"The Impact of Palm Oil Price Swings on Household Welfare: The Case of Indonesia"

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This document represents part of the author's study programme while at the Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

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List of Acronyms

ADF	Augmented Dickey Fuller
CPO	Crude Palm Oil
CPI	Consumer Price Index
CSBC	Commission for the Supervision of Business Competition
DMO	Domestic Market Obligation
IMF	International Monetary Fund
IRF	Impulse Response Function
RER	Real Exchange Rate
SUSENAS	Survey Sosial Ekonomi Nasional (The National Socio Economic Survey)
UNCTAD	United Nation Conference on Trade and Development
USDA	United States Department of Agriculture
VAT	Value Added Tax
VECM	Vector Error Correction Model
WWF	World Wild Fund

Abstract

Indonesia is the biggest producer as well as the second main consumer of palm oil in the world market. 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 focus is investigating the role of price in commodity product and social welfare. To answer the questions, this research employs five variables which are international and domestic palm oil prices, export volume, Real Exchange Rate, and inflation. This research works on the framework of market co-integration and price transmission. To assess the price, we utilize time series techniques which are Stationarity test, Johansen Co-integration Test, Vector Error Correction Model for short run and long run, Impulse Response Function and also Granger causality. Further to discuss the link of price with household welfare, we use descriptive analysis on household expenditure. The last method intends to explore consumer demand by assessing contribution of palm oil on household budget.

The research found that domestic price is co-integrated with international price, export volume, and RER 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. Further, household analysis found that increase of the domestic price leads to welfare inequality between the poor and the rich. 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. Combination of VAT subsidy to stimulate domestic supply with progressive export tax might be effective to protect the poor when domestic price soars. This research also argues that government support for development of processing and distribution chain may improve supply of frying oil product.

Relevance to Development Studies

The studies of market co-integration intend to address the discussion about price transmission between international prices with domestic price. The analysis will provide an understanding of the extent to which the international price influences on domestic price, and what factors constitute the channel between the two markets. Similar with previous research about Indonesian palm oil price co-integration, this research have found the existence of co-integration

between international and domestic palm oil price. In doing so, this discussion provides consideration for policy making for managing domestic price.

There were several studies in the past about co-integration of international and Indonesian domestic palm oil price, which have provided evidence of the co-integration between the two prices. However, those researches did not incorporate the discussion of the impact of price changes on household welfare; hence it becomes a gap to be filled by this research. The author believes that the discussion about price transmission might be more useful if it is continued by incorporating a discussion of the impact on household welfare. In fact, the increase of price is closely related with welfare issue by increasing loss of purchasing power.

This research has explored the study of price by incorporating the discussion of consumer demand side. This analysis has assessed how international price fluctuations affect the domestic price and how in turn this affects the Indonesian households' welfare across the income distribution. Using descriptive analytic on household expenditure, the research has illustrated how does increase of palm oil price trigger inequality among quintiles of income. This shows that palm oil is an important commodity for the poor. Therefore, this research adds an alternative source of literature in understanding the relationship among prices and households welfare. This provides a consideration for policies studies to promote the welfare of poor households when price soars.

Keywords

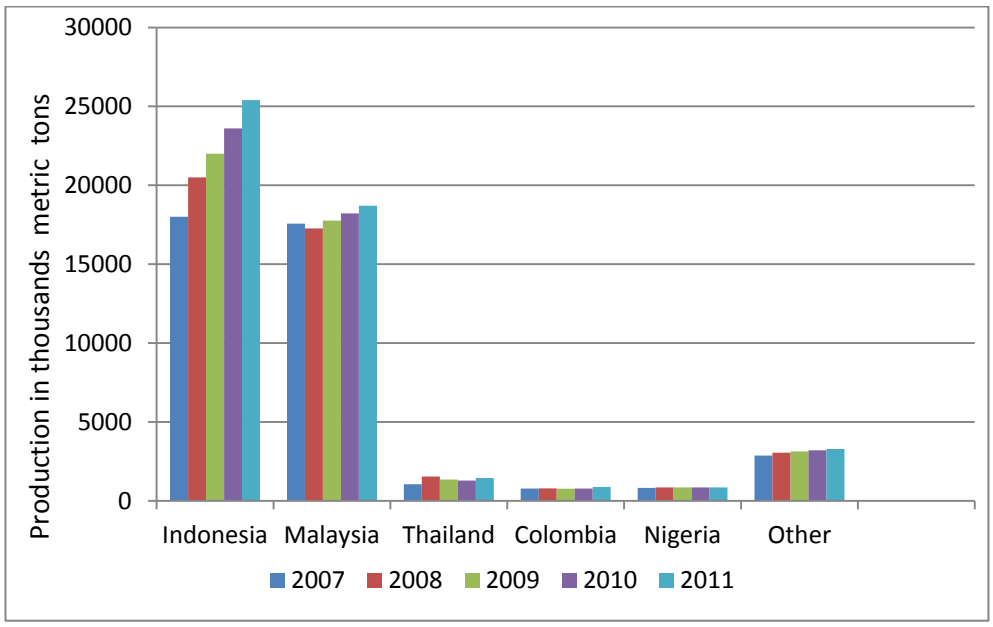
Indonesia, palm oil, price transmission, co-integration, household welfare, income distribution

Chapter 1
Introduction

1.1 Background

In world market, vegetable oil commodity is dominated by soybeans, palm oil, and sunflower (USDA: 2011). Based on the 2010 FAO data statistic the trading value of world palm oil almost reached 19.5 billion US$ in which 48% of it was supplied by Indonesia. Indonesia and Malaysia are the major producers of palm oil in the world, while China and India are the biggest importers. Not only processed for frying oil, Palm oil also used by various industries such as biofuel, animal feed, cosmetic, pharmaceutical, and fertilizer. Figure 1 reveals the dynamic of world palm oil production from five main producers since 2007 to 2011.

Figure 1 Production of Palm Oil Main Producers (2007-2011)



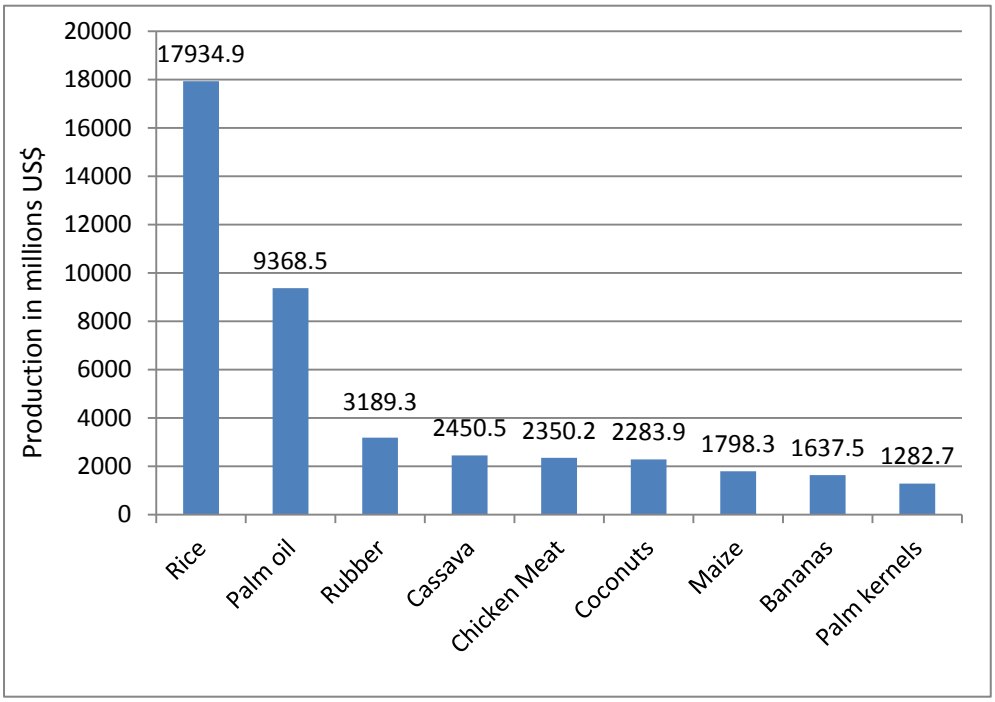
Source: United States Department of Agriculture (2011)

Although Indonesia dominates the world palm oil production, this country does not have an important role in price determination, the position of Indonesia considered only as price taker. This situation might be in part explained by the fact that palm oil in international market is substitutable with other vegetable oils. Thus the price of other vegetable oils will also determine palm oil price

Palm oil is a commodity which gives substantial influence on the Indonesian economy. The export of palm oil contributes to foreign exchange revenues and creates job opportunities for large number of farmers. In the domestic market, FAO statistics mentioned that palm oil is the second top commodcommodity product after rice as the Indonesian staple food. As depicted in figure 2, palm oil total production values on 2010 worth 9.36 billion US$

(FAO: 2012). Statistics Indonesia mentions that in 2010 Crude Palm Oil (CPO) export value of Indonesia reached more than 7.6 billion US$[1]. While rice dominated the domestic market, palm oil is mostly exported.

Figure 2 Indonesian Agriculture Products (2010)



Source: FAO (2012)

1.2 Problem Statement

In the domestic market, palm oil consumption increases annually. The main processed palm oil product in the domestic market is frying oil. Indonesian citizen consumes palm oil daily for frying food. Palm oil is exported mainly in form of CPO, while for domestic market it is processed into frying oil. The drastic hike of world palm oil prices in the international market encourages producers to export the product rather than supplying domestic market. This leads to declining palm oil supplies in domestic market which eventually will trigger frying oil price hike. Disparity between domestic and international price leads to out flow of goods. Suprihanti (2008) reveals the phenomenon on 1998 to explain the impact on domestic palm oil price when the exchange rate and the world palm oil price soared. Driven to maximize profit, the producers prefer to export palm oil rather than sell it into the domestic market. The supply of domestic palm oil plummets, frying oil becomes expensive, and inflation increases (ibid)

Based on the fact that Indonesia not only exports significant amount of CPO but also consumes massive amount for domestic market, the study of correlation between international palm oil prices with domestic price becomes interesting. Therefore precise policy should be adopted not only to keep the

[1]See http://www.bps.go.id/eng/exim-frame.php?kat=2

stability of domestic frying oil price but also to stimulate producers to gain profit through export.

There is a possibility that the gap between domestic and international price might bring losses to an economy. In the words of Dawe et al. (2010:398)

> "… deviation from the world price can lead to large misallocations of scarce resources that increase with the square of the deviation from the world price, meaning that losses increase exponentially as the deviation gets larger."

Rent seeking behaviour by exporting palm oil when International price soared might become a disruption to the economic equilibrium. Producers tend to neglect the domestic demand which lead to increasing domestic price. Dawe et al. (2010) also point that small farmer and consumer might be suffered since they do not have sufficient access for the solutions. According to them, government price stabilization policy still plays significant role to lower the risk of the poorest members of society, even though the cost effectiveness of price stabilization policy is still debatable. The main concern of price stabilization is how to control instability of supply and demand in market, hence they recommend that price stabilization policy might be more effective if the government is able to lower the policy costs and pay attention on transparency (ibid).

The issue of Indonesian palm oil export is closely related to the issue of social welfare. Frying oil is an important item for every Indonesian household. This commodity is consumed by almost all household both in urban and rural areas. Price fluctuation of frying oil influences on welfare issues. Early 2011, frying oil contributed 5% to the total monthly inflation (Statistics Indonesia: 2011). It means that any shock on frying oil price might influence household purchasing power.

1.3 Research Questions and Objectives

It is generally argued that increments on price lead to the marginalization of low income households resulting in decrease on welfare. Food price tightly influence on household expenditures, especially those of fixed income. Therefore this research aims to investigate how international palm oil price fluctuations affect the domestic price of frying oil and how in turn this affects the Indonesian households across the income distribution. The basic questions which tried to be investigated in this research are: how is the relationship between domestic prices, international prices, inflation, and export? And how price fluctuation influence household welfare? These questions are elaborated into the following four sub questions:

1) How does the domestic price for processed palm oil linked to the international palm oil price?
2) How palm oil prices influence producer's decision to allocate the product?
3) How do fluctuations in the price of processed palm oil affect the purchasing power of households across the income distribution?
4) What are the appropriate policies to protect household welfare in volatile palm oil price?

Based on the aforementioned indication, this research aims to investigate the role of price in commodity product and social welfare. Volatility of international and domestic palm oil price potentially might influence the affordability of the product in the society. To find the answer, this research explores co-integration level of international palm oil price with domestic palm oil price and adding export volume, inflation and exchange rate as explanatory variables. Frying oil inflation is set as the main variable to explain how price volatility might give on welfare. Volatility of international price potentially might bring consequence on domestic price which eventually might influence domestic inflation. The research will analyze the time series data in both short term and long term. The research will also be equipped by dynamic analyses to detect the response of each variable in the current and the future period due to changes or shock from other variable.

Previous studies by Baffes and Gardner (2003), Suprihanti (2008), and Hafizah(2009) have demonstrated the co-integration between palm oil international price and Indonesian domestic price but did not discuss the relationship between price transmission with household welfare. To fill the gap with previous studies on co-integration price, this research will analyzes how domestic palm oil price volatility will influence social welfare through the change on household expenditure. By classifying household expenditure into stratified classes, this research expected to reveal the impact of palm oil price volatility on each income distribution class.

1.4 Scope and Limitations

This research employed international palm oil price from United Nations Conference on Trade and Development (UNCTAD); domestic palm oil price from the Ministry of Commerce; export volume from the Ministry of Agriculture of The Republic of Indonesia; Inflation and real exchange rate from International Monetary Fund (IMF). These data involved 108 set of time series monthly data from 2003 to 2011. To analyze household expenditure, this research used household total expenditure and household expenditure on frying oil from SUSENAS 2010 data by Statistics Indonesia.

This paper focuses on the external factors which influence domestic palm oil price. Incorporating analysis of production sector would have supported the accuracy of the research; however data availability was one of the major obstacles. Palm oil production volume data is published by the Ministry of Agriculture on yearly basis; hence production variable cannot be incorporated in this research model which uses monthly time series, thereby this research excluding analysis of production.

1.5 Organization of the Paper

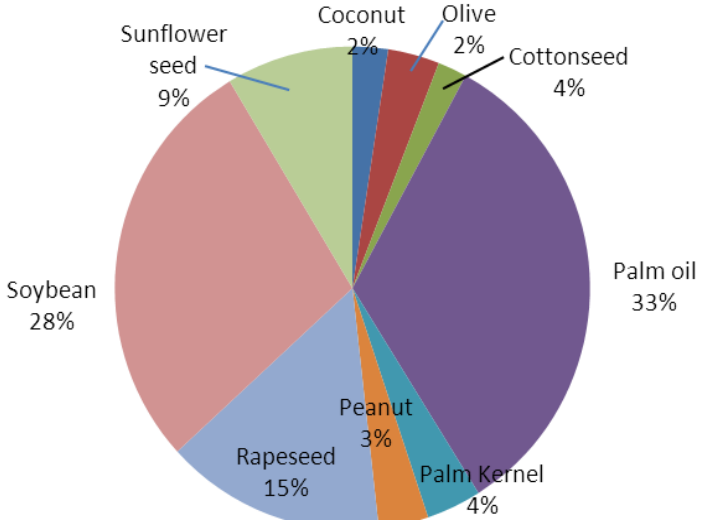
The rest of the paper is organized as follows: Chapter two highlights the role of palm oil commodity in Indonesian economy. Literature review and theoretical set up and reasons for being concerned about price, export, and household welfare are enclosed in chapter three. Chapter four describes the data and methodology. Chapter five will discuss the result and policy analysis. Finally, chapter six will give summary and conclusion.

Chapter 2
Palm Oil in International and Indonesian Domestic Market

2.1 How Palm Oil Plays a Role in the International Market

United States Department of Agriculture on their report on world market oilseeds mention that the international market of vegetable oil is dominated by nine kinds of commodities. Since 2007 continually palm oil has accounted for 33% of international market share, the second top commodity is soybean oil which has 28% of market share (USDA: 2011). Figure 3 depicts the composition of world vegetable oil.

Figure 3 Share of World Production of Vegetable Oils (2011)



Source: USDA (2011)

Based on the composition, there is no single commodity able to dominate the share of palm oil market. Price determination of a single commodity will be influenced by other commodity. In fact, palm oil is substitutable with other vegetable oils. Therefore, price determination of international palm oil price is highly correlated with supply and demand of other vegetable oils. The increase of international palm oil price is usually caused by the failure of harvest of other vegetable oils (Pahan: 2008). The other vegetable oils such as canola, sunflower, soybean, and corn are annual plants which are susceptible to the seasons, pest, and disease. Therefore, they have higher volatility price than palm oil. Whereas palm oil is perenial crop which live up to 25 years and more resistant to seasons, pest, and disease. The price of palm oil is more stable than other vegetable oils (ibid).

Pahan (2008) mentions that supply of other potential countries, which are Colombia, Brazil, Papua New Guinea, and Cameroon, will influence future price. Those countries are predicted to increase the supply of palm oil in the

future, since they have vast area for plantation, and supported by tropical climate which is suitable for palm oil. Palm oil industry in Malaysia and Indonesia grows mainly because of the support of government policy. Malaysian government started to build its palm oil industry in 1970 by issued licenses to convert forests into palm oil plantations. The Indonesian government started to issue licenses in 1980. Both countries have been inviting foreign investors to open new businesses in palm oil plantations. The banking sector in both countries also has provided loans to private owned plantations (ibid).

From the demand side, Pahan (2008) indicates population and world income as the driver of world prices. The growth of world population along with the increase of GDP will increase demand of palm oil and other vegetable oils which will raise the international price. Capehart and Richardson (2008) analyze that the change in global consumption patterns becomes a factor of increasing certain agricultural commodity price. As income level increase, people tend to consume more processed foods and meat. The change of consumption requires more feed grains and edible oil. The shift of consumption pattern has pushed the demand of meats, other livestock products, and vegetable oil in growing income countries such as India and China and also in low-income countries of sub-Saharan Africa, Asia, and Latin America (ibid).

The demand of palm oil is also influenced by the policy imposed by importing countries which intend to curb the demand (Pahan: 2008). Each importing country has concern to protect their local vegetable oils production. The European countries provided subsidies for their canola oil production, China and India set high taxes to protect their local vegetable oil products, some countries impose eco-labelling as palm oil import requirements (ibid). Consumer demand also influenced by negative campaign which pointing palm oil as the reason of tropical deforestation. Consumer tastes will also influenced by campaign which stated that palm oil is not good for health (ibid).

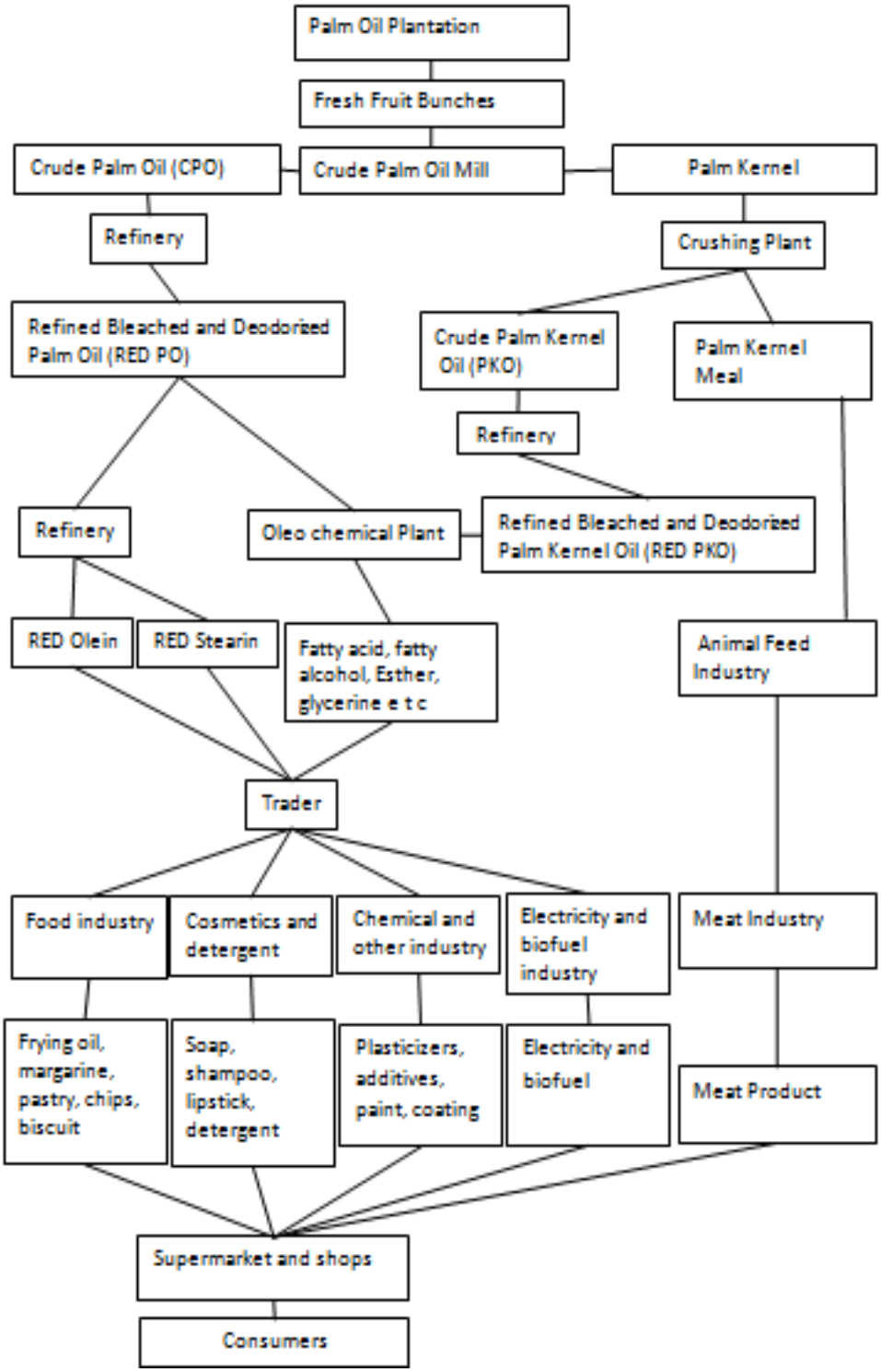
World palm oil price refers to price in Rotterdam, the main port in Europe which for decades has been the main gate of palm oil product from all over the world to Europe (Pahan: 2008). The history of Rotterdam as centre of palm oil world trade started on eighteen century when the Netherland colonized South East Asia and controlled palm oil trade from this region. Nowadays many big palm oil importers set their headquarters in Rotterdam (ibid).

Palm oil is basic ingredient for food processing industry to make frying oil, margarine, biscuits, ice cream, candy, filled milk, coffee whitener, and instant noodle (WWF: 2008). Oleo chemical industry process palm oil into methyl esters (biofuel), glycerol, fatty acids, and fatty alcohol while cosmetic industry use palm oil as the component of soap, cream lotion, and shampoo. In pharmaceutical industry, palm oil is processed into drugs, vitamin A and vitamin E. While Palm kernel used for basic ingredients on animal feed industry (ibid). Figure 4 explains palm oil process.

Thoenes (2006) indicates upward trending of world demand of vegetable oil including palm oil, for biofuel to substitute the conventional fossil fuel. The European Union is one of the world's main biofuel consuming regions while Malaysia and Indonesia are the main producers of palm oil for biofuel. Mitchell (2008) mentions that world demand for vegetable oil for biofuel has reduced the supply of vegetable oil for consumption which leads to in-

crease of world vegetable oil price. Palm oil demand for biofuel has influenced the dynamic of international palm oil price (Mitchell: 2008).

Figure 4 Palm Oil Process



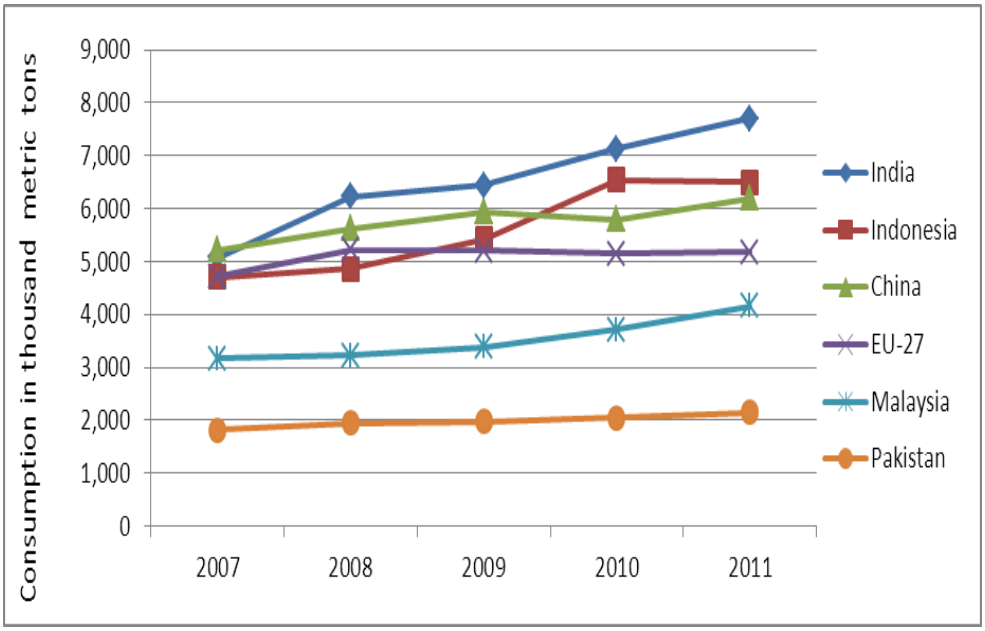
Source: (WWF: 2008)

2.2 Palm oil in Indonesian Economic

Palm oil is not an Indonesian native plant. This plant was imported from West Africa in mid of nineteenth century. Palm oil grows well in tropical areas with high humidity such as Indonesia and Malaysia (Pahan: 2008). Indonesia has a unique role both as the largest palm oil producer in the world and world second largest consumer. This reality had placed palm oil in a strategic position for the Indonesian economy. Change of international price potentially will influence domestic market through the export channel. The increasing prices in international market will push producers to export palm oil rather than sell it to domestic market. This will trigger decreasing supply of domestic palm oil which will raise domestic frying oil price.

Figure 1 in chapter 1 reveals that Indonesia has become the biggest producer of palm oil in the international market with a total production 25,400 thousand metric tons (USDA: 2011). In fact, level of domestic consumption is experiencing upward trending. The consumption of Indonesia has exceeded China and reach 6,490 thousand metric tons. It means 25% of palm oil product is consumed by domestic market (ibid).

Figure 5 Domestic Consumption of Palm Oil Main Consumer (2011)



Source: United States Department of Agriculture (2011)

Before the 80's palm oil plantations in Indonesia were mostly owned by state-owned enterprises. After 1980 Indonesian government intensively issued licenses to the private sector and individual farmer to convert forest area into palm oil plantation. Since then the area of private enterprises and farmers has increased sharply. In 2010, Ministry of Agriculture as cited in Ministry of Industry (2011) reported that the total area for palm oil production area about 8,1 million hectare which concentrated mainly in Sumatera and Kalimantan Island.

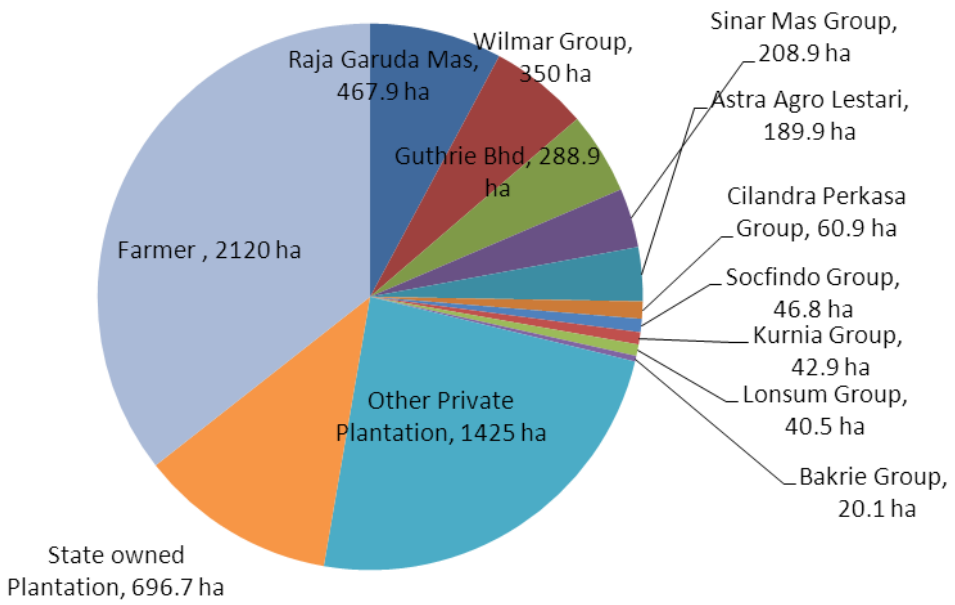
Map 1 Indonesian Plantation Area (2010)

Source: Ministry of Industry (2011)

Sumatera and Kalimantan islands have become the host of palm oil oligopoly production. Map 1 shows six main producers which are Riau, North Sumatera, South Sumatera, Jambi, West Sumatera and Aceh are located on Sumatera island. Palm oil plantation also developed in Central and West Kalimantan. Palm oil became the main driver of development in these areas.

Currently the total production of palm oil is dominated by private enterprises and farmer plantations. Commission for the Supervision of Business Competition (CSBC) of the Republic of Indonesia indicates that palm oil plantation structure is oligopolistic since part of market is controlled by small group of corporation. Data from Ministry of Agriculture as cited in CSBC (N.D.b) stated that in 2006 five big private plantations owned 25.3% of the total plantation area. The composition of plantation area is depicted in figure 6.

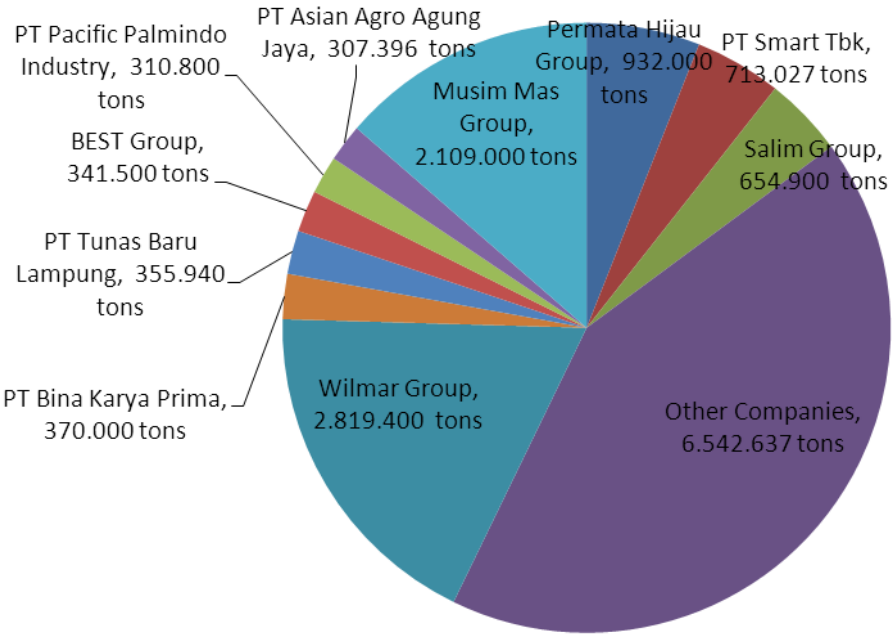
Figure 6 Share of Palm Oil Plantation Area Based on Producer



Source: Commission for the Supervision of Business Competition (CSBC) of the Republic of Indonesia (N.D.b)

In domestic markets, palm oil is mostly consumed in the form of frying oil. Pahan (2008) predict that in the future domestic demand of frying oil will increase due to the increase of Indonesian population and the raise of national income. Frying oil is an important foodstuff in the daily life of Indonesian society. The frying oil which is made from palm oil dominates the domestic market because its price is relatively cheaper than other vegetable oils and also because it is available throughout the Indonesian archipelago. In the market, there are many brands of frying oil which are packed in various sizes of bottles. CSBC (N.B.a) describes the market of domestic frying oil as oligopolistic structure. Ten big companies have dominated 58% of market share, while the rest 42% by other companies. The production capacity per year of frying oil industry is described on figure 7.

Figure 7 Frying Oil Production Capacity per Year



Source: Commission for the Supervision of Business Competition (CSBC) of the Republic of Indonesia (N.D.a)

Palm oil agro industry has developed rapidly in competitive market. 66% of the ownership of frying oil industry is integrated from upstream to downstream process (CSBC: N.D.a). It means that from plantation to frying oil cultivation is owned by the same corporation group. The interrelated processing chain leads to high efficiency production process. However, it also leads to domination of frying oil price determination by certain parties. CSBC has indicated that frying oil market is vulnerable to the influence of big corporations in the price determination. CSBC (N.D.a) explains series of policies which have been implemented by Indonesian government to stabilize frying oil market, which are:

1) Domestic Market Obligation (DMO) is a government policy which requires CPO producers to supply certain amount of the raw materials for domestic frying oil industry. This based on government regulation of the Ministry of Agriculture Number. 339/Kpts/PD.300/5/2007 (ibid). Unfortunately DMO is not fully supported by CPO producers. At May 2007 producers supplied only 59% of the target which was 97.525 tonnes. The quantity dropped into 10% in June. DMO policy then did not continue because of low commitment of CPO producers. They prefer to export their palm oil product because it is more profitable than to sell it for the domestic market (ibid).
2) Scarcity of palm oil in domestic market prompted the government to issued progressive export tax instruments since September 2007. Ministry of Finance sets the tax rate which adapted with international market price that occurred at that time. The purpose of the export tax policy is to increase the government foreign exchange revenue and to keep the stability of domestic palm oil price. Ministry of finance as cited on CSBC (N.D.a) has set 2.5% export tax when CPO price ranged between 550 to 649 US$ per tonnage. Further, if the range of price rises to 650-749 US$

the imposed tax is 5%. When the price range is 750 – 849 US$ the tax will be 7.5%, while if price more than 850US$ the tax will be 10% (ibid). The progressive rate of export tax theoretically can inhibit CPO export, because the cost of tax that must be borne by the exporters is greater when the CPO price rises. The decline of government revenue because of declining CPO export is expected to be replaced from the increasing tax rate. Progressive export tax might be appropriate to raise government revenue. However producers, exporters and investors may dislike this policy since it does not support their palm oil business. The increasing cost of tax will lower their profit (ibid). In reality, the policy might also bring detrimental effect to farmers. As the exports tax increased, CPO producers would shift the burden to farmers by lowering the purchasing price of fresh palm oil bunches (ibid).

3) To stimulate the supply side, government gives incentive to produce frying oil in hygienic packaging at affordable prices for public. The policy named "Government-borne Value Added Tax". VAT is a tax imposed on companies for each additional value added in the circulation of goods and or services from producer to consumers (ibid). Normally VAT should be borne by the company as tax payable. Indonesia adopts a single rate of VAT of 10%. On 2008 government issued regulation number 231/PMK.011/2008 which shifted VAT obligation from company to government. This incentive is given to producers who commit to produce cheap frying oil under government brand name '*Minyakita*'. This brand name specially design by government with lower price than market price, and sold on targeted poor areas (ibid).

Prior to 1998, the Indonesian government utilized National Food Logistic Agency (BULOG) to regulate palm oil distribution chain (Prastowo et al.: 2008). The role of the Logistics Agency is managing the supply and logistic basic foodstuffs[2]. However since 1998, under IMF regulation, the role of the Logistics Agency was reduced to distribute only rice and sugar (ibid).

Indonesian government has main target to build the downstream palm oil industry. Currently, there are three mega projects of palm oil processing on Sei Mangkei District North Sumatera Province, Dumai District Riau Province, and Maloy District on East Kalimantan (Ministry of Industry: 2011). Those three industrial areas were built close to palm oil plantations. Each of the three industrial centres has up to hundreds of hectares area (ibid). The processing industries are able to process CPO into biofuel, oleo chemicals, fatty alcohol and other refined palm oil products. Development of downstream industries will give value added to palm oil sector. It is expected that in the future Indonesian palm oil industry will export more processed palm oil product rather than CPO (ibid).

[2] see < http://www.bulog.co.id/eng/history_v2.php>

Chapter 3
Literature Review and Theoretical Framework

3.1 Literature Review

When two markets are linked by trade in a free market regime, excess demand or supply shocks in one market will have an impact on price in both markets. In open economy condition, an increase in the international price might result for proportional increase in the domestic price. Evidence of the existence of co-integration between international and domestic market through price transmission was provided by Baffes and Gardner (2003) in their study about ten commodity prices from eight countries. One of their objects is price of Indonesian palm oil, rice and maize. Using Error Correction Model, they reveal that compared with rice and maize, palm oil domestic price has higher degree of co-integration with international price. Hafizah (2009) in the research about correlation among International, Indonesian, and Malaysian palm oil prices reveals the existence of long run co-integration. In short run the three prices do not show co-integration but they gradually adjust every month and integrated in the long run. Using Vector Error Correction Model, Hafizah shows international price as reference for Indonesian and Malaysian price, changes in international price might be followed by the two prices. Probably the most relevant study for this analysis is the research from Suprihanti (2008) that relates CPO international price with the Indonesian price by employing the Granger causality approach. The result says that a movement of palm oil international price triggers the movement of domestic price but not conversely. This indicates the position of Indonesia as small open economy (ibid).

Studies on market integration or complete pass-through of price changes from one market to another have important implications for analyzing economic welfare. Understanding the degree of co-integration will give information on the benefits received by producers from rising international commodity prices, and how consumers experience impact of rising prices in local markets. The extents to which commodity price increases have a positive or negative impact depend on the level to which particular countries is a net importer or net exporter of the commodity considered. Ivanic and Martin (2008) study correlation between global food prices and poverty to detect the change of the poverty rate of nine low income countries as the consequence of the shift in the global food prices. The result the higher the food prices tend to worsen poverty rate. Net consumers of food tend to be hurt more by increasing of food prices. The poor people tend to have high share of staple foods in the expenditures, which will make them vulnerable to increases of food price. In contrast, poor people have limited share of output, which will limit their benefit whenever the price increase. Ferreira et al.(2008) employ household survey on Brazil in 2008 to investigate welfare consequences of food price increases. Since Brazil can be considered as a main producer as well as net exporter of food, rising international food prices should generate aggregate income gains for the country. To some extent the case of Brazil quite similar with palm oil case in Indonesia. To capture compensation of price

movement on welfare, Ferreira et al. (2008) investigate the impacts on the income side and expenditure effects. The result on expenditure effect says that the effect is negative. As food prices increase poverty rate is getting worse. However when taking account the income effect the market income effect is positive and progressive, particularly in rural areas.

Shift of commodity price might also give positive impact on household 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 hike 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. A similar issue appears on palm oil product in Indonesia. Suprihanti (2008) and Bachtiar (2010) reported that increasing international palm oil price in 2008 might have increased export volume. This condition might have reduced domestic supply and followed by increase of domestic price.

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. McCarthy (2000) said that external factors which are import prices and exchange rate give modest effect on inflation in US. Furlong and Ingenito (1996) conclude that international commodity price has strong relationship with inflation even though its coefficient is getting lower. Globalisation 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 another 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 (ibid).

Some literatures have explored the correlation structure of inflation with household income distributions. The rate of inflation experienced by the household is vary depends on the distribution of income (Günther and Grimm 2007). They raise the idea of differential inflation to analyze the pro-poor growth concept. The study from Abdel-Ghany et al. (2002) reveals that rank in actual income distribution gives statistical impact on household consumption. Levinsohn et al.(2003) studying the Indonesian crisis in 1998 that gave different effects for household across income distribution. They said that the

poor household suffered more from food inflation in 1998 crisis, based on fact that the poor consumes more of their budget on food than non poor household (ibid). Considering the variation of budget share, this research is going to explore about budget share of frying palm oil across income distribution. The result will enable us to discuss the comparison of the impact of raising palm oil price among groups.

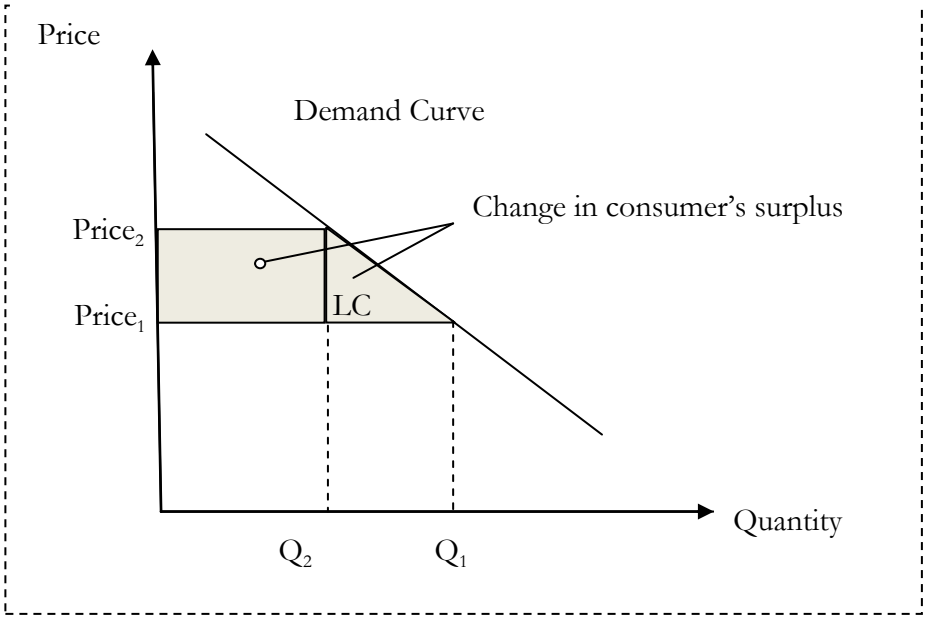
3.2 Theoretical Framework

The main question on analysing trade policy in global market is to what extent prices in domestic markets react to international prices volatility. Complete price transmission between two spatially separated markets will stimulate a situation where shifts of price in one place are completely transmitted to the other price continuously (Rapsomanikis et al.:2003). The theory also mention that if two markets are connected by in a free market trade regime, excess demand or supply shocks in one market will have an equal impact on price in both markets (ibid). The price transmission becomes the basic concept which used by the research of Krivonos (2004); Baffes and Gardner (2003); also Mundlak and Larson (1992) to find out the relationship between price in domestic commodity market with international market.

However there are many reasons which become impediment of the world price transmission. Conforti (2004) summarizes some disturbances of price transmission. The first is transport and transaction costs due to geographical reason. Second, volatility of world currency, mainly in US $, will influence market co-integration. Third, comparative ability to produce will put some agents to be price makers while some other as price takers eventually this condition will create domination of price decision on one particular agent. Fourth, the ability to substitute consumption with similar products may affect market integration and price transmission. The fifth is trade policy which is imposed by government to protect their domestic producers and local industries (ibid).

In general the change of price will change consumer's behaviour. According to Varian (2003:137) two effects emerge as the reaction of consumer as the price of product changed. The first is substitution effect which defined as adjustment in the demand due to alteration in the rate of exchange between the two goods. The second effect is income effect which means the adjustment in demand due to change in purchasing power. Rigidity of demand over changes of price usually emerges in poor family in case of staple food. In order to adjust expenditure with income, the lower income families usually consume the standard quality food with affordable price. The poor get difficulty to substitute their consumption with other products. It might be assumed that demand curve is almost vertical means that substitution effect is low. It could be inferred that in general price changes are transmitted through the income effect. Increasing price of palm oil will lead to consumer welfare loss (op.cit.:253)

Figure 8 Changes of Consumer's Surplus



Source: Varian (2003:253)

Increasing price from $Price_1$ to $Price_2$ has forced consumers to reduce consumption from Q_1 to Q_2. Compared to the initial condition, consumer have to pay more ($Price_2$ - $Price_1$) Q_2 In addition, consumer should also bear value of the loss consumption as much as triangle LC since they reduce consumption from Q_1 to Q_2. Finally, the entire of welfare loss is measured as loss of having to pay more for the products he continues to consume added with loss from reducing volume of consumption (ibid). Considering the importance of the price of palm oil for consumer purchasing power in Indonesian domestic market and its correlation with consumer welfare, this research aim to discuss the loss of household welfare due to change in price of frying oil.

The effect of rising palm oil prices on the family might be in accordance with the law of Engel which provide empirical law regarding the relation between income and expenditure on food. Engel's law mentions that the proportion of income spent on food reduces as income grows (Houthakker:1957). Compared to wealthy family, the poor spend more of their budget on food. Wealthier families tend to increase their budget on secondary consumption such as housing, education, and transportation. Thus an increase of food price will hit the poor more than the rich families.

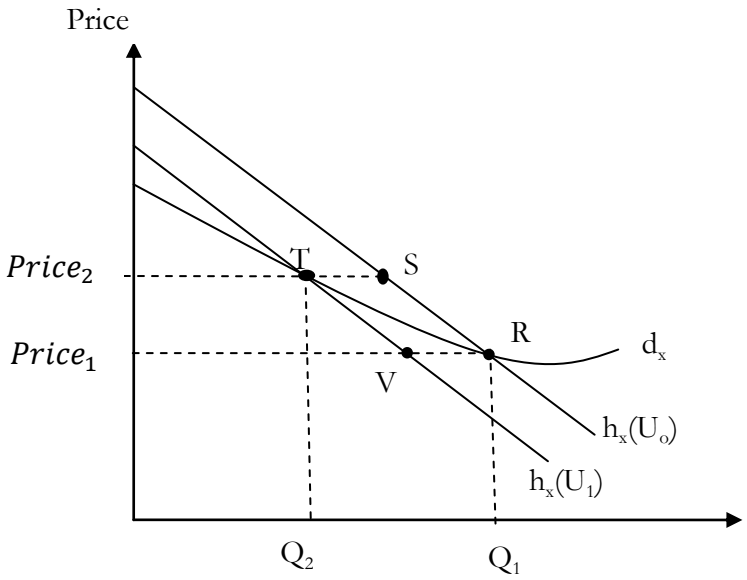
CSBC (N.D.a) indicates that the market structure of frying oil in Indonesia is oligopoly. It means that the market exists between the polar extremes of perfect competition and monopoly (Nicholson, 2002:527) Oligopoly is characterized by relatively few producers with homogeneous product while the demand is competitive. In oligopoly condition output and price decisions are interdependent; every producer must consider their competitors' decision on price determination (ibid). The level of production technology might become a barrier for newcomers. By employing high technology, big companies may lower their marginal and average costs which make newcomers unable to compete in this situation (ibid). In case of Indonesian frying oil, the factor of capital may become the barrier because it needs significant amount of capital to start business in frying oil market. Markusen (1985:280) studies the development impact on the regions that host the core of oligopolistic industry. The

host region may get benefit from the booming oligopolies sector but it could trap them in non-diversified local economy. Eventually, when the booming industries declined then the growth of host region also dropped. Markusen (1985) take the case in the U.S regions which have become the home port of oligopoly such us Detroit with automobile, also Minnesota and Tennessee with soybean. Similar case appears in oligopolistic palm oil industry in Indonesia. Palm oil plantation mostly concentrated in Sumatera and Kalimantan Island, while frying oil industry dominated by only by ten big companies.

The dynamic of oligopoly market is closely related with issue of welfare society in a country. Potential welfare gains become the motivation of economic activity (Jones: 2005). Briggs (2000) explains welfare state might be achieved by organizing power through politics and administration in an effort to modify the play of market forces. In the absence of externalities and other price distortions, welfare can be maximized in competitive markets (Jones: 2005:1). Welfare economics theory states that Pareto optimality exists only in a competitive equilibrium which means that one consumer might not be better off if at least another consumer worse off (ibid). In imperfect competition such as oligopoly, supply side is stronger than demand side. Big companies may collaborate to determine price. Nicholson (2002) indicates that Pareto efficiency might not appear under imperfect competition. Loss of consumer surplus might emerge for demanders, while part of the surplus is transferred into oligopoly supplier profits. Some of the loss of consumer represents a deadweight loss of overall economic welfare. This will lead to Pareto inefficiency (ibid). Oligopoly might appear as the opposite of welfare state objectives. However, through proper regulations a country might actualize welfare society. Price determination in oligopoly market should also consider public interest not only maximizing producers' profit.

There are plenty of literatures discussing the impact of price changes on welfare. Nicholson (2002:142) discussing the basic theory of measuring welfare effect by Marshalian curve.

Figure 9 Impact of Price Changes on Welfare



Source: Nicholson (2002:142)

In measuring welfare effect, Marshalian curve is accommodating the shift of consumer utility. $Price_1$ is initial price while $Price_2$ is the new higher price level. dx is the Marshallian demand curve for good Q. $hx(U_0)$ initial consumer utility and $hx(U_1)$ consumer utility when price increase to $Price_2$. Welfare loss area depicted as the area to the left of the Marshallian demand curve between $Price_2$, T, R, and $Price_1$.

Chapter 4
Data and Methodology

4.1 Data

This study uses quantitative data to analyse long run and short run relationship among prices and specific inflation. Time series data that will be employed in this research consists of 108 months starting from January 2003 to December 2011. The chosen time range is expected to reveal the dynamic condition in the medium term even though longer time range will give better perspective. Because of data limitation, these study able to collect only nine years period. Unavailability of palm oil production data has also limited the scope of this study. Palm oil production volume data is published annually by the Ministry of Agriculture; hence production variable is not included in this research model which uses monthly series.

To do the analysis, five variables are employed here. The first data is inflation that is obtained from IMF. Inflation is defined as percentage change of Consumer Price Index (CPI) over corresponding period of previous year (IMF: 2011a)

Data of volume export as the second variable was obtained from the Ministry of Agriculture of The Republic of Indonesia. It is represented by Crude Palm Oil (CPO) as the major form of palm oil export. During period 2002 until 2011 CPO have dominated palm oil export; even in 2011 the share of CPO value was 80% from total palm oil export value. Products derivative of CPO such as Olein and Stearin has not been widely produced in Indonesia. Export potentially becomes connector between international and domestic market. As pointed by Suprihanti (2008) changes of prices in both markets will trigger changes of producers' decision to export or to supply for domestic market.

The third is Frying Oil price in domestic market (Rupiah per litter) to represent variable domestic price. This data is taken from market price of frying oil which was collected by the Ministry of Commerce of The Republic of Indonesia. Since the price is varying across regions, this research employs the average national price each month. In domestic market, frying oil sold both with packaging (in bottle) and without packaging.

The fourth variable is Real Exchange Rate (RER) taken from the IMF. Unlike nominal exchange rate, the concept of RER enables us to capture changes in the price of domestic goods and services relative to foreign goods. Krugman and Obstfeld (2003) denote RER as:

$$Real\ Exchange\ Rate\ = Nominal\ Exchange\ Rate\ x\ \frac{Price^{foreign}}{Price^{domestic}}$$

RER calculation uses CPI as price index. CPI is defined as an indicator to measures the evolution of price for goods bought and for tariffs of services used by the households in a certain period (current period), as against previous period (base period) (International Labour Organization: 2004). CPI Indonesia will be employed to represents $\boldsymbol{price^{domestic}}$. Since palm oil is traded in US

dollar currency in world market, then CPI US will be used to represents $\boldsymbol{price}^{\boldsymbol{international}}$ (IMF: 2011b)

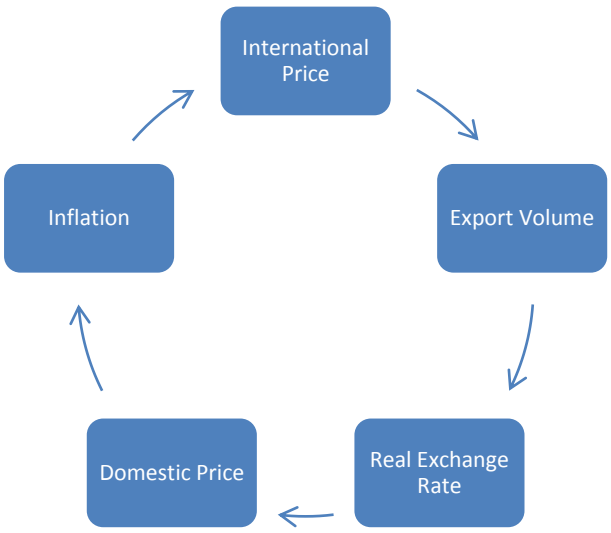
$$Real\ Exchange\ Rate\ = Nominal\ Exchange\ Rate\ x\ \frac{CPI^{US}}{CPI^{Indonesia}}$$

The fifth is International CPO price (US $ per tonnage) from UNCTAD to represent International Price (UNCTAD: 2012). World palm oil price refers to price in Rotterdam, the main port in Europe which for decades has been the main gate of palm oil product from all over the world to Europe. To be able to capture changes in domestic price compare with international palm oil price, this study will perform international price in form of real price. The formula will be:

$$Real\ International\ Price\ = International\ Price\ x\ \frac{CPI^{US}}{CPI^{Indonesia}}$$

In this research domestic price, real international price, export volume, and RER are presented in logarithm form. Line plots and descriptive analysis are provided on appendix 1 and 2. The correlation among variables is illustrated on figure 10:

Figure 10 Correlation Among Variables

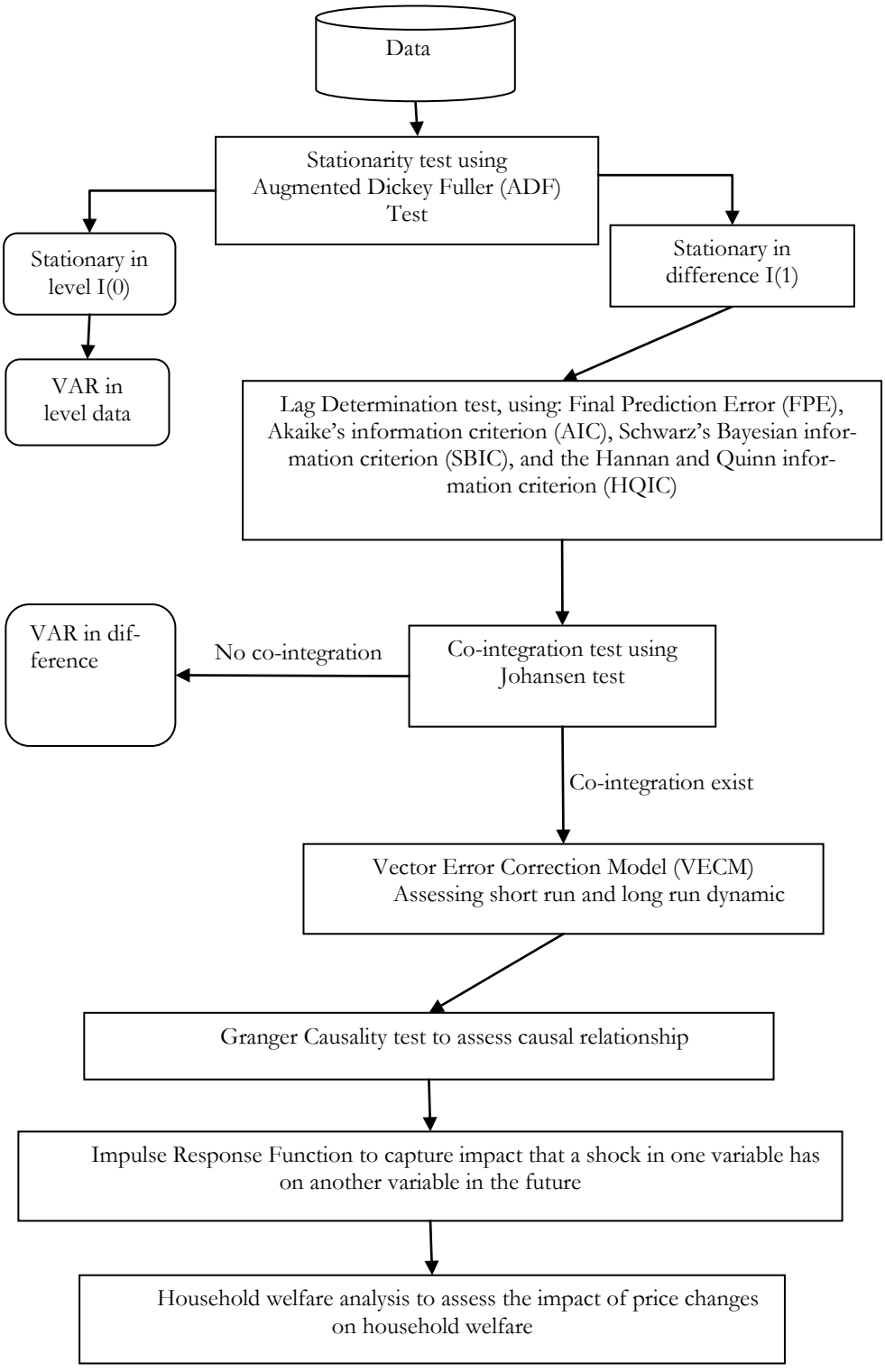


Household expenditure will be separately analyzed using descriptive analysis. The data from SUSENAS 2010 is employed in this study. SUSENAS is national data survey conducted by Statistics Indonesia to provide information about education, health, housing, social and cultural activity, and also household consumption and expenditure. SUSENAS 2010 was conducted during year 2010 and covered 293,289 household samples. To capture household expenditure this research will use household total expenditure from food and non-food, while to measure household expenditure on frying oil, this research will use data of household expenditure on vegetable oil and fat.

4.2 Methodology

The concept of price transmission and market co-integration in chapter 3 brings the idea of interrelationship among markets. It raises a question whether price in international market influence price in domestic market, and further whether fluctuation in both market influence household welfare. Co-integration concept in econometrics provide tool to assess price transmission. Johansen as cited in Rapsomanikis et al. (2003)said that co-integration technique provides a framework for estimating and testing for short run and long run equilibrium relationships between non stationary but integrated variables. The analysis steps are described in figure 11

Figure 11 Steps of Analysis



Source: Widarjono (2007)

4.2.1 Stationarity Test

Gujarati (2003) explains that stationary data tend to fluctuate around their average. A stationary data is important in time series analysis to avoid spurious regression. A stationarity test which is commonly used is the Augmented Dickey Fuller (ADF). The null hypothesis of ADF is the existence of unit root or the model is non-stationary. Based on Enders (2010) the ADF test is estimated with specifications as follow:

$$\Delta lnPDom_t = \lambda_1 + \lambda_2 t + \partial lnPDom_{t-1} + \sum_{t=1}^{l} \gamma_i \, \Delta lnPDom_{t-1} + \varepsilon_t \ldots\ldots (4.1)$$

$$\Delta lnPIntl_t = \lambda_1 + \lambda_2 t + \partial lnPIntl_{t-1} + \sum_{t=1}^{l} \gamma_i \, \Delta lnPIntl_{t-1} + \varepsilon_t \ldots\ldots (4.2)$$

$$\Delta lnEx_t = \lambda_1 + \lambda_2 t + \partial lnEx_{t-1} + \sum_{t=1}^{l} \gamma_i \, \Delta lnEx_{t-1} + \varepsilon_t \ldots\ldots (4.3)$$

$$\Delta lnRER_t = \lambda_1 + \lambda_2 t + \partial \Delta lnRER_{t-1} + \sum_{t=1}^{l} \gamma_i \, \Delta lnRER_{t-1} + \varepsilon_t \ldots\ldots (4.4)$$

$$\Delta \inf_t = \lambda_1 + \lambda_2 t + \partial \Delta inf_t + \sum_{t=1}^{l} \gamma_i \, \Delta inf_{t-1} + \varepsilon_t \ldots\ldots (4.5)$$

Where:

lnPDom	: is palm oil price in domestic market in logarithm form
lnPIntl	: is real palm oil price in international market in logarithm form
lnEx	: is export volume in logarithm form
lnRER	: is real exchange rate in logarithm form
inf	: is inflation rate
t	: time trend
l	: optimum lag
Δ	: first different operator
ε	: error term
λ_1	: drift
λ_2	: trend

The null hypothesis is $\partial = 0$ or the existence of unit root in observed time series which means that the variable is non-stationary.

Prior conducting ADF test, we need to specify the model specification and choose the optimum lag. Specification determination will detect whether a variable can be modelled as pure random walk, or having drift and

trend. To determine optimum lag, Bayesian Information Criterion (BIC) is employed as proposed by Enders (2010).

4.2.2 Co-integration Test

If two prices in spatially separated markets Yt and Xt contain stochastic trends and are integrated of the same order, say I(d),

$$Yt = \beta 1 + \beta 2Xt + \varepsilon_t \ldots\ldots.(4.6)$$

The prices are said to be co-integrated if the residual from the regression ε_t is I(0) or stationery (Gujarati,2003:822) Two or more variables are co-integrated, if there is a linear combination between them that does not have a stochastic trend even though the individual series contain stochastic trends. Co-integration implies that these prices move closely together in the long run, although in the short run they may drift apart, and thus is consistent with the concept of market integration. Johansen derived the distribution of two test statistics for the null of no co-integration referred to as the Trace and the Eigenvalue tests (Enders: 2010).

If ε_t is stationary means that the prices contain stochastic trends that have long-run equilibrium relationship between them. It means that changes in international market price are transmitted to the domestic market price. When ε_t is non-stationary means that co-integration does not exist and two prices drift apart in the long run, as they are driven by stochastic trends that are not proportional. Non co-integration among markets might be appears because of external factors, such as policies or deviations from marginal cost pricing which greatly affect the price of domestic market.

4.2.3 Vector Error Correction Model (VECM)

Based on theory, when variables are stationary in same level, called I(d), and the existence of co-integration among variables, then their relationship may be identified as Vector Error Correction Model (VECM). Based on Johansen as cited in Rapsomanikis et al.(2003) VECM can be modelled as follow:

$$\begin{bmatrix} \Delta\, lnPDom_t \\ \Delta\, lnPIntl_t \\ \Delta\, lnEx_t \\ \Delta\, lnRER_t \\ \Delta\, inf_t \end{bmatrix} = \begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \end{bmatrix} [lnPDom_{t-1}\ \ lnPIntl_{t-1}\ lnEx_{t-1}\ lnRER_{t-1}\ inf_{t-1}]\beta + \Gamma \begin{bmatrix} \Delta\, lnPDom_{t-1} \\ \Delta\, lnPIntl_{t-1} \\ \Delta\, lnEx_{t-1} \\ \Delta\, lnRER_{t-1} \\ \Delta\, inf_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon\, lnPDom_t \\ \varepsilon\, lnPIntl_t \\ \varepsilon\, lnEx_t \\ \varepsilon\, lnRER_t \\ \varepsilon\, inf_t \end{bmatrix} \ldots\ldots\ldots\ldots\ldots\ldots (4.7)$$

Where:

lnPDom : is palm oil price in domestic market in logarithm form

lnPIntl : is palm oil price in international market in logarithm form

lnEx	: is export volume in logarithm form
lnRER	: is real exchange rate in logarithm form
inf	: is inflation rate
v	: is drift term
α	: is speed of adjustment of each variable to turn to its equilibrium in case when a shock appears
β	: long run coefficient
Γ	: short run coefficient
ε	: error term

Engel and Granger as cited in Widarjono (2007) reveals that a time series data might not stationary in level but linear combination among non-stationary data might result for stationary data, which is called co-integration. VECM incorporates short run dynamic relationship among variables, in which error correction term incorporates with the long run information (Rapsomanikis et al.:2003). VECM enable us to analyse long run relationships among variables and also to see how the individual series adjust with respect to this equilibrium in the short run dynamics. This is to say that, the availability of short run and long run analysis and also the speed of adjustment analysis have made VECM framework more useful. Thus, the interaction among variables in VECM concept is depicted gradually from short run to long run which provides better perspective rather than only giving instantaneous coefficient of relationship (ibid). Conforti (2004) used VECM to analyse price transmission from world price to African, Latin American, and Asian markets. The same method was also utilized by Tuan (2010) for analysing international and domestic prices of fertilizer in Vietnam.

4.2.4 Granger Causality Test

The concept of Granger causality in econometric intends to find out whether there are two way relationships between variables (Widarjono: 2007). If the causality exists in two-way directions, it means that the model only has independent variables. It can be inferred the two variables have mutual influence relationship (ibid)

The test involves estimating the following pair of regressions (Widarjono: 2007):

$$lnPDom_t = \sum_{i=1}^{n} \gamma_i \, lnPIntl_{t-1} + \sum_{j=1}^{n} \rho_i \, lnPDom_{t-1+\mu_{1t}} \ldots\ldots (4.8)$$

Where current domestic price is related to past value of itself as well as that of international price

$$lnPIntl_t = \sum_{i=1}^{n} \delta_i \, lnPDom_{t-1} + \sum_{j=1}^{n} \pi_i \, lnPIntl_{t-1+\mu_{2t}} \ldots. (4.9)$$

And current international price is related to past value of itself as well as that of current domestic price

When causality exists from domestic price to international price or international price to domestic price only, it is called unidirectional causality (Widarjono: 2007). While if causal relationship exist both direction from domestic price to international price and international price to domestic price, it is called as bilateral causality (ibid).

The analysis will also conduct Granger causality relationship among RER with domestic price; international price with export volume; domestic price with export volume; inflation with international price; inflation with price domestic; and RER with inflation.

$$lnRER_t = \sum_{i=1}^{n} \gamma_i \, lnPDom_{t-1} + \sum_{j=1}^{n} \rho_i \, lnRER_{t-1+\mu_{1t}} \dots\dots\dots\dots (4.10)$$

$$lnPDom_t = \sum_{i=1}^{n} \delta_i \, lnRER_{t-1} + \sum_{j=1}^{n} \pi_i \, lnPDom_{t-1+\mu_{2t}} \dots\dots\dots\dots (4.11)$$

$$lnPIntl_t = \sum_{i=1}^{n} \gamma_i \, lnEx_{t-1} + \sum_{j=1}^{n} \rho_i \, lnPIntl_{t-1+\mu_{1t}} \dots\dots\dots\dots\dots (4.12)$$

$$lnEx_t = \sum_{i=1}^{n} \delta_i \, lnPIntl_{t-1} + \sum_{j=1}^{n} \pi_i \, lnEx_{t-1+\mu_{2t}} \dots\dots\dots\dots\dots\dots (4.13)$$

$$lnPDom_t = \sum_{i=1}^{n} \gamma_i \, lnEx_{t-1} + \sum_{j=1}^{n} \rho_i \, lnPDom_{t-1+\mu_{1t}} \dots\dots\dots\dots (4.14)$$

$$lnEx_t = \sum_{i=1}^{n} \delta_i \, lnPDom_{t-1} + \sum_{j=1}^{n} \pi_i \, lnEx_{t-1+\mu_{2t}} \dots\dots\dots\dots\dots (4.15)$$

$$inf_t = \sum_{i=1}^{n} \gamma_i \, lnP\_Intl_{t-1} + \sum_{j=1}^{n} \rho_i \, inf_{t-1+\mu_{1t}} \dots\dots\dots\dots\dots\dots\dots (4.16)$$

$$lnPIntl_t = \sum_{i=1}^{n} \delta_i \, inf_{t-1} + \sum_{j=1}^{n} \pi_i \, lnPIntl_{t-1+\mu_{2t}} \dots\dots\dots\dots\dots (4.17)$$

$$lnPDom_t = \sum_{i=1}^{n} \gamma_i \, inf_{t-1} + \sum_{j=1}^{n} \rho_i \, lnPDom_{t-1+\mu_{1t}} \dots\dots\dots\dots\dots (4.18)$$

$$inf_t = \sum_{i=1}^{n} \gamma_i \, lnPDom_{t-1} + \sum_{j=1}^{n} \rho_i \, inf_{t-1+\mu_{1t}} \dots\dots\dots\dots\dots\dots (4.19)$$

$$lnRER_t = \sum_{i=1}^{n} \gamma_i \, inf_{t-1} + \sum_{j=1}^{n} \rho_i \, lnRER_{t-1+\mu_{1t}} \dots\dots\dots\dots\dots\dots (4.20)$$

$$inf_t = \sum_{i=1}^{n} \delta_i \, lnRER_{t-1} + \sum_{j=1}^{n} \pi_i \, inf_{t-1+\,\mu_{2t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.21)$$

Where:

lnPDom : is palm oil price in domestic market in logarithm form

lnPIntl : is palm oil price in international market in logarithm form

lnEx : is export volume in logarithm form

lnRER : is real exchange rate in logarithm form

inf : is inflation rate

4.2.5 Impulse Response Function (IRF)

This research also performs Impulse Response Function (IRF) to analyze the dynamic response of the model. IRF is interpreted as the impact that a shock in one variable has on another variable in immediate moment and the future (Enders: 2010). IRF is able to trace out the effects over the time path in the future. IRF provide the result in a graph, which will simplify the interpretation process.

When the effect of a shock dies out over time on its initial condition, the shock is said to be transitory. When the effect of a shock does not die out over time on its initial condition, the shock is said to be permanent (StataCorp: 2009). IRF usually applied in economics studies to detect the reaction of macroeconomic variables such as consumption, employment, or Gross Domestic Product (GDP) to the respect of price changes, level of technology, government expenditure, and fiscal or monetary policy. Cheng and Bergman (2004) used IRF to analyse price adjustment and nominal exchange rate. Sharma and Panagiotidis (2005) use IRF to study export led growth in India, and Jonsson (2001) to analyse inflation, money demand, and purchasing power parity.

4.2.6 Analysis of Household Expenditure

Shift of price will certainly influence household expenditure. Household should pay more for the increasing price of frying oil. However the impact will be different for each household. Not only depend on the shift of price, the impact also depends on the proportion of frying oil in household total expenditure. It is interesting to analyse how do fluctuations in the price of processed palm oil affect households across the income distribution.

To answer this question, this study utilizes descriptive analysis from household expenditure data. Household expenditure is used here for the proxy of income. The analysis started by computing the share of oil expenditure from total household expenditure.

$$\text{Share of Oil} = \frac{\text{Oil Expenditure}}{\text{Total Expenditure}} \ldots\ldots\ldots (4.22)$$

The next step is depicting correlation of share of oil expenditure with household expenditure into a graph. Household expenditure is classified into five quintiles to show welfare stratification among group. Cranfield et al. (1998) employed similar method by displaying household budget share on the graph. They assess changes of food demand due to changes of household income and budget expenditure.

The discussion will be continued by displaying simulation of prices shift in order to seek for answer how changes of price will affect loss of purchasing power parity of households across income distribution. Household total expenditure is stratified into five quintiles in horizontal axis. While loss of purchasing power parity in percentage is displayed in vertical axis. Loss of purchasing power parity is calculated as follow:

$$\text{Loss of Purchasing Power Parity} = \text{price simulation x } \frac{\text{Oil Expenditure}}{\text{Total Expenditure}} \ldots (4.23)$$

Chapter 5
Result and Analysis

Series of procedures are applied to analyse the co-integration among variables; which are stationary data test, co-integration test, long run and short-run analysis and IRF. This research employs STATA 11.2 as software analysis.

5.1 Stationarity Test

Specification test and lag determination are conducted prior to stationary test. The specification test indicates that variable domestic price, international price, RER, and inflation are pure random walk, while export volume has drift and trend. Lag determination using Bayesian Information Criteria indicates lag one as the proper lag for international and domestic price, and RER; lag three is proper for export volume; and lag twelve for inflation. STATA output for specification test and lag determination are provided in the appendices[3].

Based on the result from specification test and lag determination, the step is continued by ADF to detect the existence of unit root.

Table 1 Unit Root Test in Level I(0)

Variables	Specification[4]	Lag[5]	ADF Test	Critical Values			Results
				1%	5%	10%	
Inflation	Pure random walk	12	-0.604	-2.602	-1.950	-1.610	Unit Root
Price Domestic	Pure random walk	1	-1.010	-3.508	-2.890	-2.580	Unit Root
Price International	Pure random walk	1	0.221	-2.599	-1.950	-1.610	Unit Root
Export	Random walk with drift and trend	3	-2.346	-2.365	-1.660	-1.290	Unit Root
RER	Pure random walk	1	-1.225	-2.599	-1.950	-1.610	Unit Root

The null hypothesis is the existence of unit root or non-stationary, to reject this ADF test must be less than 1% critical value. Based on table 1 ADF test are greater than 1% critical value meaning that they are non-stationer. The

[3] See Appendix 3 the steps to determine variable specification
[4] See Appendix 4 variable specification determination
[5] See Appendix 5 lag determination

stationary test for difference level on table 2 shows that all variables do not have unit root in order one, I(1). All variables are stationary in difference one.

Table 2 Unit Root Test in Difference I(1)

Variables	Specification	Lag	ADF Test	Critical Values			Results
				1%	5%	10%	
Inflation	Pure random walk	12	-4.731	-2.602	-1.950	-1.610	No Unit Root
Price Domestic	Pure random walk	1	-7.455	-3.508	-2.890	-2.580	No Unit Root
Price International	Pure random walk	1	-6.397	-2.599	-1.950	-1.610	No Unit Root
Export	Random walk with drift and trend	3	-9.022	-2.364	-1.660	-1.290	No Unit Root
RER	Pure random walk	1	-8.986	-2.599	-1.950	-1.610	No Unit Root

5.2 Co-integration

Based on stationarity test, all variables are stationary in first difference I(1). The step continued by lag determination test to obtain appropriate lag order for co-integration. Final Prediction Error (FPE), Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC) are applied to determine lag order.

Table 3 Lag Determination Test

Lag	P value	FPE	AIC	HQIC	SBIC
0		0.00002	3.663	3.715	3.791
1	0.000	1.3e-09	-6.298	-5.989*	-5.535*
2	0.000	1.1e-09*	-6.483*	-5.917	-5.085
3	0.005	1.1e-09	-6.457	-5.633	-4.423
4	0.008	1.2e-09	-6.412	-5.331	-3.743

Even though above criteria give for different result, the decision will be based on Akaike's information criterion (AIC) as it is the most robust criteria. Hence, this research will use 2 lags.

Having identified the proper lag, the step continued to Johansen test for co-integration.

Table 4 Johansen Test for Cointegration

Max Rank	Hypothesis		Eigenvalue	trace statistic	5% Critical value
	H_0	H_1			
0	r = 0	r ≤ 1	.	81.26	68.52
1	r ≤ 1	r ≤ 2	0.408	25.57*	47.21
2	r ≤ 2	r ≤ 3	0.107	13.56	29.68
3	r ≤ 3	r ≤ 4	0.075	5.29	15.41

Note: 1) r stands for the rank number of cointegration vectors

The null hypothesis is rejected if the trace statistic is greater than the critical value. Johansen test on table 4 shows when maximum rank = 1, the trace statistic is less than its critical value (25.57<47.21) so we cannot reject the null hypothesis. The result supported by eigenvalue which also shows the maximum level (0.408) at rank one. Thus we can accept the null hypothesis that there is at least one co-integrating equations in the model. It can be inferred that the model has one long run equation.

5.3 Vector Error Correction Model (VECM) - Short Run Analysis

Based on the indication of the existence of co-integration in the model and the fact that all variables are stationer in first difference, we choose VECM as most appropriate model.

The short run analysis in table 5 reveals immediate response of variables. Since lag determination above appoints on second lags, short run period will be number of lag minus one. We have one short run period to analyse.

Table 5 Short Run Coefficients

Γ	ΔInflation $_t$	ΔPrice Domestic $_t$	ΔPrice International $_t$	ΔRER $_t$	ΔExport $_t$
Δ inflation $_{t-1}$	0.236 (0.018)	0.0007 (0.778)	-0.005 (0.244)	-0.0008 (0.655)	0.002 (0.937)
Δ Price Domestic $_{t-1}$	-0.787 (0.835)	-0.078 (0.430)	-0.062 (0.746)	0.003 (0.968)	-2.448** (0.012)
Δ Price International $_{t-1}$	1.819 (0.462)	0.403*** (0.000)	0.464 (0.000)	-0.102 (0.039)	1.643** (0.010)
ΔRER $_{t-1}$	11.05** (0.031)	0.324** (0.016)	-0.099 (0.702)	0.028 (0.778)	1.451 (0.273)
ΔExport $_{t-1}$	-0.469 (0.901)	-0.003 (0.758)	0.013 (0.496)	-0.003 (0.646)	0.083 (0.390)

P-Value in parenthesis

Note: ***, ** and * significant in critical value 1%, 5%, and 10% respectively

In domestic price short run estimation, price international and RER shows significant coefficient. It means domestic price changes are sensitive to changes in international price and exchange rate. When international price and exchange rate increases by 1 per cent, domestic price follows by 0.4 and 0.32 per cent in a one month lag. Inflation is sensitive to changes in RER. When exchange rate increases by 1 per cent, inflation follows by 11 per cent in a one month lag.

The sensitivity of domestic price to changes of international price and exchange rate in short run becomes a reason for policy maker to pay more attention on those two factors. To design proper policies on domestic frying oil price, policy maker should monitor the dynamic of international palm oil price and exchange rate.

In short run export volume is significantly influenced by domestic and international prices. Both prices give contradict influence on export volume. If international price increase by 1%, export volume will increase by 1.6%, while 1% increase of domestic price will reduce export volume by 2.4%.

This result explains producers' decision in allocating their product in short run. When international price increases producers prefer to export CPO product. On the other hand when domestic price increase, producers reduce export volume and supply their product for local market. Producers' decision is influenced by price in international and domestic market. The result indicates that the preference of producers to supply their palm oil product depend on the price which give more benefits to them. This result is important to be taken into consideration for policy maker to control domestic market stabilization. The rising prices of international CPO might stimulate Indonesian CPO producers to export CPO. Consequently, supply of domestic CPO for palm oil consumption may decrease. Eventually it might increase the prices of palm oil in the domestic market.

5.4 Long run Analysis

The VECM has been set with one co-integrating equation and two lags on the five variables. The aforementioned Johansen co-integration test suggests one rank co-integration that means we only have one long run equation. Based on the objective of this research to reveal the variability of domestic price, we imposed the constraint on variable domestic price equal to 1. Thus the analysis would capture the relationship between domestic price and other variables. The result for long run coefficient is on table 6:

Table 6 Long Run Coefficients

Beta	coefficient	p-value
Price Domestic	1	
Price International	0.739	0.000
Export	0.592	0.000
RER	0.497	0.030
Inflation	-0.0005	0.912
constant	-8.4091	

The equation indicates the existence of an equilibrium relationship between domestic prices, international price, inflation, exchange rate and export. The p-values show significant influence. The long run equation can be written as follow:

$$\ln PDom_t = -8.4 + 0.73 \ln PIntl_t + 0.59 \ln Ex_t + 0.49 \ln RER_t - 0.0005 inf_t + \varepsilon_t$$

It means that in the long run, domestic price has positive and significant relation with international price and export and exchange rate. 1% increase of international price associates with 0.73% increase of domestic price. When export volume increase by 1% domestic price will follow to increase 0.59% and increasing RER by 1% will raise domestic price by 0.49%. Inflation is the only variable which show negative and insignificant coefficient. This study has found co-integration between palm oil international prices with Indonesian domestic price. Similar result was revealed by the study from Suprihanti (2008). To check the accuracy of VECM and autocorrelation, we use Vecstable and Lagrange Multiplier which provided on appendix 6.

The result is giving important consideration for policy maker. To manage domestic price in long run, policy maker needs to pay attention on palm oil international price, exchange rate, and export volume. Increase of those three variables might increase domestic price.

5.5 Granger Causality

Granger Causality test is employed in order to find the directional effect among variables. This research will mainly explore on the relationship between domestic price and other variables, export volume with other variables, and also inflation with other variables. 5% critical value will be used to assess the result

Table 7 Granger Causality for Domestic Price

Null Hypothesis	Probability	Result	
International Price does not Granger Cause Domestic Price	0.000	Reject H_0	Causality exist
Domestic Price does not Granger Cause International Price	0.745	Accept H_0	Causality does not exist
RER does not Granger Cause price domestic	0.013	Reject H_0	Causality exist
Price domestic does not Granger Cause RER	0.998	Accept H_0	Causality does not exist

The empirical result of Granger Causality test is reported in table 7. The table shows the null hypothesis that International price does not granger cause domestic price can be rejected, which means international price has causal relationship on domestic price. However domestic price does not give causal relationship to international price. These results establish that causal linkage is unidirectional from international price to domestic price, not vice versa. The result indicates the position of Indonesia as small open economy. The similar result suggested by the relationship between RER and international price. There is unidirectional granger causality from real exchange rate to domestic price. On the other hand domestic price does not have granger causality relation for RER.

Table 8 Granger Causality for Export Volume

Null Hypothesis	Probability	Result	
International Price does not Granger Cause Export Volume	0.011	Reject H_0	Causality exist
Export Volume does not Granger Cause International Price	0.498	Accept H_0	Causality does not exist
Domestic Price does not Granger Cause Export Volume	0.0113	Reject H_0	Causality does exist
Export Volume does not Granger Cause Domestic Price	0.774	Accept H_0	Causality does not exist
RER does not Granger Cause Export volume	0.272	Accept H_0	Causality does not exist
Export Volume does not Granger Cause RER	0.646	Accept H_0	Causality does not exist

Granger causality test shows that international price and domestic price have granger causality to export volume. The relation is unidirectional since export volume does not have granger causality to international price and domestic price. This result supports short run analysis above, which reveals significant influence on export volume from international and domestic price.

Granger causality does not exist on the relationship between real exchanges rate with export volume.

Table 9 Granger Causality for Inflation

Null Hypothesis	Probability	Result	
Inflation does not Granger Cause real international price	0.238	Accept H0	Causality does not exist
Real international price does not Granger Cause inflation	0.454	Accept H0	Causality does not exist
Inflation does not Granger Cause domestic price	0.732	Accept H0	Causality does not exist
Domestic price does not Granger Cause Inflation	0.826	Accept H0	Causality does not exist
RER does not Granger Cause Inflation	0.031	Reject H0	Causality exist
Inflation does not Granger Cause RER	0.655	Accept H0	Causality does not exist

Only real exchanges rate which has unidirectional granger causality to inflation. Inflation does not indicate granger causality to RER. Other two variables which are international price and domestic price do not indicate granger causality relationship with inflation.

5.6 Impulse Response Function (IRF)

The IRF is interpreted as the impact that a shock in one variable has on another variable. The horizontal axis shows the period in 30 months ahead, and the vertical axis shows the response value in percentage.

Figure 12 Impulse Response Function

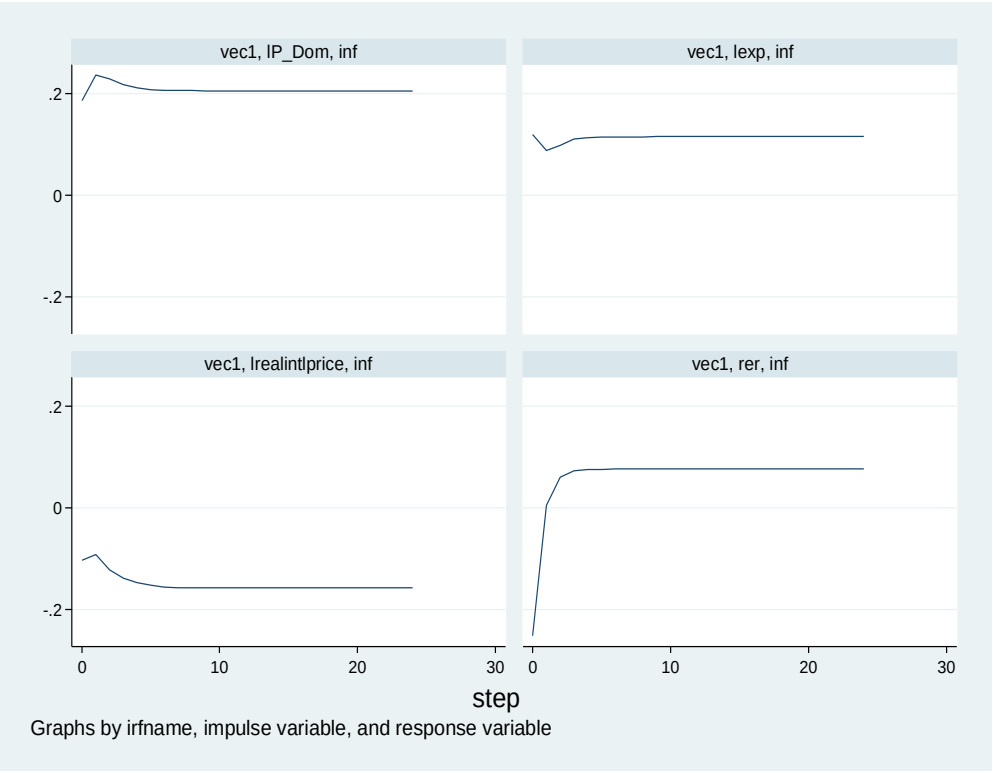
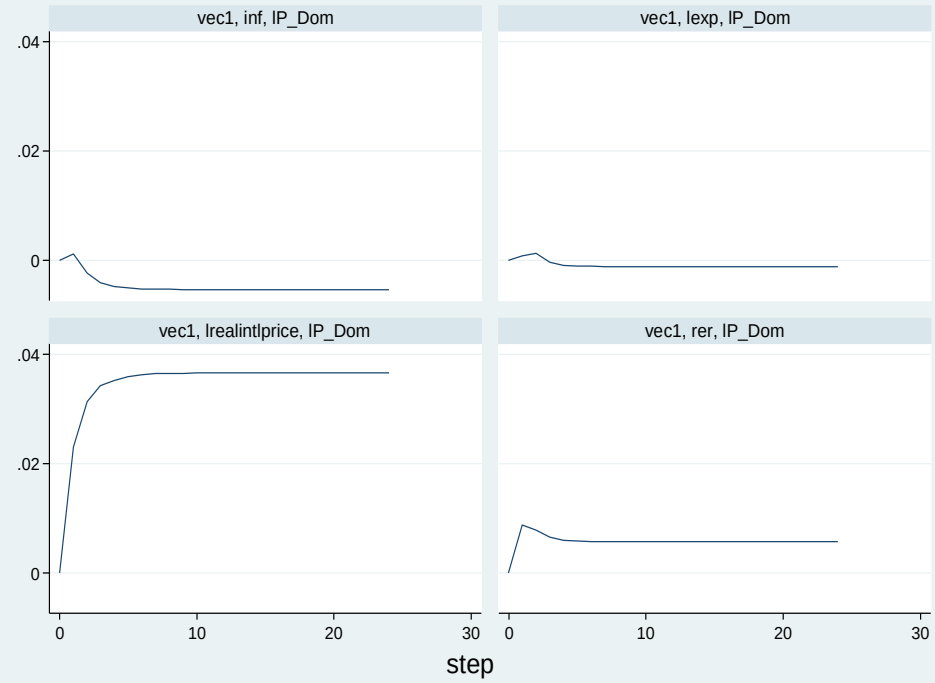


Figure 12 indicate that inflation give positive response on shocks from price domestic, export volume, and exchange rate in the future. The response of inflation is more sensitive to shock from price domestic, compare to shock from other variables. One shock from domestic price will increase inflation immediately by 0.2%. Inflation is less sensitive to export volume; its response to export volume is slightly lower than then its response to domestic price. Inflation response is increasing gradually to the shock from RER. The response is reaching stable condition slightly above its initial condition. Inflation shows negative response only for the shock from real international price.

Figure 13 Impulse Response Function



Domestic price seems not sensitive to export volume and inflation. Shock from inflation will slightly shift domestic price below its initial condition, while shock from export gives transitory effect by bringing back domestic price to its initial condition. IRF function predicts that in the future domestic price will experience permanent impact which is induced by a shock on international price and RER. The two variables will permanently increase domestic price above initial condition. Domestic price is more sensitive to shock from price international, compared to shock from other variables. One unit shock on international price will gradually increase domestic price far above its initial condition. While one unit shock on RER will increase domestic price and reach stable condition slightly above its initial condition.

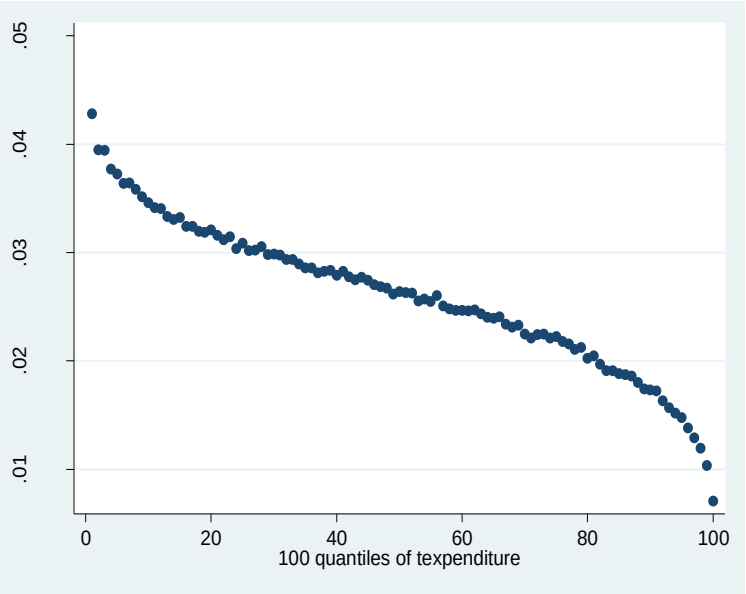
The graph recommends for consideration for policy maker to set regulation in price stabilization policy. To manage frying oil price in domestic market, we should give attention on movement of international price and exchange rate.

5.7 Analysis of Household Expenditure

The study of price volatility will be sharpened with analysis of household welfare. This research will also discuss about household welfare which will be affected by shift of oil price. As the consumer of frying oil, household should

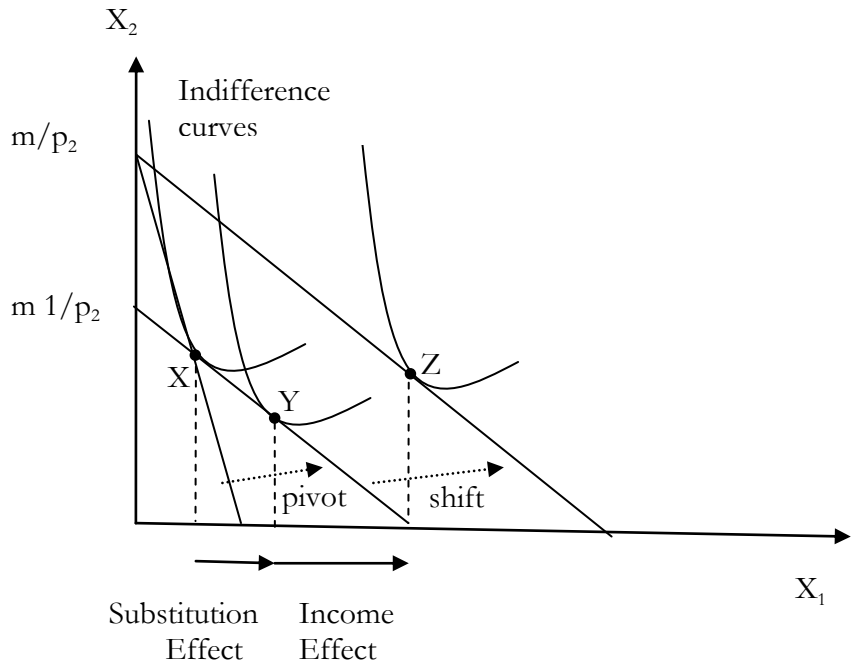
pay more for the increasing price of frying oil. Related with differential inflation concept, the impact of price changes will not be equal among households. The effect will be also influenced by the proportion of frying oil in household total expenditure. The analysis below is willing to answer the question of how fluctuations in the price of processed palm oil affect households across the income distribution.

Figure 14 Share of Frying Oil on Total Expenditure



The vertical axis is share of oil expenditure on total expenditure in percentage, while horizontal axis reports household expenditure classified into quintiles. The shape of the curve is underlining Engel's law which claims that the proportion of income spent on food reduces as income grows (Houthakker: 1957). The figure shows that the share of oil in total expenditure is relatively large for households at the lower end of the expenditure distribution. The first lower quintile spends almost 4% of their expenditure on frying oil every month. It is then decreasing with total expenditures. However, this decline is non-linear, with relatively little change in the middle range of the expenditure distribution. The rich families on upper most quintile spend only 1% of their expenditure on frying oil. This pattern shows that a price increase of oil has a regressive effect on the distribution of real income. Since the poor spend relatively more than the rich on oil, the poor are harmed more whenever frying oil prices increases. When there is 1% increase of frying oil price, those in the lowest expenditure quintile suffer four times worse than household on upper most group. Price change only gives small impact on welfare of rich families, but it gives significant impact on welfare of poor family.

Figure 15 Substitution Effect and Income Effect

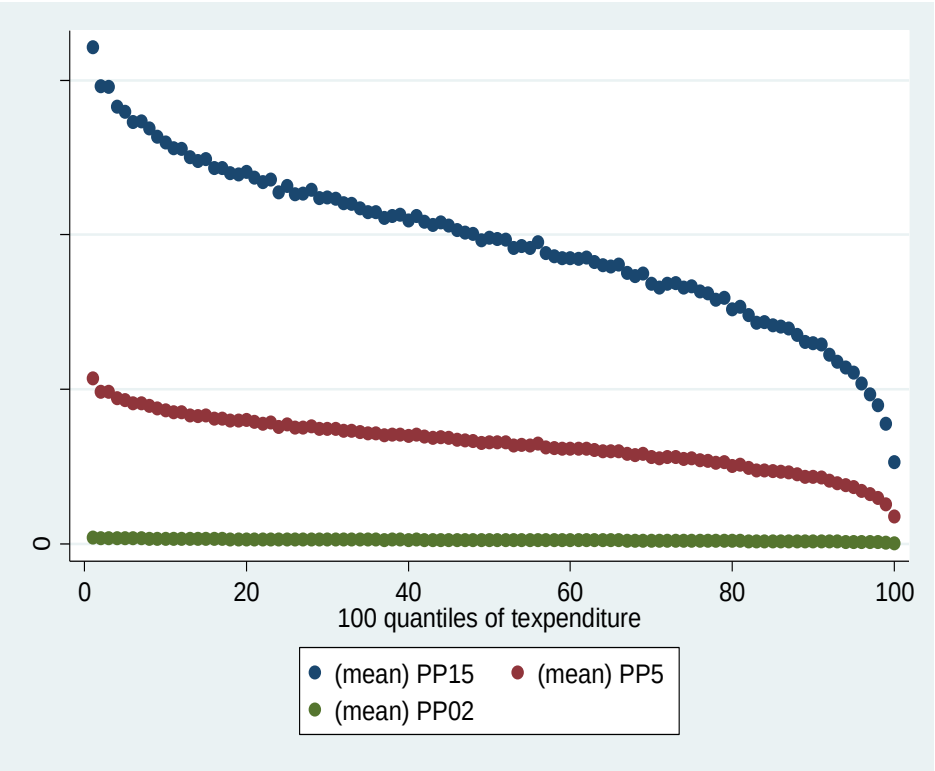


Source: Varian (2003:140)

The pivot explains substitution effect, as the movement of X to Y. It demonstrates how the consumers substitute one product for the other, in condition of fixed purchasing power but altered price. The research assumes that frying oil price elasticity is very low. In fact, palm oil is the most traded product with cheaper price compare to other vegetable oil such as soybean oil or sun flower oil in Indonesian market. Palm oil which is available in various brands has dominated frying oil market throughout the Indonesian archipelago. The rigidity of demand over the change of palm oil price emerges because it is difficult to substitute palm oil consumption with other vegetable oil products. It might be assumed that the demand curve is almost vertical which means that in general the substitution effect is low. It could be inferred that in general price changes are transmitted through the income effect. Increasing price of palm oil will lead to consumer welfare loss (Varian: 2003)

By displaying three simulation of price shift, this research provides evidence that the increase in the price will create higher inequality between poor and rich household. A similar method was employed by Cranfield et al. (1998) by displaying household budget share on the graph to assess the effect of income changes on consumption pattern. Their graphs show that as income increases, household budget share for grain decreases and share for livestock increases.

Figure 16 Loss of Purchasing Power Parity Due to Changes of Price



Vertical axis is displaying percentage of purchasing power parity loss, and horizontal axis is showing household total expenditure which is stratified into five quintiles. In the first price simulation, the change of price is set at 0.2% to represents the common frying oil inflation per month. The second simulation is demonstrating 5% increase of frying oil which usually appears during Idul Fitri and Christmas. Demand of frying oil and other consumption goods are increasing during those special days. The last simulation is demonstrating 15% increase of frying oil. Following the upward trending of international palm oil prices, in the beginning 2008 the price of frying oil in Indonesia has increased dramatically by 15%. Mitchell (2008) illustrates the reason that drought in Australia in 2006 and 2007, and poor crops in Europe in 2007 has worsen the supply of grain and vegetable oil in world market. Additionally world demand was pushed by increase of vegetable oil demand for biofuels by European countries, demand of oilseeds by China to feed its growing livestock and poultry industry (ibid).

The three curves are depicting the impact of price changes on household across income distribution. Increasing palm oil price brings worse effect on lower quintiles compared with upper quintile. The curve of purchasing power parity is getting steeper as the inflation is getting higher. The flat curve, which demonstrates 0.2% price increase, means no difference on purchasing power parity loss between the rich and the poor household. The curve is getting steeper for 5% price increase. Further, the condition gets worse for the third curve when the price increase by 15%. This means when price of palm oil is increasing, the poor are losing their purchasing power parity more than the rich.

5.8 Policy Implication

Product allocation is a complex problem in Indonesian palm oil industry. As mentioned in chapter two, Indonesia has become the biggest producer of palm oil in international market, and the second biggest consumer. As the largest producer, upward trending of international price is good to support Indonesian palm oil export. Based on aforementioned idea, Larson (1996) argues to take advantage of upward price trend by attract more investors, give credits to producers, and provide infrastructure in order to spur the production volume. In addition Larson argues that palm oil tax export and frying oil buffer stock policy are ineffective to protect consumer welfare. Thus he suggests the elimination of government intervention on frying oil market (ibid). Larson argument based on his calculation which states that benefits gained from export tax are smaller than the reduction of export revenue due to tax. In his perspective frying oil does not have an important role on household welfare analysis and increasing price of frying oil will be compensated by growth of national income.

Taking into account the result of analysis, this research gives counter arguments to Larson's idea. The long run analysis has shown statistical evidence of co-integration among variables. It means that external factors which are international price, export volume, and exchange rate can explain changes of domestic price. Granger causality underlined the role of Indonesia as small open economy, given unidirectional relationship from international to domestic price. The short run analysis has provided evidence that export volume move in opposite direction with domestic price but it moves in the same direction with international price. When domestic price increase, producers tend to supply for domestic market. Further, increase of international price stimulates producers to increase export. These facts will reduce domestic supply and eventually will increase domestic price. The findings show that many factors influence domestic price, and place it on unstable condition.

Price volatility is creating uncomfortable condition for welfare society. Frying oil is an important commodity for the Indonesian economy. Opening the domestic market without a price regulation will sacrifice the household welfare. The argument based on the result on figure 14 that the poorest 20% household spends 4% of their budget on frying oil. In fact the increase of palm oil price has worsened welfare inequality between the rich and the poor as shown on figure 16. The argument is also supported by the research of Prastowo et al. (2008), which mention that the frying oil expenditure comprises 1.4 % from total basket of national expenditure. Statistics Indonesia has placed frying oil as important commodity on inflation calculation; frying oil is the fourth main contributors on monthly inflation (Statistics Indonesia: 2011)[6]. Those reasons have placed frying oil as an important commodity in the studies about Indonesian household welfare. Considering the fact that the structure of both Indonesian palm oil plantation and frying oil industry is oligopolistic, we might say that the boom of price increase will only benefit certain groups. Producers, plantation owners, and frying oil manufactures in Sumatera and Ka-

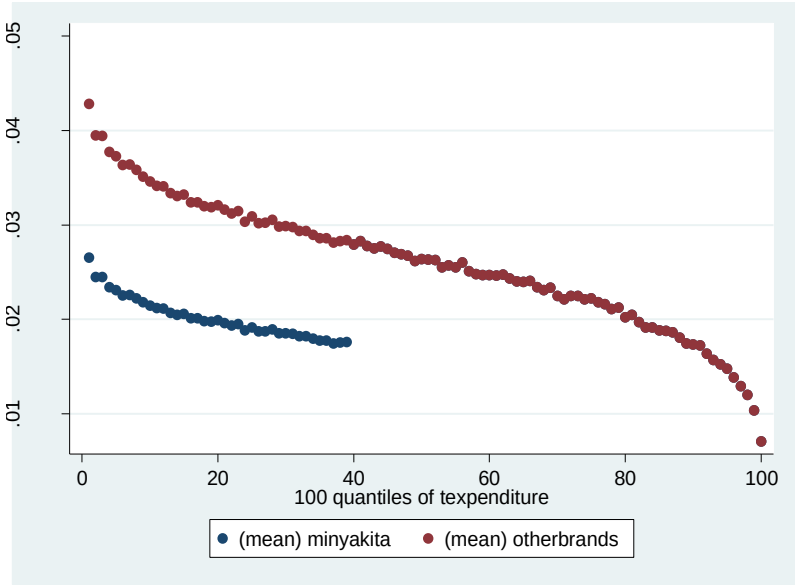
[6] Contributor of inflation on January 2011 in sequence order was rice, chili, jewelry, and frying oil

limantan islands might get the biggest proportion of the benefit. For all this, it is reasonable for the government to pay attention to the frying oil market in order to protect the poor.

Based on the shape of the curve, it seems that giving subsidy to the poor in particular is more effective than giving subsidy on price level. Some part of price subsidy would be enjoyed by the rich that do not need it. Subsidy to the poor can be effective by providing cheap frying oil which sold only in poor areas.

Implementation of program *Minyakita* [7] might become an alternative solution. The facility of "Government-borne VAT" could stimulate producers to provide affordable frying oil for domestic market. The incentive is given to producers who commit to produce cheap frying oil under government brand name *Minyakita* (CSBC: N.D.a). Under this program VAT obligation is shifted from company to government. In other words, government subsidizes producers in a form of government borne VAT. This brand name is specially designed by government with lower price than market price, and sold on targeted poor area. The price of *Minyakita* frying oil on November 2011 was 9,500 rupiah/litre (Antaranews: 2011). It was 38% cheaper compare to other brands which sold on 15,400 rupiah/litre (Ministry of Commerce: 2011). The comparison of purchasing power parity loss between *Minyakita* and other brands was depicted on figure 17

Figure 17 Loss of Purchasing Power Parity
Comparison between *Minyakita* and Other Commercial Brands



Assuming that *Minyakita* product is consumed only by the poorest families (the lowest two quintiles), the graph shows that loss of purchasing power parity of *Minyakita* (with blue dots) is lower than other brands (with red dots). It shows that the poor suffer less when they consume *Minyakita* product. However this program has not been widely implemented in the market due to problems such as producer's commitment and distribution to the poorest sec-

[7] See on chapter 2 page 12

tion of the society as target market (CSBC: N.D.a). Producers give less commitment to *Minyakita* due to smaller profit margin compare with other commercial brand names (Vivanews: 2009).

Combining policy to stimulate domestic supply with progressive export tax probably will be more effective. Producers tend to maximize profit by selling abroad when international price soars. Progressive tax rate is expected to stem excessive export volume (Casson and CIFOR: 2000). The increase of international price was followed by the rise of export tax rate and eventually the burden tax borne by exporter also increases. Hasan et al. (2001), Susila (2011) and Munadi (2007) reveals that export tax rate has negative impact on export volume. This is to say that government can use export tax to control export boom. Conversely, Susila (2011) also Casson and CIFOR (2000) express that progressive export rate bring positive impact on government revenue. For instance, the Implementation of progressive export tax during 1994-1999 had brought 5.2 billion rupiah for government revenue (Susila: 2011). Further, by using econometric analysis, Susila (2011) provides evidence that increase of progressive export tax will also lower palm oil price in domestic market. As the consequences, producer surplus decreases while consumer surplus rises. He underlines the effectiveness of export tax policy to control domestic price and protect consumer interest.

Not only bring positive effects as mentioned above, progressive export tax also brings unexpected effects. Casson and CIFOR (2000) reveal that increasing export tax will lower investment. Based on his analysis, Susila (2011) shows that increase of export tax will lower value added of palm oil industry sector, and plantation product. Eventually, employment will decline as the consequences of progressive export tax (ibid). Casson and CIFOR (2000) also point that palm oil industry mostly has integrated production chain. Thus, the corporation could shift the burden of tax rate to farmer, by lowering purchasing price of fresh fruit bunch from farmer. Hence, export tax will also bring negative impact on small farmer (ibid). Considering the benefit and loss brought by progressive export tax, government needs to be very careful to manage the export tax rate. To achieve the target and minimizing loss, it is necessary to incorporate the cost benefit calculation in designing export tax policy.

Increase of frying oil supply to market is expected to lower frying oil price in the market. Development of downstream industry[8] will provide supply of raw material for frying oil processing industry[9]. By integrating downstream palm oil industry with frying oil factory eventually will improve the output of frying oil product to fulfill the consumer demand.

Drajat (2007) and Prastowo et al. (2008) mention that distribution chain play important role in frying oil price. They recommend for efficiency of distribution chain from farmer to consumers to support frying oil stabilization in domestic market. Prastowo et al. (2008) added that volatility of fuel price, natural disaster, and accessible transportation facilities might become determinant factors of frying oil distribution chain.

[8] See on page 12 development of palm oil downstream industry

[9] See on figure 4 Palm Oil Process

The position of Indonesia as main producer as well as main consumer of palm oil commodity has triggered the problem of product allocation for domestic market and international market. This research has tried to discuss on the benefit and consequences of recommended policies which are VAT facilities for domestic market, progressive export tax, and improvement of processing and distribution chain. Those policies could bring benefit but they also bring consequences. Further, studies on policy effectiveness are necessary to handle the condition when price soars to maintain balanced interest between consumer welfare and export sector.

Chapter 6
Conclusion

Conclusion

In the past many studies have been done about the co-integration between international prices with national price, but not much is known about the channel that link price co-integration with household welfare. The author considers that the study between international and domestic palm oil price is more useful when it is linked with household welfare analysis. Under the framework of price transmission, this research seeks for answer whether price in international market influence price in domestic market, and further whether fluctuation in both market influence household welfare. Price has connected market with household through the channel of inflation. Co-integration concept in econometric has been used as an instrument to explore the relationship of price transmission and household welfare. Palm oil plays important role in Indonesian economic. Due to the fact that Indonesia is the world biggest producer as well as the second main consumer, product allocation for domestic market and international market has been indicated as a crucial problem in Indonesian palm oil industry. The research aims to analyze correlation between international and domestic prices and its effect on household welfare. This research intends to assess the time series data in both short run and long run; assessing dynamic analysis of each variable in giving response to shock from other variable in the current and the future period; and discussing impact of price shift based on household expenditure stratification.

A number of time series techniques which are stationarity test, Johansen co-integration test, VECM for short run and long run, Granger causality and also IRF have been used to assess price transmission. The analysis has been continued with discussion on household welfare. Export volume, RER, and inflation are three additional variables to explain correlation between both international and domestic palm oil price.

The long run analysis has shown the existence of co-integration among variables. Domestic price has positive and significant relationship with international price, export volume, and RER. The result for short run analysis revealed that domestic price will respond positively to stimulus from international price and RER. Short run analysis for export volume indicates positive response of export on international price. However the export volume moves on the opposite direction with domestic price in short run. The result denotes that producers' decision to supply their palm oil product depend on the price which give more benefit for them. When international price increase, producers tend to increase export. On the other hand, if domestic price increase producers tend to reduce export and shift their supply to domestic market. Consequently, supply of domestic CPO for palm oil consumption decrease and domestic price rise. This result is important to be consideration for policy maker to control domestic market stabilization.

The result from Granger causality test has explained that international price and RER have unidirectional causal relationship to domestic price. Unidirectional causality also appears on the relationship between international price and domestic price to export volume. Only real exchanges rate which has unidirectional granger causality to inflation. IRF predicted that in the future inflation gives positive response to the shock from price domestic, export volume, and RER. In addition, IRF also predict that domestic price is more sensitive to shock from international price, compare to shock from other variables. The IRF result support the result of short run analysis, that policy maker should pay attention to the movement of international price to set regulation in domestic price stabilization policy.

This study has continued by exploring the impacts on price changes on welfare of household based on quintiles of income distribution. By displaying the share of oil expenditure from total expenditure for five quintile of household expenditure, this research has shown that those in the lowest expenditure suffer four times worse than household on upper most group. This study has simulated how purchasing power parity changes due to shift on price by demonstrated three different prices. It can be inferred that a higher price will lead to higher inequality across households expenditure quintiles. The poor will lose purchasing power parity relatively more than the rich.

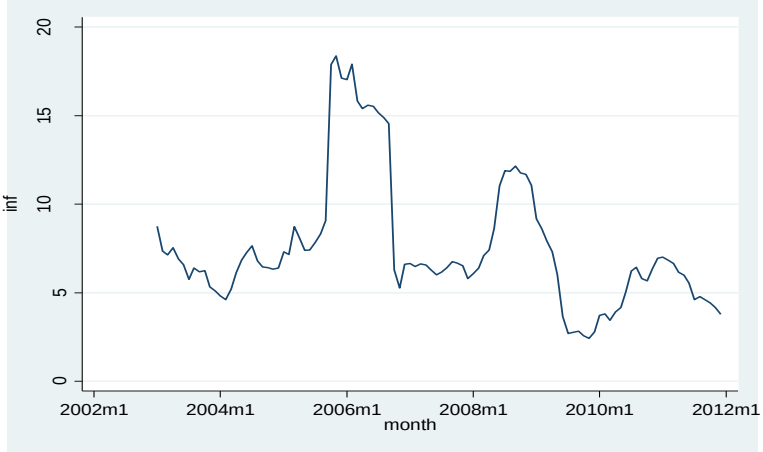
Based on the findings it can be inferred that domestic price is highly influenced by international price, export volume, and real exchange. Unfortunately, volatility of domestic price leads to inequality of purchasing power parity loss between the poor and the rich. Thus, this research argues that government intervention is important to protect the poor when domestic price soars. Combining policy to stimulate domestic supply with progressive export tax probably will be effective to stabilize market when price soars. This research have explored *Minyakita* program as one of alternative solutions. Government gives incentive by subsidizing VAT to producers who commit to provide cheap frying oil for targeted poor community. To limit excessive export when international price soars, this research argues that implementation of progressive tax rate might become the solution. The increase of export tax rate eventually will add tax burden borne by exporter. However government should be wise in setting the rate, because improper progressive tax rate brings unexpected impacts to palm oil industry. This research also supports development of processing and distribution chain to improve supply of frying oil product.

In order to assess the policy effectiveness for protecting the poor when price soars, this research has discussed the benefits and weaknesses of the suggested policies. As mentioned on the background, product allocation of palm oil for domestic market and international market is indicated as an important issue in Indonesian palm oil industry, thus further research is necessary to identify proper policies in managing the condition when price soars to protect the interest of domestic consumers as well as to support export activity. To obtain effective recommendations, the future studies may add cost-benefit analysis of the various policy interventions, or distinguish short term from long term impacts. The analysis should be supported by household level information about consumption under alternative prices. Thus the analysis might results for effective problem solving policies

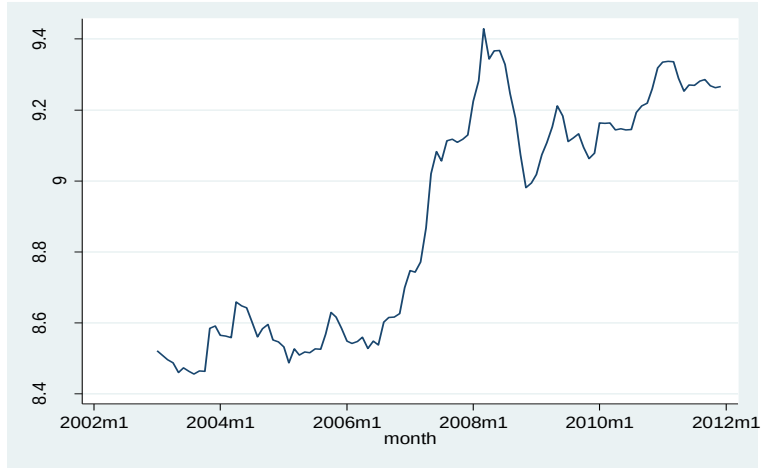
Appendices

Appendix 1. Line Plots for Time-series Data

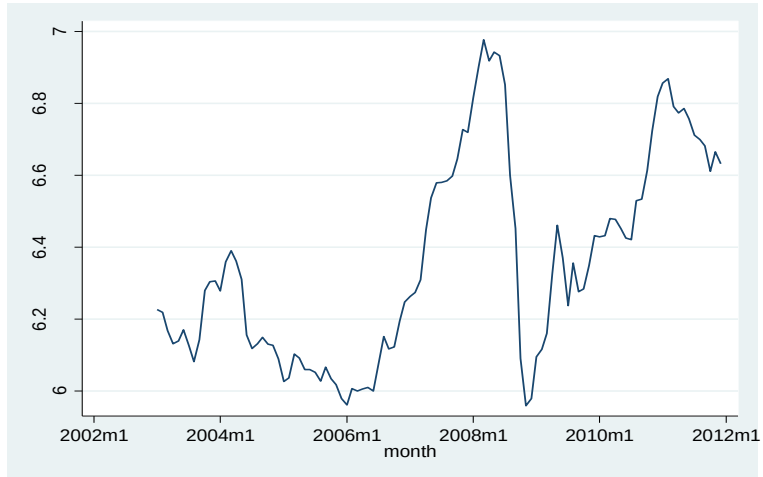
Inflation



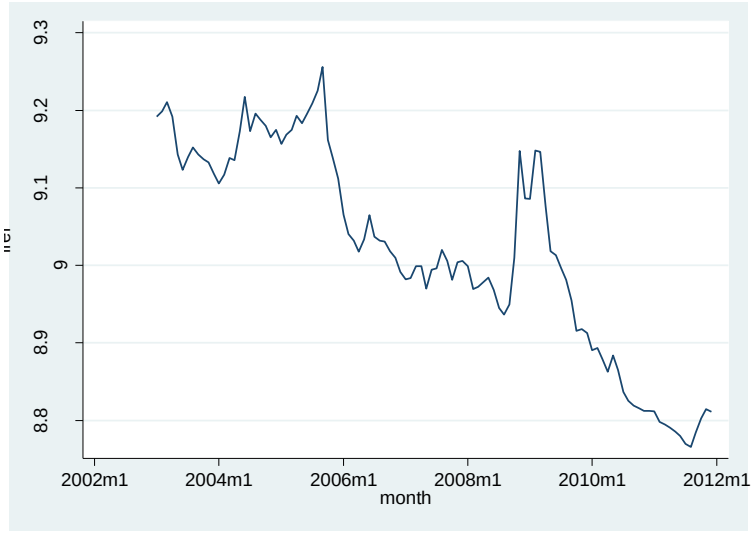
Price Domestic



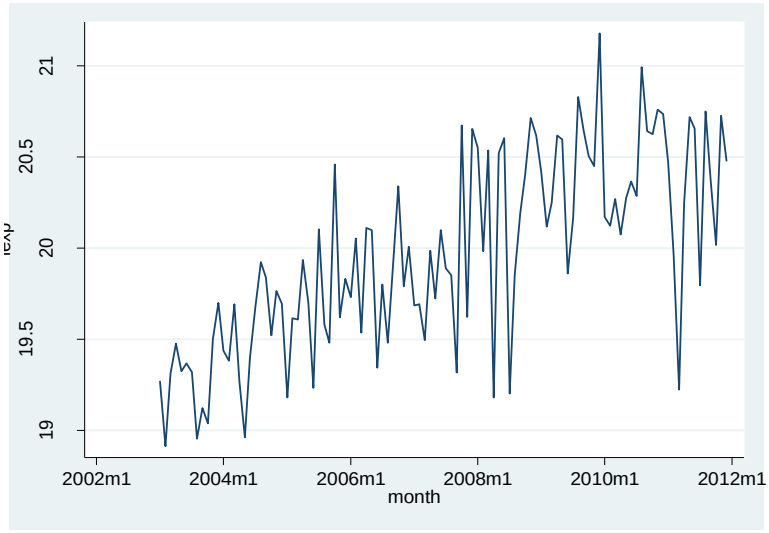
Price International



Real Exchange Rate



Export Volume



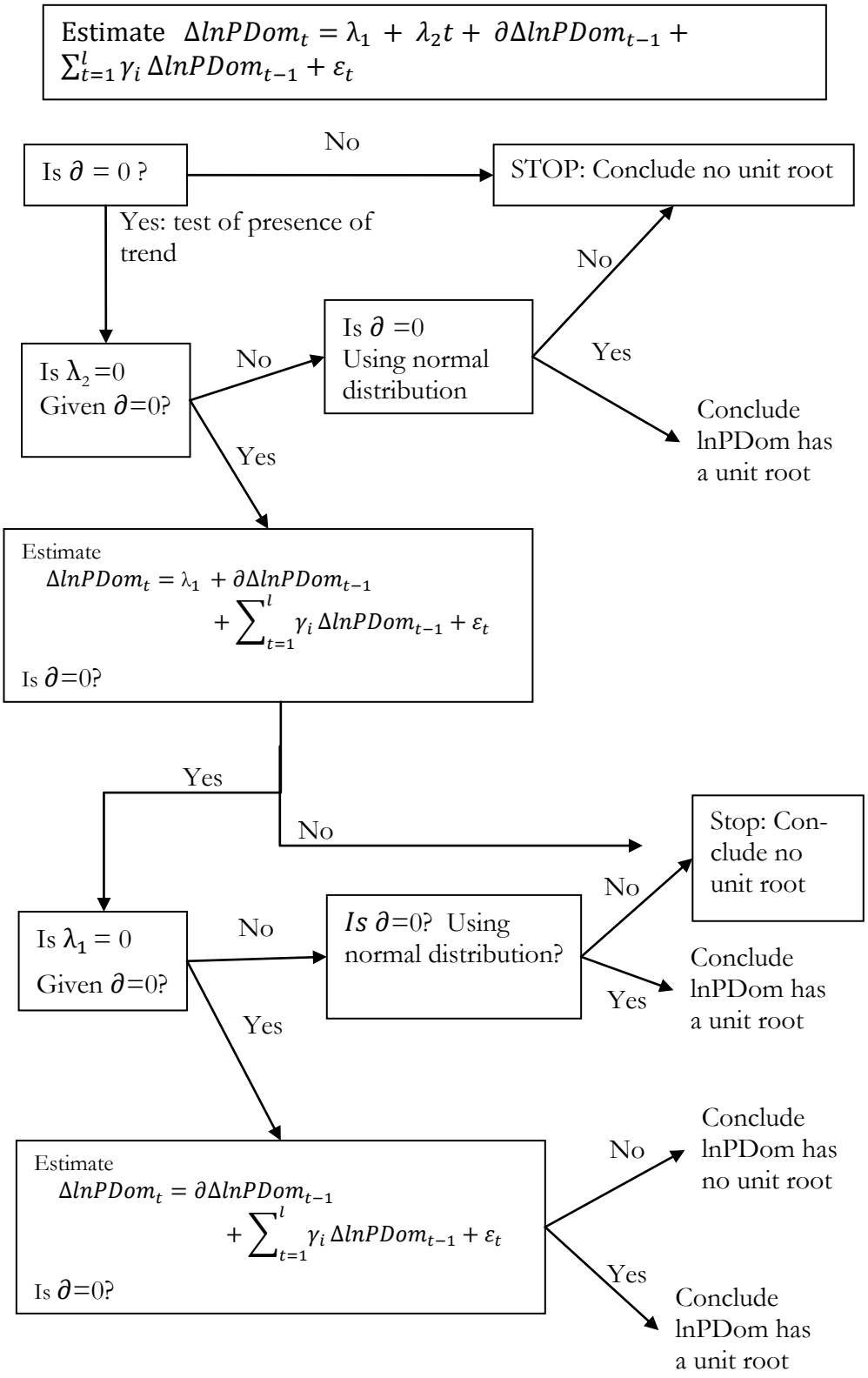
Appendix 2 Descriptive Statistics

Variable	Observation Number	Mean	Standard Deviation
Ln Domestic Price	108	8.89	0.32
Ln International Price	108	6.35	0.28
Ln Export	108	19.9	0.52
Ln RER	108	9.02	0.13
Inflation	108	7.57	3.69

Variables	Observation Number	Mean	Standard Deviation
Household Total Expenditure	293289	1949265	1801530
Household Expenditure on Frying Oil	293289	41493.7	32191.4

Appendix 3 Decision Tree of Variables Specification

The decision tree bellow is depicting the step to determine whether a time series data experiencing deterministic trend



Source: Enders (2010)

Appendix 4 Model Specification

Based on above decision tree we can determine the model specification of each variable.

Variable: Real Exchange Rate (RER)	F value	F statistic	Result
Step 1 Estimation model $\Delta lnRER_t = \lambda_1 + \lambda_2 t + \partial \Delta lnRER_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnRER_{t-1} + \varepsilon_t$ Hypothesis: H_0:λ_1=λ_2= ∂ =0 H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ and or $\lambda_2 \neq 0$	2.47	6.49	Accept H_0
Step 2 Estimation model $\Delta lnRER_t = \lambda_1 + \partial \Delta lnRER_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnRER_{t-1} + \varepsilon_t$ Hypothesis: H_0:λ_1= ∂ =0 H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ Conclude that variable RER can be modelled by pure random walk	1.28	4.71	Accept H_0

Variable: inflation	F value	F statistic	Result
Step 1 Estimation model $\Delta inf_t = \lambda_1 + \lambda_2 t + \partial \Delta inf_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta inf_{t-1} + \varepsilon_t$ Hypothesis: H_0:λ_1=λ_2= ∂ =0 H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ and or $\lambda_2 \neq 0$	1.35	6.49	Accept H_0

Step 2 Estimation model $\Delta inf_t = \lambda_1 + \partial \Delta inf_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta inf_{t-1} + \varepsilon_t$ Hypothesis: H_0: $\lambda_1 = \partial = 0$ H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ Conclude that variable inflation can be modelled by pure random walk	1.69	4.71	Accept H_0

Variable: Price International	F value	F statistic	Result
Step 1 Estimation model $\Delta lnPIntl_t = \lambda_1 + \lambda_2 t + \partial \Delta lnPIntl_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnPIntl_{t-1} + \varepsilon_t$ Hypothesis: H_0: $\lambda_1 = \lambda_2 = \partial = 0$ H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ and or $\lambda_2 \neq 0$	1.22	6.49	Accept H_0
Step 2 Estimation model $\Delta lnPIntl_t = \lambda_1 + \partial \Delta lnPIntl_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnPIntl_{t-1} + \varepsilon_t$ Hypothesis: H_0: $\lambda_1 = \partial = 0$ H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ Conclude that variable price international can be modelled by pure random walk	0.88	4.71	Accept H_0

Variable: Price Domestic	F value	F Statistic	Result
Step 1 Estimation model $\Delta lnPDom_t = \lambda_1 + \lambda_2 t + \partial \Delta lnPDom_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnPDom_{t-1} + \varepsilon_t$ Hypothesis: H_0: $\lambda_1 = \lambda_2 = \partial = 0$ H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ and or $\lambda_2 \neq 0$	1.74	6.49	Accept H_0
Step 2 Estimation model $\Delta lnPDom_t = \lambda_1 + \partial \Delta lnPDom_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnPDom_{t-1} + \varepsilon_t$ Hypothesis: H_0: $\lambda_1 = \partial = 0$ H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ Conclude that variable price domestic can be modelled by pure random walk	1.55	4.71	Accept H_0

Variable: Export Volume	F value	F statistic	Result
Step 1 Estimation model $\Delta lnEx_t = \lambda_1 + \lambda_2 t + \partial \Delta lnEx_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnEx_{t-1} + \varepsilon_t$ Hypothesis: H_0: $\lambda_1 = \lambda_2 = \partial = 0$ H_1: $\partial \neq 0$ and/or $\lambda_1 \neq 0$ and or $\lambda_2 \neq 0$	33.37	6.49	Reject H_0

Step 2 Estimation model $\Delta lnEx_t = \lambda_1 + \partial \Delta lnEx_{t-1} + \sum_{t=1}^{l} \gamma_i \Delta lnEx_{t-1} + \varepsilon_t$ Hypothesis: H_0 :$\lambda_1 = \partial = 0$ H_1 : $\partial \neq 0$ and/or $\lambda_1 \neq 0$ Conclude that variable export volume can be modelled by random walk with drift and trend	16.30	4.71	Reject H_0

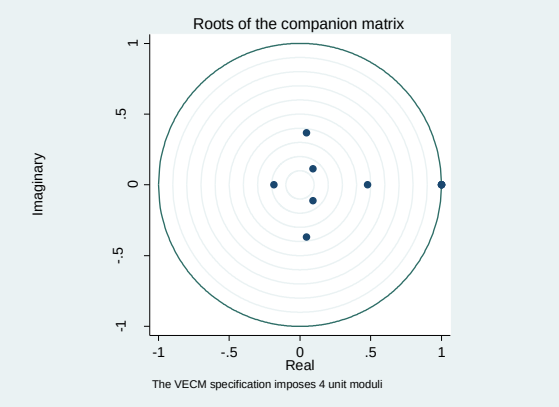
Appendix 5. Lag Determination

To determine the proper lag, we choose the smallest Bayesian Information Criteria Determination Lag bellow:

lag	Inflation	Ln Price Domestic	Ln Real International Price	Ln Export Volume	Ln Exchange Rate
1	371.5	**-360.7**	**-261**	131.4	**-450.9**
2	373.6	-351.8	-253.8	124.7	-443.1
3	373.4	-342.9	-246.6	**123.6**	-435.5
4	374	-334.6	-239.6	127.8	-427.8
5	376.1	-325.7	-236	131.8	-418
6	376.9	-320.9	-229	132.2	-409
7	374.5	-312.13	-221	130.5	-403
8	376.7	-303.3	-213.9	133.8	-394.9
9	376.9	-296	-208.8	135.7	-386
10	377.9	-294.9	-202	135.9	-377
11	380	-286.9	-196	133.2	-367.9
12	**364**	-278.9	-191	137.8	-358

Based on the result of model specification and lag determination we can continue to ADF test on page 31

Vecstable is used to examine whether VECM has accurate specification by plotting the eigenvalues of the companion on the unit circle matrix.



The eigenvalue graph displays that all eigenvalues are strictly less than one. Therefore it denotes that VECM is not miss-specified.

To detect autocorrelation we use Lagrange-Multiplier Test

Lag	Ho	Chi2	df	Prob>chi2
2	No autocorrelation at lag order	40.55	25	0.0255

The test reveals that under 1% critical value we can accept H_0 of no autocorrelation

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