TOK HUI MEI B.Sc. (Honours) Statistical Computing and Operations Research 2023

IMPACT ANALYSIS OF THE MALAYSIA'S ECONOMY ON THE PALM OIL STOCK RETURNS IN MALAYSIA, SINGAPORE, AND INDONESIA THROUGH NARDL MODEL

TOK HUI MEI

BACHELOR OF SCIENCE (HONOURS) STATISTICAL COMPUTING AND OPERATIONS RESEARCH

FACULTY OF SCIENCE
UNIVERSITI TUNKU ABDUL RAHMAN

JANUARY 2023

IMPACT ANALYSIS OF THE MALAYSIA'S ECONOMY ON THE PALM OIL STOCK RETURNS IN MALAYSIA, SINGAPORE, AND INDONESIA THROUGH NARDL MODEL

By

TOK HUI MEI

A project report submitted to the

Department of Physical and Mathematical Science

Faculty of Science

Universiti Tunku Abdul Rahman

in partial fulfilment of the requirements for the degree of

Bachelor of Science (Honours) Statistical Computing and Operations Research

January 2023

ABSTRACT

IMPACT ANALYSIS OF THE MALAYSIA'S ECONOMY ON THE PALM OIL STOCK RETURNS IN MALAYSIA, SINGAPORE, AND INDONESIA THROUGH NARDL MODEL

Tok Hui Mei

In this study, we investigate the impact of Malaysia economic conditions on the palm oil stock returns in Malaysia, Indonesia, and Singapore. As one of the top producers and traders of palm oil globally, changes in the palm oil industry affect the economies of all three countries. In 2022, the Russia-Ukraine conflict has triggered a profit surge in the Malaysian palm oil industry. As such, we employ the Non-Linear Autoregressive Distributed Lag (NARDL) framework to examine the asymmetric influence of the Malaysian economic condition on palm oil stock returns in Malaysia, Indonesia, and Singapore. Our results indicate that in the long run, the exchange rate, inflation rate, and crude oil price significantly determine palm oil stock returns. Positive and negative shocks of in the exchange rate show a significant positive relationship with the palm oil stock return, while only positive shocks in the inflation rate and crude oil price significantly affect palm oil stock return fluctuations. Overall, our study sheds light on the interdependence of the palm oil industry and macroeconomic factors, giving insights for investors and policymakers in the palm oil industry.

Keywords: NARDL, asymmetry impact, palm oil stock returns, Malaysia, Singapore, Indonesia, Malaysian economy

ACKNOWLEDGEMENTS

First and foremost, I would like to express my deepest gratitude to my Final Year Project supervisor, Dr. Beh Woan Lin. I am extremely thankful for the guidance and feedback she had generously given throughout the whole process. Her extensive knowledge in this field had been critical and played a vital role in the success of this project.

Apart from that, I would also like to thank my family for their love and support. They had relentlessly provided financial and mental support throughout my years of study. Their trust in me kept me motivated even when I am struggling academically.

I appreciate all those who had taken part in assisting my study. Without their support and guidance, this project would have been impossible to complete.

DECLARATION

I hereby declare that the project report is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

____

Tok Hui Mei

APPROVAL SHEET

This project report entitled "IMPACT ANALYSIS OF THE MALAYSIA'S ECONOMY ON THE PALM OIL STOCK RETURNS IN MALAYSIA, SINGAPORE, AND INDONESIA THROUGH NARDL MODEL" was prepared by TOK HUI MEI and submitted as partial fulfilment of the requirements for the degree of Bachelor of Science (Hons) Statistical Computing and Operations Research at Universiti Tunku Abdul Rahman.

Approved by:

____

Dr. Beh Woan Lin Date: 18 April 2023

Supervisor

Department of Physical and Mathematical Science

Faculty of Science

Universiti Tunku Abdul Rahman

FACULTY OF SCIENCE

UNIVERSITI TUNKU ABDUL RAHMAN

Date: 18 April 2023

PERMISSION SHEET

It is hereby certified that TOK HUI MEI (ID No: 19ADB03396) has completed this final year project report entitled "IMPACT ANALYSIS OF THE MALAYSIA'S ECONOMY ON THE PALM OIL STOCK RETURNS IN MALAYSIA, SINGAPORE, AND INDONESIA THROUGH NARDL MODEL" under the supervision of Dr. Beh Woan Lin (Supervisor) from the Department of Physical and Mathematical Science, Faculty of Science.

I hereby give permission to the University to upload the softcopy of my final year project in pdf format into the UTAR Institutional Repository, which may be made accessible to the UTAR community and public.

Yours truly,

____

(TOK HUI MEI)

TABLE OF CONTENTS

LIST OF TABLES

Table **Page**

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ARDL	Autoregressive distributed lag
CPI	Consumer price index
CUSUM	Cumulative sum
CUSUMSQ	Cumulative sum of squares
ECM	Error correction model
ECT	Error correction term
NARDL	Nonlinear autoregressive distributed lag
RM	Ringgit Malaysia
SVAR	Structural vector autoregressive
US	United States
VECM	Vector error correction model

CHAPTER 1

INTRODUCTION

1.1.Introduction

Following national independence, the Malaysian government aimed to diversify the agricultural sector and further promote oil palm cultivation. As a result of these efforts over the past few decades, Malaysia is now recognized as the world's second-largest oil palm producer (Malaysian Palm Oil Council, n.d.). The palm oil sector contributes approximately 3.6% of the nation's total gross domestic product (GDP) and according to Malaysian Palm Oil Board (2022), generated a profit of RM108.52 billion in 2021. Thus, the oil palm industry's significance in driving Malaysia's economic growth is evident.

Indonesia, the world's top palm oil producer, has continuously supplied palm oil to the international market year after year, cementing the country's position in the industry. A report by The Observatory of Economic Complexity(n.d.) has claimed that Indonesia's palm oil exports amounted to $17.9 billion in 2020, making it the country's most traded product. In 2021, Indonesia once again claimed its position as the world's largest palm oil producer by manufacturing a staggering 46 million tons of palm oil, accounting for 4.5% of the country's national GDP (Rylander and Gardner, 2022). These achievements reflect Indonesia's global and domestic significance in palm oil manufacturing. On the other hand, while Singapore is not a significant palm oil producer, it plays an important role. As a global palm oil trader, particularly for palm oil produced by Malaysia and Indonesia (Feryanto et al., 2020).

The war between Russia and Ukraine in 2022 caused a shortage of sunflower oil as Ukraine, the largest exporter of sunflower oil, was unable to maintain its production due to the crisis. This resulted in a dramatic rise in edible oil prices around the world (Hauser, 2022). In response, Indonesia, the world's largest palm oil exporter, enforced a palm oil export ban to regulate the domestic edible oil price. As a consequence, other countries turned to Malaysia for palm oil supply, causing a surge in palm oil prices in Malaysia (Teo, 2022). However, Singapore was only slightly impacted by the Indonesia palm oil export ban where Singaporeans observe a minute increase in the price of consumer palm oil. The influence is said to be small because Indonesia is not the only source of edible oil for Singapore (Mahmud, 2022).

1.2.Problem Statement

How does the economic condition of Malaysia influence the returns of palm oil stocks in Malaysia, Indonesia, and Singapore? Investors are curious about the asymmetric effects of Malaysia's economic conditions on palm oil stock returns in neighboring nations, as well as the factors that contribute to the volatility of palm oil stock returns. Given the importance of the palm oil sector in the three nations, it is critical for investors to grasp the relationship between macroeconomic conditions and palm oil stock returns in order to minimize losses and alter their investment strategy accordingly.

The aim of this study is to analyze the impact of palm oil price, gold price, crude oil price, palm oil export, and other selected macroeconomic variables on palm oil stock returns. To establish the connection between these variables, the study will employ the nonlinear autoregressive distributed lag (NARDL) framework.

1.3.Research Objective

The objectives of this study are:

1. To identify the variables that have an impact on palm oil stock returns in Malaysia, Indonesia, and Singapore, including Brent Crude Oil price, world gold price, world palm oil price, Malaysia's inflation rate, Malaysia's unemployment rate, US Dollars – Malaysian Ringgit exchange rate, Malaysia's palm oil export volume, and Malaysia's money supply which are M1 (narrow money) and M3 (broad money).
2. To examine the asymmetric impacts of the identified factors on palm oil stock returns, both in the short and long run.

1.4.Significance and Limitation of Study

This study is significant as it will provide insight into the relationship between economic variables and the return on the palm oil stock index in three key palm oil-producing and trading countries. The NARDL approach can help investors alter their investing strategies by providing a greater understanding of the unequal impacts of these variables on stock returns. Furthermore, policymakers can also use the findings to design policies that can maximize profit by controlling the determinants that affect stock returns.

One of the limitations of this study is that it only focuses on three countries, namely Malaysia, Indonesia, and Singapore, and may not necessarily generalize to other palm oil-producing and trading countries. Additionally, the study is based on secondary data, which may have limitations in terms of accuracy and reliability. Thirdly, the prices of certain commodity products, particularly gold and crude oil prices, are global prices sourced from the World Bank database, and are not limited to Malaysia. Finally, the NARDL framework used in this study is just one of many analytical tools available and may be limited in its ability to capture the full complexity of how the macroeconomic variables that interact with the stock index returns.

1.5.Chapter Layout

This thesis will begin with a review of journals relevant to the study in Chapter 2. Chapter 3 will discuss the tests and methods used in this study, as well as introduce the data. The results of the analysis will then be shown in Chapter 4. Lastly, Chapter 5 will conclude the findings of this study.

CHAPTER 2

LITERATURE REVIEW

Luqman and Kouser(2018) conducted a study in Pakistan and the G8+5 countries respectively, and concluded the existence of an asymmetric link between exchange rate and stock prices, using a NARDL model. This is due to the fact that fluctuations in exchange rates affect both import and export rates, resulting in a decrease in stock prices for import-oriented companies when the home currency depreciates, and an increase in stock prices for export-oriented companies when the home currency appreciates. Similarly, a study conducted in Shenzhen confirmed a negative linear relationship between exchange rates and stock prices, using an ARDL model, indicating the need for policymakers to stabilize exchange rates (Khan, 2019). In Malaysia, Al-hajj et al. (2018) conducted a similar study using a NARDL model, which also confirms the asymmetric and negative influence of the exchange rates on the stock market returns. The study also found that oil price fluctuations also have a negative asymmetric impact on stock market prices, which is consistent with previous findings.

Kilian and Park (2009) examined the effect of crude oil prices on the US stock market performance. The Structural Vector Autoregressions (SVAR) model was used to demonstrate that the influence of crude oil price changes on stock market returns varies depending on whether the industry is a supplier or buyer of crude oil.

Similarly, Sadorsky (1999) emphasized the need of comprehending the link between oil price volatility, interest rate volatility, and inflation rate. The study's empirical findings, based on the Vector Autoregression (VAR) model, revealed a negative link between the crude oil price volatility and the returns of stock market. The rise in oil price causes an increase in production costs, which reduces profitability and, as a result, decreases stock market returns. Additionally, fluctuations in oil price also negatively impact stock market price because they raise investor expectations The time range for this effect is determined by the stock market's sensitivity. Therefore, a sensitive stock market will react rapidly to changes in oil prices, but a less sensitive stock market will react later.

On the other hand, unemployment is also included as one of the regressors because it can be an indicator of the economic condition of a country (Tangjitprom, 2012). However, many studies were unable to prove the significance of the unemployment factor in determining stock market returns (Ergun and Özlen, 2012). Farsio and Fazel (2013) have conducted research in the United States, China, and Japan to investigate the relationship between unemployment rates and stock prices. They have come to the same conclusion that the unemployment rate is not a significant factor in predicting stock values in these nations using Granger causality tests. Nonetheless, some researchers manage to establish a linkage between the unemployment rate and stock market performance (Francisco and Loredana, 2016).

Next, Adusei (2014), to examine the interaction between the fluctuation in inflation rate and stock prices, had also utilized Granger Causality. The findings indicate that the mentioned predictor variable, indeed have a significant positive effect on the dependent variable in the study. Omran and Pointon (2001) have explained that this is because ultimately, stock is also a form of goods. Thus, inflation, which increases the price of goods will also lead to an increase in stock prices. Nonetheless, some researchers have documented different conclusions. According to the Proxy Effect, the inflation rate will cause hindrance in economic activities. Consequently, corporate stock price declines (Fama, 1981). Additionally, increases in the inflation rate are also mostly linked to higher financial pressure on investors. Thus, leading to fewer investing activities which decrease demand for stocks.

Using a VAR model, Sellin (2001) explored the relationship between narrow money (M1) and broad money (M3) supply and the performance of the US stocks. The author found that M1 and M3 have a positive relationship with the US stocks' prices. This is supported by past literature which provided the explanation that an increase in money supply leads to a positive effect on the stock market because demand for stocks increases as investors have more financial assets to invest (Wong et. al, 2006; Barakat et.al, 2016). However, some researches have found contradicting outcomes where a negative relationship has been established between money supply and stock price (Praphan and Subhash, 2002; Osamwonyi and Evbayiro-Osagie, 2012). This is attributed to the impact of inflation on stock demand and corporate yield. When the money supply expands, inflation tends to rise, leading to a decrease in the real value of equities and making them a less attractive investment.

Since this study will be on palm oil stock returns, naturally, we would also be incorporating variables related to palm oil which are palm oil price and palm oil trade volume. A study in Indonesia, who had used the panel regression method along with the Fixed Effect model to analyze the factors which influence the return on equity of the palm oil industry. One of the findings of this research is that when palm oil price increases, the profit also increases. Thus, that causes a rise in corporate stock prices (Mubarok, Hartoyo, and Maulana, 2019).

However, as shown by some studies, a price increase can bring adverse effects, when there are substitute products. Another research in Malaysia that aims to establish the influence of supply and demand of palm oil on palm oil prices has documented how an increase in soybean oil price increases the demand for palm oil, which is a substitute for soybean oil (Rahman, Balu and Shariff, 2013). As a result of the surge in demand, palm oil prices increase. However, this could also work the other way around where because palm oil price increases, it decreases the demand for palm oil and thus, influence the profitability of palm oil companies. Consequently, researchers seem to obtain different results on the impact of the rise in palm oil.

Next, palm oil trade volume is analysed. This variable is included because much past literature has concluded that trade volume has a significant impact on prices (Kapoff, 1987; Khan and Rizwan, 2008). Following that, the world gold price is also included to observe how the stock market behaves under the influence of fluctuations in the gold price. Empirical evidence has shown that gold can be a determinant of stock prices because it is an investment tool, that is safer than the stock market, especially in times of financial crisis (Baur and Lucey, 2010; Aguilera and Radetzki; 2017; Kinateder et. al, 2021). Thus, gold is an alternative to stock for investment purposes. Therefore, when the price of stock declines, the price of gold will rise. This gradually leads to an increment in the gold price as demand for the said commodity increases. However, some studies have commented that gold is not a factor in the changes in stock price (Baig et. al, 2013).

Based on the evidence provided above, this study will be including gold price, crude oil price, unemployment rate, US Dollar-Malaysian Ringgit exchange rate, inflation rate, palm oil export volume, palm oil price, and money supply as regressors in this study to see how stock index price reacts to changes in the independent variables mentioned.

CHAPTER 3

METHODOLOGY

3.1. Data

The study will analyze 10 variables in total, using monthly data ranging from January 2012 to April 2022, with 124 observations. The choice of monthly data is preferred as it captures the correlations between the variables more accurately than quarterly or yearly data due to its higher sensitivity. According to Gandhi (2022), high-frequency data allows stakeholders to respond promptly to changes in the data. Although daily data would be optimal, it is not available for some of the variables such as the inflation rate. Thus, this study will use monthly data to analyze the economic variables. Additionally, all of the data will undergo logarithmic transformation to standardize it.

The returns of palm oil stock in Malaysia, Singapore, and Indonesia will be represented by the FTSE Bursa Malaysia Asian Palm Oil Plantation Index (FBMAP Index). This index was selected because it includes companies from all three countries under study, and all companies in this index generate at least 30% of their revenue from activities in the palm oil industry (FTSE Russell, 2022). As a result, this index is appropriate for evaluating the linkage between fluctuations in economic variables on palm oil stock index returns. Furthermore, because gold is an investment choice, we will investigate the effect of global gold prices on palm oil stock returns. When gold prices vary, some investors prefer to invest in gold rather than stock indexes since gold is safer and less subject to inflation (Gokmenoglu and Fazlollahi, 2015).

In this study, two forms of money supply will be included as predictor variables: M1 (narrow money) and M3 (broad money). M1 includes highly liquid financial instruments such as cash and savings accounts, whereas M3 covers a broader range of money supplies such as deposits and securities with longer maturities that are more difficult to convert to cash. Money supply is known to be closely tied to inflation, as an increase in money supply often leads to inflationary pressures (Gorton, 2022).

In this analysis of palm oil stock returns, inflation, unemployment rate, and the US Dollar – Malaysian Ringgit exchange rate will be included as predictor variables. Inflation, as an indicator of economic growth, will be represented by Malaysia’s Consumer Price Index (CPI). While the relationship between inflation and stock price is debatable among academics, rising inflation rates are thought to have a detrimental impact on a company's financial performance due to increased manufacturing costs and taxes (Feldstein and Summers, 1979). Furthermore, the Malaysian unemployment rate will be investigated because it is seen as an essential indicator of economic development (Shahid, 2014; Makaringe and Khobai, 2018). Furthermore, the impact of the USD-MYR exchange rate will be considered due to the importance of the US as Malaysia's major trading partner and its involvement in global economic growth. As a result, the profitability of Malaysian exports to the United States is affected by this exchange rate.

Furthermore, Brent crude oil will be used as a predictor variable in this study to explore its impact on palm oil stock returns. Brent crude oil, along with West Texas Intermediate and Dubai crude, is one of the most extensively used benchmark crude oils in the world. Benchmark crude oil, in simpler terms, acts as a reference for price reasons in the petroleum business and is widely utilized by traders and investors (Downey, 2022). Brent crude oil, which is primarily utilized for petrol and diesel production, was chosen as the benchmark crude oil to investigate the relationship between crude oil price changes and palm oil returns since it is the most prominent benchmark globally (George and Breul, 2014). Furthermore, as Kurt (2022) points out, Brent crude is utilized as a benchmark for pricing around 70% of international crude oil contracts. While most researches have focused on the impact of crude oil price changes on enterprises that produce and use crude oil, the purpose of this study is to look at the impact on the palm oil industry, which uses crude oil as one of its inputs. As a result, when crude oil prices rise, resulting in higher input costs in the production of palm oil, palm oil stock returns are predicted to fall (Bergmann, O'Connor, and Thümmel, 2016).

Subsequently, due to the stock index includes companies whose major activities are tied to palm oil production and distribution, changes in palm oil price and export volume can have a substantial impact on the profitability and performance of the companies' stock returns. Therefore, this study makes use of Malaysia's palm oil export volume, as it focuses on the effects of Malaysia's economy on stock returns in Malaysia, Indonesia, and Singapore. However, because Malaysia is one of the world's largest palm oil exporters, global palm oil prices are used instead of Malaysian domestic palm oil pricing. Therefore, international palm oil prices, which influence the profit obtained from palm oil export, would better reflect Malaysia's economy. In general, when the price of palm oil rises, stock returns tend to rise as well, as palm oil companies benefit from the increase in profit (Nordin, Nordin, and Ismail, 2014).

On the other hand, there is also a possibility of palm oil prices rising when crude oil prices increase. This is because palm oil is regarded as a feasible substitute for crude oil in certain industries, most notably biodiesel as a substitute for petroleum diesel (Hayyan et al., 2010). Therefore, if the price of crude oil rises, demand for palm oil may rise as customers seek out more cost-effective alternatives. As a result, demand for palm oil may rise, causing its price to climb and, as a result, palm oil stock returns to rise as the value of palm oil rises.

The list of all variables, both independent and dependent, will be outlined in Table 3.1.

Table 3.1.: Data Summary

Variables	Abbreviation	Unit	Sources
FTSE Bursa Malaysia Asian Palm Oil Plantation Index	*ln_fbmap*	Index	Investing.com
Brent Crude Oil Price	*ln_co*	USD per barrel	World Bank
Malaysia Consumer Price Index	*ln_cpi*	Index (2010=100)	Bank Negara Malaysia
United States Dollar-Malaysian Ringgit Exchange Rate	*ln_exr*	Malaysian Ringgit (MYR) per United States Dollar (USD)	Federal Reserve Bank of St. Louis
World Gold Price	*ln_g*	USD per Troy Ounce	World Bank
World Palm Oil Price	*ln_po*	USD per million tonne	World Bank
Narrow Money, M1 in Malaysia	*ln_m1*	MYR (millions)	Bank Negara Malaysia
Broad Money, M3 in Malaysia	*ln_m3*	MYR (millions)	Bank Negara Malaysia
Palm Oil Export in Malaysia	*ln_poe*	Tonne	Malaysian Palm Oil Council
Unemployment Rate in Malaysia	*ln_uepr*	Million persons	Bank Negara Malaysia

3.2. Unit Root Test

The Non-linear Autoregressive Distributed Lag (NARDL) model is capable of accommodating variables that are either stationary without differencing, or, stationary by taking the first difference. These are represented as I(0) and I(1) respectively. As a result, before adding any of the time series into the non-linear model, an Augmented Dickey-Fuller (ADF) test, a sort of unit root test, will be performed to ensure that the time series meets this criterion. The null hypothesis in the ADF test claims that the time series has a unit root, whereas the alternative hypothesis proposes that the time series does not have a unit root. The presence of a unit root suggests a non-stationary time series. As a result, the ADF test can establish a time series' stationarity by assessing whether unit root exist in the variable.

3.3. Non-linear Autoregressive Distributed Lag Model (NARDL)

The Non-linear Autoregressive Distributed Lag (NARDL) model is used in this study to evaluate how economic variables affect the palm oil stock index price. This framework was created by Greenwood-Nimmo, Shin, and Yu (2014) to allow variables with heterogeneous order of integration for both response and predictor variables. The NARDL model also allows the estimation of asymmetry effects, which describe how changes in regressors affect the stock index price individually. This is an important aspect since the Autoregressive Distributed Lag (ARDL) paradigm, which exclusively estimates symmetry effects, assumes that changes in the regressor have the same effect on the dependent variable regardless of direction. As a result, ARDL may generate model parameters that are inelastic and non-robust (Chen et al., 2020). Non-linearity can emerge as a result of high oscillations in variables or asymmetric reactions to shocks from other variables, both of which can occur in practise. Furthermore, NARDL model is able to produce accurate results regardless of the sample size used (Pesaran et al., 2001; Narayan and Narayan, 2005).

The NARDL model is used to analyse non-linear cointegration interactions between variables in the short and long run (Raza et al, 2016). This model is also used to investigate variable non-linearity and non-stationarity by developing an error correction model (ECM). The general form of a NARDL equation is shown below:

$$y_t = \gamma^+ x_t^+ + \gamma^- x_t^- + u_t \tag{1}$$

In equation (1), y_t would be representing the response variables. On the other hand, γ^+ and γ^- serves as the coefficients of the regressor, which are, x_t^+ and x_t^- respectively.

In the process of modelling cointegration relationship between variables, using NARDL, each of the explanatory variables would first need to be decomposed into partial sums of positive and negative shocks in the independent variable, x_t.

The partial sums of positive shocks in x_t is denoted as x_t^+:

$$x_t^+ = \sum_{i=1}^{t} \Delta x_i^+ = \sum_{i=1}^{t} \max(\Delta x_i, 0) \quad (2)$$

The partial sums of negative shocks in x_t is denoted as x_t^-:

$$x_t^- = \sum_{i=1}^{t} \Delta x_i^- = \sum_{i=1}^{t} \min(\Delta x_i, 0) \quad (3)$$

Thus, the regressor, x_t is actually:

$$x_t = x_0 + x_t^+ + x_t^- \quad (4)$$

With all the above equations, the NARDL model can be expressed as an asymmetric error correction model (ECM) is to be generated where the equation is as follows:

$$\Delta y_t = \theta y_{t-1} + \beta^+ x_{t-1}^+ + \beta^- x_{t-1}^- + \sum_{j=1}^{p-1} \rho_j \Delta y_{t-1} + \sum_{j=0}^{q} (\alpha_j^+ \Delta x_{t-j}^+ + \alpha_j^- \Delta x_{j-t}^-) + \varepsilon_t \quad (5)$$

Where β^+ and β^- is the long -run asymmetric coefficients whereas α_j^+ and α_j^- are the short-run asymmetric coefficients. Variables that are insignificant, or, insignificant lags of a significant variables would be removed from the estimated equation. This is to ensure the NARDL model formed is a parsimonious model.

However, before a model is confirmed it is important to establish the long-run relationship between the variables. This is done by first estimating Equation (5) based on the ordinary least squares (OLS) method, which is a popular method in estimating the parameters of models. Next, the limits testing approach developed by Shin, Smith, and Pesaran (2001) is utilised to determine whether a non-linear long-run relationship exists between variables in the model. Then, after the long-run asymmetry relationship is established, the focus would be placed on individual variables and the Wald test would be used to study whether the variable gives a non-linear effect. The test is done for both the short and, long-run. For the short-run results, if there is no asymmetry effect, then $\alpha^{+} = \alpha^{-}$, and the opposite if there is an asymmetric relationship. For long-run, if asymmetry effect is confirmed, then $\beta^{+} \neq \beta^{-}$, and vice versa when the relationship is symmetry.

Finally, an asymmetric cumulative dynamic multiplier effect would be generated. The equation of dynamic multiplier effect is shown below:

$$m_j^{+} = \sum_{i=0}^{j} \frac{\partial y_{t+i}}{\partial x_t^{+}}, j=0, 1,2, \ldots \quad (6)$$

$$m_j^{-} = \sum_{i=0}^{j} \frac{\partial y_{t+i}}{\partial x_t^{-}}, j=0, 1,2, \ldots \quad (7)$$

3.4. F-Bounds Test for Testing Cointegration

In this study, the F-bounds test, which is introduced by Shin, Smith, and Pesaran (2001) will be used to confirm that there is cointegration, also known as long-run relationship between the variables included in the Non-linear Autoregressive Distributed Lag (NARDL) model. A general form of the NARDL bounds cointegration equation is shown below:

$$\Delta Y_t = \theta + \sum_{i=1}^{p-1} \alpha_i \Delta Y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{q_j-1} \Delta X_{j,t-1} \gamma_{j,i} + \varphi Y_{t-1} + \sum_{j=1}^{k} X_{j,t-1} \tau_j + \varepsilon_t \quad (8)$$

In the equation above, Y_t is the response variables and ΔY_t would be referring to the first difference of the response variable. Next, θ represent the constant in the equation, α serves as the coefficient for the first-differenced response variable and φ represent the parameter for the lagged response variable. On the other hand, X_t is the predictor variable and ΔX_t is the differenced predictor variable, where τ and γ are their respective coefficients. Lastly, the ε_t stands for error term. The model that is represented by the equation above is also known as the conditional error correction model (ECM) (Shin, Smith, and Pesaran, 2001).

In this cointegration test, the purpose is to examine the presence of long-run cointegration where:

$$H_0: \tau_1 = \tau_2 = \tau_3 = \cdots = \tau_k = 0 \quad (9)$$

$$H_0: At\ least\ one\ \tau_j\ is\ not\ equal\ to\ 0. \quad (10)$$

Unlike the conventional F-tests, the NARDL F-bounds test for cointegration will have two F- values, which are the upper bound critical F-value and lower bound critical F-value. The reason why there are two critical F-values is that the NARDL model can have a mix of either variable that are stationary at level, I(0), or, variables that are stationary at the first difference, I(1).

If the test statistic is less than the lower bound, it shows the absence of cointegration in the model. On the other hand, if test statistic is between the upper and lower bound critical values, then it is concluded that there is no cointegration relationship in the model. Lastly, if the test value is above the upper critical value, it indicates that cointegration exists among the variables of interest (Shin, Smith, and Pesaran, 2001).

3.5. Granger Causality Test

Once cointegration among variables is established, the subsequent step involves determining the direction of the causality relationship. This can be achieved through the application of the Error Correction Model (ECM). The ECM incorporates an Error Correction Term (ECT), which elucidates the direction of the causality relationship in the long run (Granger, 1988). In essence, the ECT reflects how quickly the dependent variable adjusts to attain long-run equilibrium in response to fluctuations in the independent variables. Typically, the ECT varies between -1 and 0, and if it falls outside this range, it signifies that the selected model is inappropriate.

Furthermore, in order to validate the NARDL model, it is necessary for the ECT to be negative, since a negative sign indicates a convergence and a causal relationship. In simpler terms, when the ECT has a negative value, it means that deviations from equilibrium are reduced. Conversely, if the ECT is positive, then deviations from the long-run equilibrium would increase. Furthermore, the ECT must also be statistically significant to confirm a long-run causality relationship. For short-run causality, on the other hand, it is necessary for the lagged version of the predictor variables to be statistically significant (Granger, 1988). The ECM equation is provided below to help with understanding.:

$$\Delta Y_t = \theta + \sum_{i=1}^{p-1} \alpha_i \Delta Y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{q_j-1} \Delta X_{j,t-1} \varphi_{j,i} + \pi ECT_{t-1} + \varepsilon_t \qquad (11)$$

In the equation above, Y_t is the response variable and ΔY_t is the first difference of the response variable where α is the parameter for the first-differenced response variable. Next, θ represents the constant and, ΔX_j shows the differenced predictor variable where φ is its coefficient. As usual, ε_t represents the error term. Most importantly, ECT stands for the error correction term and π is its coefficient which should always be negative to provide a valid model.

3.6. Stability Test

This study will utilize the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests to assess the stability of the constructed model. These tests were proposed by Evans, Durbin, and Brown (1975) and are used to determine whether the constant parameter in the model remains stable over time or not. The null hypothesis for these tests is that the parameter is stable, while the alternative hypothesis suggests that it is not. The results of the tests are presented graphically as CUSUM and CUSUMSQ plots, which display upper and lower significance lines at the 5% level. If the plots show that the CUSUM or CUSUMSQ value exceeds the critical lines significantly, it indicates that the parameter is unstable, and the model would be considered unreliable and rejected.

CHAPTER 4

RESULTS AND DISCUSSION

4.1. Unit Root Test

The unit root test used would be the Augmented Dickey-Fuller (ADF) test.

According to the result of the test as shown in Table 4.1.1., out of the 10 variables included in this study, only *ln_fbmap* and *ln_poe* are stationary at level, I(0), at 5% and 1% significance level respectively. This means that both time series mentioned are stationary without differencing. On the other hand, other variables, namely *ln_co, ln_cpi, ln_exr, ln_g, ln_m1, ln_m3, ln_po,* and *ln_uepr*, are shown to be integrated at the first difference, I(1). To put it more clearly, the outcome of the ADF test implies that these time series will only be stationary after the first difference. Additionally, all of these variables are proven to be stationary at the first difference, at 1% significance level.

The Non-Linear Autoregressive Distributed Lag (NARDL) model allows the variables included, to either be stationary at level, I(0) or stationary after the first difference, I(1). Hence, since all the variables are either I(0) or I(1), all of them can be used in further analysis since they fulfill the stationarity assumption.

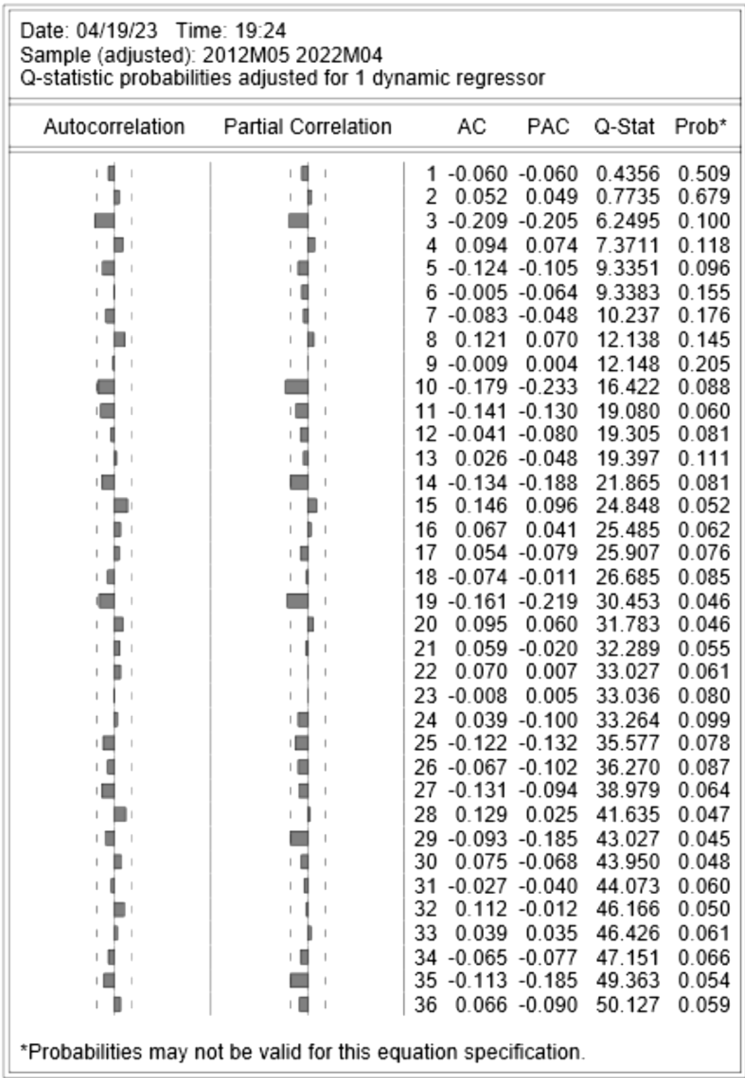
Table 4.1.1: **ADF unit root test**

Variables	t-statistics		Order of Integration
	Level	First Difference	
ln_fbmap	-2.913539**	-11.45275***	I(0)
ln_co	-2.002112	-8.337099***	I(1)
ln_cpi	-1.141824	-8.386000***	I(1)
ln_exr	-1.830512	-7.568244***	I(1)
ln_g	-1.103738	-8.334354***	I(1)
ln_m1	0.257972	-12.06003***	I(1)
ln_m3	-0.785241	-12.54064***	I(1)
ln_po	-0.857396	-8.244646***	I(1)
ln_poe	-6.133780***	-14.50986***	I(0)
ln_uepr	-1.438295	-12.41831***	I(1)

Note: *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

4.2. Diagnostic Statistics for NARDL Models

Correlogram of Residuals



Date: 04/19/23 Time: 19:24
Sample (adjusted): 2012M05 2022M04
Q-statistic probabilities adjusted for 1 dynamic regressor

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.060	-0.060	0.4356	0.509
		2	0.052	0.049	0.7735	0.679
		3	-0.209	-0.205	6.2495	0.100
		4	0.094	0.074	7.3711	0.118
		5	-0.124	-0.105	9.3351	0.096
		6	-0.005	-0.064	9.3383	0.155
		7	-0.083	-0.048	10.237	0.176
		8	0.121	0.070	12.138	0.145
		9	-0.009	0.004	12.148	0.205
		10	-0.179	-0.233	16.422	0.088
		11	-0.141	-0.130	19.080	0.060
		12	-0.041	-0.080	19.305	0.081
		13	0.026	-0.048	19.397	0.111
		14	-0.134	-0.188	21.865	0.081
		15	0.146	0.096	24.848	0.052
		16	0.067	0.041	25.485	0.062
		17	0.054	-0.079	25.907	0.076
		18	-0.074	-0.011	26.685	0.085
		19	-0.161	-0.219	30.453	0.046
		20	0.095	0.060	31.783	0.046
		21	0.059	-0.020	32.289	0.055
		22	0.070	0.007	33.027	0.061
		23	-0.008	0.005	33.036	0.080
		24	0.039	-0.100	33.264	0.099
		25	-0.122	-0.132	35.577	0.078
		26	-0.067	-0.102	36.270	0.087
		27	-0.131	-0.094	38.979	0.064
		28	0.129	0.025	41.635	0.047
		29	-0.093	-0.185	43.027	0.045
		30	0.075	-0.068	43.950	0.048
		31	-0.027	-0.040	44.073	0.060
		32	0.112	-0.012	46.166	0.050
		33	0.039	0.035	46.426	0.061
		34	-0.065	-0.077	47.151	0.066
		35	-0.113	-0.185	49.363	0.054
		36	0.066	-0.090	50.127	0.059

*Probabilities may not be valid for this equation specification.

Figure 4.2.1. Correlogram of Residuals

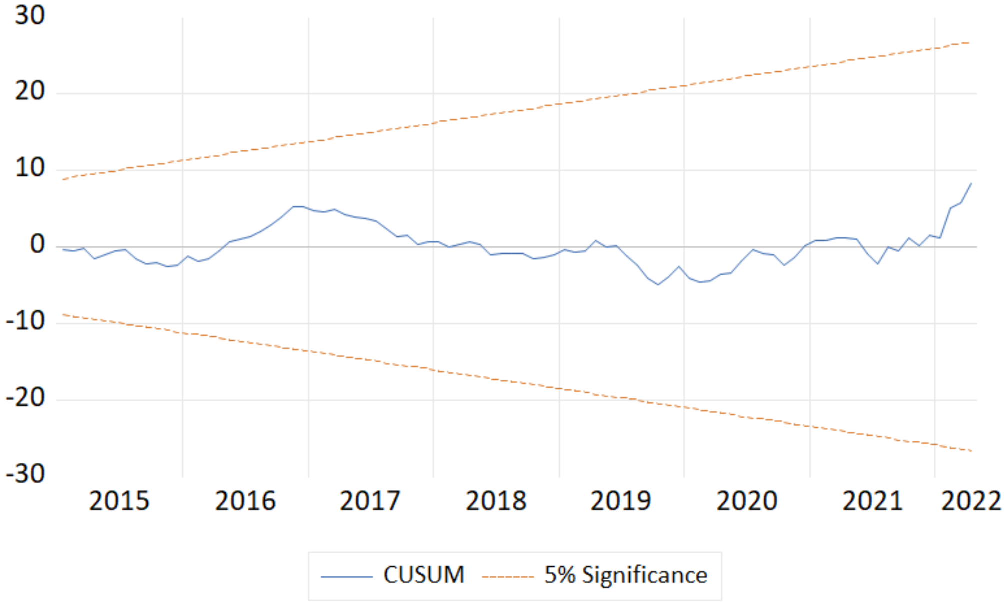


Figure 4.2.2. CUSUM test

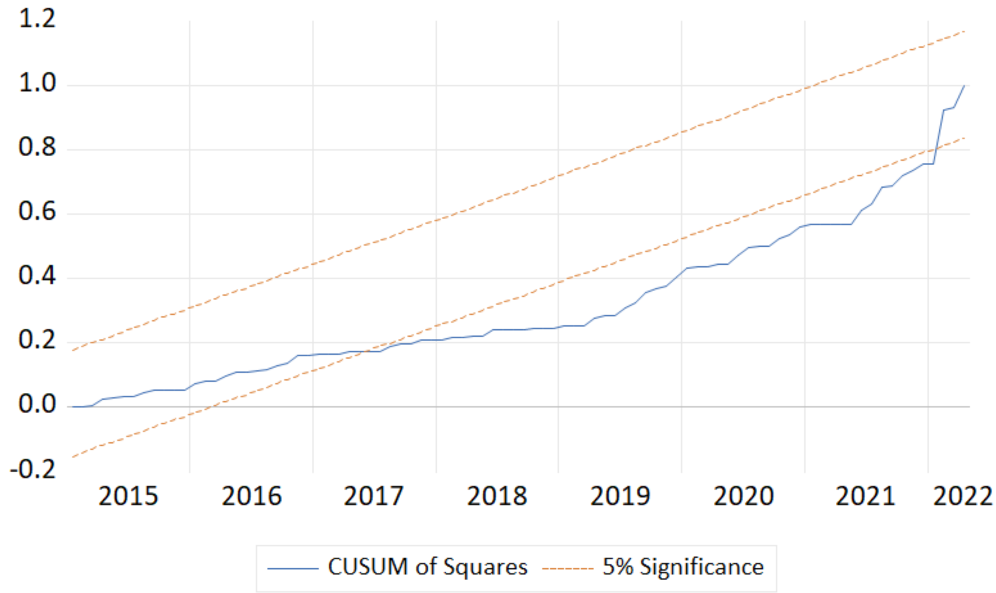


Figure 4.2.3. CUSUMSQ test

After testing the stationarity of all the variables to make sure all of them fulfill the assumptions, an analysis will be performed using the Non-Linear Autoregressive Distributed Lag (NARDL) framework. The model built will undergo diagnostic checking to make sure that satisfies the basic assumptions that it needs to fulfill to be considered a valid and robust NARDL model.

Firstly, the correlogram of residuals shows that at lag 10 and lag 19, slightly crosses the 5% significant line (Figure 4.2.1.). Thus, indicating that there might be a presence of serial correlation. However, the possibility is low because lag 10 and lag 19 is considered a further lag. Therefore, another serial correlation test, the Breusch-Godfrey Serial Correlation Lagrange Multiplier Test is used to further confirm the presence of correlation in the model formed. The test provides a p-value of 0.7027, which is larger than 0.05. This means that the test is not able to reject the null hypothesis at the 5% significance level. As such, we are able to confirm the absence of correlation.

Next, the model will also be tested to see if it fulfills the normality assumption. The test used would be the Jarque-Bera test. Since the p-value is 0.7396, which is also larger than 0.05, it is concluded that the model fulfills the assumption tested, with a 5% significance level. Following that, the Autoregressive Conditional Heteroskedasticity (ARCH) test is applied to examine the presence of heteroskedasticity in the model. The p-value generated for the test is 0.1567, which is also larger than 0.05 indicating that the null hypothesis is not rejected and supports the fact that the model does not have the heteroskedasticity issue, at a 5% significance level. Therefore, the model fulfills the basic assumptions.

Additionally, we would also like to know whether the model is stable. That is to say, whether the parameters would be staying constant over some time. The CUSUM and CUSUMSQ graph will be used to analyze stability. The CUSUM graph displays a line plot that stays inside the upper and lower 5% significance bound, suggesting that the parameters of the model are stable (Figure 4.2.2.). Nonetheless, when studying the CUSUMSQ graph, the line plot deviates out of the 5% lower significance bound but stays relatively near to it (Figure 4.2.3.). Therefore, the result of both graphs is taken into consideration, and it could be concluded that the model is acceptable, such that the parameters are stable, at a significance level of 5%.

4.3. NARDL F-Bounds Test for Cointegration

Pesaran, Shin, and Smith (2001) have introduced the bounds test, which helps to analyze whether a long-run relationship or cointegration, could be established between variables in the model. For the model which contains Brent crude oil price, world gold price, Malaysia's CPI Index, Malaysia's unemployment rate, and the exchange rate between the US Dollars (USD) and Malaysian Ringgit (MYR) as explanatory variables, the F-statistics is 4.4031. At a significance level of 1%, the lower critical bound is 2.41 and the upper critical bound is 3.61. The F-statistics of the model are higher than the upper critical bound. As such, it is concluded that there is cointegration between the variables in the model, at a 1% significance level. This implies that cointegration is present between the return of the palm oil stock indexes and the variables mentioned. Thus, when there are fluctuations in the unemployment rate, gold price, crude oil price, inflation rate, or exchange rate, it will be followed by changes in palm oil stock return. However, palm oil stock return will not be reacting to changes in other independent variables, that are not significant.

4.4. NARDL Long-Run Estimation

Note that the term 'non-linear' refers to the fact that the independent variable will have a different impact on the dependent variable when it increases, and when it decreases. This term is used interchangeably with 'asymmetry'. On the other hand, a 'linear' or 'symmetrical' relationship means that, regardless of a positive or negative change in an independent variable, it will have the same impact on the dependent variable.

After making sure that cointegration exists, Non-Linear Autoregressive Distributed Lag (NARDL) framework is applied. Predictor variables that are found to be significant are Malaysia's unemployment rate, world gold price, US Dollar- Malaysian Ringgit exchange rate, Brent's crude oil price, and Malaysia's Consumer Price Index (CPI) and their long-run coefficient is estimated as shown in Table 4.4.1.

For a NARDL model, where FBMAP Index is the response variable, a positive change in the exchange rate is found to have a significant positive relationship with the said response variable. Likewise, a decrease in the exchange rate is also significant and has a positive relationship with the FBMAP index. 1 percent increase in the exchange rate will bring to a 0.4132 percent rise in FBMAP Index and a 1 percent decrease in the exchange rate leads to an estimated 0.6167 percent drop in FBMAP Index, when other independent variables are kept constant. In general, both the increase and decrease of the exchange rate have a positive relationship with FBMAP Index because the direction of change is the same between the dependent and independent variable. That is, when the exchange rate decreases, the FBMAP Index price also decreases and vice versa.

This is because Malaysia, Indonesia, and Singapore are exporters of palm oil. Thus, when the exchange rate increases (decreases), in this context, it means that the home currency depreciates (appreciates). Thus, at a global level, the competitiveness of export products of these countries increases (decreases) because it cost of buying palm oil products lowers (rises). As such, these export companies are generating income (experiencing monetary loss) as demand increases (decreases) which leads to a rise (drop) in their stock prices. This is in accordance with the finding of Ma and Kao (1990) who confirm that appreciation in home currency decreases the competitiveness of export-oriented firms. Apart from that, the gold price fluctuations also have a significant impact in determining FBMAP Index return. Furthermore, the effect of decrease and increase in gold price seems to have a similar magnitude.

Furthermore, regarding the CPI Index, which represents the inflation rate, its positive change is found to have a significant positive relationship with the dependent variable. Specifically, a percent increase in the inflation rate is estimated to cause a 2.5940 percent increase in FBMAP Index when holding other independent variables constant. This is because in the end, stock is still a good. Consequently, increase in inflation which increases prices of goods will increase stock prices (Omran and Pointon, 2001). For the same reason, a percent decrease in the inflation rate from previous month along with a percent decrease of the first differencing of the inflation rate both causes a 3.4000 percent decrease in the dependent variable.

On the other hand, for the crude oil variable, only its negative shocks are significant in the long run. The decrease in crude oil price is has a positive relationship with the dependent variable where a percent decrease in crude oil price leads to a 0.2226 percent decrease in the dependent variable when other independent variables remain constant. This outcome can be attributed to the fact that palm oil is a substitute for crude oil in certain industries. Therefore, when the price of crude oil decreases, consumers would choose to use crude oil over palm oil, resulting in a decrease in demand for palm oil and profits for firms that produce it. As a result, stock prices decrease. Additionally, unemployment rate which is used as an indicator of the Malaysia's economic health also have a significant impact on FBMAP Index price where a percent increase in unemployment rate leads to 0.2769 percent increase in FBMAP Index price whereas a percent decrease in unemployment rate leads to a 0.1827 percent decrease in FBMAP Index price.

Next, the Wald test is used to further confirm whether the difference between the coefficient for the negative and positive shock of each independent variable is significant enough for it to be claimed as having an asymmetry effect. The null hypothesis of this test states that the predictor variable tested has a symmetrical impact on the response variable. On the other hand, the alternative hypothesis assumes otherwise in which the predictor variable is said to have an asymmetry relationship with the response variable.

As shown in Table 4.4.2, only the p-value for the Brent's crude oil price variable has a p-value that is smaller than 0.01. Thus, the null hypothesis is rejected, and the said independent variable exhibit an asymmetry effect on the return of the oil palm stock index return, the FBMAP Index, in the long run. The negative shock in crude oil seems to have a more significant impact based on the magnitude of the coefficient of crude oil. Aside from that, other significant independent variables have p-value which is larger than 0.01. Consequently, the null hypothesis is not rejected proving that when these independent variables do not have an asymmetric relationship with the FBMAPs index such that when it experiences a positive shock, the impact of the change on the palm oil stock return in Indonesia, Malaysia, and Singapore is not significantly different to the change that a negative shock brings. In other words, although inflation rate, unemployment rate, gold price, and exchange rate play an important role in determining the price of FBMAP index in the long run, the effect is symmetry. On the other hand, the crude oil price fluctuations is not only significant but also have an asymmetry impact on the dependent variable.

Table 4.4.1: Long-run estimation results for NARDL model

Variables	Model
	fbmap
constant	-
Δln_g^{+}	0.6544***
$ln\_g^{+}_{t-1}$	0.6544***
ln_g^{-}	0.6035***
ln_exr^{+}	0.4132**
ln_exr^{-}	0.6167***
ln_cpi^{+}	2.5940***
Δln_cpi^{-}	3.4000***
$ln\_cpi^{-}_{t-1}$	3.4000***
ln_co^{+}	-0.0272
ln_co^{-}	0.2226***
ln_uepr^{+}	0.2769***
ln_uepr^{-}	0.1827*

Note: *, **, *** denote statistical significance at 10%, 5%, and 1% respectively.

Table 4.4.2.: Wald test results for NARDL Long-run estimation

Variable	p-value
ln_cpi	0.5949
ln_co	0.0006***
ln_g	0.7672
ln_uepr	0.1635
ln_exr	0.3577

Note: *, **, *** denote statistical significance at 10%, 5%, and 1% respectively.

4.5. NARDL Short-Run Estimation

The estimated short run non-linear coefficient for each regressor and, the coefficient for Error Correction Term (ECT) is shown in Table 4.5.1.

In the regression model with FBMAP Index as the dependent variable, the influence of both the rise and decline in the crude oil price regressor is significant. Specifically, decreases in crude oil price in the previous month are the lags that affect the stock index price whereas for increase in crude oil price both the current and previous month plays a significant part in determining the FBMAP Index price. Additionally, unlike the observation made in the long run estimation, inflation rate is found to have no influence on the FBMAP Index in the short run.

Furthermore, the findings reveal that fluctuations of exchange rate in the current month, in either direction, have a statistically significant influence on FBMAP Index. Aside from that, the decrease in gold price also has a significant impact on FBMAP Index. Specifically, the gold price from previous month has a negative relationship with FBMAP Index. Similarly, the two-month lagged version of gold price also has a negative relationship with the dependent variable. This indicates that with a decrease in gold price, FBMAP Index price will increase (negative relationship). Besides, the dependent variable also reacts to the decrease and increase in unemployment rate.

However, none of the other independent variables, such as money supply, have a statistically significant impact on determining the movement of FBMAP Index prices in the short term. Additionally, Wald test is also conducted to ensure the presence of asymmetry impact for each variable. Result is shown in Table 4.5.2.

From there, it is observed that all the significant regressors have an asymmetry impacts in the short run, as we can reject the null hypothesis of Wald test because their p-value is smaller than the significance level.

The ECT (Error Correction Term) also provides information about the direction of causality in the long run. A negative ECT value indicates that there is a causality relationship, and it shows the direction of causality. In this case, since the ECT value is negative, it suggests that if there is a deviation from the long-run equilibrium, the dependent variable (FBMAP Index) will adjust toward the equilibrium level in the next period. This indicates that changes in the independent variables, such as crude oil price, unemployment rate, exchange rate, and gold price, have a long-run impact on the FBMAP Index. Additionally, the magnitude of the ECT coefficient provides information about the speed of adjustment toward the equilibrium level. A higher magnitude of the ECT coefficient suggests a faster adjustment toward the equilibrium level, while a lower magnitude implies a slower adjustment. The ECT coefficient is -0.4645, indicating that if there are any deviations from the long-run equilibrium in the current month, 46.45% of the deviation will be corrected by the following month. Additionally, this also suggests that there is indeed a long-term relationship between these variables.

Table 4.5.1: Short-run estimation results for NARDL model

Variables	Model
	$\Delta fbmap$
$\Delta ln\_co^{+}_{t-1}$	0.8977***
$\Delta ln\_co^{+}_{t}$	0.6939***
$\Delta ln\_co^{-}_{t-1}$	-0.2680*
$\Delta ln\_uepr^{+}_{t}$	-0.5465**
$\Delta ln\_uepr^{+}_{t-2}$	-1.1806***
$\Delta ln\_uepr^{-}_{t-2}$	1.2197***
$\Delta ln\_exr^{+}_{t}$	-2.0017*
$\Delta ln\_exr^{-}_{t}$	1.6982*
$\Delta ln\_g^{-}_{t-1}$	-1.3935***
$\Delta ln\_g^{-}_{t-2}$	-0.9402**
ECT_{t-1}	-0.4645***

Note: *, **, *** denote statistical significance at 10%, 5%, and 1% respectively.

Table 4.5.2.: Wald test results for NARDL Short-run estimation

Variable	p-value
ln_co	0.0000***
ln_g	0.0006***
ln_uepr	0.0000***
ln_exr	0.0136**

Note: *, **, *** denote statistical significance at 10%, 5%, and 1% respectively.

CHAPTER 5

CONCLUSIONS

5.1. Introduction and Important Findings

This is a study that examines how the Malaysian economic situation affects returns of oil palm stock returns in Malaysia, Singapore, and Indonesia. In order, to know the asymmetric impact that the significant independent variables have on dependent variables, Non-Linear Autoregressive Distributed Lag (NARDL) framework would be used. Results reveal that crude oil price, inflation rate, exchange rate, unemployment rate, and gold price are significant in determining the long run oil palm stock index returns in Singapore, Indonesia, and Malaysia. Nonetheless, in the short run, only the exchange rate, crude oil price, gold price, and the unemployment rate have significant impacts on the FBMAP Index return.

In the long run, although each independent variables that are significant seems to have asymmetry impact, results of Wald test shows that the difference in the impact is not significant enough to be considered as asymmetry impact. However, in the short run, all the significant independent variables are confirmed to have asymmetry impacts.

The value of ECT also suggests the presence of cointegration between these variables, with a rapid speed of adjustment when there is disequilibrium from the long run. Overall, these findings can be useful for investors and policymakers in understanding the factors that are important in determining the performance of the FBMAP Index.

This study is significant as it provides insights into the relationships between various macroeconomic variables and the performance of corporate stock of palm oil companies in Malaysia, Singapore, and Indonesia. The outcome of this study can be used by investors who are interested in investing in the palm oil industry or related industries. Additionally, policymakers and regulators can also use this information to make informed decisions regarding economic policies that affect the palm oil industry. Furthermore, this study contributes to the existing literature on the determinants of stock prices and can be a valuable reference for future researchers who want to investigate the linkage between economic variables and stock prices in other industries or regions.

5.2. Recommendations for Future Research

One of the limitations of this study is that it only focuses on three countries, namely Malaysia, Indonesia, and Singapore, and may not necessarily generalize to other palm oil-producing and trading countries. Additionally, the study relies on secondary data, which may have limitations in terms of accuracy and reliability. Finally, the NARDL framework used in this study is only one of many analytical tools and may have limitations in terms of its ability to capture the full complexity of the linkage between certain economic variables and stock returns. A future study could look into the effect of macroeconomic variables like interest rates and GDP on the FBMAP Index return. Additionally, it could be valuable to explore the relationship between the FBMAP Index return and other related industries, such as the food and beverage industry, as well as conducting a cross-country analysis to compare the behavior of the FBMAP Index with similar indices in other countries. Finally, a study on the impact of technological advancements and innovations in the palm oil industry on the FBMAP Index return could also be a worthwhile topic for future research.

References

Ab Rahman, A.K., Nambiappan, B. and Shariff, F.M., 2013. Impact of Palm Oil Supply and Demand on Palm Oil Price Behaviour. *Oil Palm Industry Economic Journal*, [e-journal] 13(1), pp.1-13. http://palmoilis.mpob.gov.my/publications/OPIEJ/opiejv13n1-ayat.pdf

Adusei, M., 2014. The Inflation-Stock market returns Nexus: Evidence from the Ghana Stock Exchange. *Journal of Economics and International Finance*, [e-journal] 6(2), p.38. https://doi.org/10.5897/JEIF2013.0556

Aguilera, R.F. and Radetzki, M., 2017. The synchronized and exceptional price performance of oil and gold: explanations and prospects. *Resources Policy*, [e-journal] 54, pp.81-87. https://doi.org/10.1016/j.resourpol.2017.09.005

Al-hajj, E., Al-Mulali, U. and Solarin, S.A., 2018. Oil price shocks and stock returns nexus for Malaysia: Fresh evidence from nonlinear ARDL test. *Energy Reports*, [e-journal] 4, pp.624-637. https://doi.org/10.1016/j.egyr.2018.10.002

Baig, M.M., Shahbaz, M., Imran, M., Jabbar, M. and Ain, Q.U., 2013. Relationship between gold and oil prices and stock market returns. *Acta Universitatis Danubius*, [e-journal] 9(5), pp.28-39. https://www.ceeol.com/search/article-detail?id=564055

Bank Negara Malaysia, 2001. *FAQs on the Kijang Emas Gold Bullion Coin*. [online] Available at: < https://www.bnm.gov.my/-/faqs-on-the-kijang-emas-gold-bullion-coin> [Accessed at: 5 April 2023]

Bank Negara Malaysia, 2001. *Kijang Emas Gold Bullion Coin launched.* [online] Available at: < https://www.bnm.gov.my/-/kijang-emas-gold-bullion-coin-launched> [Accessed at: 6 April 2023]

Barakat, M.R., Elgazzar, S.H. and Hanafy, K.M., 2016. Impact of Macroeconomic Variables on Stock Markets: Evidence from Emerging Markets. *International Journal of Economics and Finance*, [e-journal] 8(1), pp.195-207. http://dx.doi.org/10.5539/ijef.v8n1p195

Baur, D.G. and Lucey, B.M., 2010. Is Gold a Hedge or a Safe Haven? An Analysis of Stocks, Bonds and Gold. *The Financial Review*, [e-journal] 45(2), pp.217-229. https://sttc.brictly.com/file/fd98f6f479561ce1.pdf

Bergmann, D., O'Connor, D. and Thümmel, A., 2016. An Analysis of Price and Volatility Transmission in Butter, Palm Oil and Crude Oil Markets. *Agricultural and Food Economics*, [e-journal] 4(1), pp.1-23. https://agrifoodecon.springeropen.com/articles/10.1186/s40100-016-0067-4

Brown, R.L., Durbin, J. and Evans, J.M., 1975. Techniques for Testing the Constancy of Regression Relationships over Time. *Journal of the Royal Statistical Society: Series B (Methodological)*, [e-journal] 37(2), pp. 149-163. https://www.jstor.org/stable/2984889

Bureau of East Asian and Pacific Affairs, 2022. *U.S. Relations With Malaysia*. [online] Available at: <https://www.state.gov/u-s-relations-with-malaysia/> [Accessed 20 September 2022]

Chen, H., Hongo, D.O., Ssali, M.W., Nyaranga, M.S. and Nderitu, C.W., 2020. The Asymmetric Influence of Financial Development on Economic Growth in Kenya: Evidence From NARDL. *Sage Open*, [e-journal] 10(1), pp. 1-17. https://doi.org/10.1177/215824401989407

Downey, L., 2022. *Benchmark Crude Oil*. [online] Available at: < https://www.investopedia.com/terms/b/benchmark-crude-oil.asp#:~:text=Benchmark%20crude%20oil%20is%20the,crude%20oil%20varieties%20and%20blends.> [Accessed at: 11 October 2023]

Fama, E.F., 1981. Stock Returns, Real Activity, Inflation, and Money. *The American Economic Review*, [e-journal] 71(4), pp.545-565. https://www.jstor.org/stable/1806180

Farsio, F. and Fazel, S., 2013. The stock market/unemployment relationship in USA, China and Japan. *International Journal of Economics and Finance*, [e-journal] 5(3), pp.24-29. http://dx.doi.org/10.5539/ijef.v5n3p24

Feldstein, M. and Summers, L., 1979. Inflation and the taxation of capital income in the corporate sector. *National Tax Journal*, [e-journal] 32(4), pp.445-470. https://www.nber.org/system/files/working_papers/w0312/w0312.pdf

Feryanto, Rifin, A., Herawati and Harianto, 2020. Assessing the impact of limiting Indonesian palm oil exports to the European Union. *Journal of Economic Structures*, [e-journal] 9(26), pp.1-13. https://doi.org/10.1186/s40008-020-00202-8

Francisco, J.C. and Loredana, N., 2016. US Stock Market and Macroeconomic Factors. *The Journal of Applied Business Research*, [e-journal] 32(1), pp.325-340.https://ruidera.uclm.es/xmlui/bitstream/handle/10578/7960/fi_1452425568-9541360082pb.pdf?sequence=1

FTSE Russell, 2022. *FTSE Bursa Malaysia Asian Palm Oil Plantation*

Gandhi, V., 2022. *Navigating the economy with high-frequency data.* [online] Available at: <https://www.cbi.org.uk/articles/navigating-the-economy-with-high-frequency-data/#:~:text=High%2Dfrequency%20data%20provides%20real,crucial%20information%20in%20uncertain%20environments.&text=High%2Dfrequency%20data%20helps%20to,act%20in%20times%20of%20crisis.> [Accessed 25 July 2022]

George, R. and Breul, H., 2014. *Benchmarks play an important role in pricing crude oil*. [online] Available at: <https://www.eia.gov/todayinenergy/detail.php?id=18571> [Accessed at: 23 August 2022]

Ghatak, S. and Siddiki, J.U., 2001. The use of the ARDL approach in estimating virtual exchange rates in India. Journal of Applied statistics, 28(5), pp. 573-583.

Gokmenoglu, K.K. and Fazlollahi, N., 2015. The Interactions among Gold, Oil, and Stock Market: Evidence from S&P500. *Procedia Economics and Finance*, [e-journal] 25, pp.478-488. https://doi.org/10.1016/S2212-5671(15)00760-1

Gorton, D., 2022. *How Does Money Supply Affect Inflation?* [online] Available at: <https://www.investopedia.com/ask/answers/042015/how-does-money-supply-affect-inflation.asp> [Accessed at: 3 July 2022]

Granger, C.W., 1988. Causality, cointegration, and control. Journal of Economic Dynamics and Control, 12(2-3), pp. 551-559.

Hauser, C., 2022. Sunflower Oil 'Vanishes' as Ukraine War Grinds On. *The New York Times*, [online] 2 May. Available at: <https://www.nytimes.com/2022/04/30/world/europe/cooking-oil-shortage-ukraine.html> [Accessed 30 August 2022]

Index (MYR). [online] Available at: <https://research.ftserussell.com/Analytics/Factsheets/Home/DownloadSingleIssue?issueName=FBMAPM&IsManual=false> [Accessed 20 September 2022]

Karpoff, J.M., 1987. The Relation Between Price Changes and Trading Volume: A Survey. *Journal of Financial and Quantitative Analysis*, [e-journal] 22(1), pp.109-126. https://www.jstor.org/stable/2330874

Khan, M.K., 2019. Impact of exchange rate on stock returns in Shenzhen stock exchange: Analysis through ARDL approach. *International Journal of economics and management*, [e-journal] 1(2), pp.15-26. https://dergipark.org.tr/en/download/article-file/837692

Khan, S.U. and Rizwan, F., 2008. Trading Volume and Stock Returns: Evidence from Pakistan's Stock Market. *International Review of Business Research Papers*, [e-journal] 4(2), pp.151-162. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=ac5aeeefb21d2efa4011ec73d2664b7240841c9f

Kilian, L. and Park, C., 2009. The impact of oil price shocks on the US stock market. *International Economic Review*, [e-journal] 50(4), pp.1267-1287. https://www.jstor.org/stable/25621509

Kinateder, H., Campbell, R. and Choudhury, T., 2021. Safe haven in GFC versus COVID-19: 100 turbulent days in the financial markets. *Finance Research Letters*, [e-journal] 43, pp.101951. https://doi.org/10.1016/j.frl.2021.101951

Kurt, D., 2022. *Benchmark Oils: Brent Crude, WTI and Dubai*. [online] Available at: <https://www.investopedia.com/articles/investing/102314/understanding-benchmark-oils-brent-blend-wti-and-dubai.asp> [Accessed 3 March 2023]

Luqman, R. and Kouser, R., 2018. Asymmetrical linkages between foreign exchange and stock markets: Empirical evidence through linear and non-linear ARDL. *Journal of Risk and Financial Management,* [e-journal] 11(3), p.51. https://doi.org/10.3390/jrfm11030051

Ma, C.K. and Kao, G.W., 1990. On Exchange Rate Changes and Stock Price Reactions. *Journal of Business Finance & Accounting*, [e-journal] 17(3), pp.441-449. https://doi.org/10.1111/j.1468-5957.1990.tb01196.x

Mahmud, A.H., 2022. Expect 'further pressure' on cooking oil prices in Singapore as Indonesia bans palm oil exports: MTI. *CNA*, [online] 5 May. Available at: <https://www.channelnewsasia.com/singapore/cooking-oil-price-indonesia-palm-oil-export-ban-2666526#:~:text=%22For%20now%2C%20the%20export%20ban,response%20to%20queries%20from%20CNA.> [Accessed 10 June 2022]

Makaringe, S.C. and Khobai, H., 2018. The effect of unemployment on economic growth in South Africa (1994-2016). https://mpra.ub.uni-muenchen.de/85305/1/MPRA_paper_85305.pdf

Malaysian Palm Oil Board, 2022. *Overview of the Malaysian Oil Palm Industry 2021*. [online] Available at: < https://bepi.mpob.gov.my/images/overview/Overview2021.pdf> [Accessed 25 July 2022]

Malaysian Palm Oil Council, n.d. *About Palm Oil*. [online] Available at: <https://mpoc.org.my/about-palm-oil/> [Accessed 27 July 2022]

Mubarok, I.Z., Hartoyo, S. and Maulana, T.N.A., 2019. The Effects of The World CPO Prices, Macroecomony, and Capital Structures on The Profitability of Palm Oil Companies. *Russian Journal of Agricultural and Socio-Economic Sciences*, [e-journal] 85(1), pp.369-374. https://doi.org/10.18551/rjoas.2019-01.45

Narayan, P.K. and Narayan, S., 2007. Modelling oil price volatility. Energy policy, 35(12), pp. 6549-6553.

Nordin, S., Nordin, N. and Ismail, R., 2014. The Impact of Palm Oil Price on the Malaysian Stock Market Performance. *Journal of Economics and Behavioral Studies*, [e-journal] 6(1), pp.1-9. https://ojs.amhinternational.com/index.php/jebs/article/download/464/464

Omran, M. and Pointon, J., 2001. Does the inflation rate affect the performance of the stock market? The case of Egypt. *Emerging Markets Review*, [e-journal] 2(3), pp.263-279. https://doi.org/10.1016/S1566-0141(01)00020-6

Osamwonyi, I.O. and Evbayiro-Osagie, E.I., 2012. The relationship between macroeconomic variables and stock market index in Nigeria. *Journal of Economics*, [e-journal] 3(1), pp.55-63. https://www.researchgate.net/profile/Esther-Evbayiro-Osagie/publication/266461861_The_Relationship_between_Macroeconomic_Variables_and_Stock_Market_Index_in_Nigeria/links/5c5ae173a6fdccb608ab51d8/The-Relationship-between-Macroeconomic-Variables-and-Stock-Market-Index-in-Nigeria.pdf

Özlen, S. and Ergun, U., 2012. Macroeconomic Factors and Stock Returns. *International Journal of Academic Research in Business and Social Sciences*, [e-journal] 2(9), pp.315-343. https://www.researchgate.net/profile/Serife-Oezlen/publication/270904736_Macroeconomic_Factors_and_Stock_Returns_ARDL_Approach/links/54dbc3340cf2a7769d92fbec/Macroeconomic-Factors-and-Stock-Returns-ARDL-Approach.pdf

Pesaran, M.H., Shin, Y. and Smith, R.J., 2001. Bounds testing approaches to the analysis of level relationships. Journal of applied econometrics, 16(3), pp. 289-326.

Praphan, W. and Subhash, C.S., 2002. Stock market and macroeconomic fundamental dynamic interactions: ASEAN-5 countries. *Journal of Asian Economics*, [e-journal] 13(1), pp.27-51. https://doi.org/10.1016/S1049-0078(01)00111-7

Raza, N., Shahzad, S.J.H., Tiwari, A.K. and Shahbaz, M., 2016. Asymmetric impact of gold, oil prices and their volatilities on stock prices of emerging markets. *Resources Policy*, [e-journal] 49, pp.290-301. https://doi.org/10.1016/j.resourpol.2016.06.011

Rylander, Y. and Gardner, T., 2022. *Indonesia makes progress towards zero palm oil deforestation – but gains in forest protection are fragile*. [online] Available at: <https://www.sei.org/featured/zero-palm-oil-deforestation/> [Accessed 27 August 2022]

Sadorsky, P., 1999. Oil price shocks and stock market activity. *Energy Economics*, [e-journal] 21(5), pp.449-469. https://doi.org/10.1016/S0140-9883(99)00020-1

Sellin, P., 2001. Monetary Policy and the Stock Market: Theory and Empirical Evidence. *Journal of Economic Surveys*, [e-journal] 15(4), pp.491-541. https://doi.org/10.1111/1467-6419.00147

Shahid, M., 2014. Effect of Inflation and Unemployment on Economic Growth in Pakistan. *Journal of Economics and Sustainable Development*, [e-journal] 5(15), pp.103-106. https://core.ac.uk/download/pdf/234646504.pdf

Shin, Y., Yu, B. and Greenwood-Nimmo, M., 2014. Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In Festschrift in honor of Peter Schmidt. New York: Springer, pp. 281-314.

Tangjitprom, N., 2012. Macroeconomic Factors of Emerging Stock Market: The Evidence from Thailand. *International Journal of Financial Research*, 3(2), pp.105-114.

Teo, R., 2022. Malaysia to gain from Indonesia’s palm oil export ban. *The Borneo Post*, [online] 25 April. Available at: <https://www.theborneopost.com/2022/04/25/malaysia-to-gain-from-indonesias-palm-oil-export-ban/> [Accessed 17 July 2022]

The Evidence from Thailand. *International Journal of Financial Research*, [e-journal] 3(2), pp.105-114. http://dx.doi.org/10.5430/ijfr.v3n2p105

The Observatory of Economic Complexity, n.d. *Palm Oil in Indonesia*. [online] Available at: <https://oec.world/en/profile/bilateral-product/palm-oil/reporter/idn> [Accessed 26 July 2022]

Westfall, P., 2023. *Money Supply Definition: Types and How It Affects the Economy.* [online] Available at: < https://www.investopedia.com/terms/m/moneysupply.asp> [Accessed at: 15 March 2023]

Wong, W.K., Khan, H. and Du, J., 2006. Do money and interest rates matter for stock prices? An econometric study of Singapore and USA. *The Singapore Economic Review*, [e-journal] 51(01), pp.31-51. https://doi.org/10.1142/S0217590806002214

Appendix A

Acceptance Letter of International Conference Proceedings

LEADING THE WAY | SUSTAINABILITY INSTITUTION OF THE YEAR

KULLIYYAH OF SCIENCE (KOS)

Our Ref: IIUM/307/CTS/2/1/ICMCTS2023
Date: 23/2/23

NAME: DR. BEH WOAN LIN
PAPER ID: 08
TITLE: IMPACT ANALYSIS OF THE MALAYSIA'S ECONOMY ON THE PALM OIL STOCK RETURNS IN MALAYSIA, SINGAPORE AND INDONESIA THROUGH NARDL MODEL

Dear Prof./Assoc. Prof./Dr./Mr./Madam,

NOTIFICATION OF ABSTRACT ACCEPTANCE

We are pleased to inform you that your abstract has been accepted for presentation at the International Conference on Mathematics: Computational and Theoretical Sciences (ICMCTS) 2023 on 8th - 10th August 2023.

Please note that the deadline for full paper submission is on **31st July 2023**. Further details of the conference are available at our website https://conference.iium.edu.my/icmcts/2023/ .

If you have any concerns, please do not hesitate to contact us at icmcts@iium.edu.my.

We look forward to welcoming you to this event. Thank you.

Yours Sincerely,

ASSOC. PROF. DR. PAH CHIN HEE

Chairman
International Conference on Mathematics: Computational and Theoretical Sciences (ICMCTS) 2023

Appendix B

Abstract for Journal of Sustainability Science and Management (JSSM)

Impact Analysis of the Malaysia's Economy on the Palm Oil Stock Returns in Malaysia, Singapore and Indonesia Through NARDL Model

Beh Woan-Lin[1, a)] and Tok Hui-Mei[1, b)]

[1] *Faculty of Science, Universiti Tunku Abdul Rahman, 31900 Kampar, Perak, Malaysia.*

[a)]Corresponding author: behwl@utar.edu.my
[b)]u7671484@gmail.com

Abstract: The palm oil industry has a significant impact on the global economy, and palm oil companies' stock returns are subject to various macroeconomic factors. Therefore, this study examines the impact of Malaysia's economic conditions, such as gold prices, crude oil prices, palm oil prices, and exports, as well as other macroeconomic variables like inflation and exchange rates, on the returns of the palm oil stock index, which includes stocks from Malaysia, Singapore, and Indonesia. This study also seeks to develop a predictive model that can accurately forecast future palm oil stock returns based in the significant macroeconomic factors. Non-Linear Autoregressive Distributed Lag (NARDL) model is proposed to analysis the linkage between the factors mentioned and stock index return. Monthly data collected from January 2012 to April 2022 revealed that the stock index return is indeed influenced by the price of crude oil price, gold price, the inflation rate and exchange rate. As a result, it demonstrates that the palm oil industry is volatile as it may be affected by fluctuations in other industries such as gold and crude oil. In conclusion,