THE IMPACT OF SINGLE STOCK FUTURES ON SPOT PRICE VOLATILITY OF UNDERLYING STOCK IN THE STOCK EXCHANGE OF THAILAND DURING 2006 - 2012

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ABSTRACT: *The impact of the Stock Futures Trading to spot market has been considered by many countries all around the world. The debate on whether Stock Futures destabilizes or stabilizes the spot market has been well established in the developed market and emerging market on the Stock Index level. This research aims to examine the impact of the introduction of the Single Stock Futures on the volatility of the underlying equity in the Stock Exchange of Thailand from year 2006 to 2012, using the GARCH model. Based on (GARCH 1,1) model analysis, this study showed the introduction of Single Stock Futures stabilized the spot market volatility in Thailand. The coefficient γ of all 11 stocks shows a statistically significant level. Additionally, the SET Index was included and set up another model to test as another factor that causes volatility and found post-futures period volatility in the spot market decreased after an introduction of Single Stock Futures trading. In conclusion, the introduction of Single Stock Futures trading decreases the spot price volatility in the market. By considering (SET) as market factors, the results also found most Single Stock Futures trading also decreases the spot price volatility.*

Keywords: *Single Stock Futures, SSF, Stock Volatility, GARCH, spot market volatility*

Introduction

Historically derivatives were first used to secure the supply of the commodity and trade to help insure farmers against crop failure. They developed to serve for other purposes such as the source of funding. (EFTA Seminar on Regulation of Derivatives markets, Zurich, 3 May 2012). The Derivative markets relate to the spot market as it provides the function of price discovery and risk management. A kind of Derivatives instrument which are the Futures allows traders to expose to higher opportunity to make a profit with lower transaction cost which also provides higher leverage, (Bessembinder & Paul, 1992). The futures contract also offers institutional investors the opportunity to reduce the risk in their portfolio by hedging and increases in leverage which help enhance the liquidity.

Empirically, the research on the impact of futures trading on the volatility of the underlying asset has been one of the most well-researched topics in many countries (Bessembinder & Paul, 1992, Grossman & Miller, 1988, Zonghao 2014, Faff & McKenzie, 2002). Nevertheless, academic literature has noted conflicting results, particularly whether the effect of the futures trading has increased or decreased the volatility of the underlying assets. According to Stoll and Whaley (1988), the introduction of S&P 500 futures contracts stabilized the volatility of the underlying spot market. Similarly, Bessembinder and Paul (1992) discovered that the introduction of S&P 500 futures trading decreased the spot volatility of S&P 500. Furthermore, Grossman and Miller (1988) discovered that index arbitrageur helped improve the market depth. These findings were also supported by the earlier work of Danthine (1978), which concluded that the existence of futures markets

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improved market depth and reduced volatility.

It is important to note that the preceding debate is mainly based on research conducted on the effect of the Stock Index Futures on the spot market. With the advancement of the derivatives markets, the Single Stock Futures, a Future contract on the individual equity, has been introduced and widely used across several markets over the past 18 years. In the U.S. market, for instance, the Single Stock Futures has started trading since 2002. Currently, OneChicago, the futures exchange, offered approximately 12,509 Single Stock Futures (SSF) products, for leading equities such as IBM, Apple and Google. Future contracts are regulated by Commodity Futures Trading Commission Act of 1974.

In Thailand, Stock Index Futures have been introduced since 2006, by Thailand Futures Exchange (TFEX). The first product, launched for trading, is the SET 50 Index Futures, for which the underlying asset is the SET 50 Index, an index covering the top 50 stocks in Thailand by market capitalization. From the academic perspectives, several studies have been conducted to assess the impact of SET50 Index Futures trading on the spot price volatility as well as contribution to the market development.'

As the futures market becomes more developed, the Single Stock Futures were first introduced in Thailand Futures Exchange (TFEX) in November 2008. The first batch of Single Stock Futures are PTT Public Company Limited (PTT), PTT Exploration and Production Company Limited (PTTEP) and Advanced Info Service Public Company Limited (ADVANC), which were the top three stocks with highest market capitalization at that time. Each Single Stock Futures contract constitutes 1,000 shares of the underlying equity per contract with maturities in March, June, September and December. Since then, the Single Stock Futures has been continuously developed. As of 20 Mar 2020, the total number of actively traded Single Stock Futures are 112 stocks, with the volume of 404,351 contracts and 1,571,388 open interests.

Compared with the research on the SET 50 Index Futures, the study of Thai Single Stock Futures is still limited. There has been only one study by Chiyapluek Yamramai, (2013).

To contribute to the deeper development of empirical literature in this area, this study proposes to investigate the impact of Thai Single Stock futures on spot market volatility by expanding the study period, as well as the number of Single Stock Futures in the analysis. Explain research objectives here.

In this study, 11 Single Stock Futures were selected based on the same launching date on 22 June 2009.

Literature Review

Futures prices reflect the collective wisdom of those willing to put their money on the line, and this information is available to the entire economy of making consistent and rational decisions about resource allocation, Cagan (1981). The belief that futures trading leads to higher spot market volatility due to the low cost of investment and high leverage attract the speculator into the market is widely held.

The analysis of Stock Index Futures and its impact on the spot market in academic and finance literature have been pointed out widely; especially, the index in the developed market such as FTSE-100, S&P 500 and NIKKEI225. More specifically, Antoniou and Holmes (1992) studied the impact of FTSE-100 Stock Index futures trading on the volatility of the underlying spot market, using GARCH (1,1). They discovered that the Stock Index futures trading significantly impacted the spot market volatility. In the studies by Edwards (1988b, 1988a), results indicated that the spot price of S&P 500 decreased significantly after an introduction of S&P Index future trading during 1972 - 1987 (Excluding 1979-1982).

Apart from the preceding evidence in developed markets, empirical evidence in the emerging market remains mixed. On the one hand, researches seem to suggest that the Future Index Trading had helped reduce the spot price volatility. Debasish (2009) studied the effect of NSE Nifty futures trading on spot price volatility by using GARCH (1,1). Their study also found that the futures markets improved pricing efficiency by providing hedging vehicles that lessened the volatility in the spot market. In contrast, the study of FTSE/ASE20 (Athens Stock Exchange) on Index Futures Trading and spot price volatility, using E-GARCH found futures trading has no effect on the volatility of the underlying market (Spyrou, 2005).

With the preceding debate, researchers have been exploring the relationship of the Single Stock Futures trading on the spot price volatility, in addition to the Stock Index Futures. At the same time, the interest in Single Stock Futures trading impact on spot price volatility among researchers is still not common to be found. Single Stock Futures has been examined by different researchers by different dimensions of practical implementation. A majority of studies on Single Stock Futures have focused on the relationship between futures contracts and their impact on spot market volatility of the underlying assets. According to Beer (2009) the spot price volatility of South African stocks is significantly affected by the initial trading of Single Stock Futures contracts corresponding with a reduction in the level and structure of stock price volatility in the underlying market. The other research on Italian stock exchange using GARCH (1,1) found the result that supports the hypothesis that Fib30 futures contract has a stabilizing effect on the underlying stock market (Bologna and Cavallo, 2002).

The study of the impact on futures trading on spot price volatility has been well established in developed countries but only a few studies in an emerging market like Thailand.

As in Thailand, Bamrungsap (2018) investigated the Impact of Futures Market on Spot Price Volatility, using SET50 Stock Index data, ranging from January 2000 to April 2008; the result found new information has been transmitted to the spot market faster after the introduction of futures market in Thailand, the persistence of past information also reduces; as a result spot price volatility was found decreased. Thus, the market efficiency was improved. While Ouppathumchua (2015) studied the aspect of the Efficiency of Thailand's Stock Index Futures Market using SET50 Index Futures; the result found there was no market efficiency in all the contracts. When the Error Correction Model (ECM) was utilized, it was found that the speed of adjustment on spot price in long-term contract had higher volatility.

The Study of Single Stock Future was done by Chiyapluek Yamramai (2013), the research paper was published but limited to use only in Chulalongkorn University internally. In summary, this study was conducted in 2013 with 30 Single Stock Futures during that time using the data of daily return before and after the starting date of future trading for 3 years. The result of the study indicated that it cannot be concluded that Single Stock Futures trading has impact the volatility of the underlying stock.

Hypotheses

The purpose of this study is to examine the effect of Single Stock Futures trading on spot price volatility. Then test whether SET as a market factor leads to higher volatility in the spot market or not. The samples of the Single Stock Futures have been selected based on the timing of the group launching date in order to justify the data more precisely.

The impact of Single Stock Futures on Spot price volatility Hypotheses.

H_o = The Single Stock Futures Trading does not affect on the volatility of the spot price.

H_a= The Single Stock Futures Trading affects on the volatility of the spot price.

Data and Methodology

Data Collection

The timeline has been set up in order to test the impact of Single Stock Futures introduction on spot market volatility. Thus, the trading of 11 individual stocks on SET50 under Thailand Stock Exchange which starts Single Stock Futures trading on 22 Jun 2009, the pre-future and post-future data are collected begins 22 Jun 2006 and ends 22 Jun 2012. All data was obtained from Thompson Reuters Datastream. A daily return (log) of 11 stocks has been collected, as a total of 1,564 observations.

The 11 Stocks that are studied based on the same date of Single Stock Futures Trading launch.

1. Banpu Public Company Limited. (BANPU)
2. Bank of Ayudhya Public Company Limited. (BAY)
3. Bangkok Bank Public Company Limited. (BBL)
4. Italian-Thai Development Public Company Limited. (ITD)
5. Kasikornbank Public Company Limited. (KBANK)
6. Krung Thai Bank Public Company Limited. (KTB)
7. Quality Houses Public Company Limited. (QH)
8. Land and Houses Public Company Limited. (LH)
9. The Siam Commercial Bank Public Company Limited. (SCB)
10. The Siam Cement Public Company Limited. (SCG)
11. Thoresen Thai Agencies Public Company Limited. (TTA)

Methodology

Based on the descriptive statistics of 11 Stock returns presented in Table 2 shows the mean and median of 11 Stocks are negative. The excess kurtosis value (more than 3) shows the volatility clustering, which indicates the set of data are heteroscedastic. Thus, GARCH is a proper model to use in the study.

The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) Model developed by (Bollerslev ,1986) from the Autoregressive Conditional Heteroscedasticity (ARCH) model introduced by (Engle, 1982). "A natural way to capture the time-varying nature of volatility is to model the conditional variance as a GARCH process" (Antoniou, 1995).

Table 1: Summary statistics of 11 stocks daily returns (log)

	Mean	***Median***	***Maximum***	***Minimum***	***Std. Dev.***	***Skewness***	***Kurtosis***
BANPU	0.0008	0.0000	0.1656	-0.1862	0.0255	-0.5124	10.5576
BAY	0.0003	0.0000	0.1554	-0.2120	0.0265	-0.2948	12.3664
BBL	0.0004	0.0000	0.0857	-0.1775	0.0210	-0.8926	12.0529
ITD	-0.0003	0.0000	0.2630	-0.3371	0.0353	-0.1669	15.2409
KBANK	0.0007	0.0000	0.1149	-0.2038	0.0223	-0.4570	9.5713
KTB	0.0003	0.0000	0.1451	-0.2438	0.0237	-0.6384	13.5917
LH	0.0001	0.0000	0.1335	-0.1608	0.0291	-0.0032	6.1964
QH	0.0004	0.0000	0.1793	-0.2336	0.0300	-0.2994	11.3314
SCB	0.0006	0.0000	0.1394	-0.2324	0.0233	-0.5413	13.4103
SC	0.0003	0.0000	0.1184	-0.1335	0.0188	0.1589	8.5205

TTA	0.0000	0.0000	0.1590	-0.2672	0.0309	-0.6175	10.9490
Note : *** 1% Significance level							

Two studies have been done in this empirical test.

- The impact of Single Stock Futures trading on volatility of the spot market is tested by GARCH (1,1) model using two dummy variables, which represent the pre-futures period by using zero "0" and represent post-futures period by using one "1".
- The other hypothesis considers factors that might also affect the spot market were also tested. In this study, the SET index has been included as a proxy and tested whether the futures dummy remains significant.

<u>The impact of futures trading on volatility</u>;

GARCH (1,1) has been found to be the most convenient way at least within the GARCH class of models to represent conditional variance for financial time series.

The specification which provides the best fit is the following:

$$R_t = \beta_0+\beta_1 R_t\text{-}1 + \varepsilon_t \quad (1)$$

$$\varepsilon_t | \phi_{t-1} \sim N(0,h_t) \quad (2)$$

$$h_t = \alpha_0+\alpha_1\varepsilon^2_{t-1}+\alpha_2 h_{t-1}+\gamma D_F \quad (3)$$

In Equation 1 R_t is the daily return on each of 11 stock and R_{t-1} is a proxy for the mean of R_t conditional on past information. In Equation 3, the dummy variable which is DF has been included. This dummy shows the relation between the change in Single stock futures and the volatility of the spot market.

<u>The impact of Single Stock Futures trading on volatility of the spot market considering the market factor (SET)</u>

The next step is to test whether futures trading introduction is the only factor that affect the stock market volatility. Additionally, SET index returns have been used to test as an additional factor to test the impact on the volatility of the stock market.

The model used is as show:

$$R_t = \beta_0+\beta_1 R_t\text{-}1 + \beta_3 SET_{t+} \varepsilon_t \quad (4)$$

$$\varepsilon_t | \phi_{t-1} \sim N(0,h_t) \quad (5)$$

$$h_t = \alpha_0+\alpha_1\varepsilon^2_{t-1}+\alpha_2 h_{t-1}+\gamma D_F \quad (6)$$

The hypothesis has been tested on whether the futures trading is the only factor that causes volatility in the spot market.

The estimation of two GARCH (1,1) models is used, one for the pre-futures period and the other for the post-futures period to check how the GARCH coefficients change between pre-futures and post-futures. The results obtained show the effect of the introduction of each Single Stock Futures Trading in Thailand. In both tests, the equations 7 to 9 are used except the variance equation does not include dummy variable D_F. The results are in Table 2.

Furthermore, the unconditional variance in pre-futures and post-futures also been observed to confirm the market efficiency after the introduction of Single Stock Futures introduction. When the sum of α1 and α_2 is less than one, the model has finite unconditional variance *h* and it can be found by setting $E[\varepsilon^2_{t-1}] = h_t = h_{t-1} = h$, then solving *h* by using the formula below. The results are shown in Table 5.

$$h = \frac{\alpha_0}{1-\alpha_1-\alpha_2} \quad (7)$$

Empirical Result

The impact of the Single Stock Futures trading on volatility of the spot market.

The result of GARCH (1,1) adding dummy variable of the pre-post futures trading period are shown in Table 2 show that all coefficients in the conditional variance equation of 11 stocks are

significant at the 1% level. The introduction of the Single Stock Futures affects the spot market volatility is confirmed. Moreover, the measure of the effect due to the introduction of Single Stock Futures (the value of the coefficient γ) has a negative sign, indicated that Single Stock Futures Trading reduces spot market volatility.

Table 2 *The esitmates for the GARCH (1,1) model with dummy variable. A Dummy taking on the value zero for pre-future and one for post-future.*

Stocks	β_0	β_1	α_0	α_1	α_2	Result
BANPU	0.00105	0.05832	0.00003	0.06602	0.90015	-0.000018 ***
	(0.0526)	(0.0345)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
BAY	0.00132	0.01420	0.00005	0.13433	0.79368	-0.000010 ***
	(0.0294)	(0.6216)	(0.0000)	(0.0000)	(0.0000)	(0.0049)
BBL	0.00087	0.00246	0.00002	0.06494	0.89942	-0.000008 ***
	(0.0735)	(0.9310)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
ITD	0.00006	0.00099	0.00056	0.09258	0.57704	-0.000326 ***
	(0.9427)	(0.9731)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
KBANK	0.00107	0.03248	0.00004	0.06630	0.87351	-0.000014 ***
	(0.0491)	(0.2374)	(0.0000)	(0.0000)	(0.0000)	(0.0002)
KTB	0.00101	0.02155	0.00007	0.13630	0.76427	-0.000023 ***
	(0.0647)	(0.4762)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
QH	0.00082	-0.00809	0.00003	0.04649	0.92351	-0.000016 ***
	(0.2406)	(0.7676)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LH	0.00067	0.02497	0.00004	0.08264	0.87426	-0.000014 ***
	(0.3129)	(0.3420)	(0.0000)	(0.0000)	(0.0000)	(0.0076)
SCB	0.00108	0.00868	0.00005	0.04989	0.88194	-0.000028 ***
	(0.0530)	(0.7531)	(0.0001)	(0.0000)	(0.0000)	(0.0001)
SCC	0.00026	0.04269	0.00002	0.08234	0.87444	-0.000005 ***
	(0.5545)	(0.1126)	(0.0000)	(0.0000)	(0.0000)	(0.0048)
TTA	0.00030	0.01251	0.00007	0.07100	0.88107	-0.000047 ***

Note.*** indicate 1% level of significance.

The impact of Single Stock Futures trading on volatility of the spot market considering the market factor (SET).

The results from adding the SET index as an additional factor are shown in Table 3. The negative sign of the coefficient γ of the dummy variable D_F in all 11 stocks, as well as the value of the unconditional variance for the two sub-periods confirmed the result; indicated overall volatility of 11 stocks reduced after the introduction of each Single Stock Futures. The coefficient γ *of* all 11 equations range from -0.000000145 to -0.00001 which are all negative and statistically significant. The data support the hypothesis that Single Stock Futures reduced volatility of the spot market and also showed that the reduction in volatility might be a direct result of Single Stock Futures Trading.

Table 3 *The esitmates for the GARCH (1,1) with SET index in the mean equation*

	β_0	β_1	β_3	α_0	α_1	α_2	γ
Estimates for the whole period							
BANPU *	-0.00021	0.07005	1.16994	0.00002	0.06650	0.87875	-0.00001 ***
	(0.000396)	(0.015792)	(0.021299)	(0.00000477)	(0.010130)	(0.018707)	(0.00000295)
Before the introduction of Single Stock Future							
	0.00137	0.07798	1.27658	0.00002	0.07109	0.89090	
	(0.000704)	(0.024475)	(0.026947)	(0.00000504)	(0.014033)	(0.022737)	
After the introduction of Single Stock Future							
	-0.00104	0.06023	1.09990	0.00004	0.16217	0.60343	
	(0.000467)	(0.023349)	(0.02596)	(0.00000798)	(0.026403)	(0.063358)	

Notes : Significance levles: * =10%, ** = 5%, ***=1% , Standard Errors are presented in parentheses.

Banpu result is shown as sample data, the remaining results are in appendix

The results in Table 4 shows the unconditional variance (h formula) in the post-futures period is substantially lower than that of the pre-futures period. The data shows the robust result that each 11 stocks volatility reduces after the introduction of each Single Stock Futures.

Table 4 *Unconditional Variance in Pre-future period and Post-future period.*

Unconditional variance	Pre-future period	Post-future period
BANPU	0.0004421	0.0001745
BAY	0.0004986	0.0001990
BBL	0.0002116	0.0001331
ITD	0.0008810	0.0004532
KBANK	0.0001804	0.0001543
KTB	0.0003004	0.0001833
LH	0.0005239	0.0003460
QH	0.0008432	0.0003050
SCB	0.0002529	0.0001446
SCC	0.0012156	0.0001126
TTA	0.0007392	0.0002827

Conclusions

In this study, the GARCH (1,1) model was used to analyze the effect of the Single Stock Futures and Spot market volatility of 11 stocks on the Stock Exchange of Thailand. The result found the hypothesis that Single Stock Futures Trading was stabilizing the effect on the spot market. In the study, the SET index has also been taken into account as an additional factor to test whether Single Stock Futures alone affected on spot market volatility. The results still found that Single Stock Futures may be a direct result of lower spot market volatility. The unconditional variance between the pre-futures period and the post-futures period also been tested and showed that lower spot market volatility after the Single Stock Future introduction.

The result of this paper is in line with (P.Bologna and L. Cavallo, 2010) that found index futures introduction in Italian Stock Market stabilizing the underlying stock market. The data is support by the finding that unconditional volatility in the post-futures period was lower than that in the pre-futures period.

Limitations and futures study

The GARCH (1, 1) model which has been selected as the fit method for this study has a symmetric distribution; however, Stock market in Thailand might have asymmetric distribution in stock return. The unconditional variance between pre-futures and post-futures period varies among 11 stocks, the futures study can be done to investigate the factor that makes the result varies.

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