Co-integration and Causality between the Spot and Futures Markets: Pre and Post Implementation of NKEAs

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Abstract

The Tenth Malaysian Plan (RMK10) through the Economic Transformation Programme (ETP) focuses on 12 National Key Economic Areas (NKEAs). One of the key areas is the palm oil industry. Hence, this study is aimed at examining the implication of the ETP/NKEAs (pre and post) towards the crude palm oil (CPO) and its futures (FCPO) markets. The Johansen approach and the Granger test were employed to prove the co-integration and causality respectively between both markets for the period January 2008 to May 2015. Other empirical tests including the correlation analysis and multiple regressions were also conducted in order to investigate the relationship between the CPO price with the FCPO price, trading volume and open interest. The findings from the Johansen test show that there exists a co-integration in the long run between the Malaysian CPO and FCPO markets. The Granger test result indicates that there is causality of FCPO prices on the CPO prices, but not the other way around. In addition, the Regression analysis shows that FCPO price is the only significant factor that affects CPO price whilst the other two independent variables show insignificant results. The findings would be useful to the market regulators, operators and traders in setting their policy and regulations, and also in their decision making process

1.0 Background of Study

Malaysia's palm oil industry is the fourth largest contributor to the national economy and currently accounts for RM53 billion GNI. The industry spans the value chain from upstream plantations to downstream processing. The development is mainly private sector driven and remains heavily skewed towards upstream activities. This sector contributes more than 30% of the total income to the country. Since 1960, planted area had increased at a rapid pace. In 1985, 1.5 million hectares were planted with palm tree, and it had increased to 4.3 million hectares in 2007. Since then, it has become the most important commodity crop in Malaysia. As of 2011, the total planted area was 4.917 million hectares. In 2003, Malaysia became the largest producer and followed by Indonesia as the second largest producer. However, as years come by and Indonesia actively opened its land to plant the palm oil, the country's production has exceeded the hectares of plantation in Malaysia. Thus, Indonesia had become the largest producer in the world followed by Malaysia. This is because of the tremendous increase in production and export volume of palm oil to fulfil the world demand.

In order to improve the palm oil industry since this industry contributed a high percentage of income to Malaysia, the government had comes out with the Economic Transformation Programme (ETP). The ETP focuses on 12 National Key Economic Areas (NKEAs) as announced in the Tenth Malaysia Plan, which one of the key areas is the palm oil industry. These NKEAs will receive prioritized government support including funding, top talent and Prime Ministerial attention. This programme was launched on 25 September 2010 and formulated as part of Malaysia's National Transformation Programme. Its goal is to elevate the country to developed-nation status by 2020, targeting GNI per capita of US$15,000. This will be achieved by attracting US$444 billion in investments which will, in turn, create 3.3 million new jobs.

Malaysian government through its agency, the Malaysian Palm Oil Board (MPOB), and the industry players have given the synergistic effort in carrying out R&D and marketing activities and thus led the palm oil industry to succeed. These non-stop efforts resulted to higher production and exports, making palm oil always readily available in the world market. However, oil palm is also facing challenges in enhancing productivity, increasing workflow efficiency and maximizing profits. As the second leader in the palm oil industry, it is worthwhile monitoring the development of its CPO production and price. The prices of palm oil are not pegged by the government; it always fluctuates every time depending on the economic condition.

There are many factors that influence the price of palm oil such as hectares of land, supply of palm oil, export of palm oil, and consumption of palm oil. Decreasing in import tariffs causes the value of palm oil increase quickly and the land for palm oil plantation also increased in order to expand their business where it can produce more product of palm oil. The price of CPO is dependent a lot on factors that varying according to time. CPO price behavior is determined by fundamental factors such as supply and demand in the world market. In addition, CPO price is also dependent on the market sentiment, which comes from unpredictable factors such as the extreme weather phenomenon, political crisis, new policies and regulations and the impact of natural disasters. Strong demand for oil palm products will lead to an increase in CPO prices in the market. However, if the supply of palm oil growth is much faster than that of its demand, CPO prices will be affected in a negative manner. Price of substitute products for palm oil, such as soybean and rapeseed oils has also become a fundamental factor that is able to influence CPO prices in the world market (Rahman n.d.).

While the supply shows a tremendous increase combined with escalating oil prices, the CPO prices declined. Even though the CPO prices increased in 2008 as compared to their 2007 level, they experienced an extreme price fluctuations over the year, with the highest month average in March 2008 which is RM3,695 per tonne and the lowest in November of RM1,520.50 per tonne. During the first half of the year trading was above RM 3,500 per tonne where this level was supported by higher crude oil prices, demand for biodiesel, tight global vegetable oils situation and higher vegetable oil prices. However, towards the end of the year there was a sharp decline in CPO prices as well as other vegetables oil prices, high palm oil stocks, global financial crisis and fear of global recession results the price to fall below RM 2000 (MPOB, 2009).

CPO price behaviour at this moment is more complex, thus creating high volatility in its prices. This is because palm oil is the largest vegetable oil that is traded in the world market, with a volume of 38.68 million tonnes in 2011. According to Rahman n.d., in 2012, CPO price behaviour was affected negatively by a combination of both supply and demand factors. From the supply perspective, the CPO stock build-up arising from high carry-over stocks at the beginning of the year and an increase in CPO production had contributed to the CPO price bearishness in 2012. Meanwhile, weaker export demand from major importing countries such as China, P.R. and Pakistan has become a significant factor in contributing to the decline in CPO prices in 2012.

In 2014, the overall CPO price showed a slight upward trend, increased by 0.5% to RM2,383.50/tonne against RM2,371.00/tonne in 2013. The highest traded price was in March at RM2,855.00/tonne and the lowest price was in September at RM2,055.50/tonne. CPO price was traded higher during the 1st half of 2014, averaging at RM2,605.00, up by 12.8% compared to RM2,310.00/tonne during the same period in 2013. The higher price was mainly due to tight domestic palm oil supply during this period. However, price was generally on a downward trend during the 2nd half of 2014, averaging at RM2,183.00, down by 9.3% compared to RM2,407.50 during the same period in 2013. The lower prices was in line with the weaker soybean oil prices resulting from bumper crops, coupled with the weaker Brent crude oil prices traded hovering USD60/barrel (MPOB, 2014).

On the other side, futures or derivatives market has been used by hedgers, arbitrageurs, speculators, producers and policymakers for risk management and profit seeking purposes by predicting the spot prices in the future. A stress test of any futures market is its ability to generate prices that are efficient especially during extremely volatile economic uncertainty periods. Economic agents are exposed to high risks associated with movements in commodities cash prices during the trading of physical commodities. Therefore, the interest and main objective of the development in commodity futures markets is due to the demand for hedging facilities. It is important to understand the role of commodity futures market for risk management purpose. People commonly know that the prices are fluctuating over time for shares, commodities and currency. So, there is possibility of adverse price changes in future creates risk arising from unforeseen price changes.

2.0 Previous Studies

Fluctuations in commodity prices pose a real challenge to many economies and developed economies like United States and Japan are no exception (Razak et al., 2011). Sadorsky (1999) and Hamilton (1983) indicate that commodity prices especially energy prices, exert significant effect on a country's economy. This is true in the case of crude palm oil and crude oil prices. Oil is an important commodity which is used in almost every aspect of economic activity. The fluctuations in commodity prices, particularly during the 1973 – 1974 oil price crises, have an impact on USA, Canada, UK, Japan and Germany's national GNP and unemployment. The high price of crude oil continues to be an issue of concern all over the world, particularly, developing agro-based countries. This is inevitable because the determination of agricultural commodities prices is based on complex interactions among multiple factors

including crude oil prices, exchange rates, time-lag, demand and supply situations and slowing growth in agricultural productivity as well as governments' policies.

Similarly, the energy crisis, bad weather and international trade policy diversities made by nations of the world also influenced the prices of agricultural commodities. Prices of agricultural product have been found to be particularly volatile and susceptible to sharp fluctuations, which expose producers and traders to increased risk in handling these products. Palm oil is currently the second most important vegetable oil in the world oils and fats market, accounting for 14.35% of world production of seventeen major oils and fats, ranking only behind soybean oil, which contributed 20.23% of world output. In terms of world exports of oils and fats, palm oil is currently leading with a market share of 32% while soybean oil has a share of 16.2%. Palm oil and palm kernel oil have become the production growth leaders in the oils and fats complex since the early seventies (Mielke, 1991).

Rahman, (n.d.) carried out a study that mainly focused on the empirical test of the effect of production, stock and export variables on the prices of the Malaysian crude palm oil futures market. Using Johansen approach to test the co-integration, he found there is a strong long-run relationship between the spot and the futures prices of the Malaysian crude palm oil futures market and the production, stock and export variables for the period under investigation. Meanwhile based on VECM results, there is a causal relationship from the spot and future prices with the fundamental factors. The results also support the earlier findings of Mad. Nasir and Fatimah (1992) that there are relationship between prices of palm oil with the level of stock, production and export.

Mohd Zaini & Chan (2005) research tells about the difference in trading mechanisms in the stock index futures and spot markets in Malaysia is argued to contribute to the lead-lag relationship between the two. Results of the study suggest that cash market and futures market are co-integrated. The results also indicate that spot price do lead futures price but the lead-lag relationship is relatively weak as compared to the impact of futures price on spot price.

A study conducted by Ahmad, (2010) investigates the effects of the Malaysian futures - cash market relationship after the migration of Malaysian crude palm oil futures (FCPO) to automated system in December 2001 by employing EGARCH-t (p, q) model specifications. The result found that the introduction of the automated trading system in the FCPO market has no impact on the level of volatility persistence in the underlying spot market. On the other hand, it seems that volatility persistence is marginally higher under the automated trading system relative to the open outcry system for FCPO futures contracts. Regarding the asymmetric effect on FCPO contracts and its underlying market, it is found that no significant asymmetric effect is documented in the CPO market. An analysis of this effect on FCPO contracts reveals statistically significant positive asymmetric effect for FCPO after it migrated to screen trading system.

The upward trend of oil prices over the last ten years has put heavy burden on global economy in particular. The highest price was recorded sometime in June 2008 when it went up to almost USD140 per barrel. There have been numerous studies done in

investigating interrelationship between commodity prices and the economy (Hamilton, 1983; Gisser and Goodwin, 1986; Ferderer, 1996). Most of the studies concentrate on the relationship between oil price changes and the reaction of the economic activity that ensues. Studies in agricultural economics have shown that the fluctuation of commodities prices is significant and persistent (Wilkinson 1976). According to Mad Nasir and Fatimah (1992), two of the salient features of agricultural commodities are the volatility and variability in prices.

Khin, Mohamed, Awad, & Hameed, (2012) investigate the impact of world crude oil price on the supply, demand, stock, synthetic rubber and natural rubber (NR) prices of the Malaysian NR industry. Monthly data were used for the period from January 1990 until December 2010, which employed the method of Vector Error Correction Method (VECM) with co-integration method for residual error correction of the system of equations. The finding indicates that crude oil price and the supply, demand, stock, synthetic and natural rubber prices are significantly co-integrated, which means that the long-term equilibrium between the variables are met.

Razak et al., (2011) investigate the relationship between crude palm oil and crude oil prices. Using Engle-Granger Cointegration test and Error Correction Model (ECM) to analyse data covers the period January 2000 through November 2010, this study found that there is a significant long-term between the prices of crude palm oil (CPO) and petroleum crude oil (COP). From the Granger-Causality test, there is a significant short-term relationship between COP and CPO. It also implies that now confirmed CPO is the leading indicator. The two variables are also found to be positively correlated. Basiron (2008) in his study also reveals that there is a correlation between crude oil and crude palm oil prices.

Arshad, Awad, & Hameed, (2013) carried out a study on the nature of links or relationships between crude palm oil prices and stocks and its short term implications on the palm oil trend in 2013. They employed the method of Autoregressive Distributed Lag (ARDL) and they found that crude palm oil price both in the short and long terms, are causally related to changes in the two variables. Furthermore, the crude palm oil price elasticity with respect of the two variables is highly elastic in the long run, which reflects high sensitivity of the price to these two determinants over time.

Study conducted by Chuangchid, et al., (2012) examines the dependence structure of extreme realization of growth rate between palm oil prices and factors affecting, which are soybean oil and crude oil prices by employing Bivariate Extreme Value methods for daily palm oil, soybean oil and crude oil prices ranging from July 1988 to January 2012. Their result showed that the growth rate of palm oil and soybean oil prices has some dependence in extremes. However, in the case of the growth rate of palm oil and crude oil prices, it has fairly weak dependence or even independence in extremes. Hameed & Arshad (2009) studied the relationship between the prices of crude oil and selected vegetable oils using the Granger causality test. According to this study, the results show that in the long-run there was one direction relationship between crude oil price and the prices of each of four vegetable oils, i.e., palm, rapeseed, soybean, and sunflower oils, but the reverse was not true.

On the other hand, a study conducted by Rahman, (n.d). on the impact of price

behaviour on Malaysian palm oil supply and demand and its impact in 2013 found that on the supply side, both CPO production and PO stock play a significant role in terms of influencing CPO price behaviour. Meanwhile on the demand side, export of oil palm products is a key factor influencing CPO price behaviour.

According to Karia, Bujang, & Ahmad, (2013) in forecasting crude palm oil prices using artificial intelligence approaches, which employed in-sample forecasting on daily free-on-board CPO prices in Malaysia and the series data is stretching from a period of January first, 2004 to the end of December 2011. They proposed the ANN, ANFIS and ARFIMA models to forecast the CPO prices in Malaysia. Findings from the result show that the ANN provides the best fits result followed by ARFIMA and AN-FIS respectively. The most striking result to emerge from the forecasting performance is that the ARFIMA model has same standard level of forecasting ability among the listed artificial intelligence approaches. More to the point, it is found that the applied ARFIMA model outperformed compared the ANFIS model in predicting the CPO prices. Relying to the fact that the CPO prices are strongly auto-correlated as well as consisting linearity which significantly degrades the performance of the ANFIS model.

Iv, Shamsudin, & Yusop, (2009) conducted a study to examine the impact of rising biodiesel demand on Malaysian palm oil industry using estimated structural econometric model. Annual data for the period 1980-2007 was used to simulate the effect of increase in Malaysian biodiesel demand. A counterfactual analysis of a sustained 70 percent increase in Malaysian biodiesel demand predicts a direct effect of a 0.36 percent in Malaysian export demand of palm oil. The indirect effects via the export demand transmission channels are: 142.6 percent decrease in stock, 21.86 percent increase in supply, 109.74 percent increase in CPO price, 9.84 percent decrease in domestic consumption and there is also 0.04 percent increase in world price. The higher price would be disadvantage to biodiesel producers as CPO is the main feedstock for biodiesel.

A study to describe the important factors affecting Malaysian palm oil industry especially biodiesel demand is also conducted by Dewi (2011). Using market model representing palm oil production, import, world excess demand, domestic consumption, export demand, rest of the world excess supply and palm oil prices is formulated by employing two stage least squares method using annual data for the period 1976-2008. The results indicate that the Malaysian palm oil price function has a reasonably good fit and all the variables have expected signs and significant coefficients except stock of palm oil with correct sign but insignificant value. The inclusion of new element of biodiesel demand results show that this variable has a significant effect on the palm oil prices. Therefore, biodiesel demand has a positive impact on the Malaysian palm oil domestic price.

Commodity futures' trading was formally introduced in Malaysia in October 1980 with two major purposes. Firstly, is to provide an efficient price discovery mechanism. Secondly, is to provide hedging facilities to market participants against the vagaries of price fluctuations. Prices of agricultural product have been found to be particularly volatile and susceptible to sharp fluctuations which expose producers and traders to increased risk in handling these products (Muhammad, Ab, & Nawi, 2012).

As far as volatility and variability of prices are concerned, the impact is more remarkable in the vegetable oils and fats market, notably palm oil, which is the most widely consumed edible oil in the world. If producers are in fact using futures prices as expected output prices when allocating resources, an assessment of the quality of the prices is important. Thus studies on the efficiency of futures markets have important implications on the issue of whether economics resources are being optimally allocated in the agricultural sector.

It is particularly important to assess the Malaysian Derivatives Exchange (MDEX) market since it is the only futures market for palm oil and producers and other market intermediaries use it as a price indicator. The existence of pricing efficiency in the markets will assume that futures prices move in lines with cash prices in the long-term and that they do not deviate from cash prices for long periods of time (Khin et al., 2012). According to Liu, (2009) futures market efficiency implies that futures price will totally reflect the expected future spot price with random risk error terms. It indicates that all new information is immediately incorporated into the expectations about future prices.

A study conducted by Muhammad et al., (2012) on the market efficiency of the Malaysian crude palm oil prices using data for the sample period spanning from 1998/2001 and 2010/2012 using Johansen multivariate test provides empirical evidence for spot and futures prices are co-integrated. This implies that the market efficiency hypothesis can be easily rejected. Meanwhile using the Error-Correction Model (ECM) found that there is a dynamics relationship between spot and futures prices. In other words, the changers in the lagged crude palm oil future prices do effectively influence changers in the spot price. This provides further evidence that the crude palm oil future prices does possess the price discovery function, therefore future prices may be used by producers and traders as the relevant price signal for decision making purposes.

Muhamad & Ab, (2013) studied the effect of production, stock and export variables towards the prices of the Malaysian crude palm oil market. The study proved that the spot prices of the Malaysian crude palm oil market has a stable long-run and short-run relationships with the production, stock and export from the results of Johansen's co-integration and vector error-correction model. This indicates that the production, stock level and export variables play an important role in influencing the prices of the crude palm oil.

In a study conducted by Liu, (2009) investigates the CPO futures market efficiency of BMD for the European participants whose delivery location was in the EU, using Johanson cointegration test and Vector Error Cointegration Mechnism (VECM) to test long-run and short-run efficiency for the European spot market and four different futures forecasting horizons that are one week, two weeks, one month and two months. The results find that CPO futures prices in BMD futures market is an unbiased predictor of spot price in the long-term. Nevertheless, she also found the futures market of BMD is still not a very efficient market for the European market. The research found in both short-term and long-term efficiency test that the European spot price has strong tendency to lead the CPO futures prices for many forecasting periods.

Binti, Saad, Ismail, Edi, & Binti, (2013) investigate the performance of two contracts

traded that are FCPO and Crude Palm Kernel Oil futures (FPKO) in Malaysian derivatives market. They analysed the effects of contract's settlement, volume and open interest towards open price for both contracts traded. The secondary data were used, for N=1,296 over the period between 2006 and 2010. The correlations results for price indicate positive insignificant with volume (+0.040). As for multivariate regression result, the volume (-2.822) indicate 1% confidence level be negatively significant relationship with price. The finding also found that correlations for price indicate positive coefficient with open interest (+0.20). As for multivariate regression result, the coefficient is positive and significant for open interest (+6.028). Overall, the scenario had been proven statistically from the result by regression, whereby it indicates a significant relation between price with the open interest, volume of trading and cash settlement.

3.0 Methodology

The data set consists of monthly crude palm oil price, future crude palm oil price, future crude palm oil trading volume, and future crude palm oil open interest from January 2008 until May 2015. A monthly data is chosen because high frequency data is more preferable to see the sensitivity of spot and futures market. This study will use event study which is a method to assess the impact of an event on the value of a stock and bond. Mackinlay (1997) design the time frame for an event study for accounting and finance, management, economics, marketing, information technology, law, and political science. In this study, there are two data set are employed which is before and after launched the ETP Programme. Figure 1 illustrates the time frame for this study.

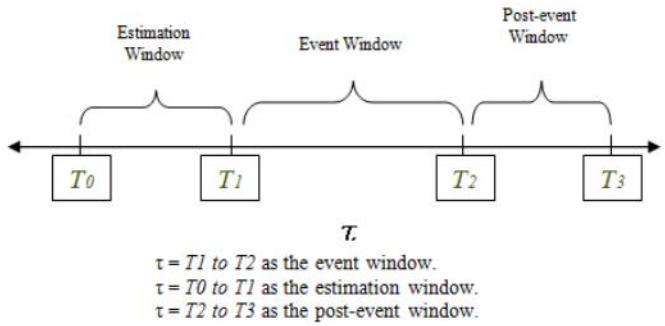

Figure 1: Diagrams for Event Study Period

This paper uses January 2008 as its starting point because based on Mackinlay (1997), the length of observation at least 120 days before the event and 120 days after the event. In this case, Prime Minister was launched on 25 September 2010 and formulated as part of Malaysia's National Transformation Programme. In this papers, the estimation window start from January 2008 until August 2010 (from T0 to T1) which include only 5working days, consist of 128 data. This research start the post-event window from September 2010 until May 2015 (from T2 to T3) which is consists of 228 data. The time line for event study is split with estimation window, and post-event window to make sure the data are not overlap. Data analysis starts with test the stationary. The stationary process is a stochastic process whose joint probability distribution does not change when shifted in time or space. Consequently, parameters such as the mean and variance, if they exist, also do not change over time or position. Stationary is used as a tool in time series analysis, where the raw data are often transformed to become stationary. The second step is to test the correlation by Covariance Analysis and Regression Analysis. After look the covariance analysis and regression analysis, the final step is the test Johansen Co-integration Test and Granger Causality Test. By testing the

Johansen Co-integration Test and Granger Causality Test can answer the objective of this study.

4.0 Findings and Discussion

4.1 Test of Stationary for CPO Price and Volume

Table 1: Augmented Dickey-Fuller (ADF) Test: CPO Price and Volume

Variables	ADF Test Prob.	ADF Test Prob.	Order of Integration
CPO_P	0.6433*	0.0000**	I (1)
FCPO_P	0.4895*	0.0000**	I (1)
FCPO_TV	0.0000*	-	I (0)
FCPO_OI	0.0000*	-	I (0)

*** Augmented Dickey-Fuller (ADF) test by using Trend-Stationary Process (TSP) to test the stationary of the data series at level; Intercept; Lag = 0**

****Augmented Dickey-Fuller (ADF) test by using Trend-Stationary Process (TSP) to test the stationary of the data series at 1 different; Intercept; Lag = 0**

The process of unit root test start by using "Level, "Intercept" and "Lag differences =0 .Table 1 above shows the result of unit root for CPO_P, FCPO_P, FCPO_TV and FCPO_IO by using "Level, "Intercept" and "Lag differences =0". The above results show that FCPO_TV and FCPO_OI variable are stationary at significant level of 5%. Then, test for CPO_P and FCPO_P with "1st Different", "Intercept" and "Lagged Differences= 0". Therefore, the null hypothesis of non-stationary data are failed to reject. Thus, these two variables have been transformed at first difference to make them stationary.

4.2 Correlation Test: Covariance Analysis

Table 2: Correlation Test: Covariance Analysis CPO Price and Volume

Correlation t-Statistic Probability	ZY	ZX1	ZX2	ZX3
ZY	1.000000 ---------- ----------			
ZX1	0.536125 5.889810 0.0000	1.000000 ---------- -- ---------- --		
X2	-0.020606 -0.191129 0.8489	-0.091620 -0.853234 0.3959	1.000000 ---------- -- ---------- --	
X3	0.082568 0.768330 0.4444	0.047927 0.444971 0.6575	0.221699 2.108415 0.0379	1.000000 ---------- ----------

As been observed in Table 2, above, the pair of (ZY,ZX1), the p-value is 0.0000. Therefore reject null hypothesis at 5% significance level and can conclude that there is a (positive) correlation between ZY and ZX1. In contrast the p-value for the pair of (ZY,X2) is 0.8489, which indicate that the null hypothesis is failed to be rejected at 5% significance level and may conclude that there is no correlation between the variable ZY and X2. As for pair (ZY,X3), the p-value is 0.4444 and therefore failed to reject the null hypothesis and can be concluded that there is no correlation between ZY and X3.

4.3 Regression Analysis

Table 3: Multiple Regressions Results

Coefficient	Results
Constant	-1.271490 (0.5814)
ZX1	0.474821* (0.0000)
X2	4.93E-05** (0.8612)
X3	0.00379*** (0.5745)
F-statistic Prob. (F-statistic)	11.48842 0.000002

** FCPO price, ** FCPO trading volume, *** open interest*

Out of the three independent variables, only one variable is significant at 5% level that is ZX1 and it can be concluded that FCPO price has significant (positive) relationship with CPO price. Meanwhile, X2 and X3 are insignificant at 5% level. The F-statistic value is 11.48842 with the P-value of 0.000002. Therefore, at 5% significance level, the null hypothesis is rejected and can be concluded that at least one of the independent variables is having significant relationship with the CPO price.

4.4 Johansen Co-integration Test

As mentioned earlier, this test is divided into two sub-periods, which are pre and post implementation of the NKEAs. The pre period is from January 2008 to August 2010 and the post period is from September 2010 to May 2015. The results obtained are as follows:

Table 4: Johansen Co-integration Results

	Pre	Post
Trace Test	0.0000 0.0158	0.0000 0.0000
Maximum Eigenvalue	0.0000 0.0158	0.0000 0.0000

According to the trace test results, the p-value for both sub-periods is less than 5% significance level. Therefore, the null hypothesis is rejected and we may conclude that the co-integration exists between ZY (CPO price) and ZX1 (FCPO price). This finding is further supported by the Maximum Eigenvalue, where the p-value for both sub-periods is also less than 5% significance level. Thus, the null hypothesis is still rejected, which means the co-integration exists between CPO price and FCPO price. From the above results, we can conclude that CPO price and FCPO prices are co-integrated or having co-movement in the same direction in the long run.

4.5. Granger Causality Test

Table 5: Granger Causality Test

	Pre	Post
ZX1 does not Granger Cause ZY	0.0000	0.0000
ZY does not Granger Cause ZX	0.3290	0.1105

Based on the probability values (p-values) reported, the hypothesis 'ZX1 does not Granger Cause ZY' can be rejected for both pre and post periods since the p-values are less than 5% significance level, 0.0000009 and 0.0000000000005 respectively. In other words, this means that the FCPO price does Granger Cause the CPO price and the results are consistent before and after the implementation of NKEAs. This findings show to us that the FCPO price could be used as the predictor for CPO price. It is in line with the objective of futures instrument that serves as a price indicator or price discovery for what would happen to the CPO price in future. However, the hypothesis 'ZY does not Granger cause ZX1' cannot be rejected (we fail to reject) since the p-value is greater than 5% level of significance pre and post periods. Therefore,

it appears that Granger causality runs one way i.e. from ZX1 to ZY, but not the other way. We can conclude that the CPO price cannot be used as the predictor for the FCPO price in future.

5.0 Concluding Remarks

This study is aimed at examining the co-integration and causality between the CPO spot and futures markets, pre and post of the NKEAs implementation. Besides, the regression is also conducted to investigate the relationship between the CPO price and the determinant factors i.e. FCPO price, trading volume and open interest during the period under investigation January 2008 till May 2015.

Empirical results have provided valuable insights for answers to the problem statement and hypothesis statements. Using the basis of 5% significance level for the regression analysis, it can be concluded that only FCPO price has positive significant relationship with the CPO price. The result of the study that shows the positive significant relationship between the FCPO price with CPO price is consistent with the findings made by Muhammad et al., (2012), which stated that the FCPO price does positively affect the CPO price.

However, with regards to the other two independent variables, FCPO trading volume and FCPO open interest, they appeared to have positive insignificant relationship with CPO price. This is contradictory with the expectation of the findings that these independent variables will have positive significant relationship with the CPO price. And also this is not consistent with the findings made by Binti, Saad, Ismail, Edi, & Binti, (2013) that state there is positive significant relationship between FCPO trading volume and FCPO open interest towards the CPO price.

By using the Johansen and Granger causality approaches, we found that there exists long run and short run relationship between FCPO price and CPO price. Both periods of pre and post show that the co-integration and co-movement exists between FCPO price and CPO price. As for the causality relationship, we found that FCPO price does cause the CPO price, which can be concluded that FCPO price can be used to predict the CPO price in future. However, the CPO price could not be used to predict FCPO price in future. This finding is supported by many researchers where they found that the spot and futures prices are co-integrated Muhammad et al., (2012).

Besides that, this finding is also supported by Muhamad & Ab, (2013), where the results obtained from the study shows that there exists a significant long run and short run relationship between the cash and future prices of the Malaysian Crude Palm oil. In addition, a study by Liu, (2009) proposed that long run equilibrium exists between the futures prices and spot price of the crude palm oil.

The findings in this study are useful for various stakeholders, who are active in agricultural commodities markets such as producers, traders, commodity exchange participants, regulators and policy makers. The direction of relationship between futures and spot prices show that in general, the direction of causality is stronger for futures prices to spot prices in case of Malaysian crude palm oil, suggesting that futures prices tend to affect spot prices in the short run. Therefore futures prices may be used by producers and traders as the relevant price signal for decision making purposes. The futures market has to be closely related

to actual demand and supply conditions in order for futures prices to be good indicators for the cash market. The government should take great care on the policy of replanting of palm oil trees; so that the production of crude palm oil can be enhanced to reflect the price of the crude palm oil.

Future researchers could further expand the knowledge horizon to obtain more reliable results and comprehensive study by adding more variables such as production, supply and demand, and import and export activities. Inclusion of these variables would provide the researchers a broader base of understanding. Future researchers are also encouraged to use other types of data structure such as panel data. Additionally, different frequency of the data set such as daily, weekly, quarterly and annually could be used instead of monthly data set to test the consistency of the findings as well as increasing the reliability of the study.

This study has used Johansen and Granger causality tests. Future studies could consider other comprehensive tests like Variance Decomposition and Impulse Response Function to see the consistency and reliability of the findings. Prospective researchers should also conduct similar research on other developed and emerging countries or markets. Results from such studies would be very beneficial because it is not only showing the trend in different countries but it could be segregated into regional, developed and emerging markets. The information generated from the research study would be useful and valuable not only to investors but to all concerned parties.

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References

Ahmad, N. (2010). Impact of automated trading in the crude palm oil futures market on its underlying spot market, 36 (36).

Arshad, F. M., Awad, A., & Hameed, A. (2013). Review of economics & finance crude oil, palm oil stock and prices : how they link; 1, 48–57.

Basiron, Y. (2008). Can the current palm oil prices be maintained?. PORIM Annual Forum, 7 November 2008.

Binti, N., Saad, M., Ismail, N. B., Edi, N., & Binti, A. (2013). Performance of crude palm oil and crude palm kernel oil futures in Malaysian derivatives market, 2 (1), 26–33.

Chuangchid, K., Wiboonpongse, A., Sriboonchitta, S., & Chaiboonsri, C. (2012). Factors affecting palm oil price based on extremes value approach, *4*(6).

C.W.J. Granger. (1969). Investigating causal relations by econometrics model and cross-spectral methods, econometrica., 424-438.

Dewi, S., & Corresponding, A. P. A. (2011). An econometric analysis of the link between biodiesel demand and Malaysian palm oil market, 6 (2).

Ferderer, P.J. (1996). Oil price volatility and the macroeconomy. *Journal of Macroeconomics*; 18 (1), 1- 26.

Gisser, M. & Goodwin, T.H. (1986). Crude oil and the macroeconomy: test of some

popular notions. *Journal of Money Credit Banking*; 18 (1), 95 – 103.

Hameed, A. A., & Arshad, F. M. (2009). The impact of petroleum prices on vegetable oils prices: evidence from co-integration tests. *Oil Palm Industry Economic Journal,* 9 (2), 31-40.

Hamilton, J.D. (1983). Oil and the macroeconomy since world war II. *Journal of Political Economics*; 92 (2), 228 – 248.

Iv, P. P., Shamsudin, M. A. D. N., & Yusop, Z. (2009). The impact of biodiesel demand on the Malaysian palm oil market, 1, 566–576.

Karia, A. A., Bujang, I., & Ahmad, I. (2013). Forecasting on crude palm oil prices using artificial intelligence approaches, 2013 (March), 259–267.

Khin, A. A., Mohamed, Z., Awad, A., & Hameed, A. (2012). The impact of the changes of the world crude oil prices on the natural rubber industry in Malaysia, 20 (5), 730–737.

Liu, X. (2009). Testing market efficiency of crude palm oil futures to european participants, 1–16.

Mad Nasir, Shamsudin., & Fatimah, Mohd. Arshad. (1992). Short term forecasting of crude palm oil prices: fundamental and technical approaches. Paper presented at 1992/93 Palm Oil Outlook Forum, 10 April, Kuala Lumpur, Malaysia.

Mad Nasir Shamsudin, Zainalabidin Mohamed and Fatimah Mohd. Arshad. (1992). Selected factors affecting CPO prices. *Malaysian Journal of Agricultural Economics,* 5, Dec: 20-29.

Mielke, S. (1991). Economic prospect of oilseeds, oils and fats towards the 21st century. Paper presented at the PORIM International Palm Oil Conference, 9-14 September 1991, Kuala Lumpur.

Mohd Zaini, A. K., & Chan, S. G. (2005). The lead-lag relationship between stock index futures and spot market in malaysia: a cointegration and error correction model approach. *Chulalongkorn Journal of Economics,* 17 (1), 53-72.

Muhammad, N., & Ab, N. (2012). The cointegration analysis on the spot prices of the malaysian crude palm oil futures market, 4 (7), 95–104.

Muhammad, N., Ab, N., & Nawi, A. S. (2012). The price discovery of the malaysian crude palm oil futures markets, 2 (4), 25–47.

Muhamad, N. I. K., & Ab, N. (2013). The empirical analysis on prices of the malaysian crude palm oil futures market, (1988), 401–412.

MPOB (2012), Malaysian Oil Palm Statistics. Ministry of Primary Industries, Malaysia, 2013.

MPOB (Various Issues) Palm Oil Update, Palm Oil Research and Licensing Authority of Malaysia, Kuala Lumpur.

Rahman, A. K. A. (n.d.). Impact of palm oil supply and demand on palm oil price behaviour.

Razak, A., Hadi, A., Yahya, M. H., Shaari, A. H., Huridi, M. H., (2011). Investigating relationship between crude palm oil and crude oil prices – cointegration approach, (76), 1554–1565.

Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy Economics*; 21, 449 – 469.

Wilkinson, M. (1976). Economic models of food and agricultural system: U.S livestock and grain markets. *Columbia Journal World of Business, Winter*, 46-51.