The Price-Volume Relationship of the Malaysian Stock Index Futures Market

Author

Kambla Surya Mukesh
Faculty of Commerce
University of Malasia, Malasia.

ABSTRACT

The objective of this study is to determine the relationship and the causality between the price index and trading volume for both the spot and the next month contracts in the Malaysian stock index futures market and how that relationship changes over time. The daily data of the stock index futures (FKLI) closing price and the daily data of the stock index futures (FKLI) trading volume from December 10, 2005 until December 31, 2014 are used in this study. The data are divided into four sub-periods, a learning period, a crisis period, a recovery period and a stable period, to analyze the variation in activity during the opening of the new market, the Asian financial crisis in 1997-1998, the recovery period after the financial crisis, and a stable period. The findings provide information to allow investors to use the price-volume relationship in both the spot-month and the next-month contracts to speculate or to hedge their portfolios.

Keywords: stock, stock index, Malaysian stock index, futures, Asian markets

INTRODUCTION

Forward and futures contracts have generated a great deal of interest in the last decade. The volume, the futures market indicator, has increased dramatically. Moreover, in recent years the most popular futures contracts have been financial futures, which are contracts to buy or sell financial securities (Haugen, 2001). Forward and futures are financial instruments whose values are derived from the price or value of some underlying securities such as stock price.

Stock index futures trading in Malaysia started on December 10, 2005 with the establishment of Kuala Lumpur Options and Financial Futures Exchange (KLOFFE), a self-regulated exchange that governs the membership of the exchange, administration of the exchange, member-customer relationship and trading practices. Kuala Lumpur stock exchange Composite Index Futures (FKLI) contract was first traded whose value is based on Kuala Lumpur stock exchange (KLSE) composite index price. The contract months available for FKLI are the spot month, next month and the next two calendar quarterly months – March, June, September and December). Every futures contract has an expiry data and usually falls on the last business day of that particular month contract. On that day, any open position must be liquidated by delivery or cash settlement. FKLI is cash settled.

In this study, we analyze the price-volume relationship and causality in the Malaysian stock index futures market. Many studies have been done in foreign derivatives markets. Earlier research on price-volume relations focused mainly on the spot month contract such as studies by Wan Mansor(1999), Moosa and Silvapulle (2000), and Chen, Firth, and Rui (2001). Karpof (1987) suggests that study of the price-volume relationship is important because: 1) it provides insight into the structure of financial markets, especially regarding the information flow process within the market; 2) it increases the power of tests in event studies which use a combination of price and volume data; 3) it is crucial to the debate over the empirical distribution of speculative

prices; and 4) it has significant implications for research into futures markets (e.g. if trading volume in futures contracts affects price, then speculation could be a stabilizing or destabilizing factor in futures prices). Ramasamy and Shanmugam (2003) is one of the few studies that focused on the Malaysian stock index futures market but analyzes the spot month contract only and the sample data ends on June 30, 2001. The findings from the current study would be able to provide relevant information to investors to determine whether stock index futures price causes the stock index futures volume in both spot month and next month contract or vice versa and whether there exist causality effect between spot month and next month contracts trading activities.

LITERATURE REVIEW

Previous empirical investigations have studied the relationship between stock prices and trading volume from a variety of perspectives such as the relationships between absolute stock price changes and trading volume in the stock market, Smirlock and Starks (1988)), between the log of futures prices and the log of trading volume, Moosa and Silvapullle (2001)) and Silvapulle and Choi (1999), between the ratio of short interest to outstanding shares in the stock market to the price-volume relationship, Assogbavi, Khoury and Yourougou (1995), between volume and absolute price changes and price changes per se and volume, Moosa and Loughani (1995), between volume and both the magnitude of price change and price change itself, Saatcioglu and Starks (1998). While most of the earlier empirical work focused on the contemporaneous relationship between trading volume and stock returns, some more recent studies began to address the dynamic relationship, i.e. causality, between daily stock returns and trading volume following the notion of Granger causality, Chen and Liau (2004), and by far the most popular choice has been the use of daily data, Moosa and Loughani (1995).

Intuitively, Moosa and Loughani (1995) suggest the following two statements to represent two empirical regularities. First, "it takes volume to make prices move," and second "volume is relatively heavy in bull markets and light in bear markets." Irrespective of the price measure, there is ample empirical evidence supporting the hypothesis that there is a positive correlation between volume and price changes. However, the direction of causality is not always specified explicitly, and the direction of causality is a controversial issue although there is now a growing tendency to believe that causality could run in either direction.

Ying (1966) in Ramasamy and Shanmugam (2003) is among the pioneers in the study relating to asymmetry in the price-volume relationship. Ying tries to determine whether the signed price change or the absolute price change is the appropriate price variable to be used in empirical studies of this relationship. Ying (1966) argues that if there was asymmetry in the behavior of the ratio of volume to price change then what was relevant was the signed price change rather than the absolute price change. Smirlock and Starks (1988) use absolute stock price changes and trading volume in the stock market. Using Granger causality tests they find that there is a significant causal relationship between absolute price changes and volume at the firm level and that this relationship is stronger in periods surrounding earnings announcements.

Moosa and Loughani (1995) test the price-volume relation using data for four emerging Asian stock markets: Malaysia, the Philippines, Singapore, and Thailand. Evidence is found for causality from volume to absolute price changes and from price changes per se to volume and the relation is contemporaneous, lagged, positive and sensitive to institutional, organizational and structural factors.

METHODOLOGY

The daily closing price and trading volume of the KLSE Composite Index futures will be used in this study. The data covers the period of December 10, 2005until December 31, 2014is divided into four sub-periods in this study. The sub-periods are:

Subperiod 1 : December 10, 2005– June 30,2007 (Learning period)
Subperiod 2 : July 1, 2007 - September 30, 2008 (Crisis period)
Subperiod 3 : October 1, 2008 – December 31, 2011 (Recovering period)
Subperiod 4 : January 1, 2011 - December 31, 2014(Stable period)

The first three sub-periods are similar to the study done by Mahdhir and Annuar (2001) while sub-period 4 is extended until December 31, 2003. Sub-period is referred to as the stable period. The sample is split into the first three sub-periods similar to Mahdhir and Annuar (2001) to reflect the changing volatility levels throughout the five-year period (December 10, 2005until December 31, 2001). Basically, sub-period 1 is established to reflect the learning due to the recent introductions to the stock index futures market. During sub-period 1, the volume is relatively low and the market condition is stable. Sub-period 2 is established to reflect the effect due to the onset of the financial crisis which reflects highly fluctuating prices and high trading volume, while sub-period 3 is the period of mildly volatile prices and fairly high trading volume. Sub-period 4 reflects the quite stable fluctuation in price and volume of FKLI following the financial crisis.

There are four different FKLI contracts that are traded on the Malaysian Derivatives Exchange (MDEX), namely the spot-month contract, next-month contract and the next two calendar quarterly month contracts (March, June, September and December). The spot-month and next-month contract used in this study are obtained from MDEX website

DATA ANALYSIS

The price-volume relationship and causality analysis will be tested using the E-Views computer program. The long-run relationships between the both variables are investigated by the cointegration test. However, prior to testing for cointegration, the time-series properties of the individual variables should be investigated. If the variables are stationary, conventional regression procedures are appropriate. However, if the variables are nonstationary, with time-dependent means and variances, then, tests of cointegration are necessary to establish the long run relations. In this study, the test for stationary is the Augmented Dickey-Fuller test, which was suggested by Dickey and Fuller (1979).

If the two variables are nonstationary and integrated of the same order, then the relationship of these variables is estimated by employing the cointegration methodology suggested by Johansen (1988) and Johansen and Juselius (1990). Cointegration is a long-run relationship and it implies that deviations from equilibrium are stationary, with finite variance, even though the series themselves are nonstatioanry and have infinite variance (see Engle and Granger, 1987). The Johansen and Juselius (1990) procedure provides the appropriate test statistics and the point distributions to test the hypothesis for the number of cointegrating vectors and tests of restrictions upon the coefficients of the vectors.

The Johansen procedure involves the identification of rank of the *m* by *m* matrix Π in the specification given by

$$X_t = \delta + \sum_{=1}^{k=1} {}_i X_{t-i} + \Pi X_{t-k} + \varepsilon_{t\,i}$$

where X_t is a column vector of the *m* variables, and Π represent coefficient matrices, is a differ rence operator, k denotes the lag length, and δ is a constant. In the absence of cointegration, Π is a singular matric, its rank, r, equals 0). Hence, in a cointegrated case, the rank of Π could be

anywhere between zero and *m*. The procedure provides two likelihood ratio (LR) tests for the rank of Π, they are the maximum eigenvalue (λ-max) and the trace statistics.

If the two variables move together in the long-run, an equilibrium relationship exists, and the short-run Granger causality tests should be constructed within a vector error-correction model (VECM) to avoid misspecification (see Granger 1988)[1]. Otherwise, the analysis may be conducted as a standard vector autoregressive (VAR) model[2]. The direction of Granger-causal effect running from one variable to another can be detected using the vector error-correction model (VECM) derived from the long-run cointegrating vectors.

The short-run Granger causality test is implemented by calculating the F-statistic based on the null hypothesis that the set of coefficients of the lagged values of independent variables (in first difference except the I(0) variable will be in its level) are not statistically different from zero. If the null hypothesis is not rejected, then it can be concluded that the independent variable does not cause the dependent variable. For instance, if the *F*-statistic of the price of FKLI (price as a independent variable in the equation) is significant at a 5% level (i.e. H_0: $\beta_i(L) = 0$, for *i* refers to price), and the volume of FKLI is the dependent variable of the equation, then we can say that there is a causal effect running from price to the volume. Besides the detection of the short-run causal effects, the VECM allows us to examine the effective adjustment towards equilibrium in the long run through the significance of the *t*-test of the lagged error-correction terms (ECT) of the equation.

Table 1 and Table 2 show the summary statistics for price and volume of FKLI for spot and next month contracts during the four different sub-periods. For the price level data for sub-period 4 of spot month contract and sub-period 3 of next month contract, have the highest mean of annualized returns of 0.000288% and 0.000917%, respectively. With regards to the volume level, the highest mean of annualized percentage is recorded in sub-period 2 for both spot and next month contract, 0.190161 and 1.616428, respectively.

Jarque-Bera is a test statistic to determine whether the data series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The statistic is computed as:

$$JB = \frac{N-K}{6} (S^2 + \tfrac{1}{4} (K-3)^2)$$

Where S is the skewness, K is the kurtosis, and k represents the number of estimated coefficients used to create the series. All of sample periods show that the series for price returns and volume changes are normally distributed. Finally, the highest variance for both the variables in spot and next month contract is recorded during sub-period 2 (high volatility period) and the data for variance is based on original time series.

The stationarity of the price and volume data of FKLI for both spot and next month contracts is tested using the Augmented-Dickey Fuller unit root test. Table 3 shows the results for this test for both variables under each sub-period. The price returns and volume changes for all sub-periods for spot and next month contracts are stationary in level. The results indicate that the null hypothesis of a unit root is rejected for all variables, price and volume, in levels in the four sub-sample periods. This indicates that all the variables are stationary in their levels, or I(0). Therefore, all these variables should appear in levels stationary form in the causality tests within the VAR/VECM framework.

Price returns and volume changes indicate short-term relationship between the variables, therefore, the long-run relationship between the two variables is investigated by using the cointegration test suggested of Johansen (1998) and Johansen and Juselius (1990). Table 4 indicates that there is at most one cointegrating vector existing in the system for all sample periods for both spot and next month contract. This implies that both variables have tendency to move together in the long-run. Even within the short sample period, the long-run

relationship is already established for both price and volume of FKLI.

The cointegration test results in Table 4 indicate that price and volume of FKLI are cointegrated. Table 5 shows that the only statistically significant Granger causality is for sub-period two, Spot Month Contract from volume to price. Further analysis is conducted to determine the short-run and long-run dynamic relationships between both variables within the vector error-correction model (VECM). The results of the causality test under the framework of VECM are presented in Table 6. The relationship between from volume to price is statistically significant in all sub-periods for both months. The relationship from price to volume is less stable.

CONCLUSIONS

In this study, we analyze the relationship and the causality between price index and trading volume for both spot and next month contracts in the Malaysian stock index futures market. The daily data of the stock index futures (FKLI) closing price and the daily data of the stock index futures (FKLI) trading volume since December 10, 2005 until December 31, 2014 are used in this study. The data is divided into four sub-periods to analyze the variation in activity especially due to the Asian financial crisis in 1997-1998. Both price returns and volume changes of FKLI have tendency to move together in the long-run. This is an important signal as suggested by Karpof (1987) that study of the price-volume relationship is important because it provides insight into the structure of financial markets, especially regarding the information flow process within the market. Even within the short sample period, the long-run relationship is already established for both price and volume of FKLI.

The only statistically significant Granger causality is for sub-period 2, during crisis period, for Spot Month Contract from volume to price. This is consistent with the statistics results that show the volume level with the highest mean of annualized percentage is recorded in sub-period 2 for spot month contract. The results of the causality test under the framework of VECM show the relationship between from volume to price is statistically significant in all sub-periods for both spot and next month contracts. Karpof (1987) has suggested that it has significant implications for research into futures markets that if trading volume in futures contracts affects price, then speculation could be a stabilizing or destabilizing factor in futures prices. In conclusion, this study has provided relevant information to investors by the price-volume relationship in both spot-month and next-month contracts either to speculate or to hedge their portfolios especially during the high volatility period, the crisis period.

Table 1: Summary Statistics for Price and Volume (Returns) of FKLI for Spot Month Contract

Subperiod (#)	1 (383)	1 (383)	2 (310)	2 (310)	3 (799)	3 (799)	4 (404)	4 (404)
Variable	Price	Volume	Price	Volume	Price	Volume	Price	Volume
Mean	0.000195	0.180635	-0.002222	0.190161	0.000940	0.129033	0.000288	0.164949
Median	0.000000	0.015038	-0.007475	0.000586	-0.000680	-0.029650	0.000000	0.008312
Maximum	0.029589	6.287879	0.333503	6.287879	0.083192	5.352941	0.033462	6.895522
Minimum	-0.041549	-0.841270	-0.321850	-0.841270	-0.070740	-0.664300	-0.033449	-0.926786
Std.Dev	0.009329	0.769205	0.048721	0.789051	0.018557	0.677734	0.009811	0.768401
Skewness	-0.457370	3.001073	0.771608	2.945760	0.428160	3.126179	0.036321	3.305144
Kurtosis	5.337269	18.559480	16.954860	18.266200	5.278584	17.810370	3.660956	21.472150
Jarque-Bera	100.53	4438.38	2546.13	3458.66	197.26	8603.87	9.03	7858.71
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010960	0.000000

Table 2: Summary Statistics on Price and Volume (Returns) of FKLI for Next Month Contract

Subperiod (#)	1 (383)	1 (383)	2 (310)	2 (310)	3 (799)	3 (799)	4 (404)	4 (404)
Variable	Price	Volume	Price	Volume	Price	Volume	Price	Volume
Mean	-0.005093	1.132402	-0.002109	1.616428	0.000917	0.548887	0.000212	0.629676
Median	0.000278	0.000000	-0.006861	0.032413	-0.000451	0.167382	-0.000225	0.019575
Maximum	0.026185	34.500000	0.336041	128.333300	0.083665	24.444440	0.031537	13.000000
Minimum	-1.000000	-1.000000	-0.321239	-1.000000	-0.073055	-1.000000	-0.044321	-1.000000
Std.Dev	0.072904	3.920190	0.048892	9.327792	0.018855	1.707815	0.010360	1.808836
Skewness	-13.355580	4.501014	0.705862	10.463250	0.347270	5.945226	-0.090923	3.775114
Kurtosis	182.54	27.74	16.77	128.08	5.33	62.21	4.06	21.27
Jarque-Bera	524447.90	11062.73	2472.16	207724.40	197.42	121441.00	19.35	6579.41
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000063	0.000000

Table 4: Johansen's Test for Cointegrating Vectors

	Spot Month Contract		Next Month Contract	
Ho	Maximum EigenValue	Critical Value 99%	Maximum EigenValue	Critical Value 99%
Full Sample Period				
p= 0	0.229568**	20.04	0.178267**	20.04
p< 1	0.183187	6.65	0.167091	6.65
Before Crisis				
p= 0	0.223784**	20.04	0.180234**	20.04
p< 1	0.204759	6.65	0.090791	6.65
During Crisis				
p= 0	0.227322**	20.04	0.212271**	20.04
p< 1	0.194682	6.65	0.177289	6.65
Recovery				
p= 0	0.248726**	20.04	0.198814**	20.04
p< 1	0.140053	6.65	0.136427	6.65
Stable				
p= 0	0.230341**	20.04	0.220005**	20.04
p< 1	0.153712	6.65	0.149803	6.65

Notes: p indicates the number of cointegrating vectors.
The (**) indicates rejection at the 99% critical values.

Table 5: Granger Causality Test

Lag: 2 Spot sub 1

Null Hypothesis:	Obs	F-Statistic	Probability

VOLUME does not Granger Cause PRICE	379	1.35178	0.25025
PRICE does not Granger Cause VOLUME		0.28050	0.89056

Lags:4 Spot sub 2

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause PRICE	306	2.47530	0.04444**
PRICE does not Granger Cause VOLUME		2.00784	0.09338

Lags: 5 Spot sub 3

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause PRICE	794	1.86729	0.09772
PRICE does not Granger Cause VOLUME		0.07223	0.99632

Lags: 1 Spot sub 4

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause PRICE	489	2.75202	0.09778
PRICE does not Granger Cause VOLUME		0.29140	0.58957

Notes: The F-statistics tests the joint significance of the lagged values of the independent variables. The asterisks indicate the following levels of significance: *10%, **5% and ***1%.

Table 5: Granger Causality Test
FKLI Next Month Contract

Lags: 2 Next sub 1

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause PRICE	378	0.09152	0.91257
PRICE does not Granger Cause VOLUME		0.15451	0.85689

Lags: 3 Next sub 2

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause PRICE	307	0.62674	0.59822
PRICE does not Granger Cause VOLUME		0.10047	0.95970

Lags: 2 Next sub 3

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause PRICE	797	0.99856	0.36887
PRICE does not Granger Cause VOLUME		0.22859	0.79571

Lags: 3 Next sub 4

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause PRICE	401	2.84176	0.03766
PRICE does not Granger Cause VOLUME		0.45158	0.71632

Note: The F-statistics tests the joint significance of the lagged values of the independent variables. The asterisks indicate the following levels of significance: *10%, **5% and ***1%.

Table 6: VECM Results

	Spot Month Vector Error Correction Model Results			
			Coefficient (t-statistics)	
	Before Crisis	During Crisis	Recovery	Stable
Price(%)	-0.02557	-0.00598	0.005702	0.002739
	(-1.62812)*	(-0.40288)	(-1.04025)	(-0.58422)
Volume(%)	15.48391	-1.94084	3.513954	4.786351
	(-14.2201)***	(-13.0204)***	(-20.1158)***	(-15.3149)***

	Next Month Vector Error Correction Model Results			
			Coefficient (t-statistics)	
	Before Crisis	During Crisis	Recovery	Stable
Price(%)	-0.01112	-0.71366	-0.00648	-0.15882
	(-0.97166)	(-7.90874)***	(-1.49084)	(-4.69190)***
Volume(%)	6.479656	-99.2602	6.03573	-66.148
	(-11.7909)***	(-5.49190)***	(-17.3421)***	(-11.9745)***

Note: The t-statistics tests the significance of the error correction term (ECT).
The asterisks indicate the following levels of significance: *10%, **5% and ***1%.

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