

Independent variable dependent variable economics essay

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Chapter 3

3. 0: Introduction

The technical flow of how the research is conducted will be outline in this chapter. Econometric analysis is used to carry out this research where the model is created and regressed and investigating the relationship either short term or long term or both between the economic variable and crude oil prices towards the price of crude palm oil in Malaysia. Furthermore, the methods that will applied in this study are include; unit root test, co-integration test, vector error correction model, vector auto-regressive model and Granger-causality test. Firstly, unit root test will be applied in order to test whether the time series data of those variables are stationary or non-stationary. Once this requirement has met, VAR model is applied to select the optimal lag in order to perform the Johansen Co-integration test, Granger causality test and VECM. Johansen Co-integration test is applied to determine the existence of co-integration between crude palm oil prices with the economic variables and crude oil price. Moreover, the Granger causality test would be utilized to test the short term relationship between these variables. After that, VECM will be applied in order to test the long-term relationship between economic variables and crude oil prices towards the price of crude palm oil. Other than the discussion of methodology, the data sources for this study will be explained during this chapter.

3. 1: Data Sources

The data of interest rate, exchange rate, Crude oil price, and price of crude palm oil are collected based on monthly data basis. The periods chosen for

this research is from January 1996 until Nov 2012, which consists of 203 months. During the period from year 1995 to year 2012, there is many economic events occurred, such as the financial crisis in Asia on year 1998 to year 1999, global economic recession within the years 2007 to year 2009, and the credit crisis on U. S. A. in year 2008 to year 2010. Due to the long period chosen in this study, thus the nature of long-run relationships between the series can be determined. Besides that, there is a phenomenal increase in commodity prices during the period chosen for this study. The variables Price of crude palm oil are the export price quoted in Malaysia Ringgit per ton. Besides, the variables crude oil prices are quoted in Malaysia Ringgit per barrel, variables interest rate are collected based on the real interest rate in Malaysia and variables exchange rate are collected based on the MYR/USD. All the source data are obtained from Bank Negara Malaysia, World Bank and MPOB.

3. 2: Econometric Methodology

This study undertakes econometric techniques in order to study the relationship between the economic variables and crude oil prices towards the export price of crude palm oil in Malaysia throughout 17 years using monthly prices. This research project will evaluate the hypothesis of whether or not the changes in crude oil prices, interest rate and exchange rate affect the export price of crude palm oil in Malaysia. The research method apply in this study consists of unit root test, co-integration test, vector auto-regressive model, granger-causality test and vector error correction model. In order to study the theoretical relations between the independent variables and dependent variables, this research project will applied the methodology

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suggested by Sadorsky(1999). After that, this research paper will continue to test the stationarity of the times series variables by using Engle-Granger Co-integration test which it is suggested by Engle and Granger (1987). In the end, Granger causality test will be used to investigate the short-term relationship between those independent variables and dependent variables. In short, this study is summarized in the research framework as shown in the Figure 3. 0.

Figure 3: Research Framework

Export Price of Crude Palm Oil

Exchange Rate

Interest Rate

Price of Crude oil

Independent VariableDependent Variable

Figure 4: Relationship between Independent Variables and Dependent Variable

Long TermShort-TermType of relationshipMovement of export price of Crude Palm OilChange in Exchange RateChange in Interest RateChange in price of Crude OilThe independent variables applied in this study are crude oil price (COP), interest rate (IR), and exchange rate (ER), while the dependent variable is export price of crude palm oil (CPO). This research paper adopts an econometrics model in order to denote the relationship between interest rate, exchange rate and crude oil prices towards the price of crude palm oil. The following are the model that will be applied in this study.

$$\text{CPO}_t = \alpha + \beta_1 \text{IR}_{t-1} + \beta_2 \text{ER}_{t-1} + \beta_3 \text{COP}_{t-1} + \epsilon_t(1)$$

$$\text{LN_CPO}_t = \alpha + \beta_1 \text{LN_IR}_{t-1} + \beta_2 \text{LN_ER}_{t-1} + \beta_3 \text{LN_COP}_{t-1} + \epsilon_t(2)$$

$$\text{1stDiff_CPO}_t = \alpha + \beta_1 \text{1stDiff_IR}_{t-1} + \beta_2 \text{1stDiff_ER}_{t-1} + \beta_3 \text{1stDiff_COP}_{t-1} + \epsilon_t(3)$$

Where; CPO = Export Price of CPO in Malaysia (monthly) α = Constant

Variable IR = Interest Rate COP = Price of Crude Oil ER = Exchange Rate β_1 ,

β_2 , β_3 = Coefficient describe how changes in all this variable affect the value

of CPO ϵ = Random error

3. 2. 1: Unit Root Test

The Unit-root tests are applied in order to investigate whether a time series variable is stationary or non-stationary. Hatanaka (2003) proves that the mean and covariance of the time series do not depend on time, then it is said to be non-stationary. In other words, when there is a variable contain a unit root then it is said to be non-stationary. Besides, in order to test the long term relationship between the variables, co-integration test need to be applied when time series data are integrated at first difference, I(1).

Augmented Dickey-Fuller (ADF) test and Phillips Perron (PP) test can utilized to determine the existence of the unit root in the variables. ADF test and PP test are used to test whether the time series variable is stationary or it should be difference to result in a stationary series.

3. 2. 1. 1: Augmented Dickey- Fuller Test (ADF)

In this research paper, ADF unit root test applied to test the order of the integration of the series of the four variables. Difference the time series data

by using ADF t-statistic is the best way to transform the non stationary time series data into a stationary form. ADF test is the wider version of the standard DF test which it is applied to solve the problem of autocorrelation in the standard DF test. DF test can be augmented through adding various lagged dependent variables. By using Akaike criteria (AIC), the optimal number of lags where it is necessary requirement for perform further testing can be determined. The AIC formula is as:

(4)

Where k is the number of parameters in the statistical model, and L is the maximized value of the likelihood function for the estimated model. The AIC is applied in the model selection and the smaller values of the AIC will be better. This is supported by the Lee (2009) which assume that the y series follows an $AR(p)$ process and adding p lagged difference terms of the dependent variable y to the right hand side of the test regression as follow:

(5)

Where α is a constant, β the coefficient on a time trend and p the lag order of the autoregressive process. If the variables are stationary in 1st difference, then the model should be estimated by using first difference in the variable. The null hypothesis of the ADF t-test is: $H_0: \theta = 0$ (There is unit root)

(6) Which indicates that the time series data need to be differenced until it become stationary form. The hypothesis alternative as: $H_A: \theta < 0$ (There is no unit root)
(7) Where it indicates the time series is trend stationary and required to be analyzed by using a time trend in the regression model instead of differencing the data. If the time series need to be differenced by

n times until it become stationary, then it contains of q unit-roots. In short, it is said to be integrated of order of q denoted as I(q). X and Y variables are said to be co-integrated.

3. 2. 1. 2: Phillips – Perron Test

Phillips – Perron (PP) test is another method of unit root test which is known as Phillips – Perron (PP) test. Lee (2009) reveals that the PP test estimates the non-augmented Dickey – Fuller test equation: $\Delta(8)$ Where Δ is the first difference operator. PP test make a non-parametric to the t-test statistic. Moreover, the test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation. However, Davidson and Mackinnon (2004) suggest that the performance of Philips-Perron test is worse in finite samples as compared to the augmented Dickey-Fuller test.

3. 2. 2: Johansen Co-integration Test

Johansen Co-integration test is the test utilized to determine the number of co-integration vectors. Johansen (1991) suggests Johansen test has both the estimation and hypothesis testing performed in a unified framework.

Johansen's methodology takes its starting point in the vector autoregression (VAR) of order P given by:

(9)

Where y_t is an $n \times 1$ vector of variables that are integrated of order one - commonly denoted I(1) - and ϵ_t is an $n \times 1$ vector of innovations. Co-integration is an econometric property of time series variables and there is a correction among variables. There will be a possible of the existence of a

series of residuals when there is relationship between variables. When the residual has a pattern, and are stationary, it indicates that these variables are co-integrated. Besides that, it also shows that there is a long-term relationship between the variables. However, if the residual is normal, it means that the short term and long-term relationship between the variables is same. The variables are not co-integrated when the residuals are random walk. In order to perform co-integration test, firstly we need to select an optimal lag interval, the lag interval with the lowest AIC value will be chosen for the co-integration test. Then, Granger causality test would be applied in the further analysis. The procedure applied two test to test the co-integration, which are; the Maximum Eigenvalue test and the Trace test. There is no co-integration between the variables when the Trace and Maximum eigenvalue statistics are smaller than their critical value, do not reject H_0 , and vice versa. The hypothesis for co-integration is as follow: H_0 : The variables are not co-integrated. H_A : The variables are co-integrated. The Trace statistic tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of n co-integrating vectors. The equation for Trace statistic test is as follow:

(10)

On the other hand, the maximum eigenvalue test tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of $r+1$ co-integrating vectors. Neither of these test statistics follows a chi square distribution in general; asymptotic critical values can be found in Johansen and Juselius (1990) and are also given by most econometric software packages. The equation for the maximum eigenvalue test is as follow:

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(11)

3. 2. 3: Granger Causality Test

Granger (1969) proposed that a time series variable X is said to be Granger-cause Y if it can be shown, usually through a series of t-test and F-tests on lagged values of X (with lagged values of Y also included), that those X values provide statistically significant information about the future values of Y . Therefore, if in the past X contains useful information (in addition to the information in past Y) to predict future Y , then X is said to Granger-cause Y . This test involves estimating the simple vector auto regressions (VAR). The number of lags to be included is usually chosen using an information criterion, such as the Akaike information criterion or the Schwarz information criterion. The causality relationship can be determined by estimating the following:

(12)

and

(13)

The hypothesis for the Granger causality test is as follow: $H_0 : \beta_{1j} = 0, j = 1, 2, \dots, m$ (x does not Granger-cause y) $H_A: \beta_{1j} \neq 0, j = 1, 2, \dots, m$ According to Engle and Granger (1987), two $I(1)$ series are said to be co-integrated if there is an existence of linear combination of the two variables which produces a stationary trend. Any non-stationary series are co-integrated may diverge in the short run, but they must be linked together in the long run (Amna and Fatimah, 2009). In This analysis, we will obtain two tests, which are: (1) investigates the null hypothesis that the X does not Granger-cause Y

and (2) investigates the null hypothesis that the Y does not Granger-cause X. If we fail to reject the previous null hypothesis and reject the latter, then we conclude that X changes are Granger-caused by a change in Y. Unidirectional causality will occur between two variables if either null hypothesis of equation (12) or (13) is rejected. However, if the null hypothesis of equation (12) and (13) are rejected, it indicates that there is bi-directional causality between X and Y.

3. 2. 4: Vector Error Correction Model (VECM)

The VECM method apply in order to evaluate the short run properties of the co-integrated series once the co-integration test indicates that there is co-integration between series and we know that long term equilibrium relationship between series was exists. A VECM can lead to a better understanding of any non-stationarity among the time series. The VECM model has co-integration equation built into the specification so that it restricts the long-term behavior of the endogenous variables to converge to their co-integrating relationship while allowing for short-term adjustment dynamics. The co-integration equation is known as the error correction method (ECM) since the deviation from long-term equation is corrected gradually through a series of partial short-term adjustments. (Engle and Granger, 1991). The regression equation form for VECM is as follows:

(14)

(15)

The number of co-integrating vector will indicates on the co-integration rank in VECM. Besides that, a rank of two indicates that two linearly independent

combinations of the non-stationary variables will be stationary. Furthermore, VECM would be able to separate the short-term from long-term relationship. A negative and significant coefficient of the ECM (i. e. ϵ_{t-1} in the above equations) indicates that any short-term fluctuations between the independent variables and the dependant variable will give rise to a stable long run relationship between the variables.

Chapter 4

Data Analysis

4. 0: Introduction

In this chapter, I will analysis all the outcomes from the test that I apply for this research paper. This research consist couple of tests that are conducted in order to test the goodness of fit of the model. It is can't be denied that, the variability of export price of crude palm oil Malaysia is very important to Malaysia country's economy, as Malaysia is the second largest exporter of Crude Palm Oil (CPO) in the world. Therefore, investigating the impact of interest rate, exchange rate and crude oil price towards export price of CPO Malaysia is necessary because it might affect Malaysia's GDP growth and also many related sectors which have heavily dependent on the use of crude palm oil. The objectives of this research paper are to examine the impact of the crude oil prices and economic variables towards Malaysia Palm Oil market with apply VECM and Granger Causality test by E-VIEWS software. VECM is an method to test the long term and short term relationship between the independent variables and dependent variables, whereas Granger causality test was a statistical concept on predict the causality relation between two variables.

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4. 1: Unit Root Test

$H_0: \theta = 0$ (There is unit root)
 $H_A: \theta < 0$ (There is no unit root)

Firstly, in order to estimate and develop a model, we have to check whether the time series is contains unit root (non-stationary) or no unit root (stationary). Gujarat (2003), Enders (2004), Pindyck and Rubinfeld (1998) proposed that most of the time series variables were non-stationary (contains unit root), with non constant mean and variance. A series was stationary indicates it's mean and auto-covariance do not depended on time. Time series data that are non-stationary can lead to spurious regression result. Box and Jenkins (1970) proposed that integrated time series should be transformed into stationary by differencing before used modellization. Hence, the pre-requirement for regression analysis is to removing unit roots. During this research paper, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests are utilized to determine whether the time series are stationary or non stationary. The Table 2 as below is the outcomes of the unit root test (ADF & PP test) for all the variables of this research paper.

Table 2: Summary of Unit Root Test Results for All Variables

Series	ADF Test	PP Test	Level	1st Difference	Level	1st Difference	CPO
1. 6860-11.7859	***-1.4296	-16.5917	***	COP-1.5996	-9.4752	***-1.4078	-9.4282
***ER-2.3198	-14.5476	***-2.2835	07-14.5763	***IR-1.8749	-7.0636	***-1.8002	91-10.2398

***Note: *** Statistically significance at 0. 01 level**

Statistically significance at 0. 05 level* Statistically significance at 0. 10

levelAs shown on the Table 2, the time series for all the variables are

contains unit root (non-stationary) in level term on both ADF Test and PP

Test. It is because the ADF and PP test statistic value for all the time series are greater than the "Mackinnon critical values" at all three levels, and also the p-value shows that the ADF and PP test statistic is not statistically significant at 0.05 levels. Therefore, do not reject null hypothesis, the variables CPO, COP, ER, and IR contain unit root and the time series are non-stationary in level. Once we found that all the variables are non-stationary in level, then we go for the unit root test for all variables in their first difference level. According to the results indicated on Table 2, it shows that all the variables time series do not contain unit root (stationary) on the first difference level. It is because the ADF and PP test statistic value for all the time series are smaller than the "Mackinnon critical values" at all three levels, and also the p-value shows that the ADF and PP test statistic is statistically significant at 0.01 levels. Hence, reject the null hypothesis. In conclusion, the variables CPO, COP, ER, and IR do not contain unit root and the time series are stationary in the first difference level. When this requirement has been met, the crude oil prices, interest rate, exchange rate and export price of crude palm oil are said to be co-integrated. The movements of these independent variables and dependent variable are shown in Figure 3.0

Figure 3. 0: Co-integration between independent variables and dependent variable

4. 2: Johansen Co-integration Rank Test

Determination of optimal lag

First of all, in order to perform Johansen co-integration rank test, we have to select the optimal lag before proceeding to the co-integration test. According to <https://assignbuster.com/independent-variable-dependent-variable-economics-essay/>

the table 3 below, it indicates that the optimal lag for the model is lag 2. The optimal lag length be chosen are base on the lowest AIC criterion. The critical values used in this test are 0. 05.

Table 3: Summary of Lag Length Selection

Lag	LogL	LLR	FPE	AIC	SCH	Q	027	83757NA9	25e-06-0	239574-0	173376-0
0	21278211249	2162381	3815	07e-11-12	35393-12	02294*-12					
1	21997*21272	52444	507294	71e-11*-12	42737*-11	83160-12					
2	1862531286	62426	35846*4	80e-11-12	40828-11	54772-12					
3	0599941292	30010	382495	33e-11-12	30452-11	17917-11	84906*				

indicates lag order selected by the criterion

Johansen Co-integration Test

H0: The variables are not co-integrated. HA: The variables are co-integrated. Engle and Granger (1987) proposed that a linear combination of two or more non stationary series might be stationary. When there is a stationary linear presence, the non-stationary time series were said to be co-integration. The long term relationship between the variables can be interpreted by the co-integration equation which it called as stationary linear combination. Co-integration rank is estimated using Johansen methodology. Johansen's approach derives two likelihood estimators for the CI rank: a trace test and a maximum Eigen value test. The outcomes of Trace and Max-eigenvalue statistics for testing the co-integration between the variables export price of crude palm oil Malaysia (LN_CPO), crude oil prices (LN_COP), exchange Rate (LN_ER) and interest rate (LN_IR) are shown in the Table 4.

Table 4: Johansen Co-integration Rank Test Results

Unrestricted Cointegration Rank Test (Trace) Hypothesized Trace 0.05 No. of CE(s) Eigenvalue Statistic Critical Value Prob. **None *0.11109566.9104863.876100.0272 At most 1 *0.08884143.3575642.915250.0451 At most 20.07227624.7500025.872110.0685 At most 30.0475619.74589512.517980.1392 Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue) Hypothesized Max-Eigen 0.05 No. of CE(s) Eigenvalue Statistic Critical Value Prob. **None 0.11109523.5529232.118320.3789 At most 10.08884118.6075625.823210.3324 At most 20.07227615.0041119.387040.1934 At most 30.0475619.74589512.517980.1392 Max-eigenvalue test indicates no cointegration at the 0.05 level

Assuming for linear deterministic with intercept, trend in CE and no trend in VAR, the Trace statistic value of 66.91 and 43.36 at none and at most one co-integration are greater than its critical value of 63.88 and 42.92. Therefore, according to the Trace statistic results, we need to reject null hypothesis and conclude that the Trace Test indicates there is 2 co-integrating equation with statistically significance at 0.05 level. Besides, it also means that the long-term equilibrium between the variables were met and the variable are co-integrated. However, the Max-Eigen statistic value of 23.55, 18.61, 15.00 and 9.75 at none, at most one, at most two and at most three co-integration are smaller than its critical value of 32.12, 25.82, 19.39 and 12.52. Therefore, base on the Max-Eigen statistic results, we do not reject null hypothesis and conclude that the Max-Eigen test indicates there is no co-integrating equation with statistically significance at 0.05 level. Furthermore, it also indicates that the long term equilibrium between

variable were not met and the variables are not cointegrated. Although the Max-Eigen statistic value indicates there is no co-integrating equation, but the Trace statistic value had indicates that there is 2 co-integrating equation. Hence, we could conclude that there is co-integration between the independent variables and dependent variables. Once there is co-integration among variables, the VECM model can be conducted.

4. 3: Vector Error Correction Model (VECM)

VECM was a method developed to apply in non-stationary data that presence co-integration relationship (Gilbert, 1986) (Henry and Ericsson, 2001). The existed of co-integration between variables indicates a long term relationship among the variables under consideration. Therefore, VECM is conducted for future analysis on the long-term and short-term relationship between independent variables and dependent variables. An optimal lag interval of 1 is apply in this method. The Table 5 as below shows the outcome of the VECM estimation for the export price of Crude Palm Oil Malaysia model. As shown in the Table 5, the outcomes shows that the Crude Oil Price (LN_COP), Exchange Rate (LN_ER), and Interest Rate (LN_IR) are accounted about 11.02% of short term Export price of Crude Palm Oil Malaysia (LN_CPO) in VECM equation. Furthermore, the VECM estimations also reveal that the explanatory variables namely Crude Oil Prices (LN_CO_Pt-1), and Export price of Crude Palm Oil Malaysia (LN_CPO_t-1) in previous/ lag period were the most important variables that influence the current month export price of crude palm oil Malaysia in short term at significant level of 0.10 and 0.05 level respectively. However, the explanatory variables namely exchange rate (LN_ER_t-1) and interest rate (LN_IR_t-1) in the previous/lag period were not

the most important variables that affect the export price of crude palm oil Malaysia (LN_CPO_t) in short term, as their p-value are not statistically significance at 0. 10 level. On the other hand, according to the LN_CPO co-integration equation, International Crude Oil Price (LN_CO_{Pt-1}) in previous/lag period exerted positive influence in long term export price of crude palm oil Malaysia at significant level of 0. 05. However, the Interest Rate (LN_IR_{t-1}) exerted negative influence in long term export price of crude palm oil Malaysia at significant level at 0. 10. Furthermore, according to the result shown in Table 5, the explanatory variables namely exchange rate (LN_ER_{t-1}) in the previous/lag period doesn't not exerted either positive and negative influence in the export price of crude palm oil Malaysia in long term, as it's p-value is not statistically significance at the 0. 10 level.

VECM equation of Export Price of Crude Palm Oil Malaysia (LN_CPO) model:

$$\text{LN_CPO}_t = 0.00866 + 0.1978 \text{LN_CO}_{Pt-1} + 0.2251 \text{LN_ER}_{t-1} - 5.2583 \text{LN_IR}_{t-1} - t\text{-statistic} = [1.8521^*][0.7267][0.1178]0.0420 \text{LN_CPO}_{t-1} - 0.0087 \text{Et}[-3.7615^{**}] [0.9651] R^2 = 0.1102 \text{Adj. } R^2 = 0.0874$$

Co-integration equation for Export Price of Crude Palm Oil Malaysia (LN_CPO) model:

$$-0.0550 \text{LN_CPO}_{t-1} + 0.0478 \text{LN_COP}_{t-1} - 0.0046 \text{LN_ER}_{t-1} - 0.0092 \text{LN_IR}_{t-1} = 0[-2.2874^{**}][3.0182^{**}][0.8178][1.9157^*]$$

Table 5: VECM Test Results (LN_CPO)

Error Correction: D(LN_CPO_)D(LN_COP_)D(LN_ER_)D(LN_IR_)CointEq1-0.0550060.047830-0.004594-0.009221(0.02409)(0.01585)(0.00562)(0.

00481)[-2. 28373][3. 01821][-0. 81780][-1. 91569]D(LN_CPO_(-1))-0.
 260771-0. 005792-0. 002886-0. 025874(0. 06933)(0. 04561)(0. 01617)(0.
 01385)[-3. 76153][-0. 12698][-0. 17849][-1. 86768]D(LN_COP_(-1))0.
 1978280. 245905-0. 0024130. 015411(0. 10681)(0. 07028)(0. 02491)(0.
 02135)[1. 85207][3. 49902][-0. 09687][0. 72200]D(LN_ER_(-1))0. 225100-
 0. 1531260. 039858-0. 112162(0. 30975)(0. 20380)(0. 07224)(0. 06190)[0.
 72672][-0. 75136][0. 55176][-1. 81204]D(LN_IR_(-1))-0. 0419780. 4564290.
 0750030. 305977(0. 35638)(0. 23448)(0. 08311)(0. 07122)[-0. 11779][1.
 94656][0. 90242][4. 29642]C0. 0083590. 0079120. 000983-0. 000764(0.
 00866)(0. 00570)(0. 00202)(0. 00173)[0. 96509][1. 38834][0. 48659][-0.
 44136]R-squared0. 1101860. 1011580. 0146220. 154092Adj. R-squared0.
 0873700. 078111-0. 0106440. 132402

4. 4: Granger Causality Test

Through applying the Granger Causality Test, we can predict the causality relation and direction between two variables. Economic theory proves that there is always Granger Causality in at least one direction. The optimal lag 2 is chosen in applying Granger-Causality Test base on the results of Johansen Co-integration Test in section 4. 2, Table 3. The Table 6 shown the Pairwise Granger-Causality Test Results for export price of Crude Palm Oil Malaysia (LN_CPO) model.

Table 6: Pairwise Granger-Causality Test Results (LN_CPO model)

Null Hypothesis: ObsF-StatisticProb. LN_COP_ does not Granger Cause

LN_CPO_2012. 743760. 0668

*

LN_CPO_ does not Granger Cause LN_COP_

0. 303180. 7388LN_ER_ does not Granger Cause LN_CPO_2010. 858270.

4255LN_CPO_ does not Granger Cause LN_ER_

1. 193960. 3052LN_IR_ does not Granger Cause LN_CPO_2010. 234050.

7915LN_CPO_ does not Granger Cause LN_IR_

2. 484120. 0860

*

Base on the Table 6 on above, in the Granger-causality test, F-statistic of the two variables of Crude Oil Price and export price of Crude Palm Oil Malaysia (LN_COP \leftrightarrow LN_CPO) is significance at 0. 10 level, this results indicates that the null hypothesis of LN_COP does not Granger-cause LN_CPO should be rejected. Therefore, there is a variable LN_COP " granger-causes" a variable LN_CPO. On the other hand, F-statistic of the two variables LN_CPO \leftrightarrow LN_COP is not significance at 0. 10 level, this indicates that the null hypothesis of LN_CPO does not Granger-cause LN_COP should not be rejected. Thus, the direction of a Granger causality relationship of LN_COP and LN_CPO is uni-direction (LN_COP \leftrightarrow LN_CPO). Then, there is co-integrated and also a long term equilibrium relationship between the two variables of Crude Oil Price (LN_COP) and export price of Crude Palm Oil Malaysia (LN_CPO). Moreover, in the Engle-Granger test, F-statistic of the two variables of Interest Rate and export price of Crude Palm Oil Malaysia (LN_IR \leftrightarrow LN_CPO) is not significance at 0. 10 level, this results indicates that the null hypothesis of LN_IR does not Granger-cause LN_CPO should not be

rejected. However, the F-statistic of the two variables LN_CPO \leftrightarrow LN_IR is significance at 0.10 level, it indicates that the null hypothesis of LN_CPO does not Granger-cause LN_IR should be rejected. Thus, there is a variable LN_CPO "granger-cause" a variable LN_IR, and the direction of a Granger causality relationship of LN_CPO and LN_IR is uni-direction (LN_CPO \leftrightarrow LN_IR). In conclude, there is co-integrated and also a long term equilibrium relationship between the two variables of LN_CPO and LN_IR. However, the F-statistic of the two variables of Exchange Rate and export price of Crude Palm Oil Malaysia (LN_ER \leftrightarrow LN_CPO) and LN_CPO \leftrightarrow LN_ER both are not significance at 0.10 level. There is also not a variable LN_ER "Granger-causes" a variable LN_CPO. Thus, there is no co-integrated and also no long-term equilibrium relationship between the two variable LN_ER and LN_CPO.

Chapter 5

Discussion and Conclusion

5.0: Introduction

The summary and conclusion of the overall results of the examination on the impact of crude oil prices, interest rate, and exchange rate towards export price of crude palm oil Malaysia will be presented in this chapter. There are various econometrics techniques apply in this research paper which consists Unit Root test, Johansen Co-integration Test, Vector Error Correction Model, and Granger-Causality Test. Besides that, we will also discuss about the limitation of this research project, and also the recommendation for future study.

5. 1: Discussion & Conclusions

This study discusses one of the uprising issues in economics which exist in this few years. The objective of the study was to identify the important factors that influenced in short term and long term of Export Price of Crude Palm Oil Malaysia. The data period collected for this research paper extends from January 1996 until November 2012, which consists of 203 months time series data. First of all, in order to investigate the impact of crude oil prices, interest rate and exchange rate towards export price of crude palm oil Malaysia, we have to test whether the time series data is either non-stationary or stationary in level term. According to the results from ADF Test and PP Test, it indicates that all the variables time series data are non-stationary in level term. Therefore, the null hypothesis of there is unit root (non-stationary) in the variables time series data should not be rejected. However, all the variables time series data are stationary in first difference term, hence, the null hypothesis of being non-stationary should be rejected at the first difference term. Based on this result, it indicates that there is co-integrated between the variables. Thus, a further analysis on the relationship between the independent variables and dependent variable will be conducted through applied Johansen Co-integration Rank Test. An optimal lag interval need to be determine before carrying out the Johansen Co-integration Rank Test. The lag interval 1 2 is found as the optimal lag base on the AIC criterion. Therefore, the lag 2 will be chosen to conduct the Johansen Co-integration Rank Test. By choosing the assumption of linear deterministic with intercept, trend in CE and no trend in VAR for the co-integration test, the Trace statistic value indicate that there are 2 co-

integrating equation with statistically significance at 0.05 level. In another words, it shows that the long-term equilibrium between the variables were met and the variable are co-integrated. In conclusion, there is co-integration between the independent variables and dependent variables. The findings of the co-integration test of this research paper is consistent with the findings of the research of investigating the Relationship between Oil, Exchange Rates, and Commodity Prices which done by Ardian Harri, Lanier Nalley, and Darren Hudson (2009). Where the research's Co-integration test also indicates there are two co-integrating vectors between crude oil, corn and exchange rates. The VECM model can be conducted after the co-integration test indicates there is co-integration among the variables.

- According to the VECM test results, the VECM estimation and Co-intergration equation declared that the explanatory variables namely Crude Oil Prices (LN_COPT-1) in previous/lag period having both short-term and long-term relationship with the current month export price of crude palm oil Malaysia. It also indicates that the Crude Oil Prices (LN_COPT-1) exerted positive influence on the export price of crude palm oil Malaysia (LN_CPO) in short term and long-term. The result was consistent with the findings of research investigating the relationship between the crude oil and agricultural commodities prices in the global market, which done by Guo Hongpeng, Li Fan, Yang Weiguang, and Yang Yinsheng (September, 2011). The researchers declared that the increasing on prices of agricultural commodities is caused by the level of crude oil prices in two ways: 1) Price of Crude Oil affect price of oil increased, and 2) Increased on energy cost which

were employed in agricultural production is resulted by the higher price of crude oil. However, the explanatory variables namely Interest Rate (LN_IRt-1) in previous/lag period only having a long term relationship with the export price of crude palm oil Malaysia. It also shows that Interest Rate (LN_IRt-1) exerted negative influence on the export price of crude palm oil at long run. This result is consistent with the findings of the research Long-Run Relationship between the Primary Commodity Prices and Macroeconomic Variables, which done by Theodosios Palaskas and Panos Varangis (1989). The findings of the research indicate that there is a stationary long-term relationship between the interest rate and degree of commodity prices. Moreover, the results also supported the theory of commodities as financial assets and match with Powell's (1989) findings that interest rates play little role in either the short run or the long run. In order to determine the causality relation and direction between two variables, the Granger-Causality Test was applied. According to the Table 6, the variable Crude Oil Prices (LN_COP) " Granger-cause" the variable export price of Crude Palm Oil Malaysia (LN_CPO). The direction of granger causality relationship is uni-direction (LN_COP \rightarrow LN_CPO). Hence, we can conclude that LN_COP and LN_CPO have a long term equilibrium relationship and co-integrated. Furthermore, the Granger Causality test result also show that the variable export price of Crude Palm Oil Malaysia (LN_CPO) " granger cause" the variable Interest Rate (LN_IR), and the direction also is uni-direction. Therefore, there is long term equilibrium relationship between LN_CPO and LN_IR and they are co-integrated. The Granger-causality test results are consistent with the research of investigating the long-term relationship

between the prices of crude oil and selected vegetable oils, which done by Amna Awad Abdel Hameed and Fatimah Mohamed Arshad (2009). The Granger Causality test indicates that there is a long-term relationship between crude oil prices and the price of selected vegetable oils. In conclusion, the findings of this study indicates in short term, the explanatory variables International Crude Oil Prices (COP), and Export Price of Crude Palm Oil (CPOt-1) in previous/ lag period are the important factors affected the variation of current month export price of Crude Palm Oil Malaysia. On the other hand, the export price Crude Palm Oil Malaysia also affected by the factors of International Crude Oil Prices (COP), and Interest Rate (IR) in long run. We can conclude that the Crude Oil Prices (COP) is having both short run and long run relationship on the export price Crude Palm Oil Malaysia, and Interest Rate (IR) is only having a long run relationship on the export price Crude Palm Oil Malaysia.

5. 2: Recommendation for Future Study

This study provided a valuable knowledge and enriched the empirical literature in the nexus of Palm Oil Market and economic growth of Malaysia. The outcomes of this research paper can bring benefit and useful for the commodity traders in their trading strategy through the information obtain from this research project. It is because that the volatility of the Export Price of Crude Palm Oil Malaysia due to the Crude Oil Prices, Interest Rate and Exchange Rate can be predicted. Thus, traders can hedge their investment portfolio effectively based on the information obtain from this research paper. As Malaysia is the second largest country of export crude palm oil in world, thus, this study will be necessary for Malaysia government. There are

some recommendations could be made for the future research regarding this topic, such as include additional related variable that can be strongly explained the volatility of the export price of crude palm oil Malaysia. It is due to that, when the related variable increase, the R² value will be higher which it can indicate that the dependent variables can be explained more by the related explanatory variables. Furthermore, another recommendation is that the period of the time series data collected should be categorized into three categories such as, before, during and after global financial crisis or economic recession. By this categories of the periods, the impact of crude oil prices and economic variables towards Malaysia export price of crude palm oil might be forecast and describe more accurately, clearly and precisely. Besides that, more cross country study will give better understanding and insight toward the export price of crude palm oil. Finally, the above recommendations are might be the procedure to the further researcher to consider and drive the model in the effective way and obtain the efficient and reliable outcome in the future.

5. 3: Limitation of the Study

Firstly, the limitation of this research paper is this study does not consider any structural breaks for the whole time period. Secondly, there is no residual diagnostic test are conducted in this research paper such as the Normality Test, Heteroscedasticity Test, Autocorrelation Test, and Multicollinearity Test. Lastly, the important explanatory variables include in this research are too less and therefore cause to R² value be low which it shows that the explanatory variables cannot fully explained the model precisely.