Journal of Global Business Review : Volume 20 No. 1 January-June 2018 pp. 23-33

REGULATORY CHANGE AND COINTEGRATON BETWEENTHAI SPOT AND FUTURES STOCK INDICES

Treerapot Kongtoranin[1*], Thanarerk Thanakijsombat[1*],
WorapongJoungrattanakamjorn[1*]

[1]International College, Mahidol University, Nakornpathom 73170, Thailand

ABSTRACT

This study investigates the dynamics of the short-term and cointegrating relationships between SET50 index and SET50 Futures prices from 2011 – 2017, in order to examine the impacts of the change of TFEX regulation in 2014 on the market efficiency and the predictive role of both data. The findings show that the regulatory change causes both markets to be more cointegrated as revealed by a faster speed of adjustement toward their long-run equilibrium. SET50 Index Futures price is found to perform better as a leading indicator of SET50 as a result of the regulatory adjustment.

Keywords: Cointegration, vecter error correction model, causality, futures prices, stock index, Thailand

---

*Authors e-mail address: treerapot.kon@mahidol.ac.th, thanarerk.tha@mahidol.ac.th, worapong_joung@hotmail.com

Introduction

A futures market exists because it provides price insurance and acts as a financial instrument which can be used to mitigate the risk arisen from an unpredictable price movement (Kaldor, 1940).In addition, futures products are traded on an exchange market as a standardize contract, providing lower default risk comparing to a forward contract. Market participants now trade futures contracts for the purpose of hedging, speculating and arbitraging.

In general, spot and futures prices converge as time progresses. The convergence can be explained by arbitrage and the law of supply and demand. The nature of the short-term and long-term relationship between thespot and futures pricesare also of great interest by market participants, as one may be a leading indicator of another. The prices, however, may deviate from their equilibrium and their predictive ability may change when market conditions alter, especially due to a regulatory adjustment (Romano, 1996).While there is an extensive examination of the impacts of regulatory adjustments on the relationship between the spot and futures prices in the extant literature, there arestudies relationship between spot price and futures price onthe combined period of pre- and post-regulatory adjustments which were not focusing on the differentiation across periods (Ouppathumchua, 2015; Lasorn&Nittayagasetwat, 2017). Moreover, the empirical results from the studies are inconclusive with regard to the relationship between the Thai stock spot and futures prices and their role as a predictive indicator.

Our main intention is to fill the gap by examining the short-run and long-run relationship between the Thai stock spot and futures prices prior to and after the adjustments on the regulations announced by Thailand Futures Exchanges(TFEX) in 2014. The changes were made in order to include more market participants and to increase trade volumes while reducing leverage risk in the market. Higher number of participants and trading volumes may thus lead to a faster speed of adjustment of the two prices toward their equilibrium. The ultimate result is a more efficient stock market in Thailand. As emphasized in Siripipath and Sakunasingha (2016), the right mix of debt and equity is crucial for firms. Making an informed decision on equity financing requires timely foresights stemmed from an efficient market.

The present study is organised as follows: Section 2 reviews the theories andempirical evidence related to the relationship between spot and futures markets and provides a brief overview of the Thai stock futures market's regulation change in 2014. Section 3 discusses the data and statistical treaments used inthe study. Section 4 presents the empirical results and discussions. Section 5 suggests the recommendation from the study. Finally, Section 6concludes the study with final remarks.

Literature Review

According to the law of one price, an asset should be sold at the same price if they have the same levels of risk and return. An arbitrage opportunity may arise if there is a price discrepancy. The effort to reap the arbitrage profit forces price gap to be narrower and market equilibrium to be reached (Sharp & Alexander, 1990). In practice, prices can tempolarilydeviate from equilibrium due to the variation of some market microstructure factors. Roll, Schwartz and Subrahmanyam (2007) provide an example to demonstrate that a price divergence could take place in the situation which there is a very high order imbalance in a spot market, imposing an inventory problem for a market maker. Based on the Efficient Market Hypothesis (EMH) proposed by Fama (1970), futures price is expected to equal the future spot price plus time varying risk premium. Thus, if both spot and futures markets are efficient and no risk premium is available, the futures price can be an unbiased estimator of future spot prices (Holt & Mckenzie, 1998).Several researchers have tested the EMHby exploring on the relationship between a stock futures price and its underlying spot price. The empirical results are, however, rather mixed.Cornel and French (1983) conclude that arbitrage profit cannot be earned by selling stock and buying futures contract if there is a tax adjustment. Relative lower futures prices reflect the impact of taxes. However, Mackinlay and

Ramaswamy(1998) study spot and futures prices of S&P 500 Index and found that futures prices deviate from the theoretical prices and the deviation increases with the maturity.

Continue from the studies supporting the notion that the spot and futures markets are inefficient, many scholars have explored further regarding to the role of the spot and futures prices as a leading indicator. Stoll and Whaley (1990) study the causality between return of stock index and stock index futures,and find that returns on S&P500 Index and Major Market Index (MMI) futures lead the stock indices' returns around 5 minutes, on average. Their results are similar to those in the study of Tan, Mark and Choi (1992) who find a strong relationship between Hang Seng Index futures and spot market of Hand Seng stock index. The results reveal that the futures prices lead spot prices. However, Shyy, Vijayraghavan and Scott-Quin (1996) find contradicting results in the French spot and futures stock market Index, their results illustrate that spot prices lead futures prices in the French stock market.

For more modern studies, Alphonse (2000) illustrates the French spot and futures of stock index markets and the results show that the deviations from equilibrium are transmitted from futures market to spot markets. Employing Engle-Granger cointegration method, Brooks, Rew, and Ritson (2001) further find the causality relationship in French spot and futures market (FTSE100 Index). The authors also find that the changes in the spot prices are dependent upon both lagged changes in spot prices and futures prices. Nevertheless, Zakaria and Shamsuddin (2012) find an opposite result in the Malaysian context.

In contrast to the unilateral relationship between a spot and a futures price, many researchers find that the relationship is bilateral, as their findings reveal double-sided causality between the two prices (Abhyankar, 2008; Liu & Zhang, 2006; Choudhary & Bajaj, 2012). Another set of studies reveal insignificant relationship between the two prices (MacDonald & Taylor, 1988; Kenourgious & Samitas, 2004; Chowdhury, 1991; Beck, 1994).

In the context of Thai markets, Thongthip (2010) investigates the lead-lag relationship in SET50 stock index and its futures Index from the beginning of October 2008 to the end of September 2009. The study employs the Engle-Granger and Johansen cointegration methods to find the comovement between spot and futures prices. The results indicate that these prices move together in the long-run. Then, the Vector Error Correction Model (VECM) is utilized to investigate the short-run and lead-lag relationship between these two prices. The VECM constructed shows that futures price returns lead spot price returns for 5-minute data. However, Granger causality test results show no lead-lag relationship for daily data in this study. Songyoo(2013) investigates the spot and futures prices under 10-minute prices data from September 12, 2011 to November 11, 2011 in SET50 markets by applying Engle-Granger cointegration, VECM and Granger causality tests. The results indicate that the movement of futures prices leads spot prices only during some certain periods. Eventually the relationship is bi-directional.

The results in the most recent studies on the relationship between the two stock prices in the context of Thai markes are still inconclusive whether a stock or a stock futures market is a leading market. Lasorn and Nittayagasetwat (2017) gather data on spot and futures Index of SET50 during April 28, 2006 to December 31, 2016 and apply unit root, Engle-Granger and Johansen cointegration tests, and construct a VECM in the study. The results reveal that there exists a long-run relationship between spot prices and futures prices, and the movement of spot prices lead futures prices movement. Along the same line, Judge and Reancharoen (2014) apply Error Correction Model (ECM) to test the spot and futures Index of SET50 and find that lagged changes in spot prices lead changes in futures prices, using daily data during 2006 through 2012. Lastly, Ouppathumchua (2015) investigates the relationship of spot prices and futures prices in the SET50 context by applying unit root test, Engle-Granger conintegration, and ECM methodologies on the daily data from June 2006 to June 2014. The findings from this study show that futures prices lead spot prices movement, especially for short term contracts. Ouppathumchua(2015) also provides suggestion for regulators to increase the liquidity in the futures markets in order to increase the predictability in spot prices.

As suggested by Ouppathumchua(2015), the nature of the relatsionship between the two markets may change due to the change in market liquidity, which may arise from alterations in market regulations. Given that no researcher has visited the literature on the impacts of regulatory change in Thai stock futures market in 2014 and that previous empirical resuts on the relationship between the spot and stock futures markets have been rather mixed, thus the main objective of this study is to examine on the role of the regulatory changes on the nature of the short-term and long-term relationships between the two markets. The most recent and unexplored regularoty changes on TFEX was introduced in 2014 to enhance the development of Thai financial market in terms of the reduction of excessive risk taking prevention and the inclusion of more market participants in TFEX. The summary of changes as described in Thailand Futures Exchange (2017a) is demonstrated in Table 1.

Table 1 Contract specification for SET50 Index Futures

Items	Details	
	Previous	Existing
Multiplier	1,000 Baht/Point	200 Baht/Point
Exchange Fees	35 Baht/Contracts	7 Baht/Contracts
Speculative Position Limit	Max. 20,000 contracts	Max. 100,000 contracts
Large Open position	500 contracts	2,500 contracts
Maximum Volume per Order	100 contracts	500 contracts

After the regulatory changes, the volume of contracts had increased by 575% within a month. Moreover, the average number of contracts traded 32 months before and after the contract specifications changes had increased by 462% (Thailand Futures Exchange, 2017b). As suggested by Tetlock (2008), higher trading volumes may result in a higher degree of market liquidity and efficiency. Hence, we expect to see a stronger relationship between the spot and stock futures markets. The two markets also may be expected to be more efficient after the regulations changes, and that stock futures price may perform better as a leading indicator of the spot stock price based on the EMH.

Sample and Methodology

The sample in this study is constructed and is divided into two subsamples using the daily data of SET50 Index and the daily data settlement prices of SET50 Index Futures from January 8, 2011 to May 2, 2014 (32 months) as the data prior to regulations adjustments and May 7, 2014 to February 28, 2017 (32 months) as the data post regulations adjustments. The data were obtained from the Stock Exchange of Thailand through SETSMART database. The construction of SET50 Index futures based on roll-over of the two nearest quarters' contracts which are the two highest volumes (Thailand Futures Exchange, 2017b).

Our investigation of the cointegrating relationships between the SET50 Index and the SET50 Index Futures price begins by performing unit root tests to examine the stationarity of the data and to ensure that the cointegration technique, rather than the traditional multivariate regression, was appropriate for the investigation of the relationships among the two series. The standard unit root test widely adopted in the existing cointegration literature and employed in the current study is theAugmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981). The unit root tests are conducted both on the level and the first-difference data to also ensure that all the time series in the samples have an equal order of integration,, a necessary basis for further cointegration tests.

We proceed to examine pairwise cointegrating relationships between the two series in the samples by employing the Engle-Granger (EG) test (Engle & Granger, 1987)[4]. If the two series are both and have a long-run relationship, any error deviation must be pulled back to the long-run equilibrium level of zero. In other words, there must be an error correction in the data which can be modeled as shown below.

$$y_t = \alpha+\beta x_t+\varepsilon_t \quad (1)$$

$$\hat{\varepsilon}_t = y_t-\hat{\alpha}-\hat{\beta}x_t \quad (2)$$

Where, y_t and x_t are the the SET50 Index and the SET50 Index Futures pricein the samples. The OLS residuals from (1) are a measure of disequilibrium. The EG cointegration test is a test of whether $\hat{\varepsilon}_t$ is stationary. This is determined by ADF tests on the residuals, with critical values adjusted for the number of variables (MacKinnon, 1996). The rejection of the null hypothesis of nonstationary $\hat{\varepsilon}_t$ indicates that y_t and x_t are cointegrated.

The investigation of the long-run relationships extends to the adoption of the Johansen multivariate cointegration test (Johansen, 1988), to seek for and to determine the number of multivariate cointegrating relationships. The Johansen cointegration test is conducted on both pre- and post-regulatory-change subsamples. According to Johansen (1988), when time series in the sample are all $I(1)$, there can be up to n-1 cointegrating long-run relationships among the variables. The author suggests a multivariate generalization of the Dickey Fuller test as shown below to determine the number of cointegrating vectors and to estimate all the distinct relationships.

$$\Delta F_t = (A_t-I)F_{t-1}+\mu_t = \pi F_{t-1}+\mu_t \quad (3)$$

Where, for this study, F_t denotes the matrix of two data series in the sample. μ_t is the error matrix and A_t is the matrix of parameters, while is the identity matrix. If the rank of vector π is zero, each element of π equals zero. F_t is then a first-order Vector Autoregressive (VAR) process where all the variables follow unit root processes, indicating no linear combination of two data series and no cointegration among them. If the rank of r is r then there are r cointegrating vectors in which each of these r equations is an independent restriction on the long-run relationship solution of the variables. The rank π of is the number of characteristic roots of π that differs from zero and can be determined by using the following two likelihood ratio test statistics.

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n} \text{In}(1n\hat{\lambda}_t) \quad (4)$$

$$\lambda_{max}(r,r+1) = 1T\ \text{In}(1n\widehat{\lambda_{t+1}}) \quad (5)$$

Where, $\hat{\lambda}_t$ denotes the eigenvalue obtained from the reduced rank regression problem and T is the number of observations. λ_{trace} and λ_{max} are the trace and the maximum eigenvalue test statistic respectively. Using the trace statistic, the null hypothesis is that $\lambda_{trace}(r)$, $\leq r$ against the alternative hypothesis of $\lambda_{trace}(r) = 0$ while the null hypothesis, using the λ_{max}, is $\lambda_{max} = r$ against $\lambda_{max} = r+1$

Given an evidence of a cointegrating relationship between the two data series, we continue to set up and to estimate a VECMas shown by the following VECM specification.

$$\Delta F_t = \pi F_{t-1} + \sum_{i=1}^{k-1} \varphi_i \Delta F_{t-1} + \theta t \quad (6)$$

$$\varphi_i = -\sum_{j=i+1}^{k} A_j, \quad i = 1,\dots, k-1 \quad (7)$$

$$\pi = -(I-A1 - \cdots - A_k) = -A(1) \quad (8)$$

Where, π denotes the coefficient vector of error correction terms, φ_i signifies the matrix of the coefficients of short-run relationships while θ_t symbolizes the

---

[4] The EG cointegration test is the linear cointegration test which can be employed to examine whether the deviations from the long-run equilibrium are subject to a mean-reverting behavior.

residual vector, assumed to be multivariate normal with mean vector equal to zero and covariance matrix independent across time periods. $k$is the number of lag of the variables in matrix $\triangle F_t$. A negative and significant error correction coefficient indicates that there exists a long-term multivariate cointegrating relationshipbetween the SET50 Index and the SET50 Index Futures price. Short-run causalitywas determined using the Wald test on the joint significance of the lagged explanatory variables.

Results and Discussions

Unit Root Test

The results from ADF Unit Root tests are presented in Table 2. All of the t-statistics obtained from the ADF testsare significant at 1% level on the first difference but not on the level data. The results indicate that the null hypothesis of a unit root cannot be rejected for all the time series data and are integrated of order 1, or I(1). The results stand for the data in the pre- and post-regulatory-change subsamples and provide us a basis to proceed with the cointegration tests and analyses.

Table 2 ADF Unit Root Test

Variable	Pre-adjustment t-statistic		Post-adjustment t-statistic	
	Level	First Difference	Level	First Difference
SPOT	-1.2909	-25.3964 ***	-1.6530	-25.8833 ***
FUTURE1	-1.4182	-27.0682 ***	-1.7765	-26.9419 ***
FUTURE2	-1.4090	-27.5093 ***	-1.6811	-26.8390 ***

SPOT is the SET50 index, and FUTURE1 and FUTURE2 are the first- and the second-quarter nearest contract SET50 Index Futures prices in logarithmic forms respectively. *, **, and *** indicate 10%, 5% and 1% significant levels based on MacKinnon (1996) one-side p-values.

Cointegration Tests

Table 3 displays Engle-granger Cointegration test results. As demonstrated by the tau-statistics and z-statistics, the null hypothesis of no cointegration is rejected at 1% and 5% levels regardless of the depedent variable employed in the testing model and whether the first quarter or the second quarter nearest contract futures prices are used. The results indicate that there is a pairwisecointegrating relationship between the SET50 Index and the SET50 Index Futures price for both pre- and post-adjustment subsamples.

Table 3 Engle-granger Cointegration Test

Dependent Variable	Independent Variable	Pre-adjustment		Post-adjustment	
		tau-statistic	z-statistic	tau-statistic	z-statistic
SPOT	FUTURE1	-4.5412 ***	-44.3055 ***	-4.6685 ***	-46.9946 ***
FUTURE1	SPOT	-5.1324 ***	-57.4040 ***	-4.6936 ***	-47.5563 ***
SPOT	FUTURE2	-3.6328 **	-29.0273 ***	-3.8664 **	-31.4330 ***
FUTURE2	SPOT	-4.2771 ***	-39.1570 ***	-3.8588 **	-31.3130 ***

SPOT is the SET50 index, and FUTURE1 and FUTURE2 are the first- and the second-quarter nearest contract SET50 Index Futures prices in logarithmic forms respectively. *, **, and *** indicate 10%, 5% and 1% significant levels based on MacKinnon (1996) one-side p-values.

Johansen cointegration test results are shown in Table 4[5]. The null hypothesis of no cointegrating relationship between the SET50 Index and the SET50 Index Futures price is rejected at 5% level for all subsamples as demonstrated by the Trace and Max-eigen statistics. The results indicate that there are long-run relationships between the two markets both before and after the regulatory adjustment in May 2014, confirming the results obtained from the Engle-Granger cointegration test.

Table 4 Johansen Cointegration Test

Subsample	Variables	Hypothesized No. of CE(s)	Trace statistic	p-value	Max-eigen statistic	p-value	No. of Lags
Pre-adjustment	SPOT & FUTURE1	None	27.4375 ***	0.0005	25.9504 ***	0.0005	
		At most 1	1.4872	0.2227	1.4872	0.2227	4
	SPOT & FUTURE2	None	41.1988 ***	0.0000	39.3566 ***	0.0000	
		At most 1	1.8423	0.1747	1.8423	0.1747	2
Post-adjustment	SPOT & FUTURE1	None	30.5381 ***	0.0001	27.6709 ***	0.0002	
		At most 1	2.8672	0.1004	2.8672	0.1404	3
	SPOT & FUTURE2	None	20.9438 ***	0.0068	18.1439 **	0.0116	
		At most 1	2.7999	0.1143	2.7999	0.1243	3

SPOT is the SET50 index, and FUTURE1 and FUTURE2 are the first- and the second-quarter nearest contract SET50 Index Futures prices in logarithmic forms respectively. *, **, and *** indicate 10%, 5% and 1% significant levels based on MacKinnon, Huag, and Michelis(1999)p-values. The numbers of lags in the VAR models are selected based on Schwarz Information Criterion (SC).

Vector Error Correction Model

The dynamics of the short-run and long-run relationshipbetween the SET50 index and the SET50 Index Futures price is further examined by constructing and estimating a VECM.According to the VECM results shown in Table 5-A and 5-B, the coefficient of the error-correction term is negative and significant when the SET50 indexis the depedent variable and the first nearest quarter SET50 Index Futures price is the independent variable both pre- and post-regulatory adjustment. The findings confirm the cointegrating relationship between the two series previously found in this study and are in line with those found by Thongthip(2010), and Lasorn and Nittayagasetwat (2017). However, the speed of adjustment, as measured by the coefficient of the error correction term, has increased after the regulatory adjustment from 4.19 days (1/0.2386)to 1.24 days (1/0.8062) for reaching the cointegrating equilibrium. The evidence suggests that the the SET50 index and the SET50 Index Futures price are more cointegrated after the regulatory change. In line with Tetlock(2008), the increase in the speed of adjustment, may imply a higher degree of market efficiency due to in the increase in market liquidity induced by the change in the TFEX market regulation.

---

[5] The first step in performing the Johansen multivariate cointegration test is to choose a model and the lag of variables in the model that best explain the variation of the dependent variables. We perform the lag structure analysis on the unrestricted vector autoregressive (VAR) model and chose the lag length based on the SIC test statistic at 5% level.

Table 5-A Vector Error Correction Model (Pre-adjustment)

Variables	**DSPOT**	**DFUTURE1**	**DSPOT**	**DFUTURE2**
Error Correction Term	-0.2386 * (0.0885)	0.3968 *** (0.0094)	0.1510 (0.1113)	0.3150 *** (0.0034)
DSPOT(-1)	-0.3672 (0.2757)	0.0385 (0.9180)	0.0522 (0.8188)	0.3465 (0.1554)
DSPOT(-2)	-0.5081 * (0.0691)	-0.2281 (0.4156)	-	-
DSPOT(-3)	-0.4560 (0.0181)	-0.3487 (0.1128)	-	-
DFUTURE(-1)	0.3649 (0.2444)	-0.0422 (0.9036)	-0.0237 (0.9068)	-0.3393 (0.1202)
DFUTURE(-2)	0.4761 (0.1763)	0.2151 (0.4282)	-	-
DFUTURE(-3)	0.4043 (0.1208)	0.2765 (0.1618)	-	-
Constant	0.0003 (0.5050)	0.0004 (0.5356)	0.0003 (0.5871)	0.0003 (0.6384)

Table 5-B Vector Error Correction Model (Post-adjustment)

Variables	**DSPOT**	**DFUTURE1**	**DSPOT**	**DFUTURE2**
Error Correction Term	-0.8062 ** (0.0454)	0.1274 * (0.0904)	-0.7887 * (0.0839)	0.0070 * (0.0870)
DSPOT(-1)	-0.4289 ** (0.0101)	-0.1115 (0.5410)	-0.3511 ** (0.0523)	0.0035 (0.9849)
DSPOT(-2)	-0.2272 * (0.0770)	-0.1019 (0.4642)	-0.1459 (0.3350)	0.0063 (0.9704)
DFUTURE(-1)	0.4143 *** (0.0061)	0.0808 (0.6189)	0.3385 ** (0.0382)	-0.0275 (0.8632)
DFUTURE(-2)	0.2560 ** (0.0291)	0.1091 (0.3942)	0.1725 (0.2214)	0.0080 (0.9603)
Constant	0.0000 (0.8569)	0.0000 (0.8555)	0.0000 (0.8581)	0.0000 (0.8558)

DSPOT is the first difference of SET50 index, and DFUTURE1 and DFUTURE2 first difference of the first- and the second-quarter nearest contract SET50 Index Futures prices in logarithmic forms respectively. The values in parentheses represent p-values. *, **, and *** indicate 10%, 5% and 1% significant levels based on the chi-square test.

In contrast to the findings in Songyoo (2013), and Lasorn and Nittayagasetwat (2017) the results in Table 5 reveal that SET50 Index Futures price is a leading indicator of the SET50 index, but only after the regulatory adjustment in May 2017 as demonstrated by the significant coefficients of the lagged differences of the SET50 Index Futures price variables when the difference in SET50 index is used as the dependent variable. The results are consistent with the findings in Thongthip (2010) and Judge and Reancharoen (2014) and are in support of notion made by Ouppathumchua (2015) that an increase in market liquidity due to a regulatory change brings about an increase in the predictability of a spot price. The evidence of the SET50 Futures prices as a predictor of the SET50 index can also be found when the SET50 indexis the depedent variable and the second nearest quarter SET50 Index Futures price is the independent variable post-regulatory adjustment.

Recommendation

From the cointegration test, it is confirmed that the speed of the adjustment of the SET50 index and SET50 Index Futures price in Thailand increases after the regulatory change, thank to the significant increases in the number of market participants and trading volume in the TFEX market. In other words, the futures market has become more efficient, beneficial to the investors who intend to use futures price as a leading indicator for managing their portfolio.Refering to the results in this study, the regulatorsmay consider adjusting regulations for other futures products in the TFEX market so as for the underlyingmarket to be more efficient and for the futures prices to perform their roles as leading indicators. Nonetheless, researchers may investigate the relationship between spot and future prices beyond the SET50 index so that the finding can be generalized.

Conclusion

The objective of this study is to reinvestigate short-run and long-run relationships between SET50 index and SET50 Index Futures price in order to examine the impact of the regulatory change on TFEX in May 2014. Cointegration tests are conducted and VECM are constructed and tested to derive at the speed of adjustment and the predictability of the two data on one another before and after the change in the regulation.

The cointegration tests provide a strong evidence of a cointegrating relationship between the two data series both pre- and post-regulatory adjustment, in line with many previous studies in the extant literature. When examining the VECMs constructed, there exists evidence that the relationship between the two series is stronger after the change in regulation, with a faster speed of adjustment toward their long-run equilibrium. We, however, cannot find any supporting evidence on the predictive role of SET50 index and SET50 Index Futures price before the regulatory change. It is only in the period after the adjustment that SET50 Index Futures price is found to be a leading indicator of the SET50 index.

All in all, the results in this study demonstrate that the changes in TFEX regulation in May 2014 causes market liquidity to be higher, leading to more efficient futures and spot markets and a higher predicative power of SET50 Index Futures price on SET50 index.

References

Abhyankar, A. (1998). Linear and non-linear granger causality test: Evidence from UK stockindex futures market. *The Journal of Futures Market, 18*, 519-540.

Alphonse, P. (2000). Efficient price discovery in stock index cash and futures markets. *AnnalesD' EconomieEt De Statistique, 60*, 178-188.

Beck, S. E. (1994). Cointegration and market inefficiency in commodities futures markets. *Applied Economics, 26*(3), 249-257.

Brooks, C., Rew, A.G., & Ritson, S. (2001). A trading strategy based on the lead-lagrelationship between the spot index and futures contract for the FTSE 100. *InternationalJournal of Forecasting, 17*, 31-44.

Choudhary, K., & Bajaj, S. (2012). Intraday lead/lag relationships between the futures and spotmarket. *EurasianJournal of Business and Economics 2013, 5*(9), 165- 186.

Chowdhury, A. R. (1991). Futures market efficiency: Evidence from Cointegration Tests. *Journal of Futures markets, 11*, 577-589.

Cornel, B., & French, K. R. (1983). Taxes and the pricing of stock index futures. *The Journal of Finance, 3*, 675-694.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time serieswith a unit root. *Econometrica, 49*(4), 1057-1072.

Engle, R. T., & Granger, C. W. J. (1987).Cointegration and error correction: Representation,estimation and testing. *Econometrica, 55*, 251-276.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *TheJournal of Finance, 25*(2), 383-417.

Holt, M.T. & McKenzie, A. M. (1998). Market efficiency in agricultural markets. In 1998 *American Agricultural Economics Association Annual Meeting*, Salt Lake City.

Johansen, S. (1988).Statistical analysis of cointegration vectors. *Journal of EconomicDynamics and Control, 12*, 231-254.

Judge, A., & Reancharoen, T. (2014). An empirical examination of the lead–lag relationshipbetween spot and futures markets: Evidence from Thailand. *Pacific-Basin FinanceJournal, 29*, 335-358.

Kaldor, N. (1940). A Note on the Theory of the Forward Market. *The Review of Economic Studies, 7*(3), 196-201.

Kenourgios, D.F., &Samitas, A.G. (2004).Testing efficiency of the copper futures market: New evidence from London Metal Exchange. *Global Business and Economics Review*, 261-271.

Lasorn, W., & Nittayagasetwat, W. (2017). Lead-Lag RelationshipBetween Futures and Spot Prices: Case of Thailand. *Proceeding of ICARBSS 2017 Langkawi, Malaysia, 2017*(29th), 236-248.

Liu, Q. F., & Zhang, J. Q. (2006). Price discovery and volatility spillovers: Evidence from Chinese spot-futures markets. *China & World Economy, 14*(2), 79-92.

MacDonald, R. & Taylor, M. P. (1988). Metal prices, efficiency and cointegration: Someevidence from the London Metal Exchange. *Bulletin of Economic Research, 40*, 235–239.

MacKinnon, J. G. (1996). Numerical Distribution Functions for Unit Root and Cointegration Tests. *Journal of Applied Econometrics, 11*, 601-618.

MacKinnon, J. G., Huag, A. A., & Michelis, L. (1999). Numerical Distribution Functions ofLikelihood Ratio Tests for Cointegration. *Journal of Applied Econometrics, 14*, 563-77.

MacKinlay, A. C., & Ramaswamy, K. (1988). Index-futures arbitrage and the behaviour of stockindex futures prices, *Review of Financial Studies, 1*, 137-158.

Ouppathumchua, P. (2015). The Efficiency of Thailand's Stock index Futures Market. *Journal of Public and Private Management, 22*(2), 5-39.

Roll, R., Schwartz, E., & Subrahmanyam, A. (2007). Liquidity and the Law of One Price: TheCase of the Futures-Cash Basis. *The Journal of Finance, 62*(5), 2201- 2234.

Romano, R. (1996). A thumbnail sketch of derivative securities and their regulation. *Md. L. Rev.*, 55, 1-83.

Sharpe, W. E., & Alexander, G. J. (1990). *Investments*. (4th ed.). Prentice-HallInternational.

Shyy, G., Vijayraghavan, V., & Scott-Quinn, B. (1996). A further investigation of the lead-lagrelationship between the cash market and stock index futures market with the use ofbid/askquotes: The case of France. *The Journal of Futures Markets, 16*, 405-420.

Siripipath, P., & Sakunasingha, B. (2016). Determinants of capital structure: a case study in Thai steel industry. Journal of Global Business Review, 18, 1-16.

Songyoo, K. (2013). *Technical trading strategy in spot and future markets: Arbitrage signaling.*(CMRI Working Paper No. 6). Bangkok: Capital Market Research Institute, The Stock Exchangeof Thailand.

Stoll, H. R., & Whaley, R. E. (1990). The dynamics of stock index and stock index futuresreturns. *Journal of Financial and quantitative Analysis, 25*, 441-468.

Tan, G. Y. N., Mark, S. C., & Choi, D. F. S. (1992). The causal relationship between stockindex futures and cash index prices in Hong Kong. *Applied Financial Economics, 2*,187-190.

Tetlock, P. C. (2008). *Liquidity and prediction market efficiency*. Working paper, ColumbiaBusiness School.

Thailand Futures Exchange. (2017a). *Rules Amendment.* Retrieved From http://www.tfex.co.th/en/rules/modified.html

Thailand Futures Exchange. (2017b). *Monthly Market Report.* Retrieved from http://www.tfex.co.th/en/marketdata/monthlyreport.html

Thongthip, S. (2010). *Lead-Lag Relationship and Mispricing in SET50 Index Cash andFutures Markets.*Faculty of Economics, Thammasat University.

Zakaria, Z., & Shamsuddin, S. (2012). Relationship between stock futures index and cashprices index: Empirical evidence based on Malaysia data. *Journal of Business StudiesQuarterly, 4*(2), 103-112.