a selection and purchase of a stock or group of securities which can be called a portfolio at time *t,* with sale of the stock or portfolio at time *t+1* (for *i* = *1* to *n*; where *n* is some predetermined number of sub-period compromising the holding period). Fama claims that passive investment strategies, such as the BH strategy, are the most appropriate way to invest in weak-form efficient markets since share price movements are random. Therefore, it is appropriate to employ the BH strategy in order to benchmark the performance of the technical trading rules carried out.

Buy/sell signals from the above mentioned trading rules are used to generate daily profits or losses. Each rule is determined by calculating the average daily return, standard deviation and cumulative return (both before and after transactions costs) for the respective SEA tiger cub stock futures indices. Further, in order to establish the risk-adjusted returns for each trading rule, Jensen's (1968) performance model is estimated. Following this approach, the regression intercept, alpha (α), is designed to capture the risk-adjusted return (net of the 30-day Treasury bill return and transaction costs) of the respective trading rule. The Jensen model is represented by:

$$r_p = \alpha_p + \beta_p RMRF_t + \varepsilon_i \tag{8}$$

where r_p is the daily return minus the 30-day Treasury bill return and transaction costs of the respective technical trading rule; and *RMRF* is the excess return on the respective SEA tiger cub value-weighted accumulation index. A statistically significant α lower than 1.65, 1.96 or 2.57 at either the 10%, 5% or 1% significance levels, respectively, indicates that $\mathbf{H}_1$ is accepted and the trading rule has not outperformed the BH approach.

For the purpose of improving the predictive ability of the trading rules, a few assumptions and limitations of the analysis have been observed. First, as the data only consists of daily stock index futures price observations, buying and selling decisions are executed at the end of each trading day (Daskalakis and Markellos, 2008; Niblock and Harrison, 2013). Also, futures trading costs are determined to be 0.37% per trade for Indonesia and 0.50% per trade for Malaysia, Thailand and the Philippines (OCBC, 2014).[3] For example, 0.74% and 1.00% will be subtracted from the Indonesian and Malaysian, Thai and Philippine daily returns, respectively, when a buy (long) or a sell (short) signal (or vice-versa) is generated and a new position is taken (which includes the reversal of the old position) (Niblock and Harrison, 2013).

4. Results

[3] Transaction costs include brokerage/commission only. Clearing and trading access fees, taxes and stamp duty are not considered due to the variation of such costs across the tiger cub markets.

4.1 Indonesia

The results show that the EMA (20) produced the highest gross return and MACD the lowest (see Table 1). The standard deviations indicate that the four trading rules and the BH approach have similar characteristics of return volatility. The EMA (20,100) yields the highest net return, whereas MACD produces the lowest net return. Notably, the EMA (20,100) rule outperforms the BH approach, producing a 136.67% (versus 105.29%) net return, albeit at slightly greater risk. Also, the alphas of EMA (100) and EMA (20,100) reject the null hypothesis at the 10% and 5% levels, respectively, suggesting they outperform the BH approach upon consideration of transaction costs and risk. On the other hand, the alphas discovered in EMA (20) and MACD accept the null, implying that they neither under or outperform the BH approach. The performance of the BH approach over these shorter-term trading rules clearly indicates the impact of transaction costs and risk on returns. Overall, the application of longer-term trading rules such as EMA (100) and EMA (20,100) shows that investors can potentially earn abnormal profits in Indonesian stock index futures, inferring a degree of weak-form market inefficiency.

[Insert Table 1]

4.2 Malaysia

The results reveal that the EMA (20) generated the largest gross return and MACD the smallest (see Table 2). The standard deviations demonstrate similar return volatility characteristics. The BH approach produces the highest net return, whereas MACD yields the lowest net return. The alphas of EMA (20), EMA (100), EMA (20,100) and MACD accept the null hypothesis, indicating they neither under or outperform the BH approach when factoring transaction costs and risk. These findings support the notion that investors find it difficult to outperform stock index futures using technical trading rules, and that the BH remains the best approach in Malaysia. Based on this evidence, the Malaysian stock market appears to be weak-form efficient.

[Insert Table 2]

4.3 Philippines

The results show that the EMA (20) produced the highest gross return and MACD the lowest (see Table 3). The standard deviations have similar characteristics of return volatility. The BH approach yields the highest net return, whereas MACD produces the lowest net return. A contributing factor to the net performance of the trading rules is the number of transactions undertaken. For instance, the EMA (20) gross return was 146.375% (versus 81.341% for BH) before trading costs were taken into account. The alphas of EMA (20), EMA (100) and MACD fail to reject the null hypothesis, suggesting they neither under or outperform the BH approach. On the other hand, the alpha discovered in EMA (20,100) rejects the null at the 10% level, implying that this trading rule outperforms the BH approach after risk and transaction costs. Overall, Philippine stock index futures market appears to be weak-form efficient. However, the application of longer-term trading rules such as EMA (20,100) shows that investors can potentially earn abnormal profits.

[Insert Table 3]

4.4 Thailand

The results reveal that the EMA (20) generated the largest gross return and the BH approach the smallest (see Table 4). The standard deviations demonstrate similar return volatility characteristics. The EMA (20,100) approach produces the highest net return, whereas MACD yields the lowest net return. Again, the magnitude of transaction costs eliminates any gains associated with the trading strategies, making the BH the most practical approach (with the exception of EMA (20,100). The alphas of EMA (20), EMA (100) and MACD accept the null hypothesis, indicating they neither under or outperform the BH approach when factoring transaction costs and risk. However, the alpha discovered in EMA (20,100) rejects the null at the 10% level, suggesting that this rule outperforms the BH approach. Overall, the application of trading rules (that account for risk and transaction costs) cannot be manipulated to obtain abnormal profits above a simple BH approach (with the exception of EMA (20,100)); hence, the Thai stock index futures market appears to be weak-form efficient.

[Insert Table 4]

5. Conclusions

Yu et al. (2013) suggests that technical trading rules do not outperform a 'buy-and-hold' strategy in tiger cub markets; however, this finding is based on a sample that does not incorporate the full effects of the GFC and recent trading activity. As such, our sample incorporated GFC and post-GFC specific stock index futures data, lower transaction costs and additional (practitioner popular) trading rules that were not considered by Yu et al. (2013). Our results showed that: (1) technical trading rules successfully generated large gross returns; thus, revealing the predictive abilities of such strategies in emerging SEA stock index futures markets; (2) abnormal gross returns were eliminated after transaction costs were taken into consideration (with the exception of EMA (20,100) in both Indonesia and Thailand); (3) Jensen alphas were mostly positive (with the main exception being MACD across all markets), and the null accepted for the majority of the trading rules (with the exception of EMA (100) and EMA (20,100) in Indonesia, and EMA(20,100) in both the Philippines and Thailand), inferring that the 'buy-and-hold' approach is preferred; (4) short-term trading rules (e.g., EMA (20) and MACD) are not as successful as their long-term counterparts (e.g., EMA (100) and EMA (20,100)), particularly after risk and transaction costs are factored; (5) our findings differed from Yu et al. (2013) on the determination of a crisis-centric sample period (2007-2012) and application of futures instruments with lower transaction costs. Yu et al. (2013) revealed that abnormal returns were eliminated after considering relatively high brokerage costs. However, our study utilised more competitive brokerage rates; thus, increasing the potential of making profits for investors in SEA tiger cub stock index futures markets; and (6) Despite the economic uncertainty associated with the GFC and ongoing market volatility, SEA tiger cub stock index futures markets appear to be weak-form efficient, as only four out of the possible sixteen trading rules rejected the null hypothesis.

Our study extends literature related to the assessment of weak-form market efficiency in emerging economies by revealing investment characteristics of SEA tiger cub stock index futures markets during (and beyond) a significant crisis event. The overall profitability of technical trading strategies in SEA stock index futures markets clearly depend on: (1) the technical trading rules employed (i.e., shorter-term trading rules are effective before transaction costs, while longer-term trading rules appear to be more successful after transaction costs; (2) obtaining lower transaction and information gathering costs; and (3) a decline in weak-form market efficiency. Unless transaction costs can be reduced, investors are best advised to pursue passive 'buy-and-hold' investment approaches. Also, given the likelihood of increased weak-form efficiency due to ongoing financial liberalisation and better policy design via the ASEAN economic initiative, it is unlikely that abnormal profits will easily be obtained in SEA tiger cub stock index futures markets going forward.

Nevertheless, the degree of weak-form market efficiency may change in the future depending on the evolution of regional economic progress and/or development of new financial crises. Further research could address these potential issues by applying more sophisticated technical trading rules, such as stochastic oscillators, Bollinger bands and relative strength indicators, along with application of intra-daily stock index futures data and potentially lower transaction costs over time. Ultimately, a greater understanding of emerging SEA tiger cub markets and technical trading strategies will assist investors in making more informed investment decisions.

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Table 1. Trading rule profitability – Indonesia.

	EMA (20)	**EMA (100)**	**EMA (20,100)**	**MACD**	**BH**
Trading Days	1545	1465	1465	1531	1565
# Buy Signals	79	24	6	60	1

# Sell Signals	79	23	5	59	0
# Winning Days	818	803	807	760	895
Cumulative Winning Days (%)	886.756%	834.336%	842.212%	808.422%	864.402%
# Losing Days	727	662	658	771	670
Cumulative Losing Days (%)	-714.697%	-705.649%	-697.773%	-783.849%	-758.738%
Average Daily Return (%)	0.111%	0.088%	0.099%	0.016%	0.068%
Standard Deviation (%)	1.578%	1.605%	1.604%	1.587%	1.579%
Gross Cumulative Return (%)	172.059%	128.688%	144.439%	24.573%	105.664%
Transaction Costs (%)	-116.550%	-34.410%	-7.770%	-87.690%	-0.370%
Net Cumulative Return (%)	55.509%	94.278%	136.669%	-63.117%	105.294%
Alpha	0.000579	0.000770	0.000949	-0.000138	NA
(t-stat)	1.428036	1.833697*	2.258489**	-0.355663	NA

Notes: EMA, MACD and BH refer to the exponential moving average, moving average convergence divergence and buy-and-hold trading rules, respectively. Transactions costs are 0.37% per trade and incurred when opening and closing long/short positions. Trading occurs when technical signals indicate long/short positions. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Table 2. Trading rule profitability – Malaysia.

	EMA (20)	**EMA (100)**	**EMA (20,100)**	**MACD**	**BH**
Trading Days	1545	1465	1465	1531	1565
# Buy Signals	80	24	6	53	1

# Sell Signals	79	23	5	53	0
# Winning Days	834	811	807	779	862
Cumulative Winning Days (%)	498.591%	444.867%	433.477%	455.298%	467.532%
# Losing Days	711	654	658	752	703
Cumulative Losing Days (%)	-376.983%	-365.851%	-377.241%	-410.197%	-419.816%
Average Daily Return (%)	0.079%	0.054%	0.038%	0.029%	0.030%
Standard Deviation (%)	0.840%	0.823%	0.824%	0.844%	0.841%
Gross Cumulative Return (%)	121.607%	79.016%	56.236%	45.101%	47.716%
Transaction Costs (%)	-158.500%	-46.500%	-10.500%	-105.500%	-0.500%
Net Cumulative Return (%)	-36.893%	32.516%	45.736%	-60.399%	47.216%
Alpha	-0.000168	0.000262	0.000341	-0.000308	NA
(t-stat)	-0.684104	1.164807	1.575901	-1.368987	NA

Notes: EMA, MACD and BH refer to the exponential moving average, moving average convergence divergence and buy-and-hold trading rules, respectively. Transactions costs are 0.50% per trade and incurred when opening and closing long/short positions. Trading occurs when technical signals indicate long/short positions. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Table 3. Trading rule profitability – Philippines.

	EMA (20)	EMA (100)	EMA (20,100)	MACD	BH
Trading Days	1545	1465	1465	1531	1565

# Buy Signals	81	24	6	60	1
# Sell Signals	80	23	5	61	0
# Winning Days	812	776	775	772	832
Cumulative Winning Days (%)	804.693%	740.784%	732.906%	740.955%	783.074%
# Losing Days	733	689	690	759	733
Cumulative Losing Days (%)	-658.318%	-637.017%	-644.895%	-709.338%	-701.733%
Average Daily Return (%)	0.095%	0.071%	0.060%	0.021%	0.052%
Standard Deviation (%)	1.354%	1.340%	1.341%	1.359%	1.356%
Gross Cumulative Return (%)	146.375%	103.766%	88.011%	31.617%	81.341%
Transaction Costs (%)	-160.500%	-46.500%	-10.500%	-120.500%	-0.500%
Net Cumulative Return (%)	-14.125%	57.266%	77.511%	-88.883%	80.841%
Alpha	-0.000036	0.000476	0.000595	-0.000443	NA
(t-stat)	-0.099092	1.328986	1.703236*	-1.251622	NA

Notes: EMA, MACD and BH refer to the exponential moving average, moving average convergence divergence and buy-and-hold trading rules, respectively. Transactions costs are 0.50% per trade and incurred when opening and closing long/short positions. Trading occurs when technical signals indicate long/short positions. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Table 4. Trading rule profitability – Thailand.

	EMA (20)	**EMA (100)**	**EMA (20,100)**	**MACD**	**BH**
Trading Days	1545	1465	1465	1531	1565

# Buy Signals	78	27	9	54	1
# Sell Signals	77	26	8	53	0
# Winning Days	849	776	781	824	841
Cumulative Winning Days (%)	816.110%	766.333%	765.650%	778.040%	783.516%
# Losing Days	696	689	684	707	724
Cumulative Losing Days (%)	-642.360%	-652.663%	-653.346%	-670.938%	-696.508%
Average Daily Return (%)	0.112%	0.078%	0.077%	0.070%	0.056%
Standard Deviation (%)	1.345%	1.376%	1.376%	1.351%	1.349%
Gross Cumulative Return (%)	173.750%	113.671%	112.304%	107.102%	87.008%
Transaction Costs (%)	-154.500%	-52.500%	-16.500%	-106.500%	-0.500%
Net Cumulative Return (%)	19.250%	61.171%	95.804%	0.602%	86.508%
Alpha	0.000275	0.000487	0.000664	0.000185	NA
(t-stat)	0.748382	1.308379	1.836804*	0.530642	NA

Notes: EMA, MACD and BH refer to the exponential moving average, moving average convergence divergence and buy-and-hold trading rules, respectively. Transactions costs are 0.50% per trade and incurred when opening and closing long/short positions. Trading occurs when technical signals indicate long/short positions. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.