SPECULATIVE EFFICIENCY OF STOCK INDEX FUTURES MARKETS: AN ANALYSIS ON THE ASEAN MARKETS

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─Abstract─
The capital markets in emerging economies are undergoing rapid transformation due to the advancement of technological innovations and globalization of the marketplace. Thus, the risk management measures are extremely important throughout the financial system. However, the scarcity of derivative instruments such as futures and options in emerging markets, in addition to the failure to generate liquidity, have made the emerging economies to be left behind in the recent development of the world capital markets. While there are a great number of earlier studies that analyse the efficiency of futures markets in different countries, there is a lack of research that take into account of the speculative efficiency of futures markets which argues that futures prices are an unbiased

forecast of the spot prices as well as a crucial part of forecasting techniques. This paper aims to investigate the speculative efficiency of stock index futures markets in the ASEAN markets which comprises of Singapore, Malaysia and Thailand by employing an econometric time series data analysis ranging from January 2000 to December 2010.

Keywords: *Speculative Efficiency, Futures Markets, Stock Index, ASEAN*
JEL Classification: G14, G15

1. INTRODUCTION

Recent years have witnessed increasing attention in the issue of derivative financial instruments, which have proven to be among the best measures of risk management. A strong risk management measures in developed markets have proven that those markets are able to generate high liquidity with continuous development in their financial systems. Hence, the risk management measures are extremely important throughout the financial system in the emerging markets in order to mitigate any unforeseen volatilities, which the world have seen in various financial crisis in the region throughout the decade. However, the scarcity of derivative instruments in emerging markets, compounded with the weaker ability to generate liquidity, have made the emerging economies lagging behind the mainstream development of world's capital markets. In addition to that, the experiences of derivatives failures in other countries have also contribute to the delay in utilizing derivatives instruments in most countries in the region. According to Hull (2009), some corporations plan to reduce or even eliminate their use of derivatives due to the huge losses experienced from the use of derivatives.

Among a number of derivatives instruments, futures is one of them that have been extensively used by corporations as a measure of protection against unexpected movements of the markets. Futures markets are derivatives markets that exist due to the existence of a cash market. The role of the futures markets are to manage risks associated with the changes in price volatility of certain assets as well as to provide the opportunities for speculators (Malliaris 1999). Futures markets have produced numerous studies focusing on various issues mainly on market efficiency of futures, the relationship between spot and futures prices as well as the hedging mechanism of futures market (Athanasious 2010; Otto 2011; Switzer and Khoury 2007; Ibrahim and Sundaresen 2010; Pattarin and Ferretti 2004). Theoretically, the market efficiency of futures markets is being described by the

Speculative Efficiency Hypothesis which introduces a concept of unbiasedness in market efficiency and futures price is considered as the best predictor of future spot price as the market prices fully reflects available information with no risk premium.

Most of the studies on futures market efficiency have been done in the context of the developed and some selected emerging countries around the world. However, not many of them focus on regional markets such as ASEAN, which are still lacking in risk management, especially in the use of derivatives. As the market volatilities in emerging economies such as ASEAN countries are rather high, there is a need for an efficient risk management practice and eventually a well-organized equity-based financial futures and option markets in the region. Apart from that, despite the numerous studies in futures market efficiency, only a small number of them focusing on the speculative efficiency of futures markets (Otto 2011; Lean, McAleer and Wong 2010; Switzer and Khoury 2007), which argues that futures prices are an unbiased forecast of the spot prices. The literature in general, shows that there are mixed findings in prior studies that engage in the market efficiency of futures markets. In addition to a small number of research on speculative efficiency of futures markets, the majority of them are merely focusing on the commodity futures market instead of stock index futures markets. Since the nature of commodity futures is rather different from the stock index futures, it is also crucial to examine the different aspects of speculative efficiency in the selected stock index futures markets.

Hence, this study aims to gain better understanding on the speculative efficiency of stock index spot and futures markets focusing on the ASEAN markets. For that purpose, it shall examine whether futures prices are the best predictor of future spot prices in those market. The final results of the study may suggest several measures to strengthen the risk management roles of the stock index futures markets in the region.

2. LITERATURE

2.1 Theoretical Background

The speculative efficiency hypothesis by Bilson (1981) demonstrates that best unbiased forecasting using the forward price is not a necessary component of either rational expectations or an efficient market approach. He clarifies the

unbiased predictor hypothesis as speculative efficiency hypothesis by showing that market expectations are rational despite the different between futures prices and the future spot prices due to transaction cost and risk aversion. The speculative efficiency is a different concept which is in contrast to informational efficiency as it does not imply that the expectations of the future spot prices must be rational and should all be incorporated in the futures prices (Ullrich 2009). In addition to that, Bilson (1981) also shows that speculative efficiency applies when markets are efficient as any opportunity for risk-adjusted excess returns is eliminated, but in which are predictably biased in the futures price forecast.

The rationale behind the extensively used of speculative efficiency hypothesis is due to the difficulty of testing the arbitrage relationship in studying the efficiency of the futures and spot prices, which is due to the unobservable nature of storage costs and convenience yields in the commodity markets (Switzer and Khoury 2007). There are various theoretical models of market efficiency for futures. As mentioned earlier, the most common framework used in most studies in commodity futures is the arbitrage free or cost-of-carry model in which the futures price is represented as:

$$F_t = S_t e^{(r+u-d)(T-t)} \qquad (1)$$

where F_t is the futures price at time t, S_t is the spot price at time t, r is the risk-free interest rate, u is the storage cost, d is the convenience yield, T is the expiration date of the futures contract and $T - t$ is the time to expiry of the futures contract. As mentioned by Switzer and Khoury (2007), the arbitrage relationship represented in Equation (1) is difficult to be tested due to the unobservable nature of storage costs and convenience yields in the commodity markets. Therefore, most studies focus on the weak-form/speculative market efficiency tests as follows:

$$St = \alpha + \beta F_{t-i} + \mathcal{E}_t \qquad (2)$$

The speculative market efficiency tests require that futures prices should be unbiased predictors of future spot prices in order to prevent the risk-neutral speculators from making consistent profits on long or short futures positions over time. The empirical tests of the speculative efficiency hypothesis are based on tests of the joint hypothesis $\alpha = 0$, $\beta = 1$.

2.2 Speculative Efficiency of Futures Market

The argument by the speculative efficiency hypothesis that the futures price is the best unbiased predictor of the future spot price has created a great number of research in the literature. For instance, examining the efficiency of the oil market by focusing on the extreme volatility periods during the Iraqi war in 2003, Switzer and Khoury (2007) discover that the crude oil futures contract prices behave as unbiased predictors of future spot prices while confirming the market efficiency through the cointegration relationship between the futures and spot prices. Another study by McKenzie and Holt (2002) examines the market efficiency and unbiasedness of four agricultural commodity futures markets and they confirm the speculative efficiency hypothesis as the findings indicate that each market is unbiased in the long-run despite short-run inefficiencies and pricing biases for some markets. In addition to that, Kawamoto and Hamori (2011) examine market efficiency and unbiasedness among WTI futures with different maturities using cointegration analysis and short-term market efficiency and it is shown that WTI futures are consistently efficient within 8-month maturity while consistently efficient and unbiased within 2-month maturity.

Despite the various supports of the speculative efficiency hypothesis as indicated in the literature throughout the decade, there are also a number of research that disagree with the hypothesis. For instance, a study by Otto (2011) analyzes the speculative efficiency of six base metals traded at the LME using the 3-month and 15-month futures contracts and it is shown that the speculative efficiency hypothesis is rejected for all base metal contracts except for both aluminium and the 3-month lead contract, while speculative efficiency reduces significantly for the period after 2000. In addition to that, Alquist and Kilian (2010) apply a two-country, multi-period general equilibrium model of both the spot and futures market for crude oil and they discover that the price of crude oil futures is not the most accurate predictor of the spot price of crude oil in practice. Another study by He and Hong (2011) undertakes a rigorous test for the joint hypothesis by using monthly observations of spot and futures prices of WTI crude oil and they find evidences that are against the joint hypothesis of unbiasedness and market efficiency in the crude oil futures markets.

3. METHODOLOGY

3.1 Data

The data that will be used in this research is a time series data on daily closing prices of the stock index together with daily settlement prices of stock index futures of nearby contracts of selected ASEAN markets for the period as follows:

i. Malaysia's KLCI stock index and its futures contract – January 2000 to December 2010
ii. Singapore's Straits Times index and its futures contract - June 2000 to December 2010
iii. Thailand's SET50 index and its futures contract – May 2006 to December 2010

The time series data of the spot price and the futures contract prices for each country will be obtained from both *Bloomberg*. These countries are chosen as they have put in place their own futures instruments as part of their risk management measures. Among these countries, Malaysia is the pioneer in introducing the region's first stock index futures contract in December 1995, which is the Kuala Lumpur Futures Index (KLFI). It was then followed by other countries which had also introduced their own futures contracts as opposed to their underlying indices. Subsequent to the launching of Malaysia's stock index futures in December 1995, it was followed by Singapore's famous Straits Times index futures in June 2000. Thailand were then introduced her own index futures, SET50 index futures in May 2006.

The statistical characteristics of the data are shown in **Table I** which demonstrates the distribution of the daily closing nearby futures contract prices.

Table I: Distribution of Daily Contract Prices

Prices	Mean	Maximum	Minimum	SD	Skewness	Kurtosis	Jarque-Bera
Malaysia							
Futures	955.78	1531.00	549.90	250.74	0.5407	2.1940	205.46
Spot	956.96	1528.01	553.34	251.52	0.5302	2.1660	205.58
Singapore							
Futures	2259.74	3878.00	1210.00	643.61	0.4300	2.1469	161.30
Spot	2235.01	3831.19	1170.85	641.05	0.4249	2.1044	167.56
Thailand							
Futures	506.63	734.50	258.30	104.01	-0.3875	3.0246	28.59
Spot	508..14	733.22	261.30	102.14	-0.3948	3.0123	29.64

3.2 Empirical Model

To test for speculative market efficiency, the study examined whether the futures contracts are unbiased predictors of future spot prices based on monthly horizon. The unbiasedness of the futures prices that has been examined in the study is similar to those of Switzer and West (1997)'s and Khoury (2007)'s. The first test looked at how well futures and the spot prices on the day immediately after the expiration of the contract are used as the best available forecast for the coming month. For this purpose, since the data is on a daily basis, the spot prices were rolled over to monthly basis.

The second test was undertaken to see whether the basis at any period contains information about future spot prices or contains information about the risk premium at the expiration of the future contract. A regression approach by Fama (1984) was implemented for this test. For that purpose, two equations were estimated.

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The first is:

$$S_{t+1} - S_t = \alpha_1 + \beta_1(F_t - S_t) + \varepsilon_1 \qquad (3)$$

The second is:

$$F_t - S_{t+1} = \alpha_2 + \beta_2(F_t - S_t) + \varepsilon_2 \qquad (4)$$

Where $(F_t - S_t)$ is the basis at time t, S_{t+1} is the observed spot price at time $t + 1$ and F_t is the futures contract price at time t, and $\varepsilon_{1,t+1}$ and $\varepsilon_{2,t+1}$ are residual terms. If β_1 is significantly different than zero, then it is assumed that $(F_t - S_t)$ contains information about the changes in spot price. Furthermore, if β_2 is significantly different than zero then the premium, $(F_t - S_{t+1})$ has variations that shows up in the basis.

The data series in the above estimations needs to be stationary. Thus, stationarity test was undertaken by using the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests.

4. RESULTS AND ANALYSIS

It is shown in Table II show that the basis, the premium, and the change in the stock index future spot prices in all stock index futures markets in Malaysia, Singapore and Thailand are indeed stationary, and hence the regressions are well specified.

Table III reports the results of the estimation of Equations (3) and (4) for all the three markets. Based on the estimates of Equation (3), it is concluded that the basis at time *t* contains some information regarding future changes in all the spot markets. Unbiasedness of the futures as predictors of spot prices is supported for all three markets since the estimated constant terms are not significantly different from zero, and the slope coefficients are not significantly different from one, for all the markets. For Equation (4), the results are consistent with a time-varying risk premium for all three markets in ASEAN.

Table II: Unit Root Test Statistics based on Fama (1984) Model

KLCI (Malaysia)

Series: Jan. 2000-Dec.2010	**ADF**	**PP**
Change in Spot	-6.7088*	-7.0113*
Basis	-17.2652*	-44.4264*
Risk Premium	-6.6706*	-7.1672*

Straits Times Index (Singapore)

Series: June 2000-Dec.2010	**ADF**	**PP**
Change in Spot	-6.0747*	-6.5347*
Basis	-3.5768*	-50.1364*
Risk Premium	-6.2849*	-6.8105*

SET50 Index (Thailand)

Series: May 2006-Dec.2010	**ADF**	**PP**
Change in Spot	-4.2170*	-4.3792*
Basis	-14.4664*	-32.1571*
Risk Premium	-4.5588*	-4.8193*

Note: ADF and PP denote augmented Dickey-Fuller (1981) and Phillips-Perron (1988), respectively. The values reported in the table represent the t-statistics for the ADF and PP test. The asterisk denotes significance at a 1% level.

Table IV reports the Wald test results for both models in which the expectation hypothesis is examined by restricting the coefficients $\alpha_1 = 0$, $\beta_1 = 1$ in Equation (3) and $\alpha_2 = 0$, $\beta_2 = 1$ in Equation (4) for all the three markets under study.

According to Bilson (1981), the speculative efficiency hypothesis requires that the variables are jointly insignificant in the regression equation. Thus, based on the results, it is shown that the speculative efficiency hypothesis is rejected for all three stock index futures markets due to significant *p-values* indicated by the relevant regressions.

Table III: Results of Fama (1984) Model

KLCI (Malaysia)

Estimation Period: Jan. 2000-Dec.2010	α_1	β_1	***F-Stat***
Equation (3): $S_{t+1} - S_t = \alpha_1 + \beta_1(F_t - S_t) + \varepsilon_{1,t+1}$	7.391790 [1.143070]	0.808341* [0.086949]	86.42913*
	α_2	β_2	***F-Stat***
Equation (4): $F_t - S_{t+1} = \alpha_2 + \beta_2(F_t - S_t) + \varepsilon_{2,t+1}$	-7.391790 [1.143070]	0.191659** [0.086949]	4.858806**

Straits Times Index (Singapore)

Estimation Period: June 2000-Dec.2010	α_1	β_1	***F-Stat***
Equation (3): $S_{t+1} - S_t = \alpha_1 + \beta_1(F_t - S_t) + \varepsilon_{1,t+1}$	-10.79812 [3.797674]	0.915873* [0.071175]	165.5829*
	α_2	β_2	***F-Stat***
Equation (4): $F_t - S_{t+1} = \alpha_2 + \beta_2(F_t - S_t) + \varepsilon_{2,t+1}$	10.79812 3.797674]	0.084127 [0.071175]	1.397068

SET50 Index (Thailand)

Estimation Period: May 2006-Dec.2010	α_1	β_1	***F-Stat***
Equation (3): $S_{t+1} - S_t = \alpha_1 + \beta_1(F_t - S_t) + \varepsilon_{1,t+1}$	6.447040 [1.485759]	0.612079* [0.145673]	17.65451*
	α_2	β_2	***F-Stat***

Equation (4): $F_t - S_{t+1} = \alpha_2 + \beta_2(F_t - S_t) + \varepsilon_{2,t+1}$	-6.447040 [1.485759]	0.387921* [0.145673]	7.091307*

Note: Robust standard errors are reported inside parentheses.
*Denotes significance at a 1% level. ** Denotes significance at a 5% level.

Table IV: Wald Test Results of Fama (1984) Model

KLCI (Malaysia)

Estimation Period: Jan. 2000-Dec.2010	$\alpha_1 = 0, \beta_1 = 1$	$\beta_1 = 1$	$\alpha_1 = 0$
Equation (3): $S_{t+1} - S_t = \alpha_1 + \beta_1(F_t - S_t) + \varepsilon_{1,t+1}$	54.5405 [0.0000]	31.2679 [0.0000]	86.4291 [0.0000]
	$\alpha_2 = 0, \beta_2 = 1$	$\beta_2 = 1$	$\alpha_2 = 0$
Equation (4): $F_t - S_{t+1} = \alpha_2 + \beta_2(F_t - S_t) + \varepsilon_{2,t+1}$	31.1233 [0.0000]	53.8969 [0.0000]	4.8588 [0.0276]

Straits Times Index (Singapore)

Estimation Period: June 2000-Dec.2010	$\alpha_1 = 0, \beta_1 = 1$	$\beta_1 = 1$	$\alpha_1 = 0$
Equation (3): $S_{t+1} - S_t = \alpha_1 + \beta_1(F_t - S_t) + \varepsilon_{1,t+1}$	88.3161 [0.0000]	9.6514 [0.0019]	165.583 [0.0000]
	$\alpha_2 = 0, \beta_2 = 1$	$\beta_2 = 1$	$\alpha_2 = 0$
Equation (4): $F_t - S_{t+1} = \alpha_2 + \beta_2(F_t - S_t) + \varepsilon_{2,t+1}$	7.0021 [0.0009]	6.6566 [0.0099]	1.3971 [0.2373]

SET50 Index (Thailand)

Estimation Period: May 2006-Dec.2010	$\alpha_1 = 0, \beta_1 = 1$	$\beta_1 = 1$	$\alpha_1 = 0$
Equation (3): $S_{t+1} - S_t = \alpha_1 + \beta_1(F_t - S_t) + \varepsilon_{1,t+1}$	13.4863 [0.0000]	13.4408 [0.0003]	17.6545 [0.0000]

	$\alpha_2 = 0, \beta_2 = 1$	$\beta_2 = 1$	$\alpha_2 = 0$
Equation (4): $F_t - S_{t+1} = \alpha_2 + \beta_2(F_t - S_t) + e_{2,t+1}$	18.6193 [0.0000]	25.1229 [0.0000]	7.0913 [0.0079]

Note: F values reported. *p*-values reported in parentheses.

5. CONCLUSION

This research attempts to investigate the speculative market efficiency of stock index futures markets of a few selected markets in ASEAN region, namely stock index futures in Malaysia, Singapore and Thailand. From an academic point of view, the test for speculative efficiency of futures markets is especially interesting in reference to the efficient-market hypothesis. As the speculative efficiency hypothesis is rejected for all three stock index markets in Malaysia, Singapore and Thailand, it is indicated that the prices do not fully reflect all available information and the futures contracts in all three markets do not behave as unbiased predictors of future spot prices. Thus, these results are not in support of the prominent theory of efficient market hypothesis as well as the speculative efficiency hypothesis.

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