THE IMPACT OF WORLD PALM OIL PRICE CHANGES ON EDIBLE OIL INDUSTRY OF MYANMAR

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This thesis represents the original work of the author, except where otherwise stated. It has not been submitted previously for a degree at any other University.

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DEDICATED TO MY BELOVED PARENTS,

U AUNG MOE AND DAW WAH WAH

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THE IMPACT OF WORLD PALM OIL PRICE CHANGES ON EDIBLE OIL INDUSTRY OF MYANMAR

ABSTRACT

This study was carried out to study the impact of world palm oil price changes on edible oil industry of Myanmar especially on price changes of groundnut oil, sesame oil and palm oil. The specific objectives were to clarify the influence of palm oil inflow and its price changes on domestic groundnut oil, sesame oil and palm oil market prices, to determine the relationship between world palm oil price and domestic palm oil price, to determine the inter-relationships between world palm oil price changes and demand of groundnut oil in Myanmar edible oil market and to know the inter-relationships of world palm oil price changes on the demand of sesame oil in Myanmar edible oil market.

The study used secondary data from various related sources. Monthly data for groundnut oil, sesame oil and palm oil prices in Myanmar, world palm oil prices, amount of palm oil import to Myanmar and total edible oil consumption in Myanmar were collected from different sources from 2000 to 2013. Data were analyzed with Eviews version 7.

The studies revealed that world palm oil price influence the edible oil market in Myanmar significantly. According to the data analysis, the palm oil price is the lowest among others, which has significant effect on edible oil prices especially on groundnut oil price. Groundnut oil price has strong relationship not only with world palm oil price but also local palm oil price because they are close substitute goods to each other. Majority of consumers are low income earners that they cannot resist the low-price-imported-oil although they prefer better quality one. For sesame oil, it has a unique scenario because of the sweet and unique smell and medicinal value and it cannot be substituted with low-price-palm-oil. That is why, the study did not find the point of relationship between the sesame oil price and local palm oil price. The government intervened the edible oil market not to increase price very high for the edible oil. In this scenario, the low-income consumers are winners but the market participants including processors along the supply chain are losers because of market intervention. Therefore, the oil import policy should be considered well for the long term impact on health of palm oil consumers.

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LIST OF ABBREVIATIONS

ARDL	Autoregressive Distributed Lag Models
CIF	Cost, Insurance and Freight
CPO	Crude Palm Oil
CSO	Central Statistical Organization
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agricultural Organization Statistical Database
MEODA	Myanmar Edible Oil Dealer's Association
MIS	Market Information Services
MOC	Ministry of Commerce
MOCDP	Myanmar Oil Crop Development Project
MT	Metric Ton
OLS	Ordinary Least Square
OPEC	Organization of Petroleum Exporting Countries
PPO	Processed Palm Oil
UNCTAD	United Nations Conference on Trade and Development
USDA	United States Department of Agriculture
WB	World Bank Database
YGN	Yangon

CHAPTER I
INTRODUCTION

1.1 Background of the Study

A sharp increased in cheap price of palm oil imported from Malaysia over the past two years caused more Myanmar consumers to switch from relatively costly peanut oil to imported palm oil, hitting a serious blow to domestic peanut oil millers. Imported palm oil, nearly as good as peanut oil, has a clear color and the price is so cheaper. Therefore, more people prefer it. Therefore, edible oil industry of Myanmar depends on the world palm oil price changes, especially on the price changes of the exporter countries of palm oil to Myanmar.

Edible oil in Myanmar is considered as the second most important food item after rice and in accordance with its traditional uses, also plays an important role in Myanmar. Furthermore, edible oil is an important ingredient in any Myanmar traditional cuisine which accounts for 6 percent of average monthly expenditure (CSO 2006). It is used for frying and is often just mixed with other foods, such as rice, to improve taste and palatability. Fried foods are popular and the quality of curries is considered to depend very much on the quantity and quality of oil used. A salad of pickled tea leaves, fried pulses and roasted sesame seeds mixed with oil are also commonly served at the end of a meal. In some rural areas, rice with salt and oil is common as a first meal of the day or taken to the fields for lunch. For domestic consumption, the oil seed crops are generally grown in the different agro-ecological zones in Myanmar are groundnut, sesame, sunflower, niger, mustard, coconut and oil palm. Among these, groundnut is the most important oil seed crop which has been grown both in rainfed and irrigated areas and sesame occupied the largest sown area. Over 79% of the total production comes from Central Myanmar: Sagaing, Magway and Mandalay Region. The country's edible oil production is insufficient for domestic requirements. Magway Region was once an oil pot of Myanmar when the country has a few millions of population. However, as the population increased, palm oil has to be imported in order to meet the demand.

In Myanmar, per capita consumption of edible oil is around 10 kg per year (2004-2013) (Favre & Myint 2009) and total population is about 52 million (2015) that the annual edible oil requirement is about 500,000 MT. Restaurants and industry uses 250,000 MT, thus total utilization is 750,000 MT. However, 60% total production of oil seed crops is used for

edible oil production, which is about 330,000 MT. The country's edible oil production is insufficient for domestic requirements.

Due to the insufficiency of edible oil production in Myanmar, it is annually imported to fulfill the local demand. To bridge the gap between the demand and supply, cheaper palm oil is imported from neighboring countries mainly from Malaysia around 300,000 tonnes (CSO 2002). Favre and Myint (2009) stated that, in order to maintain domestic edible oil prices at a low level, Myanmar opened policy to import large quantities of cheap palm oil and Myanmar imported palm oil accounts for 32 percent of the total consumption in 2009-2010.

The increase in oil production cannot depend only on seasonal oil seed crops cultivation because there is a limited land resource for area extension. Therefore, oil production has to depend on oil palm, perennial oil crop which is being extended in a large scale on lands where annual crops were not grown.

Myanmar produces the palm oil, but the quality is the lowest among others in the world. Myanmar spend more than US$300 million annually for the import of palm oil which amounts to over 300,000 tonnes every year, according to sources from local edible oil industry. It's now more than a decade that Myanmar imports the oil annually. The imports are inevitable due to the country's insufficient supply and outdated technology for edible oil production.

Significant price movements have always been a feature for the leading oils and fats traded on world markets. Monthly average palm oil prices, CIF Rotterdam, reached a high of US$705 per ton in 1998, then falling to a low of US$234 per ton in 2001 before recovering to trade more steadily in a range of US$400 to US$500 per ton for the next four years. In the second half of 2006, prices started to rise steeply and reached levels of US$1,249 per ton in March 2008. Prices remained high until July 2008 when, in line with other commodities and as a result of the developing world financial crisis, prices started to fall materially, reaching a low point of around US$500 per ton at the end of that year. Prices have since recovered progressively, reaching levels above US$1,000 per ton in 2011 and 2012 though weakening to US$810 per ton by the end of 2012. The average CPO price, CIF Rotterdam, for the ten year period 2003 - 2012 has been US$725 per ton (http:// www.worldprices.htm).

The volume of imported palm oil influences the domestic oilseeds crop production and prices of local produce of edible oil. Generally, when palm oil supplied to the local

market is more than quantity demanded or oversupply situation, prices of edible oil decrease sharply. If oilseed farmers have bumper crop on account of favorable weather condition in rainy season especially during the time of higher palm oil import, profit margin return to farmers tends to be low compared to green gram farmers. Green gram in Myanmar is usually grown in rainy season, and unlike oilseed crops, more desirable price and attractive demand of which mostly comes from export. However, oilseed farmers sell their produce with low price to traders and oil millers. Most small farmers sell part of their produce at harvesting time and cannot wait substantial price rise due to financial constraint. However, large farmers store their crop to obtain better price in later season. Hence, large amount of palm oil import during higher domestic supply of oilseed probably has an impact on price of farmers' product and interest to invest for next season.

The country's production level of sesame and groundnut reduced because of unfavorable weather conditions. For the meantime, import volume of palm oil supplied to the market has become low due to several reasons (e.g. lower output from source country, etc.) leading to a steep price increase of edible oil in local market, which suffers to low-income consumers (Thaung 2011). After that, knowing of periodical amount of import, its import prices and domestic supply mechanism have shaped the edible oil and oilseed crops prices changes in domestic markets (MIS 2007-2011).

1.2 Overview of Edible Oil Sector in Myanmar

1.2.1 Edible Oil Market Situation in Myanmar

The edible oil in the world market consists of many closely substitutable commodities, such as soybean, oil palm, rapeseed, sunflower, and cottonseed. They have been rendered practically colorless, odorless and tasteless and therefore easily interchangeable in the kitchen. Myanmar edible oil situation is different, only a small fraction, 8.6 percent, of oil is refined, bleached and deodorized. There are two major produced edible oils, the groundnut oil and the sesame oil, marketed in a large volume. Groundnut oil and sesame oil are marketed as high branded quality oil in major market like Yangon and Mandalay markets and their prices are highest among local edible oil. The most popular edible oil in Myanmar is groundnut oil and it is widely used in lower Myanmar and some part of the upper Myanmar. Most of Myanmar people prefer this oil due to its fragrance and nutritional facts. Largest amount of edible oil produced in Myanmar is sesame oil and consumption remains mainly located in central and upper Myanmar where consumers prefer the aromatic and slightly bitter taste of sesame oil. Niger and mustard can be found on the market in small volumes. Soybean, sunflower and rice bran oils are rarely found as pure oils on the market in Myanmar. Normally, edible oil trade flow starts in the oilseed surplus producing area, which is the Central Dry Zone of Myanmar. As for the imported palm oil, traders redistribute from Yangon market to the other States and Regions.

There are several types of edible oil can be found in the markets according to quality. Groundnut oil mixed with palm oil is marketed as groundnut oil (ordinary) and similarly, sesame oil mixed with palm oil and can be seen in the market as sesame oil (ordinary). It is common practice to adulterate sesame and groundnut oils by mixing palm, sunflower, soybean, niger or rice bran oils with little danger that consumers would notice the difference, even for premium quality. To maintain the ‘nutty’ flavour of mixed oils and increase the dilution rate, artificial flavours are added into the oil mix.

The palm oil is imported to fill the gap between the domestic production and consumption. The imported palm oil entered the domestic markets in two ways, unofficially and officially. Unofficial import is mainly from Thailand, packed in 10 viss metallic containers. Normally, palm oil imported from Malaysia is mainly inflow to Yangon market and distribute to other parts of the countries. Therefore it can be found that Yangon markets is main sources of palm oil inflow, price of palm oil in Yangon markets is cheaper than other

regions. Groundnut and sesame oil entered into Mandalay market from oil mill in the city and surrounding areas, and outflow to the Yangon Region, Shan State (south and north), Bago Region, Kachin State, Mon State and Sagaing Region. Palm oil in the market is come from Yangon and transported to Sagaing and Shan State (south and north). There is small outflow of niger to Kachin State from Mandalay market.

The average price of imported palm oil by the Union of Myanmar Economic Holding is the lowest among the different brands of palm oil. The imported palm oil from Thailand with the brand name of Two Shrimps and Fishermen are the main edible oil commodity in the Mawlamying market (Win Pa Pa Soe 2009). It is distributed to Mandalay market from Mawlamying through Bago Region. The palm oil price is increased slowly month by month because of insufficient importation and increased inflation rate. The price of the palm oil is at its lowest in February and March because of groundnut and sesame harvesting time. Some oil mills in Mandalay produce only pure niger and sunflower oil which are sold in a wholesale market and not in the retail markets. The oil meal price has gradually increased because of high demand in the livestock and fishery sectors, in the snack and food industry and in agriculture sector as natural fertilizer.

Palm oil or palm olein is the main edible oil consumed in Myanmar and accounts for an estimated 53 percent of the total consumption. Usually, edible oil (palm oil) is imported yearly since domestic productions of edible oil are not met domestic demand. Trend of edible oil prices in domestic markets links to import palm oil price, imported amount, exchange rate, level of local oilseed crops production and its export demand, production costs and other several transaction costs. Palm oil is sold either pure or mixed with groundnut and sesame oil. There are three broad categories of palm oils sold in the market:

1. Officially imported palm oil sold in bulk. These account for an estimated 80 percent of the total palm oil sold in the country.
2. Unofficially imported palm oil from Thailand. These are imported in 10 viss cans from Thailand or the People's Republic of China and account for an estimated 20 percent of the total palm oil sold in the country. Along the Thai border the proportion of informally imported palm oil represents up to 80 percent of palm oil consumed while on the western part of Myanmar, this proportion is as low as 10 percent. Imported brands include: One, Two and Three Shrimps brands and Fisherman brand.

3. Locally produced palm oil refined by Yuzana plant in Yangon. These are sold in 10 viss cans. Consumers generally consider that the best quality palm oil is the imported oil from Thailand, followed by Yuzana oil while the lowest is considered to be the officially imported oil. Quality is judged by the amount of white deposit the oil produces during the cold season when temperature drops below cloud point. Most consumers assume that these deposits are cholesterol or animal fat mixed with palm oil.

In Myanmar edible oil markets, most of the oil mills have no packaging and labeling unit which favors the great possibility of mixing with different oils thus, reducing quality and standard of oil. In retail level, most of the oil mills are processed in expeller and sold in loose form for any amount ranging starts from 0.1 viss.

1.2.2 Oil Seed Export and Palm Oil Import in Myanmar

The amount of sesame export was 135,945 tonnes with average export price of US$ 1734 per tonne in 2012-13. The export amount of shelled groundnut was 62,377 tonnes with average export price of US$ 1502 per tonne and unshelled groundnut was 866 tonnes with average export price of US$ 725 per tonne. The amount of Niger was 19 tonnes with average export price of US$1473 per tonne. Therefore, total amount of oil seed export was 199,207 tonnes with total export price of US$ 330.054 million in 2012-13.

The amount of palm oil import was 393,500 Tonnes with total import price of US$ 375.15 million in 2012 (Commerce Journal 2013). The amount of oil seed export and palm oil import in Myanmar was shown in Table 1.

Table 1 Oilseed export and palm oil import in Myanmar

	Amount (Tonnes)	Average export price (US$ /Tonne)	Value (US$ million)
Oilseeds crop			
(2012-13 Export)*			
Sesame	135,945	1,734	235.734
Shelled groundnut	62,377	1,502	93.664
Unshelled groundnut	866	725	0.628
Niger	19	1,473	0.028
Total	199,207	1,658	330.054
Palm oil import (2012)*	393,500		375.15

Source: *Commerce Journal, 2013

1.2.3 Edible Oil Policy

The self-sufficiency policy for edible oil has been existed in Myanmar since the 1980s, in which government critically focused to supply domestic edible oil requirement from national production and export of oilseed crops were allowed only when domestic demand was met. The Myanmar Oil Crop Development Project (MOCDP) funded by Organization of Petroleum Exporting Countries (OPEC) aims at supporting the government to achieve its self-sufficiency objective. The outright prohibition or limitation of exports of a number of agricultural commodities is justified on the basis that there is insufficient production of these crops to meet domestic needs. It must be observed that Myanmar's policy to achieve self-sufficiency in edible oil is of doubtful practical effect, in the sense that no Asian country enjoys edible oil self-sufficiency besides the two main palm oil producing nations: Malaysia and Indonesia.

Because edible oil plays a central role in the daily diet of Myanmar people, the government committed the great intention to supply the essential food for the people directly from domestic production instead of generating foreign exchange from home production through other means and securing requirement of edible oil through import. Both of these two policies were self-defeating. The policy depressed farmer's prices and interest to boost the production of output. Myanmar Edible Oil Dealer Association (MEDA) retained 65 percent of any palm oil imported in the country and paid the importers at 'cost recovery' price. Sixty five percent of palm oil retained by MEDA is distributed to the association members who are instructed to sell palm oil to consumers at fixed price. The importers can dispose of the remaining 35 percent of palm oil not retained by MEDA and sell it to wholesalers at open market prices. As with most direct price control mechanisms, enforcement remains loose and as a result, the prices negotiated on the open market for the 35 percent share, set market price for all palm oils. As importers can only make profit on the 35 percent of the volume imported, they have to compensate for losses or absence of profit incurred on the 65 percent, through higher price negotiation on the open market. Therefore the 65/35 price control mechanism pushes the open market price up (Favre and Myint, 2009). Apparently, price control policy by retaining 50:50 (1992), 65:35 (2007) and 60:40 (2011) of total palm oil import further worsened domestic edible oil price stability.

Even though no compulsory purchasing policy exists for oilseed crops, state controls are still in position. The export and import of oilseed crop, oil meals and edible oils are entirely banned and under controls. The export control results have been limited the prices on

the domestic market, since only illegal exports markets can be contacted. It can only benefit the urban consumers in the short-run, but it has negative impact for both producers and consumers in the long-term. With depress returns on domestic markets; producers tend to reduce input usage and cropping intensity, resulting to stagnant yields and low adoption of new technologies. Consequently, the longer term trend will be towards declining supplies and increased prices even while the exports are prohibited. The export markets for oilseeds have been banned and increased import volumes of cheap palm oil have forced the domestic edible oil prices downward.

The edible oil price control policy is of strategic importance, as social stability is believed to depend on prices of rice and edible oil. There are essentially two major government policy objectives for the oil crops subsector and they are to

1. Achieve self-sufficiency in edible oil and
2. Maintain edible oil price control to avoid fluctuations.

Through the implementation of these policies, Myanmar has adopted restrictive measures on edible oil imports and exports of oilseeds and oilseed products. However, the relatively open policies to the imports of large quantities of cheap palm oil is an attempt to maintain edible oil prices at a low level on the domestic retail market. As a result, market prices of oil crops and their products in Myanmar are heavily distorted and resulted in stagnant production. Myanmar is increasingly dependent on palm oil imports, while domestic production is stagnating.

1.3 Problem Statement

According to sources from the Myanmar Edible Oil Dealer's Association (MEODA) and Phyu Thit Thwin 2013, Myanmar is experiencing a deficit of edible oil and needs to import 30 percent of the consumption each year in order to meet domestic demand. Due to imported edible oil being much cheaper than the domestic equivalent, consumers tend to use it more and if the imported oil market continues to boom, then local producers would find it difficult to compete, since the potential of local mills struggling to survive.

Part of the reason for the high price of peanut oil is the rising price of peanuts on the domestic market, driven by strong demand for Burmese peanuts in China. Therefore, palm oil is imported continuously to keep domestic edible oil price lower and to supply ever growing demand of domestic consumption. Eventually, domestic edible oil prices seem to be significantly influenced and determined by level of palm oil import and its prices because import is only source of major supply to local edible oil markets requirement. With the value of Malaysia's palm-oil exports to Myanmar reaching a record USD 682 million in 2012, the best hope for the domestic cooking-oil industry is more foreign investment to improve its access to more advanced technology.

The world palm oil price changes will affect on edible oil industry of Myanmar as Myanmar is increasingly dependent on palm oil imports and the country's edible oil production is insufficient for domestic requirements. The current status of inflow of palm oil within Myanmar's oilseed crops sector has several negative impacts for oilseed farmers, consumers and national economy. These impacts make the productivity growth slow down; market prices unstable; rural household incomes lower and concern for health and nutritional aspects lack. The most important thing is to adjust seasonal palm oil import appropriately and to avoid negative impact on domestic oil productivity. Therefore, it is necessary to observe the impacts between world palm oil prices changes and Myanmar edible oil industry.

1.4 Objectives of the Study

The overall objective is to study the impact of world palm oil price changes on edible oil industry of Myanmar.

The specific objectives are:

1. To clarify the influence of palm oil inflow and its price changes on domestic prices of groundnut oil, sesame oil and palm oil
2. To determine the relationship between world palm oil price and domestic palm oil price
3. To determine the inter-relationships between world palm oil price changes and demand of groundnut oil in Myanmar edible oil market
4. To know the inter-relationships of world palm oil price changes on the demand of sesame oil in Myanmar edible oil market

CHAPTER II
LITERATURE REVIEW

Most macroeconomic variables have a univariate time series structure argued by Nelson and Plosser (1982). Much more work has been done following Nelson and Plosser's (1982) expository research. Analysts are apparently uncertain on the issue of the unit root test because of the difficulty in ascertaining the data generating process of most economics series. Varied opinions exist in the literature as to the most appropriate technique of determining the statistical or stochastic mechanism of a data series to avoid spurious analysis. An economic time series is either stationary or non-stationary. A stationary stochastic series has a constant mean, variance and covariance. It is time invariant, mean reverting, and fluctuations around its mean have constant amplitude. Non-stationary stochastic series have varying mean, or time varying variance. A non-stationary process exhibits random walk and has unit roots. Unit root test has since 1980's attracted interest in econometrics and statistical literature.

A long-standing hypothesis is that agricultural product prices are declining relative to manufactured good prices. Analyses of the relationship of commodity to manufactured good (or wholesale) prices have used annual observations for long time periods (Cuddington and Urzua 1989). Different tests and test specifications have been used and a variety of conclusions reached. Cuddington and Urzua, using a ratio of price indexes for the years 1900-1983, cannot reject the null that the ratio series has a unit root.

With the development of the literature on co-integration, and unit root tests, applications to commodity prices became quite common. The early work led to the view that commodity price series exhibit non-stationarity, e.g, Ardeni's (1989) paper, does the law of one price really hold for commodity prices? He tested for unit roots in the import and export prices of wheat, wood, beef, sugar, tea, tin and zinc for four countries (Australia, Canada, UK, and USA) using an augmented Dickey-Fuller (ADF) test with quarterly observations from the mid-1960s through the mid-1980s. The null hypothesis, that a unit root exists, could not be rejected with the exception of UK tin prices. In this context, using a co-integration approach consistent with the presumed non-stationarity of the variables, Ardeni concluded that the "law of one price" failed.

The empirical evidence for and against unit roots in commodity prices is based on a variety of sample periods, frequencies of observations, test specifications, and data transformations, and as the literature has grown, the results seem to have become more

diverse. In a study of the effect of money supply on prices in New Zealand, Robertson and Orden (1990) found that money supply (M1), manufacturing prices (IP), and agricultural prices (FP) contained unit roots. They use quarterly observations from January 1964 through January 1987 and the data are transformed to logarithms. The ADF tests are based on equations with a constant and linear trend term- the ADF linear trend specification. The unit-root hypothesis cannot be rejected at the 0.10 level for any of the series.

Further, X_t causes Y_t directly if the predictability of Y_t is improved by considering the current value of X_t in addition to all past Y_t and X_t. Granger causality may be unidirectional or bi-directional. If X_t Granger cause Y_t and Y_t Granger also cause X_t, then bi-directional Granger causality (a simultaneous feedback relationship) is said to exist. If the causality relation only runs in one direction, unidirectional Granger causality holds; and if the null hypothesis of no Granger causality cannot be rejected in both directions, the markets are said to be independent or segmented. Several causality test methods have been formulated (e.g, Holmes and Hutton 1990).

Analyses of economic time series have been based on the null hypothesis of unit,root or absence of co-integration (i.e. r = 1, where r is the correlation coefficient of the cointegrating variables). The null hypothesis of unit root in the residual is tested against the alternative that the root is less than one, I(0). Under this dispensation, if the null of unit root I(1) is rejected then the alternative of co-integration I(0) is accepted. In some cases, the commonly expressed view is that the null hypothesis of stationary should be used. Serletis (1992) tested for unit roots in the univariate time-series representation of the daily crude oil, heating oil, and unleaded gasoline spot-month future prices. The results showed that the random walk hypothesis for daily energy future prices can be rejected if allowance is made for the possibility of a one-time break in the intercept and the slope of the trend function at an unknown point in time. Serletis (1994) reported that the maximum likelihood cointegration analysis of daily spot-month crude oil, heating oil and unleaded gasoline future prices covering the period December 1984 to April 1993 led to the conclusion that all three spot-month future prices are driven by only one common trend, suggesting that it is appropriate to model energy future prices as a cointegrated system.

Babula, Ruppel, and Bessler (1995) analyzed the effect of the exchange rate on U.S. corn exports. The variables used in the analysis were monthly observations, from February 1978 to December 1989, for the real U.S. exchange rate, the real price of corn, U.S. corn

export sales, and U.S. corn shipments. All data were transformed to logarithms, and ADF tests were conducted for these series (in levels of the logarithms). The authors concluded that the exchange rate and the price series were integrated of order one. The authors mention that a structural change may have occurred in the price and exchange rate series in February 1985, but this change does not appear to have been modeled in the tests for unit roots. The sub-periods are used to analyze out-of-sample forecast performance.

Owen *et al.* (1997) examine five major international traded oils: coconut, palm, palm kernel, soybean and sunflower to investigate the price interrelationships in the vegetable and tropical oils market whether they are cointegrated or not. Using monthly data from 1971 through 1993, a vector autoregressive approach to test for cointegration and augmented Dickey-Fuller and Phillips-Perron to test for unit root. The results showed that the relationships were not found to be strong enough to label them as cointegrated series.

Mohammad Haji Alias and Jamal Othman (1997) used bivariate cointegration technique to determine the long-run relationship of palm oil price and the soybean oil price. Using quarterly data from 1980 through 1995 and Dickey-Fuller and augmented Dickey-Fuller to test for stationarity. The results showed that the time series on palm oil and soybean oil prices are cointegrated and each time series is non-stationary.

Labys and colleagues explored the question, can commodity prices be characterized by fractal behavior (Barkoulas *et al*. 1997; Cromwell *et al.* 2000). Barkoulas *et al.* analyzed price series for 21 internationally traded commodities for the months from January 1960 to July 1993. Several unit root tests were implemented for the log level of each price series, and then a fractional integration test was applied to the differences of the logarithms of the series. In 16 of 21 cases, the hypothesis of a unit root could not be rejected, and they found evidence that favored fractal integration for six price series.

Shift of commodity price might also give positive impact on house- hold welfare in case of net producer country. A study by Minot and Goletti (1998) on the effect of liberalization and changes of rice price in Vietnam mentions that it gives positive impact on average real income and lowering poverty rate. The position of Vietnam as net producer gives benefit to this country by increasing welfare of net producer households when the international rice price soars. A similar issue also appears in case of the raise of international palm oil price for Indonesian palm oil production. As net producer, Indonesia gets benefit when world palm oil price increase. However, persistent increase of world price may reduce

domestic supply because producers prefer to export than to sell in domestic market. In case of Vietnam (Minot and Goletti 1998) increasing international price led to export high and further reduced domestic supply. Thus the government of Vietnam imposed rice export quota to keep the price in domestic market and protect net consumer household.

The use of first differences to eliminate a linear trend will result in a residual that may be stationary but which is not white noise with a first lag negative autocorrelation. It is argued in the literature that over differencing is a less serious problem than under differencing. Under or over differencing may not have serious consequences if serial correlation in the error term is taken care of. Maddala and Kim (1998) recommended estimating the equations in both levels and in first difference and choosing the one that require the smaller amount of correction to remove autocorrelation of residuals.

Chaudhry and Christie-David (1998) investigates the long-run stochastic properties of informationally linked futures contracts in diverge groups such as soft commodities, grain and oil seeds, livestock, precious metals, energy, foreign currencies, and interest-rate instruments. Using the Phillips- Perron test for unit root and Johansen's test for cointegration to analyse the monthly data covers the period July 1986 through March 1995. The results showed that most futures in the sample exhibit the presence of non-stationary. The test for cointegration within groups provides strong evidence for soft commodities, precious metals, energy, and short-term interest rates. Weaker evidence for grains and oil seeds and livestock while foreign currency and long-term interest rate futures show evidence of segmentation.

Alias, Jani and Abduliah (1999) also formulated the impact of trade liberalization policy on CPO imports of Malaysia. To examine the Malaysian palm oil sector, nine behavioural and two identities simultaneous equations model was specified in their study. Nine behavioural equations comprised oil palm area equations, CPO production, domestic consumption and exports of CPO, domestic and world price of CPO, and processed palm oil (PPO) exports. On one hand, one identity defined for total production of CPO and the other one defined for capacity utilization of refining capacity (CU). A sustained 500,000 tons increase in CPO import was played as a key policy variable on the endogenous variables of the palm oil sector. The simulation results mentioned that the increase in CPO import leads to a 6.7 % increase in CU and about 1.7 % decrease in the CPO price. The domestic consumption was expected to rise by 0.5 % that was expected to benefit the consumers.

Serletis and Herbert (1999) investigated the dynamics of North American natural gas, fuel oil and power prices in the area of eastern Pennsylvania, New Jersey, Maryland and Delaware, using daily data (October, 1996 - November, 1997) on the Henry Hub and Transco Zone natural gas prices, the PJM (Pennsylvania, New-Jersey and Maryland) power market for electricity price and the fuel oil price for New York Harbor. Correlation between prices in log levels was first investigated and the stationary properties of the prices were analysed using the ADF test. The Engle-Granger Bivariate cointegration test for the pairs of integrated series reported that each pair cointegrates, leading to the conclusion that the same underlying stochastic component affects the three markets.

The marketing system serves at both the micro and macro levels as mechanism to transmit to market participants' information that is useful in decision making in a market driven economy, transparent, accurate and timely price signals play a significant role in the conduct and performance of an efficient marketing system. In a competitive economy, the pricing mechanism is expected to transmit orders and directions to determine the flow of market activities. Pricing signals guide and regulate production, consumption and marketing decisions over time, form and place (Kohls and Uhi 2002). Identifying the causes of differences in prices in interregional or spatial markets has therefore become an important economic analytical tool to understand markets better.

Many techniques have been used to examine the dynamics of the price transmission process (Balcombe and Morrison (2002) and Rapsomanikis *et al.* (2003)). The cointegration technique has been widely used as the standard test for market integration. Co-integration between the price series suggests that two prices may behave in a different way in the short run, but that they will converge toward a common behaviour in the long run (Barrett and Li, 2002). Prices may drift apart in the short run due to policy changes or seasonal factors, but if they continue to be too far apart, economic forces, such as market mechanisms may bring them together, in the long run.

Yu *et al.* (2006) analyzed the co-integration and causality of higher crude oil prices on the price and demand for vegetable oils. They concluded that the influence of shocks in crude oil prices on the variation in vegetable oil prices is relatively small, which appears to reflect the results in Campiche (2007).

Several techniques were used in the economic literature to study the link between palm oil price and commodity prices so far. According to Wahid, Simeh, & Nordin (2007) who

have investigated the development in the world prices for palm oil, their findings considered that the impact of the trends on world palm oil price was derived from consumption, trade, price competitiveness, investment in oil palm/palm oil, and the use of palm oil producing biodiesel. In relevance to this work, the high rise in the trend of the oil palm price had a great implication for the agricultural and industrial sector in producing countries (Pleanjai, Gheewala, & Garivait 2007).

There have been many debates in analyzing the impacts of trade liberalization in developing countries, especially in their oilseeds sector since they are the major producers and consumers of oilseeds and edible oils. Recently, to understand broadly the impacts of trade liberalization of edible oil imports on economy wide households and business firms, Shivakumar, Kombairaju and Chandrasekaran (2007) formulated the trade policy analysis of edible oil imports of India under computable general equilibrium framework. Percent increases and decreases in import tariff on edible oils, which are permissible under world trade organization regime, were simulated to reflect the policy impact. Simulation results on value of output, factors of production, household consumption, exports and imports were reported in their study. Results showed that increasing import tariff led to the increase output of groundnut and oilseed sector and adverse affect came out otherwise. Edible oil sector, however, was benefited while reduction of import tariff. Similarly, increasing import tariff led to more labour and capital utilization in oilseed sectors meanwhile reducing import tariff favoured the domestic edible oil processing and vanaspati industries. Household consumption was increased when tariff was decreased and vice versa. At the same time, volume of edible oil import reduced in increased import tariff and vice versa.

Either positive or negative impact brought by changes on international price, precise policy from government is needed to protect domestic market as well as to promote export sector. The shift of world system into more open economy, tend to expose domestic market on volatility of international price. Not only give effect on the level of household welfare, the volatility of international prices also give effect on inflation in local market. Borio and Filardo (2007) revealed that global factors are getting more relevant to explain domestic inflation. Globalization has pushed world economic activity to integrate and influence each other. Low demand in one country will be offset by high demand of other country, on the other hand limited supply will be filled up by supply from an-other country (Borio and Filardo 2007). The advancement of technology, communication, and transportation has induced globalization process. The higher the level of economic integration might result for

lower inflation. Globalization has altered the trigger of the inflation process away from country specific towards global factors.

Based on the analysis of relationship with Abdullah, Abas, & Ayatollah (2007), his group reveals that soybean oil and palm oils are two good examples of agricultural commodities that have similar characteristics. They are also substitutable in many applications, and have prices of soybean and palm oil that are highly correlated.

Theodore and Emilie (2007) examined the relationship between UK wholesale gas prices and the Brent oil price over the period 1996–2003 in order to investigate whether oil and gas prices 'decoupled' during this period as orthodox gas market liberalization theory had suggested. Tests for unit roots and cointegration were carried out and it was discovered that a long-run equilibrium relationship between UK gas and oil prices exists. It was found that the cointegrating relationship is present throughout the sample period. However, the long-run solutions seem to be more volatile. Evidence was provided that the short-run relationship is linear and impulse response functions are used to examine the effects that a shock in oil would have on gas. These findings do not support the assumption that gas prices and oil prices 'decouple'.

Hameed and Arshad (2008) investigated the long-term relationship between the prices of crude oil and each of palm, soybean, sunflower and rapeseed oil prices. To achieve their goal they adopted a simple model to express the relationship between petroleum and each of the major vegetable oil prices to test the hypothesis of whether or not changes in petroleum prices play an important role in changing them. They applied the Engle-Granger two-stage estimation procedure using monthly data over the period of January 1983 through March 2008. The main focus was to confirm the hypothesis that a relationship between crude oil and vegetable oil existed. The results indicated that there is strong evidence of a long-run equilibrium relationship between the two product prices.

The relations between international CPO prices and domestic palm oil prices: a causality approach was done by Antik Suprihanti (2008). The objective of this research is to analyze the trend of the Crude Palm Oil (CPO) prices in international Market at Rotterdam-Holland for the next two years and to analyze the relations between international CPO prices and domestic palm oil prices in Indonesia. The researcher uses linier trend method to analyze the trend and Granger causality approach. The results of the research show that the trend of international CPO prices tends to increase in 2008 and 2009. The causality analysis shows

that international CPO prices cause domestic palm oil prices in Indonesia, but it is not vice-versa. The result also shows that there is a positive relation between these prices. The increasing international CPO prices cause the rising of domestic palm oil prices.

The relatively simple generalized theoretical model widely has been applied to most of the agricultural commodities (such as palm oil, soybean oil, rubber and cocoa). In Malaysia, it also been applied to analyze and model the palm oil, rubber and cocoa market. In terms of palm oil, the structure is refined to ease the penetration in the international market. Amzul Rifin (2009) studied price linkage between international price of CPO and cooking oil price in Indonesia. The objective of this research was to investigate the impacts of international price of CPO on the domestic price of CPO and cooking oil. The result indicated that international price of CPO, domestic price of CPO and cooking oil price are not cointegrated. In addition, using the Granger causality method, it shows that international price of CPO influence the domestic price of CPO and cooking oil price. Meanwhile, domestic price of CPO and cooking oil price affects each other.

The methodological and analytical problems associated with correlation coefficient as a test of market integration analysis gave rise to the popularity of regression based causality test methods. The series X_t is said to cause Y_t if it is possible to obtain better predictions of Y_t when using all available information than if only the information apart from X_t had been used (Granger 1969-1988).

In terms of the relationship between crude oil and palm oil prices, Hameed & Arshad (2009) studied the relationship between the prices of crude oil and selected vegetable oils using the Granger causality test. According to this study, the results show that in the long-run there was a one direction relationship between crude oil price and the prices of each of four vegetable oils, i.e., palm, rapeseed, soybean, and sunflower oils, but the reverse was not true.

In the food category Abdel and Arshad (2009), based on Johansen cointegration and Granger Causality test, identify a cointegration relationship between crude oil and all the four vegetable oils studied. Using the same technique Zhang *et al.* (2010) look at the price relationship of three different fuels with five standard food commodities. They do not find a cointegrating relationship between energy and food commodities. However, based on Johansen cointegration and Granger causality tests, they also find that edible oil markets are well interlinked in the contemporaneous time.

It’s important to be aware on the fact that the price of oil palm surges over time due to the uncertain price of oil palm. Therefore, the work reminds us that there are risks and unreliability for tree-crop farmers, shareholder, traders, and producers. In order to configure the trends as a way for decreasing risk and uncertainties, there should be some effective risk management strategies implemented to ensure a sound policy to take for action (Karia & Bujang 2011).

There are some studies that indicate an existing relationship between soybean oil and palm oil prices. We refer to Arshad, Shamsudin, & Hameed (2011) who described the soybean oil as a competitor to palm oil. Arhsad and his colleagues used the ‘two stage least squares method’ to estimate soybean and palm oil prices. With regards to the application employed, their work found that soybean prices would have a positive relationship with world palm oil price.

Atanu Ghoshray (2011) studied underlying trends and international price transmission of agricultural commodities. This paper examined the extent to which increases in international food prices during the past few years have been transmitted to domestic prices in selected Asian developing countries. In analyzing the historical data, evidence on price transmission for important food commodities such as rice, wheat, and edible oil have been considered. The price transmission elasticity has been estimated using regression models coupled with recent econometric techniques such as unit root tests and error correction models with threshold adjustment. Finally, the paper draws some policy implications from the empirical results. This study provides the numerical estimates on the empirical relationship between international prices and domestic prices. The analysis uses commodity-specific monthly data rather than annual data during a period of substantial policy reforms in order to understand both long-run and short-run relationships between world and domestic prices.

Moreover, our work points to Hadi, Yahya, Shaari, & Huridi (2011) studying the effect of changes in crude palm oil prices on the price of crude oil. Upon applying the Engle-Granger Cointegration test and Error Correction Model to find a significant long-term result, their work found that the prices of crude palm oil and crude oil are also positively correlated. However, we wish to mention that previous works assume that the data is normally distributed. Therefore, all of the aforementioned studies have suffered from this weakness of normality assumption since the prices of palm oil, soybean oil, and crude oil are assumed to

have a non-normal distribution. In this paper we find that the extreme information flows from soybean oil and crude oil prices to palm oil prices.

Esmaeili and Shkoohi (2011) construct a principal component of prices of different food commodities. They study the Granger causality between the food price component and the oil price, among others, and they do not find a direct relationship between the oil price and the food price component. Other authors use the ARDL approach to study cointegration relations between commodities. For example, Sari *et al.* (2011) investigate the energy-grain nexus (crude oil, gasoline, ethanol, corn, soybeans and sugar) focusing particularly on future prices. They identify dependencies that only partially comply with the general view that causal relationships within the energy-grain nexus flow from the oil price to the price of gasoline, ethanol and corn.

Kantaporn, A.W, Songsak and Chukiat (2012) studied factors affecting palm oil prices based on extremes value Approach. This study examined the dependence structure of extreme realization of growth rate between palm oil prices and factors affecting, which are soybean oil and crude oil prices. This employed the Bivariate Extreme Value methods for daily palm oil, soybean oil and crude oil prices ranging from July 1988 to January 2012. The results provided that the growth rate of palm oil and soybean oil prices has some dependence in extremes, but the growth rate of palm oil and crude oil prices has fairly weak dependence or even independence in extremes. Therefore, the authors of this study hoped that these findings not only have made a contribution to our understanding of what drives palm oil price movement of soybean oil and change in crude oil prices, but also for the practitioner who want to devise an updated model to enhance a further comprehension of the prices that drive these article of trade.

Miko Harjanti (2012) also studied the impact of palm oil price swings on household welfare: the case of Indonesia. Palm oil has an important role for the Indonesian economy through providing export revenue. On the other hand, there is strong demand on palm oil commodity from domestic market. Increment of international and domestic palm oil price possibly might bring consequences on the affordability of the product in domestic market. Therefore this research is designed to examine the consequences of international palm oil price fluctuation on domestic palm oil price and assessed price impact on welfare of Indonesian households across the income distribution. This research tries to seek the answer of how is the relationship between domestic prices, international prices, inflation, and export.

And further how price fluctuation influence household welfare. The research found that domestic price is co-integrated with international price and export volume in long run. Moreover in short run changes of prices in both markets influence producers' decision to export or to supply for domestic market. Within one month lag, increase of international price will be followed by increase export volume, while increase of domestic price tends to lower export volume. The budget analysis revealed that increase of palm oil price will hurt the poor more than the rich. Thus this research suggests that government intervention can be useful to protect the poor. This research also argues that government support for development of processing and distribution chain may improve supply of frying oil product.

Rahman (2012) also studied the cointegration analysis on the spot prices of the Malaysia Crude Palm oil futures market. The analysis of this study has mainly focused on the empirical test of the effect of production, stock and export variables on the prices of the Malaysian Crude Palm oil futures market. For the empirical work, correlation analysis, multiple regression and recent econometric analysis were conducted to determine the price relationships of the Malaysian Crude Palm oil futures markets with the production, stock and export variables. Order of integration for all the variables was checked using Augmented Dickey-Fuller and Phillips-Perron tests of unit root. The Johansen approach was used to test cointegration in multivariate system that involved long run and short run estimations. The Vector Error Correction Model was used to test for causal relationships. The empirical evidence obtained from the study shows there exist a significant long run and short run relationships between the cash and future prices of the Malaysian Crude Palm oil futures market with the production, stock and export variables. The results of the causality test also shows that there is a strong relationship between the Malaysian Crude Palm oil futures market with the production, stock and export variables This mean that any information flow regarding the price movement of the Malaysian Crude Palm oil futures market will affect the production, stock and export variables and vice-versa.

Khin *et al.* (2012) also studied the impact of the changes of the world crude oil prices on the natural rubber industry in Malaysia. This paper investigates the impact of world crude oil price on the supply, demand, stock, synthetic rubber and natural rubber (NR) prices (represented by SMR20) of the Malaysian NR industry using econometric system of equations. The study utilizes monthly data from January 1990 - December 2010. A preliminary data analysis focused on univariate properties of the data series for unit root. The Granger causality test is conducted to examine the direction and relationship between the

variables. The time series model is estimated using Vector Error Correction Method (VECM) with co-integration method for residual error correction of the system of equations. The results indicated that crude oil price and the supply, demand, stock, synthetic and natural rubber (SMR20) prices are significantly co-integrated, which means that the long-term equilibrium between the variables are met.

Aye Min Tun (2013) also studied on Myanmar edible oil market: inflow of palm oil from international market and domestic edible oil market volatility. Results showed that official import doesn't reflect domestic demand and prices variation occurred in local oil as well as oilseed crops markets owning to unpredictable amount of import. Since official palm oil import and national production of edible oil doesn't actually meet regional demand, illegal palm oil market was set especially from Thailand from which additional amount of palm oil for domestic need is supplied. Hence, whenever changes appeared in price and amount of import from Thailand also striking domestic market prices. According to annual data analysis between arrival of palm oil, its price and domestic palm oil price, it is found that change in amount of import and prices from foreign source have close link to local palm oil price movement. Higher import and lower import prices of palm oil can be lessen local edible oil prices while lower import and higher palm oil price escalated domestic oilseed prices.

Rahman (2013) studied the empirical analysis on prices of the Malaysian crude palm oil futures market. Futures markets play an important role in the price discovery and forward pricing of agricultural commodities. The analysis of this study has mainly focused on the empirical test of the effect of production, stock and export variables on the prices of the Malaysian Crude Palm oil futures market. For the empirical work, correlation analysis, multiple regression and recent econometric analysis were conducted to determine the price relationships of the Malaysian Crude Palm oil futures markets with the production, stock and export variables. Order of integration for all the variables was checked using Augmented Dickey-Fuller and Phillips-Perron tests of unit root. The Johansen approach was used to test cointegration in multivariate system that involved long run and short run estimations. The empirical evidence obtained from the study shows there exist a significant long run and short run relationships between the cash and future prices of the Malaysian Crude Palm oil futures market with the production, stock and export variables. The results of the causality test also shows that there is a strong relationship between the Malaysian Crude Palm oil futures market with the production, stock and export variables. This mean that any information flow

regarding the price movement of the Malaysian Crude Palm oil futures market will affect the production, stock and export variables and vice-versa.

CHAPTER III
RESEARCH METHDOLOGY

3.1 Data Collection and Source

This study attempted to investigate the impact of world palm oil prices on Myanmar edible oil industry; to determine whether world palm oil prices have a significant effect on the supply, demand and price changes of groundnut oil, sesame oil and palm oil in Myanmar and to know the influence of palm oil inflow and its price changes on domestic groundnut oil, sesame oil and palm oil market prices. The study used secondary data which were collected from different sources from 2000 to 2013. The relevant secondary information was taken from published and official records of Government, Market Information Services (MIS), Central Statistical Organization (CSO) and online database websites from Food and Agricultural Organization , (FAOSTAT), World Bank Database, United Nations Conference on Trade and Development (UNCTAD), United States Department of Agriculture (USDA) and other relevant database from the web. The Unit root, Cointegration test and Granger causality test were conducted to examine the direction and relationship between the variables. The data were then tested by using autoregressive distributed lag models (ARDL) to determine the relationship among the variables of equations. The regression models were analyzed by Eviews version 7. Quantitative approach was also used to clarify the influence of palm oil inflow and its prices changes on domestic groundnut oil and sesame oil market prices.

3.2 Model Specification

A model of the domestic palm oil price equation as a function of related factors as follows;

$$PDPO_t = f(PDPO_{t-1}, WPPO_t, PWPO_{t-1}) \quad (1)$$

where:

$PDPO_t$ = Domestic palm oil price in month t

$PDPO_{t-1}$ = Domestic palm oil price in month t-1

$WPPO_t$ = World palm oil price in month t

$WPPO_{t-1}$ = World palm oil price in month t-1

A short-term model of the groundnut oil price equations as a function of related factors as follow;

$$RPGO_t = f(RPGO_{t-1}, RPPO_{t-1}, WPPO_{t-1}, TCGO_{t-1}, IPO_{t-1}, T, e_t) \quad (2)$$

where:

$RPGO_t$ = Real price of groundnut oil in Myanmar in month t (USD/MT)

$RPGO_{t-1}$ = Real price of groundnut oil in Myanmar in month t-1 (USD/MT)

$RPPO_{t-1}$ = Real price of palm oil in Myanmar in month t-1 (USD/MT)

$WPPO_{t-1}$ = World palm oil price in month t-1 (USD/MT)

$TCGO_{t-1}$ = Total consumption of groundnut oil in Myanmar in month t-1(MT)

IPO_{t-1} = Amount of palm oil import in month t-1 (MT)

T = Time trend

e_t = error terms

A short-term model of the total consumption of groundnut oil equation as a function of related factors as follow:

$$TCGO_t = f\ (TCGO_{t-1}, RPGO_{t-1}, RPPO_{t-1}, WPPO_{t-1}, IPO_{t-1}, T, e_t\ ) \quad (3)$$

where:

$TCGO_t$ = Total consumption of groundnut oil in Myanmar in month t (MT)

$TCGO_{t-1}$ = Total consumption of groundnut oil in Myanmar in month t-1 (MT)

$RPGO_{t-1}$ = Real price of groundnut oil in Myanmar in month t-1 (USD/MT)

$RPPO_{t-1}$ = Real price of palm oil in Myanmar in month t-1 (USD/MT)

$WPPO_{t-1}$ = World palm oil price in month t-1 (USD/MT)

IPO_{t-1} = Amount of palm oil import in month t-1 (MT)

T = Time trend

e_t = error terms

A short-term model of the sesame oil price equation as a function of related factors as follow:

$$RPSO_t = f\ (RPSO_{t-1}, RPPO_{t-1}, WPPO_{t-1}, TCSO_{t-1}, IPO_{t-1}, T, e_t\ ) \quad (4)$$

where:

$RPSO_t$ = Real price of sesame oil in Myanmar in month t (USD/MT)

$RPSO_{t-1}$ = Real price of sesame oil in Myanmar in month t-1 (USD/MT)

$RPPO_{t-1}$ = Real price of palm oil in Myanmar in month t-1 (USD/MT)

$WPPO_{t-1}$ = World palm oil price in month t-1 (USD/MT)

$TCSO_{t-1}$ = Total consumption of sesame oil in Myanmar in month t-1 (MT)

IPO_{t-1} = Amount of palm oil import in month t-1 (MT)

T = Time trend

e_t = error terms

A short-term model of the total consumption of sesame oil equation as a function of related factors as follow:

$$TCSO_t = f(TCSO_{t-1}, RPSO_{t-1}, RPPO_{t-1}, WPPO_{t-1}, IPO_{t-1}, T, e_t) \quad (5)$$

where:

$TCSO_t$ = Total consumption of sesame oil in Myanmar in month t (MT)

$TCSO_{t-1}$ = Total consumption of sesame oil in Myanmar in month t-1 (MT)

$RPSO_{t-1}$ = Real price of sesame oil in Myanmar in month t-1 (USD/MT)

$RPPO_{t-1}$ = Real price of palm oil in Myanmar in month t-1 (USD/MT)

$WPPO_{t-1}$ = World palm oil price in month t-1 (USD/MT)

IPO_{t-1} = Amount of palm oil import in month t-1 (MT)

T = Time trend

e_t = error terms

3.3 Method of Analysis

3.3.1 Unit Root Test

To identify whether variables were stationary or not, the unit root test was used. Unit root tests can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary. A series is said to be weakly stationary if the mean and autocovariances of the series do not depend on time; any series of which mean and variance change over time is known as non-stationary. In order to avoid the spurious regression problem, checking the stationary for the time series data is very important. The non-stationary variables are differenced to become stationary although the stationary variables are already qualified to enter the regression analysis. In a stationary series, mean, variance and covariance of the series are constant over time.

In principle it is important to test the order of the integration of each variable in a model, to establish whether it is non-stationary and how many times the variable needs to be differenced to result in a stationary series. Furthermore, testing for stationarity for a single variable is very similar to testing whether a linear combination of variables co-integrates to form a stationary equilibrium relationship. A time series is stationary if it does not change overtime, which implies that its values have constant variability. Therefore, unit root tests were accounted for possible correlation of unit roots in the first differences in the time series. With evidence of unit roots, the series are said to be intergraded of order one I(1), meaning that they must be modeled in first differences ($\Delta y_t = y_t - y_{t-1}$) to make them stationary.

There are several ways of testing for the presence of a unit root. The emphasis here was on using the Augmented Dickey Fuller approach (ADF) to test the null hypothesis that a series does contain a unit-root (non-stationary) against the alternative of stationarity. The Augmented Dickey-Fuller test for the intercept and trend is applied to check the unit roots of the data series in this study. Noted that the ADF is the wider version of the standard dickey-fuller test used to overcome the problem of autocorrelation in the standard DF test; the DF test can be augmented by adding various lagged dependent variables.

3.3.2 Cointegration Test

Cointegration is a statistical tool for describing the co-movement of economic data measured over time, that is, cointegration attempts to measure common trends in series over the long run. Co-integration analysis is an alternative procedure for evaluating spatial market linkage by taking the presence of stochastic trends in the price series into account. It was developed and applied in earlier work by Engle and Granger (1987) and also Engle and Yoo (1987). Cointegration analysis ensures that deviations from equilibrium conditions between two economic variables which are individually stationary in the short-run should be stationary in the long-run. Two (or more) non-stationary time series are said to be cointegrated if a linear combination of the terms results in a stationary time series.

The concept of co-integration implies that economic forces should prohibit persistent long-run deviations from equilibrium, even though short-run deviations may be observed. Cointegration refers to a linear combination of non-stationary variables; also, when testing for cointegration, all variables must be integrated of the same order; and, if a series has "n" components there may be as many as "n–1" linearly independent cointegrating vectors.

There are two co-integration methods: Engle-Granger two-step procedures and Johansen's co-integration method. Engle-Granger method is generally used in the bi-variate situation. This method cannot identify the number of co-integration vectors. For the case of more than two variables, Engel and Granger approach also cannot estimate the parameters efficiently. Johansen's co-integration method is one-step procedure to test co-integration instead of two steps in former method. Moreover, Johansen's approach can be tested not only the estimation of co-integration vectors, but also the estimation of the short run dynamics of the system.

3.3.2 (a) Engle and Granger Two-step Estimation Procedure

Engle and Granger (1987) suggested the two-step estimation procedures. The first procedure, co-integration regression, is firstly estimated by simple ordinary least squares (OLS), obtaining the residual of the co-integrating relationship and applying a residual-based unit root for co-integration. For the second procedure, it is the estimation of the error correction model (ECM). This procedure is based on the representation theorem of Engle and Granger (1987) which states that, if a set of variables are co-integrated of the order (1,1), then there exists a valid error correction representation of the data.

3.3.2 (b) Johansen Co-integration Procedure

The Johansen procedure is the most commonly used system estimation method. The Johansen method is based on canonical correlation analysis. The procedure utilizes two tests, the trace test and the maximum eigenvalue test. The trace test is used to test the hypothesis of r = 0 against the alternative of r =1 co-integrating vector. The maximum eigenvalue test is used to test the hypothesis of r = 0 against the alternative of r = 1 co-integrating vector. The asymptotic distribution of the test is given by the maximum eigenvalue of the stochastic matrix, while that of the trace test is given by the trace of the stochastic matrix. The principal components corresponding to the smaller eigenvalues give the co-integrating vectors and those corresponding to the larger eigenvalue give the common stochastic trend.

The Johansen procedure was used to test for cointegration in this study.

3.3.3 Granger Causality Test

The Granger test (1969) is to see how much of the current *y* can be explained by a past value of *x* and then to see whether adding lagged value can improve the explanation. *y* is said to be Granger-caused by *x* if *x* helps in the prediction of *y*, or equivalently if the coefficients on the lagged *x*'s are statistically significant. Note that two-way causation is frequently the case; *x* Granger causes *y* and *y* Granger causes x.

The concept of Granger causality is based on the idea that a cause cannot come after its effect. More precisely, variable X is said to Granger-cause another variable, Y, if the current value of Y (Y_t) is conditional on the past values of X (X_{t-1}, X_{t-2}, ... , X_{t-n}) and thus the history of X is likely to help predict Y. Cointegration implies Granger causality in at least one direction. The concept of causality is here interpreted in the limited meaning of contribution to predictability. The direction of causality in edible oil prices was examined using the Granger causality test in Eviews@7.

In this study, there were twenty pair-wise Granger Causality tests for variables of real price of groundnut oil, real price of palm oil, world palm oil price, total consumption of groundnut oil and amount of palm oil import. They were the Granger causality between amount of palm oil import and real price of groundnut oil, real price of palm oil and real price of groundnut oil, total consumption of groundnut oil and real price of groundnut oil, world palm oil price and real price of groundnut oil, real price of palm oil and amount of palm oil import, total consumption of groundnut oil and amount of palm oil import, world palm oil price and amount of palm oil import, total consumption of groundnut oil and real price of

palm oil, world palm oil price and real price of palm oil, world palm oil price and total consumption of groundnut oil. There were also fourteen pair-wise Granger Causality tests for variables of sesame oil prices system. They were the Granger causality between real price of sesame oil and amount of palm oil import, total consumption of sesame oil and amount of palm oil import, real price of sesame oil and real price of palm oil, total consumption of sesame oil and real price of palm oil, real price of sesame oil and world palm oil price, total consumption of sesame oil and world palm oil price, total consumption of sesame oil and real price of sesame oil.

3.3.4 Autoregressive Distributed Lag Model

The autoregressive distributed lag model (ADL) is the major workhorse in dynamic single-equation regressions. In statistics and econometrics, a distributed lag model is a model for time series data in which a regression equation is used to predict current values of a dependent variable based on both the current values of an explanatory variable and the lagged (past period) values of this explanatory variable. Autoregressive distributed lag models, ARDL are constructed to test the short and long run relationship among the variables. It also has a "distributed lag" component, in the form of successive lags of the explanatory variable. The autoregressive component of the autoregressive moving average model involves using one or more lagged values of Y as determinants of the current value Y_t. In this study, a distributed-lag context by adding Y-t and possibly additional lags to the right-hand side. The simplest model is the Koyck lag, which has one lag of y on the right-hand side with only the current value of X. The Koyck lag model can be used with more than one regressor in the equation, such as two regressors, X and Z. For example; $Y_t=\alpha+\beta_1 Y_{t-1}+\theta_0 X_t+\gamma_0 Z_1+u_t$.

Autoregressive distributed lag model for groundnut oil price is as follows:

$$RPGO_t = \beta_0 + \beta_1 RPGO_{t-1} + \beta_2 RPPO_t + \beta_3 WPPO_t + \beta_4 TCGO_t + \beta_5 IPO_t + u_t \quad (6)$$

where:

$RPGO_t$ = Real price of groundnut oil in Myanmar in month t (USD/MT)

$RPGO_{t-1}$ = Real price of groundnut oil in Myanmar in month t-1 (USD/MT)

$RPPO_t$ = Real price of palm oil in Myanmar in month t (USD/MT)

$WPPO_t$ = World palm oil price in month t (USD/MT)

$TCGO_t$ = Total consumption of groundnut oil in month t (MT)

IPO_t = Amount of palm oil import in month t (MT)

β = the intercept term

u_t = disturbance term

Autoregressive distributed lag model for sesame oil price is as follows.

$$RPSO_t = \beta_0 + \beta_1 RPSO_{t-1} + \beta_2 RPPO_t + \beta_3 WPPO_t + \beta_4 TCSO_t + \beta_5 IPO_t + u_t \quad (7)$$

where:

$RPSO_t$ = Real price of sesame oil in Myanmar in month t (USD/MT)

$RPSO_{t-1}$ = Real price of sesame oil in Myanmar in month t-1 (USD/MT)

$RPPO_t$ = Real price of palm oil in Myanmar in month t (USD/MT)

$WPPO_t$ = World palm oil price in month t (USD/MT)

$TCSO_t$ = Total consumption of sesame oil in month t (MT)

IPO_t = Amount of palm oil import in month t (MT)

β = the intercept term

u_t = disturbance term

CHAPTER IV
RESULTS AND DISCUSSION

4.1 The Influence of Palm Oil Inflow and its Price Changes on Domestic Prices of Groundnut Oil, Sesame Oil and Palm Oil

This study estimated whether domestic groundnut oil, sesame oil and palm oil market prices reflect to palm oil import as well as world palm oil price changes. Since palm oil was demanded along with higher consumption, it played larger role in domestic edible oil markets. In 1980s, Ministry of Trade (now it is Ministry of Commerce) imported larger amount of palm oil to prevent higher domestic edible oil price and distributed to individual households through regional cooperatives. Ministry of Commerce (MOC) as well as domestic investors imported palm oil in 1990s. Amount of palm oil imports were steadily higher and begun to have some impact on domestically produced traditional oil prices. In order to clarify consequences, the link between palm oil import and world palm oil prices to domestic groundnut oil, sesame oil and palm oil prices were identified. Prices of domestic groundnut oil, sesame oil and palm oil respond to periodically arrival of import palm oil and world palm oil price changes were revealed in Table 2.

The data for the amount of palm oil import were based on the legal import which was obtained from the online data source. The study was not able to include the amount of illegal palm oil import. In the year 2001 and 2009, domestic groundnut oil, sesame oil and palm oil prices decreased with decreasing amount of palm oil import in spite of decreasing of world palm oil price. This may be impact of illegal palm oil import. In Myanmar, the edible oil requirement is kept increasing as the population is growing. Therefore, Myanmar seems not to follow the demand theory for palm oil import. Hence, despite the fact of world palm oil price increase, Myanmar import more amount of palm oil to meet the demand of edible oil in the country. So, the impact of world palm oil price to amount of legal palm oil import was not able to be detected. However, the impact of world palm oil price changes on domestically produced edible oil prices was clearly observed in the study. Myanmar palm oil import policy is to maintain domestic edible oil prices at a low level. It can be seen that this objective has been achieved after 2011. Myanmar edible oil policy has been relaxed more during the time of democratic government. The government encouraged more on legal import of palm oil that the official import data reflects the achievement of nation edible oil price stability policy. As the policy becomes more transparent and more flexible, the legal trade of palm oil is

encouraged and decrease in domestic palm oil prices were observed from the year 2011-2013.

In Figure 1, domestic groundnut oil prices, domestic sesame oil prices and domestic palm oil prices movements were relatively similar with world palm oil prices movement. In the year 2001, world palm oil price decreased and domestic groundnut oil, sesame oil and palm oil prices also decreased. In the year 2002, domestic palm oil price in Yangon was the lowest in 14 years and the price of palm oil in Yangon market were lower than the world palm oil price although the amount of palm oil import was decreased (MIS 2002). It may be impact of illegal import of palm oil through border trade.

In the year 2003-2005, world palm oil prices and domestic groundnut oil price, sesame oil price and palm oil price had the steady trend. In the year 2006, although world palm oil price increased, domestic groundnut oil, sesame oil and palm oil prices decreased. In the year 2007, domestic groundnut oil, sesame oil and palm oil prices started increased. In the year 2008, world palm oil price sharply increased and domestic groundnut oil price, sesame oil price and palm oil price also increased. In the year 2009, prices of domestic oils decreased with decreased price of world palm oil price. Domestic groundnut oil, sesame oil and palm oil prices increased the maximum in the year 2011 following the rise of world palm oil price. After the year 2011, world palm oil price and domestic groundnut oil, sesame oil and palm oil prices had decreased.

Whatever lower or higher palm oil price has certain impact on branded oil in the markets because palm oil is the one mostly used to mix with branded oil. Generally, domestic groundnut oil and sesame oil prices have interrelationship with amount of palm oil import. On the demand side, Myanmar consumers are more responsive to changes in oil prices than that of changes in oilseed prices. For example, consumers choose cheap palm oil by substituting domestic oil due to the high price of groundnut and sesame oil. In order to raise the competitiveness of groundnut oil and sesame oil, wholesalers, retailers and traders are selling domestic oil mixed with palm oil in the market.

Thaung (2011), pointed out that with regard to imported palm oil, supply volume influences the domestic oilseeds crop production and prices of local produce of edible oil. Generally, when palm oil supplied to the local market is more than quantity demanded or oversupply situation, prices of edible oil decrease sharply which depressed the oilseeds crops prices. Supply shortage of imported palm oil during lower domestic oilseed output push the local edible oil price steep higher. However, the main factor that determines domestic

groundnut oil and sesame oil prices is price of imported palm oil (world palm oil price) that can be seen in the Figure 1. Since palm oil played major role in domestic edible oil market, the domestic prices undoubtedly tend to fluctuate when volume of import and import prices change. The factors above clarify that although there are several reasons which determined prices of local edible oil, prices of imported palm oil have significant impact on domestic edible oil prices fluctuation. In addition, it is said that periodical amount of import, its import prices and domestic supply mechanism had shaped the edible oil and oilseed crops prices changes in domestic markets (MIS 2007-2011).

Table 2 Palm oil import, world palm oil prices and domestic groundnut oil, sesame oil and palm oil prices changes

Year	Amount of Palm Oil Import (,000 MT)[1]	World Palm Oil Prices (US$/MT)[2]	Domestic Prices (US$/MT) (Yangon)[3]		
			Groundnut Oil	Sesame Oil	Palm Oil
2000	220	310	763	680	584
2001	188	286	647	645	336
2002	192	390	930	850	323
2003	224	443	902	804	793
2004	278	471	913	831	782
2005	304	422	884	829	755
2006	330	478	822	729	647
2007	360	780	1337	1107	1020
2008	367	949	1811	1791	1454
2009	345	683	1218	1167	1033
2010	390	901	1655	1630	1267
2011	470	1125	2054	2231	1567
2012	583	999	1671	2051	1229
2013	600	857	1326	1907	982

Source: 1 = United States Department of Agriculture (USDA),

2 = World Bank Database (WB),

3 = Market Information Services (MIS)

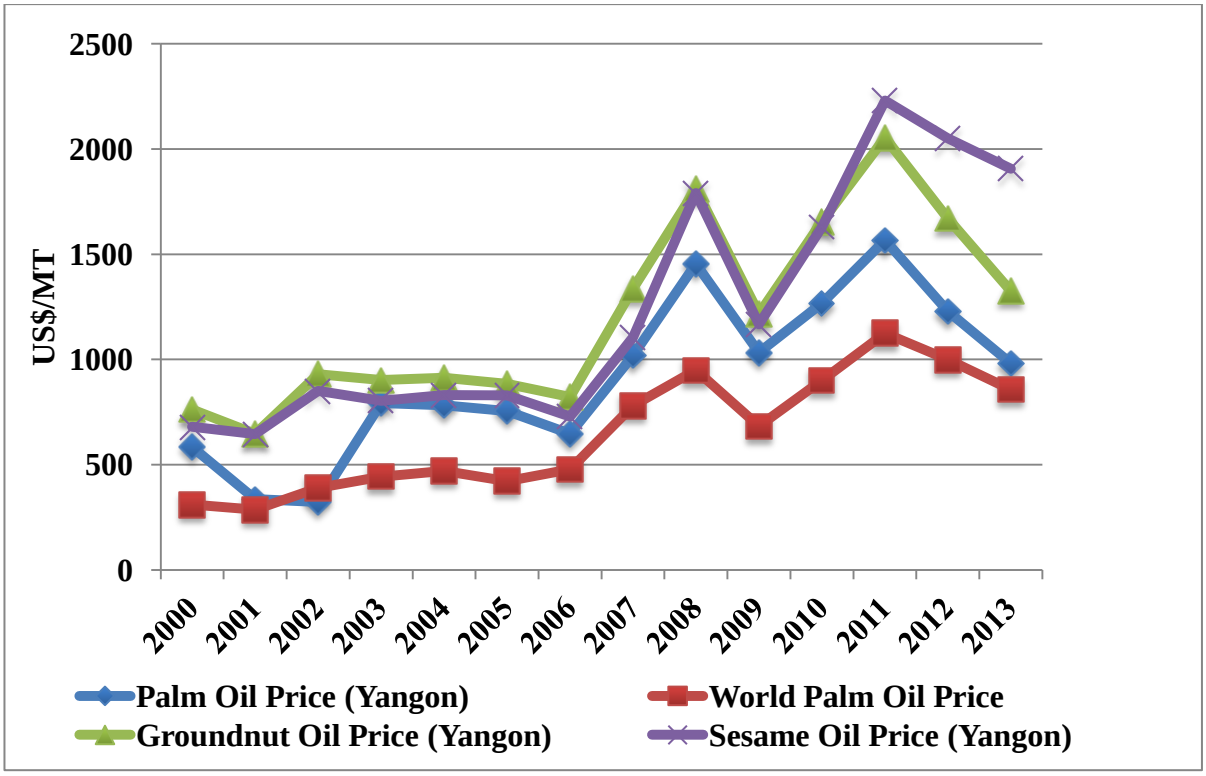

Figure 1 **Annual domestic groundnut oil price (Yangon), sesame oil price (Yangon), palm oil price (Yangon) and world palm oil price movements (2000-2013)**

4.2 The Relationship between World Palm Oil Price and Domestic Palm Oil Price

The relationship between world palm oil price and domestic palm oil price is shown in Table 3. The dependent variable was domestic palm oil price in the current month and independent variables were domestic palm oil price in the previous month, world palm oil price in the current month and world palm oil price in the last month. From this result, domestic palm oil price in the previous month and world palm oil price in the current month had positive relationship with domestic palm oil price in the current month at one percent significant level. Therefore, if 1 percent increased in domestic palm oil price in the previous month and world palm oil price in the current month, domestic palm oil price in the current month will increase 0.857 and 0.411 percent respectively and other variables remain constant. However, world palm oil price in the last month had negative relationship with domestic palm oil price in the current month at 5 percent significant level. Therefore, if 1 percent increased in world palm oil price in the last month, domestic palm oil price in the current month will decrease 0.217 percent and other variables remain constant. The adjusted R squared points out that the model is significant and it can explain on this variation by 88 percent.

This result show that domestic palm oil price in the current month will increase with increasing domestic palm oil price in the previous month and increasing world palm oil price in the current month. If world palm oil price in the last month increased, domestic palm oil price in the current period will decrease.

Table 3 The relationship between world palm oil price and domestic palm oil price

Independent Variables	Coefficient	Probability
Constant	-5.642^{ns}	0.636
Domestic palm oil price in month t-1	0.857***	0.000
World palm oil price in month t	0.411***	0.000
World palm oil price in month t-1	-0.217**	0.044
R-squared	0.895	
Adjusted R-squared	0.884	
Durbin-Watson	1.475	

Note: Dependent Variable: Domestic palm oil price in month t

*** = significant at 1% level, ** = significant at 5% level,

* = significant at 10% level and ns = not significant

4.3 The Inter-relationships between World Palm Oil Prices Changes on Demand of Groundnut Oil

4.3.1 Unit Root Test

In economic research, test for stationary condition for time series is vital. Different tests have been developed by researchers to test for unit root. Two popular tests for time series data are the Dickey-Fuller (DF) test and Phillips-Perron (PP) test. Null hypothesis of both PP and DF test is that unit root exists in time series with the alternative being no unit root. The main difference between these two tests is how they treat serial correlation in the test regressions.

In this study, Augmented Dickey-Fuller unit root test was used. The null hypothesis of the test was that the variable contains a unit root, and the alternative was that the variable was generated by a stationary process. If unit root was found on levels then test was applied on first difference and second difference until evidence of unit root vanishes.

The vector of variables used in estimation of equation included real price of groundnut oil in Myanmar (RPGO), real price of palm oil (RPPO), world palm oil price (WPPO), total consumption of groundnut oil (TCGO) and amount of palm oil import (IPO). All preliminarily considered variables were checked for their stationarity. Augmented Dickey-Fuller's (ADF) tests for the intercept and trend were conducted to check if the null hypothesis of respective variables had a unit root.

Monthly price covered from January 2000 to December 2013 with a total of 168 observations was used in this study. Groundnut oil prices and palm oil prices were collected from market information service (MIS). Consumption of groundnut oil data was collected from United States Department of Agriculture (USDA). Import amount of palm oil and world palm oil prices were obtained from World Bank data base (WB).

The results of unit roots tests are reported in Table 4. At the level form, the null hypothesis of unit root is not rejected for all variables indicating that all time series are non stationary. The first difference of the variables was examined and the hypothesis of unit root is rejected. All the variables are significantly stationary at the first difference form at the 1% level of significant using Augmented Dickey Fuller (ADF). Thus, all variables were integrated of order one I (1).

The ADF statistic value of level form for (RPGO) was -2.44. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14 that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.36 that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 1). The ADF statistic value of first difference level for (RPGO) was -8.62. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was smaller than the critical values so that we reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 2).

The ADF statistic value of level form for (RPPO) was -2.36. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14 that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.4, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 3). The ADF statistic value of first difference level for (RPPO) was -9.25 and the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14 that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 4).

The ADF statistic value of level form for (WPPO) was -3.22. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.08 that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 5). The ADF statistic value of first difference level for (WPPO) was -8.21. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 6).

The ADF statistic value of level form for (TCGO) was -2.63. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The probability

value of the ADF test statistic value was 0.27, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 7). The ADF statistic value of first difference level for (TCGO) was -13.41. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 8).

The ADF statistic value of level form for (IPO) was -2.27. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.45, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 9). The ADF statistic value of first difference level for (IPO) was -8.62. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -13.30. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 10).

Table 4 Results of unit root tests (Augmented Dickey-Fuller test) for 2000-2013 (monthly data)

Variables	ADF Test (level form)		ADF Test (first difference)		Order of integration
	t-statistics	Probability	t-statistics	Probability	
RPGO	-2.443	0.356	-8.625	0.000	I(1)
RPPO	-2.361	0.399	-9.254	0.000	I(1)
WPPO	-3.219	0.084	-8.207	0.000	I(1)
TCGO	-2.631	0.267	-13.409	0.000	I(1)
IPO	-2.274	0.445	-13.302	0.000	I(1)

Note: 1. ADF Test = Augmented Dickey-Fuller Test

2. Augmented Dickey-Fuller (ADF) test the hypothesis of H_0: $\beta = 0$ vs H_1: $\beta < 0$

3. ADF Analysis was carried out in EVIEWS@7

4. RPGO = Real Price of Groundnut Oil

RPPO = Real Price of Palm Oil

WPPO = Total Consumption of Groundnut Oil

TCGO = Total Consumption of Groundnut Oil

IPO = Amount of Palm Oil Import

Data source: Market Information Services (MIS), Central Statistical Organization (CSO), Food and Agricultural Organization (FAO), World Bank Database (WB), United Nations Conference on Trade and Development (UNCTAD), United States Department of Agriculture (USDA) and other relevant database from the web

4.3.2 Cointegration Test

In this study, the next step involves checking for cointegration among the price series. The co-integration relation among variables was checked using the cointegration technique. The cointegrating variables are real price of groundnut oil, real price of palm oil, world palm oil price, total consumption of groundnut oil and amount of palm oil import for monthly data of 2000-2013. Johansen's multivariate procedure was used whether data series have co-integration or not. Using Akaike Information Criterion (AIC), a lag length of 1 was chosen and used in the cointegration test estimated with a linear deterministic trend. Cointegration required the variables to be integrated of the same order.

The results of the cointegration tests summarized in the following Table 5 and indicated that there was evidence of cointegrating relationships among the variables at the 95 percent significant level. The economic interpretation of co-integration was that if two (or more) series were linked to form an equilibrium relationship spanning the long-run, then even though the series themselves may contain stochastic trends (i.e, be non-stationary) they will nevertheless move closely together over time and the difference between them will be stable.

The result of the cointegration condition (that is the existence of a long term linear relation) was presented in Table 5 using methodology proposed by Johansen and Juselius (1990). The values of computed (λ trace) and (λ max) statistics were found to be greater than the critical values. If the value of (λ trace) and (λ max) excess the critical value, we can reject the null hypothesis and accept the alternative hypothesis of more co-integration vectors. In the cointegration tables, both trace statistic and maximum eigenvalue statistic indicated cointegration at the 5 percent level of significance, suggesting that there was cointegration (or long run) relationship among the variables.

Table 5 **Unrestricted cointegration rank test for real price of groundnut oil, real price of palm oil, world palm oil price, total consumption of groundnut oil and amount of palm oil import for 2000-2013 (monthly data)**

Hypothesized No. of CE(s)	Eigenvalue	Statistical Value	0.05 Critical Value	Prob.[b]
		Trace Test		
None [a]	0.373	248.219	79.341	0.000
At most 1 [a]	0.315	172.672	55.246	0.000
At most 2 [a]	0.288	111.313	35.011	0.000
At most 3 [a]	0.205	56.182	18.398	0.000
At most 4 [a]	0.110	18.926	3.841	0.000
		Maximum Eigenvalue Test		
None [a]	0.373	75.547	37.164	0.000
At most 1 [a]	0.315	61.359	30.815	0.000
At most 2 [a]	0.288	55.131	24.252	0.000
At most 3 [a]	0.205	37.256	17.148	0.000
At most 4 [a]	0.110	18.926	3.841	0.000

Note: a = denotes rejection of the hypothesis at the 0.05 level
b = MacKinnon-Haug-Michelis (1999) p-values

4.3.3 Granger Causality Test

If the series are stationary, it is useful to run the Granger Causality test for their short run relationship. The concept of Granger causality is based on the idea that a cause cannot come after its effect. It is said that A is a causal factor for event B, if event A is happened before B and thus the history of A is likely to help predict B. In econometric analysis, it is usually defined to the variables as dependent (Y) and explanatory variables (X_i). If OLS suggests the significance for probability, we could say that X has explanatory power to Y.

In time series analysis, the long-term relationship between variables of interest can be tested. Cointegration implies Granger causality in at least one direction. The concept of causality is here interpreted in the limited meaning of contribution to predictability. The direction of causality was examined using the Granger causality test in EVIEWS. The Granger causality test can be conducted not only for level stationary but also for differenced stationary series. If the Granger causality test holds, it suggests X Granger causes Y. It can be interpreted that the past values of X have explanatory power for Y, or X might be causing Y.

There are twenty pair-wise Granger Causality tests in this study. They were the Granger causality between amount of palm oil import and real price of groundnut oil, real price of palm oil and real price of groundnut oil, total consumption of groundnut oil and real price of groundnut oil, world palm oil price and real price of groundnut oil, real price of palm oil and amount of palm oil import, total consumption of groundnut oil and amount of palm oil import, world palm oil price and amount of palm oil import, total consumption of groundnut oil and real price of palm oil, world palm oil price and real price of palm oil, world palm oil price and total consumption of groundnut oil.

The hypotheses are such as amount of palm oil import does not Granger cause real price of groundnut oil, real price of groundnut oil does not Granger cause import of palm oil, real price of palm oil does not Granger cause real price of groundnut oil, real price of groundnut oil does not Granger cause real price of palm oil, total consumption of groundnut oil does not Granger cause real price of groundnut oil, real price of groundnut oil does not Granger cause total consumption of groundnut oil, world palm oil price does not Granger cause real price of groundnut oil, real price of groundnut oil does not Granger cause world palm oil price, real price of palm oil does not Granger cause amount of palm oil import, amount of palm oil import does not Granger cause real price of palm oil, total consumption of groundnut oil does not Granger cause amount of palm oil import, amount of palm oil import

does not Granger cause total consumption of groundnut oil, world palm oil price does not Granger cause amount of palm oil import, amount of palm oil import does not Granger cause world palm oil price, total consumption of groundnut oil does not Granger cause real price of palm oil, real price of palm oil does not Granger cause total consumption of groundnut oil, world palm oil price does not Granger cause real price of palm oil, real price of palm oil does not Granger cause world palm oil price, world palm oil price does not Granger cause total consumption of groundnut oil and total consumption of groundnut oil does not Granger cause world palm oil price

The results of the granger causality tests were presented in Table 6. The null hypothesis that X does not Granger cause Y was rejected based on the value of F statistics. The null hypothesis that real price of palm oil does not Granger cause real price of groundnut oil is rejected at 5 percent level. This means that real price of palm oil might be a causal factor for the real price of groundnut oil. The F statistic reject the null hypothesis of real price of groundnut oil does not Granger cause real price of palm oil at 1 percent significant level. This means that real price of groundnut oil might be a causal factor for the real price of palm oil. And then, the null hypothesis of world palm oil price does not Granger cause real price of groundnut oil is rejected at 1 percent significant level. This means that world palm oil price might be a causal factor for real price of groundnut oil. Moreover, the null hypothesis of world palm oil price does not Granger cause amount of palm oil import is rejected at 5 percent significant level. Therefore, world palm oil price might be a causal factor for the amount of palm oil import.

The analysis of Granger causality between the variables verified the hypothesis. The analysis indicated simultaneous dependencies between world palm oil price, amount of palm oil import, real price of palm oil and real price of groundnut oil. The null hypothesis of real price of palm oil does not Granger cause real price of groundnut oil, real price of groundnut oil does not Granger cause real price of palm oil, world palm oil price does not Granger cause real price of groundnut oil, world palm oil price does not Granger cause amount of palm oil import and world palm oil price does not Granger cause real price of palm oil are rejected. The rest of the pairs do not Granger cause each other. Therefore, the results indicated that world palm oil price might be a causal factor for the amount of palm oil import to Myanmar, real price of palm oil in Myanmar and real price of groundnut oil in Myanmar. Moreover, real price of palm oil in Myanmar and real price of groundnut oil in Myanmar have mutual causality for the price changes.

From these results, causal relationship among the variables from the result of granger causality test was shown in Figure 2. In this, world palm oil price has unidirectional movement with amount of palm oil import to Myanmar, real price of palm oil in Myanmar (YGN) and real price of groundnut oil in Myanmar (YGN). Therefore, world palm oil price might be a causal factor for the changes of amount of palm oil import to Myanmar, real price of palm oil in Myanmar and real price of groundnut oil in Myanmar. Furthermore, real price of palm oil in Myanmar and real price of groundnut oil in Myanmar have bi-directional movement with each other. Therefore, real price of palm oil in Myanmar and real price of groundnut oil in Myanmar have mutual relationship to change prices. Groundnut oil price has strong relationship not only with world palm oil price but also local palm oil price because they are close substitute goods to each other. Majority of consumers are such low income earners that they cannot resist the low-price-imported-oil although they prefer better quality one.

Table 6 Results of granger causality tests

Null Hypothesis	F-statistic	Probability
1. Amount of palm oil import does not Granger cause real price of groundnut oil	0.227	0.797^{ns}
2. Real price of groundnut oil does not Granger cause import of palm oil	0.319	0.727^{ns}
3. Real price of palm oil does not Granger cause real price of groundnut oil	4.231	0.016**
4. Real price of groundnut oil does not Granger cause real price of palm oil	4.880	0.009***
5. Total consumption of groundnut oil does not Granger cause real price of groundnut oil	0.110	0.896^{ns}
6. Real price of groundnut oil does not Granger cause total consumption of groundnut oil	0.380	0.684^{ns}
7. World palm oil price does not Granger cause real price of groundnut oil	9.682	0.000***
8. Real price of groundnut oil does not Granger cause world palm oil price	1.042	0.355^{ns}
9. Real price of palm oil does not Granger cause amount of palm oil import	2.010	0.137^{ns}
10. Amount of palm oil import does not Granger cause real price of palm oil	0.013	0.987^{ns}
11. Total consumption of groundnut oil does not Granger cause amount of palm oil import	0.121	0.886^{ns}
12. Amount of palm oil import does not Granger cause total consumption of groundnut oil	0.034	0.967^{ns}
13. World palm oil price does not Granger cause amount of palm oil import	3.621	0.029**
14. Amount of palm oil import does not Granger cause world palm oil price	0.629	0.535^{ns}
15. Total consumption of groundnut oil does not Granger cause real price of palm oil	0.048	0.953^{ns}
16. Real price of palm oil does not Granger cause total consumption of groundnut oil	0.021	0.979^{ns}
17. World palm oil price does not Granger cause real price of palm oil	9.865	9.E-05***
18. Real price of palm oil does not Granger cause world palm oil price	0.888	0.414^{ns}
19. World palm oil price does not Granger cause total consumption of groundnut oil	1.532	0.219^{ns}
20. Total consumption of groundnut oil does not Granger cause world palm oil price	0.233	0.792^{ns}

Note: Numbers are F-Statistics, *** = significant at 1% level,

** = significant at 5% level, * = significant at 10% level and ns = not significant

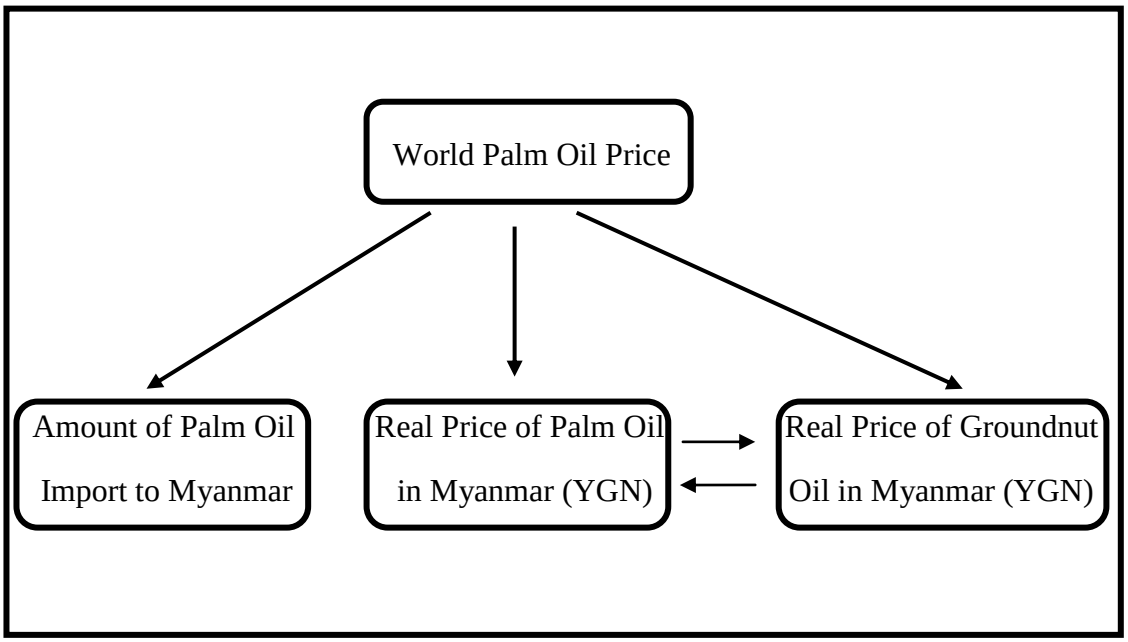

Figure 2 Causal relationships among variables, result of granger causality test

4.3.4 Short-term Groundnut Oil Price (GORP) Model and Total Consumption of Groundnut Oil (TCGO) Model

In this study, results of system of equations of short-term groundnut oil price model and total consumption of groundnut oil model were shown in the following Table 7 and 8.

Firstly, the dependent variable was real price of groundnut oil in the current month ($RPGO_t$). The independent variables were real price of groundnut oil in the previous month ($RPGO_{t-1}$), real price of palm oil in the last month ($RPPO_{t-1}$), world palm oil price in the previous month ($WPPO_{t-1}$), total consumption of groundnut oil in the last month ($TCGO_{t-1}$) and amount of palm oil import in the previous month (IPO_{t-1}). According to the regression estimates, the significant factors were real price of groundnut oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month, total consumption of groundnut oil in the last month and amount of palm oil import in the previous month. Real price of groundnut oil in the previous month, real price of palm oil in the previous month, world palm oil price in the previous month and total consumption of groundnut oil in the last month had positive relationship with real price of groundnut oil in the current month at 1 percent significant level. If 1 percent increased in real price of groundnut oil in the previous month, real price of groundnut oil in the current month will increase 0.622 percent and other variables remain constant. If 1 percent increased in real price of palm oil in the previous month, real price of groundnut oil in the current month will increase 0.236 percent. If 1 percent increased in world palm oil price in the previous month, real price of groundnut oil in the current month will increase 0.425 percent. If 1 percent increased in total consumption of groundnut oil in the last month, real price of groundnut oil in the current month will increase 0.024 percent. Amount of palm oil import in the previous month had negative relationship with real price of groundnut oil in the current month at 1 percent significant level. If 1 percent increased in amount of palm oil import in the previous month, real price of groundnut oil in the current month will decrease 0.005 percent. Therefore, real price of groundnut oil in the current month will increase with increasing real price of groundnut oil in the previous month, increasing in real price of palm oil in the previous month, increasing of world palm oil price in the previous month and increasing total consumption of groundnut oil in the last month. Real price of groundnut oil in the current month will decrease with increasing the amount of palm oil import in the previous month. The adjusted R square pointed out the model could explain on the variation of groundnut oil price by 79 percent (Table 7).

Likewise, the explanatory variables accounted for about 89 percent of the variation in the total consumption of groundnut oil model. The dependent variable was total consumption of groundnut oil in the current month and the independent variables were total consumption of groundnut oil in the last month, real price of groundnut oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month and amount of palm oil import in the previous month. Estimations revealed that the explanatory variable, namely total consumption of groundnut oil in the last month is the most important explanatory variable with statistical significant at 1 percent significant level and had positive relationship. If 1 percent increased in total consumption of groundnut oil in the last month, total consumption of groundnut oil in the current month will increase 1.009 percent. World palm oil price in the previous month had positive relationship with total consumption of groundnut oil in the current month at 10 percent significant level. Thus, if 1 percent increased in world palm oil price in the previous month, total consumption of groundnut oil in the current month will increase 0.322 percent. Total consumption of groundnut oil in the current month will increase with increasing total consumption of groundnut oil in the last month and increasing world palm oil price in the previous month (Table 8).

Therefore, real price of groundnut oil in the current month was the impact of increasing of real price of groundnut oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month, total consumption of groundnut oil in the last month. Real price of groundnut oil in the current month would be decreased by increasing amount of palm oil import in the previous month. Total consumption of groundnut oil in the current month increase along with increasing total consumption of groundnut oil in the last month and increasing world palm oil price in the previous month.

Table 7 Result of groundnut oil price model

Independent Variables	Coefficient	Probability
Constant	-191.901***	0.000
Real price of groundnut oil in month t-1	0.622***	0.000
Real price of palm oil in month t-1	0.236***	0.003
World palm oil price in month t-1	0.425***	0.000
Total consumption of groundnut oil in month t-1	0.024***	0.001
Amount of palm oil import in month t-1	-0.005***	0.002
R-squared	0.787	
Adjusted R-squared	0.787	
Durbin-Watson	1.376	

Note: Dependent Variable: Real price of groundnut oil in month t

*** = significant at 1% level, ** = significant at 5% level,

* = significant at 10% level and ns = not significant

Table 8 Result of total consumption of groundnut oil model

Independent Variables	Coefficient	Probability
Constant	-74.294^{ns}	0.575
Total consumption of groundnut oil in month t-1	1.009***	0.000
Real price of groundnut oil in month t-1	-0.089^{ns}	0.621
Real price of palm oil in month t-1	0.082^{ns}	0.687
World palm oil price in month t-1	0.322*	0.102
Amount of palm oil import in month t-1	-0.002^{ns}	0.618
R-squared	0.895	
Adjusted R-squared	0.894	
Durbin-Watson	1.819	

Note: Dependent Variable: Total consumption of groundnut oil in month t

*** = significant at 1% level, ** = significant at 5% level,

* = significant at 10% level and ns = not significant

4.3.5 Autoregressive Distributed Lag Model for Groundnut Oil Price System

The regression analysis of Autoregressive distributed lag model was presented in Table 9. Real price of groundnut oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month, total consumption of groundnut oil in the current month and amount of palm oil import in the current month were independent variables. The dependent variable was real price of groundnut oil in the current month. In this regression analysis, 167 observations were used. The adjusted R square value pointed out the model was significant and it could be explained on the variation by 89 percent.

According to the regression estimates, all the independent variables such as real price of groundnut oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month, total consumption of groundnut oil in the current month and amount of palm oil import in the current month were found to be as significant influencing factors. Real price of groundnut oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month and total consumption of groundnut oil in the current month had positive relationship with real price of groundnut oil in the current month at 1 percent significant level. Therefore, if 1 percent increased in real price of groundnut oil in the previous month, real price of groundnut oil in the current month will increase 0.519 percent and other variables remain constant. If 1 percent increased in real price of palm oil in the current month, real price of groundnut oil in the current month will increase 0.413 percent. Real price of groundnut oil in the current month will increase 0.396 percent with increasing 1 percent of world palm oil price in the current month. Moreover, if 1 percent increased in total consumption of groundnut oil in the current month, real price of groundnut oil in the current month will increase 0.017 percent. However, amount of palm oil import in the current month had negative relationship with real price of groundnut oil in the current month at 1 percent significant level. Therefore, if 1 percent increased in amount of palm oil import in the current month, real price of groundnut oil in the current month will decrease 0.004 percent. The adjusted R squared pointed out the model was significant and it could be explained on the variation by 89 percent.

Therefore, real price of groundnut oil in the current month increased with increasing real price of groundnut oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month and total consumption of groundnut oil in the current month. However, real price of groundnut oil in the current month decreased with increasing amount of palm oil import in the current month.

Table 9 Results of autoregressive distributed lag model for groundnut oil real price system

Independent Variables	Coefficient	Probability
Constant	-147.995***	0.000
Real price of groundnut oil in month t-1	0.519***	0.000
Real price of palm oil in month t	0.413***	0.000
World palm oil price in month t	0.396***	0.000
Total consumption of groundnut oil in month t	0.017***	0.004
Amount of palm oil import in month t	-0.004***	0.001
R-squared	0.892	
Adjusted R-squared	0.891	
Durbin-Watson	1.345	

Note: Dependent Variable: Real price of groundnut oil in month t

*** = significant at 1% level, ** = significant at 5% level,

* = significant at 10% level and ns = not significant

4.4 The Inter-relationships between World Palm Oil Prices Changes on Demand of Sesame Oil in Myanmar Edible Oil Market

4.4.1 Unit Root Test

The vector of variables used in estimation of equation included real price of sesame oil in Myanmar (RPSO), real price of palm oil (RPPO), world palm oil price (WPPO), total consumption of sesame oil (TCSO) and amount of palm oil import (IPO). All preliminarily considered variables were checked for their stationarity. Augmented Dickey-Fuller's (ADF) tests for the intercept and trend were conducted to check if the null hypothesis of respective variables had a unit root.

In this study, monthly price covered from January 2000 to December 2013 with a total of 168 observations. Sesame oil prices and palm oil prices were collected from market information service (MIS). Consumption of sesame oil data was collected from United States Department of Agriculture (USDA) online data base. Import amount of palm oil and world palm oil prices were obtained from World Bank data base (WB).

The results of unit roots tests are presented in Table 10. At the level form, the null hypothesis of unit root is not rejected for all variables meaning that all time series are non stationary. The first difference of the variables was examined and the hypothesis of unit root is rejected that all the variables are significantly stationary at the first difference form at the 1% level of significant using Augmented Dickey Fuller (ADF). Thus, all variables were integrated of order one I (1).

The ADF statistic value of level form for (RPSO) was -2.52 and the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14 that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.32, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 11). The ADF statistic value of first difference level for (RPSO) was -5.65. In addition, the critical value at 1% levels was -4.01.The statistic t_{α} value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that it did not have a unit root and the data series is significantly stationary (Appendix 12).

The ADF statistic value of level form for (RPPO) was -2.36 and the critical values at10% level was -3.14 that we did not reject the null hypothesis and indicated that it had a

unit root (Appendix 3). The ADF statistic value of first difference level for (RPPO) was -9.25 and statistically significant at 1% level. This indicated that it did not have a unit root and significantly stationary (Appendix 4).

The ADF statistic value of level form for (WPPO) was -3.22. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.08, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 5). The ADF statistic value of first difference level for (WPOP) was -8.21. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 6).

The ADF statistic value of level form for (TCSO) was -2.75. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.22, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 13). The ADF statistic value of first difference level for (TCSO) was -13.1. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 14).

The ADF statistic value of level form for (IPO) was -2.27. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -3.14. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The probability value of the ADF test statistic value was 0.45, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root (Appendix 9). The ADF statistic value of first difference level for (IPO) was -8.62. In addition, the critical values at 1%, 5% and 10% levels were -4.01, -3.44 and -13.30. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had

a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and significantly stationary (Appendix 10).

Table 10 Results of unit root tests (Augmented Dickey-Fuller test) for 2000-2013 (monthly data)

Variables	ADF Test (level form)		ADF Test (first difference)		Order of integration
	t-statistics	Probability	t-statistics	Probability	
RPSO	-2.518	0.319	-5.644	0.000	I(1)
RPPO	-2.361	0.399	-9.254	0.000	I(1)
WPPO	-3.220	0.084	-8.207	0.000	I(1)
TCSO	-2.749	0.219	-13.099	0.000	I(1)
IPO	-2.274	0.445	-13.302	0.000	I(1)

Note: 1. ADF Test = Augmented Dickey-Fuller Test

2. Augmented Dickey-Fuller (ADF) test the hypothesis of $H_0: \beta = 0$ vs $H_1: \beta < 0$

3. ADF Analysis was carried out in EVIEWS@7

4. RPSO = Real Price of Sesame Oil

RPPO = Real Price of Palm Oil

WPPO = Total Consumption of Sesame Oil

TCSO = Total Consumption of Sesame Oil

IPO = Amount of Palm Oil Import

Data source: Market Information Services (MIS), Central Statistical Organization (CSO), Food and Agricultural Organization (FAO), World Bank Database (WB), United Nations Conference on Trade and Development (UNCTAD), United States Department of Agriculture (USDA) and other relevant database from the web

4.4.2 Cointegration Test

The results of the cointegration tests summarized in the following Table 11 and indicated that there was evidence of cointegrating relationships among the variables at the 95 percent significant level. The economic interpretation of co-integration was that if two (or more) series were linked to form an equilibrium relationship spanning the long-run, then even though the series themselves may contain stochastic trends (i.e, be non-stationary) they will nevertheless move closely together over time and the difference between them will be stable.

The result of the cointegration condition (that is the existence of a long term linear relation) was presented in Table 11 using methodology proposed by Johansen and Juselius (1990). The values of computed (λ trace) and (λ max) statistics were found to be greater than the critical values. If the value of (λ trace) and (λ max) excess the critical value, can reject the null hypothesis and accept the alternative hypothesis of more co-integration vectors. In the cointegration tables, both trace statistic and maximum eigenvalue statistic indicated cointegration at the 5 percent level of significance, suggesting that there was cointegration (or long run) relationship among the variables.

Table 11 Unrestricted cointegration rank test for real price of sesame oil, real price of palm oil, world palm oil price, total consumption of sesame oil and amount of palm oil import for 2000-2013 (monthly data)

Hypothesized No. of CE(s)	Eigenvalue	Statistical Value	0.05 Critical Value	Prob.[b]
		Trace Test		
None [a]	0.361	202.907	79.341	0.000
At most 1 [a]	0.272	130.232	55.246	0.000
At most 2 [a]	0.186	78.913	35.011	0.000
At most 3 [a]	0.155	45.505	18.398	0.000
At most 4 [a]	0.106	18.192	3.841	0.000
		Maximum Eigenvalue Test		
None [a]	0.361	72.675	37.164	0.000
At most 1 [a]	0.272	51.319	30.815	0.000
At most 2 [a]	0.186	33.408	24.252	0.000
At most 3 [a]	0.155	27.313	17.148	0.000
At most 4 [a]	0.106	18.192	3.841	0.000

Note: a = denotes rejection of the hypothesis at the 0.05 level
b = MacKinnon-Haug-Michelis (1999) p-values

4.4.3 Granger Causality Test

In this study, there were fourteen pair-wise Granger Causality tests. They were the Granger causality between real price of sesame oil and amount of palm oil import, total consumption of sesame oil and amount of palm oil import, real price of sesame oil and real price of palm oil, total consumption of sesame oil and real price of palm oil, real price of sesame oil and world palm oil price, total consumption of sesame oil and real price of sesame oil.

The hypotheses are such as real price of sesame oil does not Granger cause amount of palm oil import, amount of palm oil import does not Granger cause real price of sesame oil, total consumption of sesame oil does not Granger cause amount of palm oil import, amount of palm oil import does not Granger cause total consumption of sesame oil, real price of sesame oil does not Granger cause real price of palm oil, real price of palm oil does not Granger cause real price of sesame oil, total consumption of sesame oil does not Granger cause real price of palm oil, real price of palm oil does not Granger cause total consumption of sesame oil, real price of sesame oil does not Granger cause world palm oil price, world palm oil price does not Granger cause real price of sesame oil, total consumption of sesame oil does not Granger cause world palm oil price, world palm oil price does not Granger cause total consumption of sesame oil, total consumption of sesame oil does not Granger cause real price of sesame oil, real price of sesame oil does not Granger cause total consumption of sesame oil.

The results of the granger causality tests were presented in Table 12. The null hypothesis that X does not Granger cause Y was rejected based on the value of F statistics. World palm oil price does not Granger cause real price of sesame oil is rejected at 1 percent significant level. This means that world palm oil price might be a causal factor for real price of sesame oil.

The analysis of Granger causality between the variables verified the hypothesis. The analysis indicated simultaneous dependencies between real price of palm oil and real price of sesame oil. The null hypothesis of world palm oil price does not Granger cause real price of sesame oil was rejected. Therefore, the result indicated that world palm oil price might be a causal factor for real price changes of sesame oil in Myanmar.

From these results, causal relationship among the variables from the result of granger causality test was shown in Figure 3. In this, world palm oil price has unidirectional

movement with amount of palm oil import to Myanmar, real price of palm oil in Myanmar (YGN) and real price of sesame oil in Myanmar (YGN). Therefore, world palm oil price might be a causal factor for the changes of amount of palm oil import to Myanmar, real price of palm oil in Myanmar and real price of sesame oil in Myanmar. For sesame oil, it has a unique scenario because of the sweet and unique smell and medicinal value and it cannot be substituted with low-price-palm-oil. That is why, the study did not find the point of relationship between the sesame oil price and local palm oil price.

Table 12 Results of granger causality tests

Null Hypothesis	F-statistic	Probability
1. Real price of sesame oil does not Granger cause amount of palm oil import	0.152	0.859^{ns}
2. Amount of palm oil import does not Granger cause real price of sesame oil	0.366	0.694^{ns}
3. Total consumption of sesame oil does not Granger cause amount of palm oil import	0.060	0.942^{ns}
4. Amount of palm oil import does not Granger cause total consumption of sesame oil	0.071	0.913^{ns}
5. Real price of sesame oil does not Granger cause real price of palm oil	1.515	0.223^{ns}
6. Real price of palm oil does not Granger cause real price of sesame oil	1.246	0.290^{ns}
7. Total consumption of sesame oil does not Granger cause real price of palm oil	0.463	0.631^{ns}
8. Real price of palm oil does not Granger cause total consumption of sesame oil	0.629	0.534^{ns}
9. Real price of sesame oil does not Granger cause world palm oil price	1.329	0.268^{ns}
10. World palm oil price does not Granger cause real price of sesame oil	7.026	0.001***
11. Total consumption of sesame oil does not Granger cause world palm oil price	0.902	0.408^{ns}
12. World palm oil price does not Granger cause total consumption of sesame oil	1.430	0.242^{ns}
13. Total consumption of sesame oil does not Granger cause real price of sesame oil	0.314	0.731^{ns}
14. Real price of sesame oil does not Granger cause total consumption of sesame oil	0.434	0.649^{ns}

Note: Numbers are F-Statistics, *** = significant at 1% level,

** = significant at 5% level, * = significant at 10% level and ns = not significant

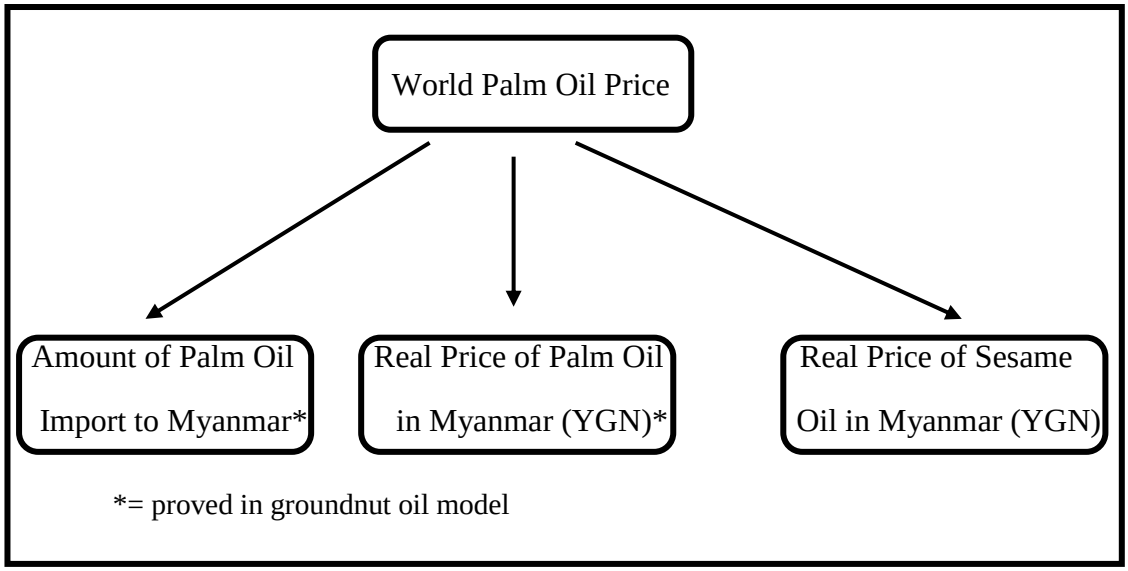

Figure 3 Causal relationships among variables, result of granger causality test

4.4.4 Short-term Sesame Oil Price (SORP) Model and Total Consumption of Sesame Oil (TCSO) Model

In this study, results of system of equations of short-term sesame oil price model and total consumption of sesame oil model were shown in the following Table 13 and 14.

At first, the independent variables which were used in the sesame oil price model were real price of sesame oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month, total consumption of sesame oil in the previous month and amount of palm oil import in the last month. The dependent variable was real price of sesame oil in the current month. In this, real price of sesame oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month and total consumption of sesame oil in the last month had positive relationship with real price of sesame oil in the current month at 1 percent significant level. Therefore, if 1 percent increased in real price of sesame oil in the previous month, real price of sesame oil in the current month will increase 0.519 percent and other variables remain constant. If real price of palm oil in the last month increased 1 percent, real price of sesame oil in the current month will increase 0.413 percent. If 1 percent increased in world palm oil price in the previous month and total consumption of sesame oil in the last month, real price of sesame oil in the current month will increase 0.396 and 0.017 percent respectively. Moreover, amount of palm oil import in the previous month had negative relationship with real price of sesame oil in the current month at 1 percent significant level. Therefore, if 1 percent increased in amount of palm oil import in the previous month, real price of sesame oil in the current month will decrease 0.004 percent.

Therefore, real price of sesame oil in the current month will increase with increasing real price of sesame oil in the previous month, increasing in real price of palm oil in the last month, increasing of world palm oil price in the previous month and increasing total consumption of sesame oil in the last month. Real price of sesame oil in the current month has decreased with increasing the amount of palm oil import in the previous month. The adjusted R squared pointed out the model was significant and it could be explained on the variation of groundnut oil price model by 89 percent (Table 13).

Likewise, in the total consumption of sesame oil model, the explanatory variables accounted for about 87 percent of the variation. The dependent variable was total consumption of sesame oil in the current month and the independent variables were total

consumption of sesame oil in the last month, real price of sesame oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month and amount of palm oil import in the previous month. Estimations revealed that the explanatory variable, namely total consumption of sesame oil in the last month is the most important explanatory variable with statistical significant at 1 percent significant level and had positive relationship. If 1 percent increased in total consumption of sesame oil in the last month, total consumption of sesame oil in the current month will increase 0.971 percent. For this reason, total consumption of sesame oil in the current month will increase with increasing total consumption of sesame oil in the last month (Table 14).

Therefore, real price of sesame oil in the current month increased with increasing of real price of sesame oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month, total consumption of sesame oil in the last month. Real price of sesame oil in the current month decreased with increasing amount of palm oil import in the previous month. Total consumption of sesame oil in the current month increased with increasing total consumption of sesame oil in the last month.

Table 13 Result of sesame oil price model

Independent Variables	Coefficient	Probability
Constant	-147.995***	0.000
Real price of sesame oil in month t-1	0.519***	0.000
Real price of palm oil in month t-1	0.413***	0.000
World palm oil price in month t-1	0.396***	0.000
Total consumption of sesame oil in month t-1	0.017***	0.004
Amount of palm oil import in month t-1	-0.004***	0.001
R-squared	0.892	
Adjusted R-squared	0.891	
Durbin-Watson	1.345	

Note: Dependent Variable: Real price of sesame oil in month t

*** = significant at 1% level, ** = significant at 5% level,

* = significant at 10% level and ns = not significant

Table 14 Result of total consumption of sesame oil model

Independent Variables	Coefficient	Probability
Constant	-32.647^{ns}	0.933
Total consumption of sesame oil in month t-1	0.971***	0.000
Real price of sesame oil in month t-1	-0.380^{ns}	0.237
Real price of palm oil in month t-1	0.168^{ns}	0.724
World palm oil price in month t-1	0.955^{ns}	0.113
Amount of palm oil import in month t-1	0.017^{ns}	0.286
R-squared	0.870	
Adjusted R-squared	0.870	
Durbin-Watson	1.845	

Note: Dependent Variable: Total consumption of sesame oil in month t

*** = significant at 1% level, ** = significant at 5% level,

* = significant at 10% level and ns = not significant

4.4.5 Autoregressive Distributed Lag Model for Sesame Oil Price System

The regression analysis of Autoregressive distributed lag model was presented in Table 15. Real price of sesame oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month, total consumption of sesame oil in the current month and amount of palm oil import in the current month were independent variables. The dependent variable was real price of sesame oil in the current month. In this regression analysis, 167 observations were used. The adjusted R square pointed out the model was significant and it could explain on the variation by 88 percent.

According to the regression estimates, all the independent variables such as real price of sesame oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month, total consumption of sesame oil in the current month and amount of palm oil import in the current month are significant influencing factors. Real price of sesame oil in the previous month and world palm oil price in the current month had positive relationship with real price of sesame oil in the current month at one percent significant level. Therefore, if 1 percent increased in real price of sesame oil in the previous month and world palm oil price in the current month, real price of sesame oil in the current month will increase 0.804 and 0.316 percent respectively. Real price of palm oil in the current month had positive relationship with real price of sesame oil in the current month at 5 percent significant level. Thus, if 1 percent increased in real price of palm oil in the current month, real price of sesame oil in the current month will increase 0.109 percent. Moreover, amount of palm oil import in the current month had positive relationship with real price of sesame oil in the current month at 10 percent significant level. Therefore, if 1 percent increased in amount of palm oil import in the current month, real price of sesame oil in the current month will increase 0.003 percent. The adjusted R square pointed out the model was significant and it could be explained on the variation by 89 percent.

Therefore, real price of sesame oil in the current month will increase with increasing of real price of sesame oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month and amount of palm oil import in the current period.

Table 15 Results of autoregressive distributed lag model for sesame oil real price system

Independent Variables	Coefficient	Probability
Constant	-129.323***	0.002
Real price of sesame oil in month t-1	0.804***	0.000
Real price of palm oil in month t	0.109**	0.033
World palm oil price in month t	0.316***	0.000
Total consumption of sesame oil in month t	0.001^{ns}	0.674
Amount of palm oil import in month t	0.003*	0.081
R-squared	0.881	
Adjusted R-squared	0.880	
Durbin-Watson	1.467	

Note: Dependent Variable: Real price of sesame oil in month t

*** = significant at 1% level, ** = significant at 5% level,

* = significant at 10% level and ns = not significant

CHAPTER V
CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Summary and Conclusion

Low income consumers in Myanmar rely on the cheap palm oil. The country's edible oil production is insufficient for domestic requirements. Due to the insufficiency of edible oil production in Myanmar, it is annually imported to fulfill the local demand. Palm oil is imported continuously to keep domestic edible oil price lower and to supply ever growing need of domestic consumption. Therefore, the world palm oil price changes affect on edible oil industry of Myanmar as Myanmar is increasingly dependent on palm oil imports and the country's edible oil production is insufficient for domestic requirements. For these reasons, edible oil industry of Myanmar depends on the world palm oil price changes. In this study, the impact of world palm oil price changes on edible oil industry of Myanmar was investigated.

5.1.1 The Influence of Palm Oil Inflow and its Prices Changes on Domestic Groundnut Oil, Sesame Oil and Palm Oil Market Prices

The focus of this study was to determine the influence of palm oil import and changes of its prices on domestic groundnut oil, sesame oil and palm oil market prices. Since amount of imports were steadily higher, there had some impact on domestically produced traditional oil prices. According to the result, there are several conditions between amount of palm oil import and world palm oil prices that can change domestic groundnut oil, sesame oil and palm oil prices can be clarified.

The study was not able to include the amount of illegal palm oil import and the data for the amount of palm oil import were based on the legal import which was obtained from the online data source. Domestic groundnut oil, sesame oil and palm oil prices decreased with decreasing amount of palm oil import in spite of decreasing of world palm oil price was found. This may be impact of illegal palm oil import. Myanmar seems not to follow the demand theory for palm oil import as the edible oil requirement is kept increasing as the population is growing. Hence, despite the fact of world palm oil price increase, Myanmar import more amount of palm oil to meet the demand of edible oil in the country. So, the impact of world palm oil price to amount of legal palm oil import was not able to be detected. However, the impact of world palm oil price changes on domestically produced edible oil prices was clearly observed in the study.

. It is assumed that amount of palm oil entered into domestic markets was depend on government's policy option. Myanmar palm oil import policy is to maintain domestic edible oil prices at a low level because domestic edible oil prices moved according to amount of palm oil entered into the markets. Government fixed quota for all palm oil import (except informal import) and developed price control system in order to curb domestic price fluctuation. It can be seen that this objective has been achieved after 2011. Myanmar edible oil policy has been relaxed more during the time of democratic government. The government encouraged more on legal import of palm oil that the official import data reflects the achievement of nation edible oil price stability policy. As the policy becomes more transparent and more flexible, the legal trade of palm oil is encouraged and decrease in domestic palm oil prices were observed from the year 2011- 2013.

Higher correlations between them mean domestic prices changes occur according to international prices movement and local prices were vacillated as long as Myanmar depends on palm oil import.

5.1.2 The Relationship between World Palm Oil Price and Domestic Palm Oil Price

In this study, the relationship between world palm oil price and domestic palm oil price was identified. Domestic palm oil price in the previous month, world palm oil price in the current month and world palm oil price in the previous month were significant factors as they were significant at 1 percent significant level. Domestic palm oil price in the current month will increase when the domestic palm oil price in the previous month and world palm oil price in the current month were increasing. However, domestic palm oil price in the current month did not increase although increasing world palm oil price in the previous month. The government intervene the edible oil market not to increase sharply for the edible oil. In this case, the low-income consumers are winners but the oil seed crop producers are losers in this scenario.

5.1.3 The Inter-relationships between World Palm Oil Price Changes and Demand of Groundnut Oil in Myanmar Edible Oil Market

This part of analysis focused on the estimation of how the groundnut oil demand and prices are related with world palm oil price changes. Real price of palm oil in Myanmar, total consumption of groundnut oil in Myanmar (Total Demand), amount of palm oil import and world palm oil prices which were collected from different sources. The study periods are from January 2000 to December 2013.

Firstly, in the stationary test, all the data series were not stationary in level but all these series were stationary at the first difference level, which means all these data were integrated in order 1.

Second, the Johansen's multivariate procedure was used to determine the presence or absence of co-integration among the data series. The Johansen procedure gives two likelihood ratio tests: the maximum eigenvalue test and the trace test. According to the results from these two tests, it was indicated the cointegration at the 5 percent level of significance, suggesting that there was cointegration (or long run) relationship among the all variables. Therefore, from the results of the Johansen co-integration test, it can generally be concluded that the long run market integration exists among real price of groundnut oil, real price of palm oil, world palm oil price, total consumption of groundnut oil and amount of palm oil import.

Third, Granger causality tests were done to test the short run relationship between the key variables. From this result, world palm oil price might be a causal factor for the amount of palm oil import to Myanmar, real price of palm oil in Myanmar and real price of groundnut oil in Myanmar. Although the palm oil price is the lowest among others, it has significant effect on edible oil prices especially on groundnut oil price. Groundnut oil price has strong relationship with not only world palm oil price but also local palm oil price because they are close substitute goods to each other. Majority of consumers are low income earners that they cannot resist the low-price-imported-oil although they want to consume better quality one.

Moreover, two empirical groundnut oil price model and total consumption of groundnut oil model were constructed to examine the relations between the variables. From this result, real price of groundnut oil in the current month will increase with increasing real price of groundnut oil in the previous month, increasing in real price of palm oil in the

previous month, increasing of world palm oil price in the previous month and increasing total consumption of groundnut oil in the last month. Real price of groundnut oil in the current month will decrease with increasing the amount of palm oil import in the previous month. Total consumption of groundnut oil in the current month will increase with increasing total consumption of groundnut oil in the last month and increasing world palm oil price in the previous month.

Finally, the Autoregressive Distributed Lag model establishes there was a long-run integration between real price of groundnut oil in the current period with other related variables. Therefore, real price of groundnut oil in the current month will increase with increasing of real price of groundnut oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month and total consumption of groundnut oil in the current month. However, real price of groundnut oil in the current month will decrease with increasing amount of palm oil import in the current month.

5.1.4 The Inter-relationships of World Palm Oil Price Changes on the Demand of Sesame Oil in Myanmar Edible Oil Market

This study analyzed the relationship between world palm oil price changes on the demand and prices of sesame oil in Myanmar edible oil industry. The secondary data of real price of sesame oil in Myanmar, real price of palm oil in Myanmar, total consumption of sesame oil in Myanmar (Total Demand), amount of palm oil import and world palm oil prices which were collected from different sources. The study periods are from January 2000 to December 2013.

The first conclusion that results from each data series showed that there existed a non-stationary at level, but the first differences in data series are stationary. This means that all these data were integrated in order 1.

The second conclusion is that determination of the presence or absence of co-integration among the data series. The Johansen procedure gives two likelihood ratio tests: the maximum eigenvalue test and the trace test. According to the results from these two tests, it was indicated the cointegration at the 5 percent level of significance, suggesting that there was cointegration (or long run) relationship among the all variables. Therefore, from the results of the Johansen co-integration test, it could generally be concluded that the long run market integration exists among real price of sesame oil, real price of palm oil, world palm oil price, total consumption of sesame oil and amount of palm oil import.

The third conclusion, the results from Granger causality tests showed the short run relationship between the key variables. From this result, world palm oil price might be a causal factor for the amount of palm oil import to Myanmar, real price of palm oil in Myanmar and real price of sesame oil in Myanmar. For sesame oil, it has a unique scenario because the sweet and unique smell and medicinal value of sesame oil cannot be substituted with low-price-palm-oil. That is why, the study did not find the point of relationship between the sesame oil price and local palm oil price.

Furthermore, observation the relations between the variables were done by sesame oil price mode and total consumption of sesame oil model. In this, real price of sesame oil in the current month will increase with increasing of real price of sesame oil in the previous month, real price of palm oil in the last month, world palm oil price in the previous month, total consumption of sesame oil in the last month. Real price of sesame oil in the current month will decrease with increasing amount of palm oil import in the previous month. Moreover, increasing total consumption of sesame oil in the current months created with increasing with increasing total consumption of sesame oil in the last month.

Finally, there is a long-run integration between real price of sesame oil in Myanmar in the current period with real price of sesame oil in Myanmar in previous period, real price of palm oil in Myanmar in the current period, world palm oil price in the current period, total consumption of sesame oil in the current period and amount of palm oil import in the current period. Therefore, real price of sesame oil in the current month will increase with increasing of real price of sesame oil in the previous month, real price of palm oil in the current month, world palm oil price in the current month and amount of palm oil import in the current period.

5.1.5 Policy Implications

Annual consumption of edible oil in Myanmar is gradually higher as population increase and larger amount of demand comes from food and others industries, which is also a reason of increasing demand although world palm oil price high. While domestic production is stagnating, Myanmar is increasingly dependent on palm oil imports. Therefore, it is needed to enhance domestic oilseed crop productivity and competitiveness to grasp market opportunity to overcome the domestic edible oil shortage.

Amount of palm oil imports to Myanmar were steadily higher and begun to have some impacts on domestically produced traditional oil prices were found. Prices of domestic groundnut oil, sesame oil and palm oil respond to periodically arrival of import palm oil and world palm oil price changes. Increasing trend of palm oil import was observed that it is a signal for effective implementation of import-substitution- industrialization policy.

It is common practice for edible oil traders to adulterate sesame and groundnut oils by mixing palm, sunflower, soybean, niger or rice bran oils to make more profit. To maintain the 'nutty' flavour of mixed oils and increase the dilution rate, artificial flavours are added into the oil mix. For these reasons, improvement of oil safety management system by strengthening the standardization infrastructure is also needed.

The government intervened the edible oil market not to increase price very high for the edible oil. In this scenario, the low-income consumers are winner but the oil seed value added producers and market participants in groundnut and sesame oil sub-sectors are loser. There are strong negative effects on health by consuming poor quality edible oil that it is urgently needed to curb the oil import policy and to protect the consumers as well as domestic edible oil industry. Therefore, the oil import policy should be considered well for the long term impact on health of palm oil consumers.

Either seasonal changes in international palm oil inflow or its price also has significant influence over domestic edible oil prices. It is also founded that the world palm oil prices have direct impact on domestic groundnut oil, sesame oil and palm oil prices changes based on world palm oil prices movement. Existence of a cointegration relation also implies a high degree of similarity between world palm oil price and domestic edible oil prices. And then, Myanmar edible oil situation has only a small fraction, 8.6 percent, of oil is refined, bleached and deodorized as different from the edible oil in the world market. Therefore,

supporting the producers or investors in agribusiness development as well as in modern oil refineries is important.

There are essential two major edible policy objectives in Myanmar for the oil crops subsector, to achieve self-sufficiency in edible oil and to maintain edible oil price control to avoid fluctuations. In order to promote the second objective of edible oil policy, engagement in constructive dialogue between all the participants in the oilseed crop and edible oil sector, from farmers to consumers, for determining a fair price level in the domestic market is also needed.

REFERENCES

Abdel, H. A., Arshad, F. M. 2008. The Impact of Petroleum Prices on Vegetable Oils Prices: Evidence from Co-integration Tests. Paper presented at the International Borneo Business Conference on Global Changes, Malaysia, 15-17 December, 2008.

Abdel, H. A., Arshad, F. M. 2009. The Impact of Petroleum Prices on Vegetable Oils Prices: Evidence from Co-integration Tests .Oil Palm Industry Economic Journal 9(2), p. 31-40.

Abdullah, R., Abas, R., & Ayatollah, K. 2007. Impact of Palm Oil-based Biodiesel Demand on Palm Oil Price. Oil Palm Industry Economic Journal, 7(2), p.19-27.

Alias, M. H., M. F. M. Jani, and R. Abduliah. 1999. Interactions between Malaysian and Indonesian Palm oil industries: Simulating the impact of liberalization of imports of COP from Indonesia. Journal of Oil Palm Research 11(2): p.46- 56.

Amzul Rifin. 2009. Price Linkage between International Price of Crude Palm Oil (CPO) and Cooking Oil Price in Indonesia. Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China, August 16-22, 2009.

Antik Suprihanti. 2008. The Relations between International CPO Prices and Domestic Palm Oil Prices: A Causality Approach. Journal Economic Pembangunan Vol.13 No.3.

Ardeni, P. G. 1989. Does the Law of One Price Really Hold for Commodity Prices? American Journal of Agricultural Prices 71 (August 1989): 661 – 669.

Arshad, F., Shamsudin, M. N., & Hameed, A. A. 2011. An Econometric Analysis of the Link between Biodiesel Demand and Malaysia Palm Oil Market. International Journal of Business and Management, 6(2), 35-45.

Atanu Ghoshray. 2011. Underlying Trends and International Price Transmission of Agricultural Commodities. ADB Economics Working Paper Series; No. 257 | May 2011.

Aye Min Tun. 2013. Study on Myanmar Edible Oil Market: Inflow of Palm Oil from International Market and Domestic Edible Oil Market Volatility. Master Thesis, Ritsumeika University.

Babula, R. A., F. J. Ruppel, and D. A. Bessler. 1995. U. S. Corn Exports: the Role of the Exchange Rate. Agricultural Economics 13: 75 - 88.

Balcombe, K. & Morrison J. 2002. Commodity Price Transmission: A Critical Review of Techniques and an Application to Selected Tropical Export Commodities, a study for FAO - ESCR, 2002.

Barkoulas, J. T., W. C. Labys, and J. Onochie. 1997. Fractional Dynamics in International Commodity Prices, Journal of Agricultural Economics 51: 161 - 189.

Borio, C. E. V and A. Filardo. 2007. BIS Working Papers No 227, Globalisation and inflation: New cross-country evidence on the global determinants of domestic inflation.

Campiche, J., Bryant, H., Richardson, J., and Outlaw, J. 2007. Examining the Evolving Correspondence between Petroleum Prices and Agricultural Commodity Prices. Paper presented at the American Agricultural Economics Association Annual Meeting, Portland, OR, July 29-August 1, 2007.

Central Statistical Organization. 2006. Statistical Year Book 2006. Ministry of National Planning and Economic Development, Yangon, Myanmar.

Chaudhry, M. & Christie-David, R. 1998. Long-Term Structural Price Relationships in Futures Markets. Journal of Derivatives, 45-59.

Commerce Journal. 2013. Ministry of commerce, Vol.13, No.22, June 17, 2013.

Cormwell, J. B., W. C. Labys, and E. Kouassi. 2000. What Color are Commodity Prices: A fractal Analyais. Empirical Economics 25: 563-580.

Cuddington, J. T., and C. M. Urzua. 1989. Trends and Cycles in the Net Barter Terms of Trade: A New Approach. Economic Journal 99 : 426 - 442.

Esmaeili, A., Shokoohi, Z. 2011. Assessing the effect of oil price on world food prices: Application of principal component analysis. Energy Policy 39, p. 1022–1025.

Favre, R. and K, Myint. 2009. An Analysis of the Myanmar Edible Oil Crops Sub-sector. Rome: FAO.

Granger, C. W. J. 1969. Investigating Causal Relationship by Econometric Models and Cross Spectral Methods. Econometrica 37: 424-438.

Granger, C. W. J. 1981. Some Properties of Time Series Data and their Use in Econometric Model Specification. Journal of Econometrics 16: 121-30.

Granger, C. W. J. 1988. Some Recent Developments in a Concept of Causality. Journal of Econometrics 39: 199-211.

Granger, C.W.J. 1988. Causality, cointegration and control. Journal of Economic Dynamics and Control 2, 329-352.

Hadi, A. R., Yahya, M. H., Shaari, A. H., & Huridi, M. H. 2011. Investigating Relationship Between Crude Palm Oil and Crude Oil Prices-Cointegration Approach. 2nd International Conference on Business and Economic Research Proceeding, No.2011-281, pp. 1554-1565.

Hameed, A. A., & Arshad, F. M. 2008. The Impact of Petroleum Prices on Vegetable Oils Prices: Evidence from Co-integration Tests. Oil Palm Industry Economic Journal, 9(2), 31-40.

Holmes, J. M., and P. A. Hutton. 1990. On the Causal Relationship between Government Expenditures and National Income. Review of Economics and Statistics 72: 87-95.

http:// www.worldprices.htm

Kantaporn, A. W, Songsak & Chukiat. 2012. Factors Affecting Palm Oil Price Based on Extremes Value Approach. International Journal of Marketing Studies; Vol. 4, No. 6; 2012.

Karia, A. A., & Bujang, I. 2011. Progress Accuracy of CPO Price Prediction: Evidence from ARMA Family and Artificial Neural Network Approach. International Research Journal of Finance and Economics, 64, 66-79.

Khin, A. A., M. Zainalabidin, A. A. A. Hameed. 2012. The Impact of the Changes of the World Crude Oil Prices on the Natural Rubber Industry in Malaysia. World Applied Sciences Journal 20 (5): 730-737, 2012.

Kohls, R. L., and J. N. Uhi. 2002. Marketing of Agricultural Products. 9th edition. Upper Saddle River, N.J: Prentice Hall.

Maddala, G. S. and I. M. Kim. 1998. Unit Roots, Cointegration and Structural Change. Oxford University Press, Oxford.

Miko Harjanti. 2012. The Impact of Palm Oil Price Swings on Household Welfare: The Case of Indonesia. Research paper; International Institute of Social Studies, The Hague, the Netherlands.

Minot, N. and F. Goletti. 1998. Export Liberalization and Household Welfare: The Case of Rice in Vietnam. American Journal of Agricultural Economics 80(4): 738-749.

MIS. 2007, 2008, 2009, 2010 and 2011. Annual domestic and international agricultural prices bulletin (Pyi Twin Pyi Pa Lae Yar Hwet Kone Zay Hnone Myar Hnint Choke Sar Oak, 2007) (In Myanmar). Yangon: Department of Agricultural Planning.

MIS. 2014. Annual domestic and international agricultural prices bulletin (Pyi Twin Pyi Pa Lae Yar Hwet Kone Zay Hnone Myar Hnint Choke Sar Oak, 2014) (In Myanmar). Nay Pyi Taw: Department of Agricultural Planning.

Mohammad Haji Alias, and Jamal Othman. 1997. Cointegration Between Palm Oil Price And Soyabean Oil Price: A Study on Market Integration. Malaysian Oil Science and Technology, 6(2), 92-95.

Nelson C. R. and C. I. Plosser. 1982. Trends and random walks in macroeconmic time series: Some evidence and implications. Journal of Monetary Economics, 10(2): 139-162.

Nik Muhammad Naziman Ab Rahman. 2012. The Cointegration Analysis on the Spot Prices of the Malaysian Crude Palm Oil Futures Market. International Journal of Economics and Finance, Vol. 4, No. 7; July 2012.

Nik Muhammad Naziman Ab Rahman. 2013. The Empirical Analysis on Prices of the Malaysian Crude Palm oil Futures Market. International Review of Management and Business Research. Vol. 2, Issue.2.

Nyein Nyein Thaung. 2011. Integration of Myanmar Domestic Agricultural Marketing into ASEAN. Journal of Management Policy and Practice, 12 (5), 99-101.

Owen, A. D., Chowdhury, K., and Garrido, J. R. R. 1997. Price Interrelationships in the Vegetable and Tropical Oils Market. Applied Economics, 29, 119-127.

Phyu Thit Twin. 2013. Myanmar faces Edible Oil Deficit, Myanmar business today journal, October 24, 2013 Vol 1 Issue 38.

Robertson, J. C., and D. Orden. 1990. Monetary Impacts on Prices in the Short and Long Run: Some Evidence from New Zealand. American Journal of Agricultural Economics 72: 160 - 171.

Serletis, A. 1992. Unit Root Behavior in Energy Futures Prices. The Energy Journal, Vol. 13, pp119-128.

Serletis, A. 1994. A Cointegration Analysis of Petroleum Futures Prices. Energy Economics, Vol. 16, pp. 93-97.

Serletis, A., Herbert, J. 1999. The Message in North American Energy Prices. Energy Economics, Vol. 21, pp. 471-483.

Shivakumar. K. M., S. Kombairaju, and M. Chandrasekaran. 2007. Trade Policy Analysis of Edible Oil Imports of India under CGE framework.

Theodore, P., Emilie, R. 2007. Oil and gas markets in the UK: Evidence from a cointegration approach, Energy economics, Vol. 29, pp.329-347.

Wahid, M. B., Simeh, M. A., & Nordin, J. 2007. Recent Development in the World Palm Oil Prices: An Overview. Oil Palm Industry Economic Journal, 7(2).

Win Pa Pa Soe. 2009. A Study of Oil Seed Crop and Edible Oil Marketing in Myanmar. Master Thesis, Kyushu University.

Yu, Tun-Hsiang, Bessler, D. A., and Fuller, S. 2006. Cointegration and Causality Analysis of World Vegetable Oil and Crude Oil Prices. Paper presented at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26, 2006.

Zhang, Z., Lohr, L., Escalante, C., Wetzstein, M. 2010. Food versus fuel: what do prices tell us? Energy Policy 38, p. 445-451.

APPENDICES

Appendix 1 ADF Level Test for Real Price of Groundnut Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.442771	0.3563
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (Groundnut oil real price)
Method: Least Squares
Date: 06/20/15 Time: 22:56
Sample (adjusted): 2000M03 2013M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Groundnut oil real price(-1)	-0.049445	0.020241	-2.442771	0.0156
D (Groundnut oil real price(-1))	0.402964	0.072594	5.550892	0.0000
C	0.467713	13.91844	0.033604	0.9732

R-squared	0.171291	Mean dependent var	8.045161
Adjusted R-squared	0.155944	S.D. dependent var	92.74218
S.E. of regression	85.20457	Akaike info criterion	11.75179
Sum squared resid	1176091.	Schwarz criterion	11.82678
Log likelihood	-971.3984	Hannan-Quinn criter.	11.78223
F-statistic	11.16156	Durbin-Watson stat	2.047501
Prob(F-statistic)	0.000001		

Appendix 2 ADF First Difference Test for Real Price of Groundnut Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.624996	0.0000
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (Groundnut oil real price, 2)
Method: Least Squares
Date: 06/20/15 Time: 22:58
Sample (adjusted): 2000M03 2013M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (Groundnut oil real price (-1))	-0.626662	0.072657	-8.624996	0.0000
C	9.267328	13.64750	0.679050	0.4981
S.E. of regression	86.49305	Akaike info criterion		11.77591
Sum squared resid	1219411.	Schwarz criterion		11.83215
Log likelihood	-974.4007	Hannan-Quinn criter.		11.79874
Durbin-Watson stat	2.011498			

Appendix 3 ADF Level Test for Real Price of Palm Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.360753	0.3987
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (Palm oil real price)
Method: Least Squares
Date: 06/20/15 Time: 23:02
Sample (adjusted): 2000M03 2013M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Palm oil real price (-1)	-0.048819	0.020679	-2.360753	0.0194
D (Palm oil real price (-1))	0.337408	0.074281	4.542334	0.0000
C	-3.101060	10.92268	-0.283910	0.7768
S.E. of regression	64.80547	Akaike info criterion		11.20446
Sum squared resid	680359.3	Schwarz criterion		11.27945
Log likelihood	-925.9700	Hannan-Quinn criter.		11.23490
Durbin-Watson stat	2.044278			

Appendix 4 ADF First Difference Test for Real Price of Palm Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.254351	0.0000
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (Palm oil real price, 2)
Method: Least Squares
Date: 06/20/15 Time: 23:03
Sample (adjusted): 2000M03 2013M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (palm oil real price(-1))	-0.689029	0.074455	-9.254351	0.0000
C	6.035065	10.35640	0.582738	0.5609
S.E. of regression	65.70828	Akaike info criterion		11.22623
Sum squared resid	703765.1	Schwarz criterion		11.28247
Log likelihood	-928.7774	Hannan-Quinn criter.		11.24906
Durbin-Watson stat	2.017748			

Appendix 5 ADF Level Test for World Palm Oil Price

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.219619	0.0842
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (World palm oil price)
Method: Least Squares
Date: 06/20/15 Time: 23:30
Sample (adjusted): 2000M03 2013M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
World palm oil price (-1)	-0.071797	0.022300	-3.219619	0.0016
D (World palm oil price (-1))	0.452080	0.070177	6.441983	0.0000
C	18.49915	8.566571	2.159458	0.0323

S.E. of regression	44.92200	Akaike info criterion	10.47153
Sum squared resid	326913.8	Schwarz criterion	10.54652
Log likelihood	-865.1373	Hannan-Quinn criter.	10.50197
Durbin-Watson stat	2.037048		

Appendix 6 ADF First Difference Test for World Palm Oil Price

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.207055	0.0000
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (World palm oil price, 2)
Method: Least Squares
Date: 06/20/15 Time: 23:30
Sample (adjusted): 2000M03 2013M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (World palm oil price (-1))	-0.584465	0.071215	-8.207055	0.0000
C	2.940234	7.273765	0.404225	0.6866

S.E. of regression	46.19458	Akaike info criterion	10.52151
Sum squared resid	347832.1	Schwarz criterion	10.57775
Log likelihood	-870.2853	Hannan-Quinn criter.	10.54434
Durbin-Watson stat	1.981816		

Appendix 7 ADF Level Test for Total Consumption of Groundnut Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.631223	0.2671
Test critical values:	1% level	-4.013946	
	5% level	-3.436957	
	10% level	-3.142642	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D (Total consumption of groundnut oil)

Method: Least Squares

Date: 06/20/15 Time: 23:22

Sample (adjusted): 2000M02 2013M12

Included observations: 167 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Total consumption of groundnut oil (-1)	-0.083355	0.031679	-2.631223	0.0093
C	584.7227	206.1912	2.835828	0.0051

R-squared	0.040536	Mean dependent var	46.98398
Adjusted R-squared	0.028835	S.D. dependent var	213.7111
S.E. of regression	210.6074	Akaike info criterion	13.55567
Sum squared resid	7274298.	Schwarz criterion	13.61168
Log likelihood	-1128.898	Hannan-Quinn criter.	13.57840
F-statistic	3.464370	Durbin-Watson stat	2.010909
Prob(F-statistic)	0.033601		

Appendix 8 ADF First Differrence Test for Total Consumption of Groundnut Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.40864	0.0000
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D (Total consumption of groundnut oil ,2)

Method: Least Squares

Date: 06/20/15 Time: 23:22

Sample (adjusted): 2000M03 2013M12

Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (Total consumption of groundnut oil (-1))	-1.048959	0.078230	-13.40864	0.0000
C	52.65092	34.09886	1.544067	0.1245
S.E. of regression	215.3718	Akaike info criterion		13.60052
Sum squared resid	7560755.	Schwarz criterion		13.65676
Log likelihood	-1125.843	Hannan-Quinn criter.		13.62334
Durbin-Watson stat	2.005116			

Appendix 9 ADF Level Test for Amount of Palm Oil Import

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.274330	0.4452
Test critical values:	1% level	-4.013946	
	5% level	-3.436957	
	10% level	-3.142642	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (Amount of palm oil import)
Method: Least Squares
Date: 06/20/15 Time: 22:59
Sample (adjusted): 2000M02 2013M12
Included observations: 167 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Amount of palm oil import (-1)	-0.053175	0.023380	-2.274330	0.0242
C	612.7346	319.5381	1.917563	0.0569

S.E. of regression	1076.350	Akaike info criterion	16.81834
Sum squared resid	1.90E+08	Schwarz criterion	16.87435
Log likelihood	-1401.331	Hannan-Quinn criter.	16.84107
Durbin-Watson stat	2.036397		

Appendix 10 ADF First Difference Test for Amount of Palm Oil Import

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.30196	0.0000
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D (Amount of palm oil import, 2)

Method: Least Squares

Date: 06/20/15 Time: 23:00

Sample (adjusted): 2000M03 2013M12

Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (Amount of palm oil import(1))	-1.041393	0.078289	-13.30196	0.0000
C	-7.044734	172.3862	-0.040866	0.9675

S.E. of regression	1095.602	Akaike info criterion	16.85390
Sum squared resid	1.96E+08	Schwarz criterion	16.91014
Log likelihood	-1395.874	Hannan-Quinn criter.	16.87673
Durbin-Watson stat	2.002798		

Appendix 11 ADF Level Test for Real Price of Sesame Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.517872	0.3192
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D (Real price of sesame oil)

Method: Least Squares

Date: 06/20/15 Time: 23:13

Sample (adjusted): 2000M03 2013M12

Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Real price of sesame oil (-1)	-0.053264	0.021154	-2.517872	0.0128
D (Real price of sesame oil (-1))	0.348531	0.073877	4.717710	0.0000
C	-10.31609	16.12224	-0.639867	0.5232

R-squared	0.136447	Mean dependent var	10.28494
Adjusted R-squared	0.120455	S.D. dependent var	96.53025
S.E. of regression	90.52998	Akaike info criterion	11.87304
Sum squared resid	1327700.	Schwarz criterion	11.94803
Log likelihood	-981.4624	Hannan-Quinn criter.	11.90348
F-statistic	8.532340	Durbin-Watson stat	2.220093
Prob(F-statistic)	0.000027		

Appendix 12 ADF First Difference Test for Real Price of Sesame Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.643758	0.0000
Test critical values:	1% level	-4.014635	
	5% level	-3.437289	
	10% level	-3.142837	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D (Real price of sesame oil, 2)
Method: Least Squares
Date: 06/20/15 Time: 23:11
Sample (adjusted): 2000M04 2013M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (Real price of sesame oil (-1))	-0.500257	0.088639	-5.643758	0.0000
D (Real price of sesame oil (-1), 2)	-0.264216	0.076024	-3.475420	0.0007
C	6.394793	14.26167	0.448390	0.6545

R-squared	0.386014	Mean dependent var	0.036401
Adjusted R-squared	0.374574	S.D. dependent var	112.8949
S.E. of regression	89.28173	Akaike info criterion	11.84541
Sum squared resid	1283367.	Schwarz criterion	11.92071
Log likelihood	-973.2467	Hannan-Quinn criter.	11.87598
F-statistic	33.74038	Durbin-Watson stat	1.953224
Prob(F-statistic)	0.000000		

Appendix 13 ADF Level Test for Total Consumption of Sesame Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.748711	0.2187
Test critical values:	1% level	-4.013946	
	5% level	-3.436957	
	10% level	-3.142642	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D (Total consumption of sesame oil)

Method: Least Squares

Date: 06/20/15 Time: 23:26

Sample (adjusted): 2000M02 2013M12

Included observations: 167 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Total consumption of sesame oil (-1)	-0.083065	0.030220	-2.748711	0.0067
C	988.9528	343.0403	2.882906	0.0045
R-squared	0.044235	Mean dependent var		119.7026
Adjusted R-squared	0.032580	S.D. dependent var		754.7603
S.E. of regression	742.3637	Akaike info criterion		16.07536
Sum squared resid	90381022	Schwarz criterion		16.13137
Log likelihood	-1339.292	Hannan-Quinn criter.		16.09809
F-statistic	3.795164	Durbin-Watson stat		1.974532
Prob(F-statistic)	0.024479			

Appendix 14 ADF First Difference Test for Total Consumption of Sesame Oil

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.09859	0.0000
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D (Total consumption of sesame oil, 2)

Method: Least Squares

Date: 06/20/15 Time: 23:26

Sample (adjusted): 2000M03 2013M12

Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (Total consumption of sesame oil (-1))	-1.025672	0.078304	-13.09859	0.0000
C	106.0251	120.0351	0.883284	0.3784
R-squared	0.512815	Mean dependent var		0.000000
Adjusted R-squared	0.506837	S.D. dependent var		1084.083
S.E. of regression	761.3036	Akaike info criterion		16.12585
Sum squared resid	94472047	Schwarz criterion		16.18209
Log likelihood	-1335.445	Hannan-Quinn criter.		16.14868
F-statistic	85.78744	Durbin-Watson stat		2.001265
Prob(F-statistic)	0.000000			