

## Market Conduct and Derivative Product Development of CPO and PKO in Solok City, Indonesia

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### Abstract

This study is to analyze the relationship between market conduct and product development. The research is focused on the case of CPO and PKO derivative product development. The research question is that whether market conduct support or not the development of CPO and PKO derivative products in Solok City? For this purpose, there are six aspects are necessary to be analyzed: (i) by using time series data (2010-2018), the hypothesis testing of price relationship equation between the dependent variable, i.e: Pp which is considered as the realization of buying price of FFB at the farmer's level, with several related independent variables. The results show that each parameter coefficient of independent variables marked by positive sign and smaller than one, except for ETC parameter coefficient which is marked by negative sign and smaller than one. Those facts indicate that there is a big possibility of opportunity opened for creation and development of derivative products of CPO and PKO; (ii) by calculating RCA indices of CPO (2004-2018), the finding is RCAs>1 in average which implies that the development of CPO derivative products has a comparative advantage. (iii) the LQ values for most of business fields and industry in forming GRDP of Solok City is in average greater than 1 (one) which implies that market opportunities are opened for those sectors to be developed as the engine of mover economic growth of the regions. (iv) HDIs of Solok City (2014-2018) are in average equal to 77.00. (v) the palm oil industry tree shows that there are many possibilities of creating and developing CPO and PKO derivative products. (vi) the location of Solok City is quite strategic as the center for industrial derivative product development of CPO and PKO in Sumatra. All findings confirm that the existing condition of market conduct supports the development of CPO and PKO derivative products industries in Solok City.

**Keywords:** Market conduct; Industrialization; Derivative product development; Competitive added value; Palm oil products.

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### 1. Introduction

Since the Regional Autonomy Policy (RAP) implemented in 2001<sup>1</sup>, the improvement of regional development in Indonesia as whole has reached much progress. The country has embarked upon a program of fiscal, administrative and political decentralization, all done at the same time. The most important benefit of RAP is the welfare gain that comes from government closer to the people, and the state budget funds transferred to the regions and villages have increased steadily from year to year (BAPPENAS, 2012; Hadi, 2006; Ministry of Lagging Regions Development of Republic of Indonesia, 2018; Muhammad, 2015; Roy, 2009; RPJPD, 2005-25; Wolfgang and Bert, 2009; Xuejin, 2009).

The funds were transferred, for instance, to the regions and villages in 2017 reaching 742.0 trillion rupiahs or 37.0% of the national expenditures, and then increased becoming 757.8 trillion rupiahs or 34.0% of national expenditures in 2018 or increased 2.2% from previous year. The funds are transferred directly to the villages are around 60.0 trillion rupiah in average or 8.0% of national expenditures for regions during the period of 2017-2018. The provinces, districts and municipalities in Indonesia including Solok City now are as a whole managing approximately 35.5% in average of total national expenditures and half of public investment in Indonesia every year

<sup>1</sup> Indonesia has started a radical and rapid decentralization program. RAP has transformed one of the most centralized countries in the world into one that is more decentralized. Since then, the role of district and city leaders is becoming to be more important in supporting the progress of national economic development. Therefore, self initiative of regional leader is required strongly to accelerate the economic development of regencies or municipalities which he or she leads.

(Ministry of Finance of the Republic of Indonesia, 2018). This is the path that provides very positive impact on industrialization in the urban areas reach until countrysides. This condition creates the better business environment for industrial development in the regions, included the development of derivative products of CPO and PKO<sup>2</sup> in Solok City.

A city is essential to play the roles as the engine of mover to accelerate the growth of urban industrialization and its surrounding areas (Mary, 2007). The facts show that the economic growth of cities depends on industrial activities, if the industrial sector grows faster, it will push the acceleration of the city's economy to grow faster as well. To realize the industrialization which absorbs more local people and uses more local economic resources, it is necessary the development of SMTEs<sup>3</sup> in large number and the development of at least one large scale industry integrated with the SMTEs. For this purpose, a city must have at least one industrial zone as a place where industrial enterprises are facilitated, stimulated, accommodated and promoted to grow and develop (Mary, 2007; Ulrich and Christian, 2007).

The long term planning of national urban development of the Republic of Indonesia up to 2025 have fixed clearly that the government policy is to build any cities in Indonesia to be a better place for people to run their economic and business activities, to have a better life and to fulfill welfare equitably. For that purpose, each city is planned to have the role to be a central point in encouraging local, regional and national economic growth. Thus it is necessary in small city such as Solok City to have at least one of relatively big industrial enterprise integrated with SMTEs development as a trigger for economic growth in the city and the neighboring regions. The creation and development of enterprises in form of SMTEs have been proved already in developed countries as an effective strategy to accelerate industrialization which can involve people in large number in the cities (Firwan, 1994).

In Indonesia, on the one hand, it is acknowledged that there are still abundant of natural resources. On the other hand, it is also recognized that most of the natural resources have not been processed into finished goods or end products. The cities as the engine of the growth should carry out industrialization of natural resources. The problems are that not many cities in Indonesia are smart to carry out these functions, included to take advantages of RAP. Solok City does not have neither one large-scale industrial enterprise which is integrated with the SMTEs, nor an industrial park as a zone where industrial companies are facilitated, stimulated, accommodated to grow and develop. In China, for instance, almost of the small cities have at least one large scale companies integrated with the development of SMTEs supported at least one enterprise zone (EZ). Firms within the EZ has lower production costs because they do not have to deal with many regulators. The regulations and low taxes increase output per dollar of payroll (Firwan, 2005;2010; Mary, 2007; Ulrich and Christian, 2007).

## 2. The Objectives of Study

This study is to analyze the condition of industrial market conduct whether it supports or not the creation and development of CPO and PKO derivative products in Solok City? For this purpose, it is essential to analyze the pricing efficiency in buying FFB at the farmer's level, the RCA indices of CPO, the LQ values of business fields/industry in forming GRDP of Solok City, HDIs of Solok City, the industrial tree of FFB, and the geographical position of Solok City. All of those aspects can be used as the main factors to determine the existing condition of market conduct. In addition, palm is one of superior plantation crops in West Sumatra Indonesia, and palm farmers<sup>4</sup> are normally to produce FFB and sell it all the way through intermediary traders to the factory of CPO. Almost all of exporters also act as producers because they have their own factory to process FFB in order to get CPO for export. Therefore, the term exporter-producer is more appropriate to be used in this study.

## 3. Literature Review

The research conducted by Hadi (2006) in 29 regencies and 6 municipalities in Indonesia, he found the positive impact of RAP to the regional economic development. He found that fiscal decentralization has a positive and significant impact on economic growth of the regencies and municipalities within the Province of Central Java. It is strengthened by Muhammad (2015) on "the impact of central government transfer funds on regional economic growth, a case study in South Sulawesi Regencies and Cities", he found that the transfer funds from central government in form of the General Allocation Fund, Grant Aid Fund, and Special Allocation Funds create a positive and significant impact on the economic growth of South Sulawesi Regencies and Cities, however interest rates have a negative impact to budget expenditure. Both researchers tend to have the same conclusion that RAP has very positive impact on acceleration of regional development in Indonesia, and then, RAP presents freedom for

<sup>2</sup> Palm Kernel Oil (PKO) is edible vegetable oil derived from palm oil. Unlike the orange-red palm oil (CPO), yellow palm kernel oil (PKO) comes from further processed palm kernel. Therefore, PKO is a side product of CPO.

<sup>3</sup> SMTE is an abbreviation from Small Medium Sized Technological Enterprise. In Indonesian Language, SMTEs is identical as "Industri Kecil dan Menengah (IKM)", Industrialization focused on SMTEs development must be carried out intensively in regional level not only in the cities or urban areas but must reach until to the countrysides. In many literatures, SMTEs are considered as the enterprises which concern with product innovation development. The experience in many developed countries shows that the innovation products have created the strong competitiveness of the firms over the world market.

<sup>4</sup> Term of "a farmer" in this study is an independent smallholder estates who does not have a special contract agreement directly with any factories of CPO, they sale FFB to factories all the way through middlemen traders. However, they are numerous in number and dominate the economic activities of population in the village areas. In rural areas there are some big private and state-owned plantations, both of which have their own factories supported with vast areas of plantation

regional leaders to create new development ideas and to create the breakthrough policies in order to increase the regional competitiveness.

The researches conducted by Firwan Tan in different years, [Firwan \(1994\)](#), [Firwan \(2005\)](#), and [Firwan \(2018\)](#). He concluded that SMTEs are as very important industrial actors to accelerate the economic growth of the cities, SMTEs have been proved as the key actors for local economic resources development in many developed countries. He recommended finally the local government has to take the initiative in order to enlarge the human knowledges and skills, to make easier the technology transfer from R&D institutions to SMTE's creators. The industrialization based on SMTEs must be carried out not only in the cities but must reach to the countryside.

The research conducted by [Syamsurijal and Firwan \(2017\)](#), entitled "Indonesian Crude Palm Oil Export Performance during the Period (1990Q1-2015Q4)". They found that RCA-Indices during that period of study are in average greater than one; signify that Indonesian CPO exports performance is sufficiently profitable. However, some policies are still needed for the purpose to improve competitiveness of CPO export products in the world market. The value of parameter coefficient of dependent variables in functional relationship to independent variable is quite responsive. While the residual regression of coefficient variable (ECT) has a negative and significant impacts on the CPO export growth. The negative sign of the ECT coefficient indicates a low adjustment level in the short term toward the long-run equilibrium conditions.

The researches conducted by Lisa Nesti, at.al., in 2017 and 2018 concerning market competitiveness and efficiency of CPO in domestic market and the world market. They found that the competitiveness CPO in domestic market of West Sumatra and World Market is quite strong. It is indicated by the average value of Revealed Comparative Advantage (RCA) indices in domestic market during the period of 2000-2016 which is equal to 5.0., (RCA Index = 5.0), it is quite far greater than one, meaning that the CPO of West Sumatra has strong competitiveness in domestic market of Indonesia. However, the value of RCA Indices of CPO of West Sumatra in the world market is in average equal to 1.10. It is a little bit greater than one, indicates that export of CPO of West Sumatra in the world market even still having competitiveness but not too strong. In this context, it is necessary to make the position of FFB's farmers to become stronger, for that purpose it could be better to create the specific programs of training in order to increase the farmer's knowledge and skill so that becoming more productive and efficient. They found also that marketing practice in buying FFB is not efficient; the purchasing prices received by palm oil farmers are considerably too low, inadequate manner ([Lisa and Firwan, 2017a;2017b](#); [Lisa et al., 2018a](#); [Lisa et al., 2018b](#)).

Bart (2007) in his scientific paper entitled "innovation and economic growth theory: a Schumpeterian legacy and agenda" mentions that innovation and technology are very important factors to accelerate the economic growth of the regions whereas the role of government policy for science and technology development is so necessary, particularly in underdeveloped countries where R&D and innovation not yet well develop.

## 4. Methodology

From point of view industrial organization concepts [Denis and Jeffrey \(2015\)](#), there are several factors that can be considered as the economic factors to determine an industrial market conduct which opens the opportunity to create and develop the derivative products for a certain commodity. However, in this study there are six related factors should be analysis, i.e: pricing efficiency, RCA indices, LQs indices; HDI indices, Industrial trees of product, and industrial project locations. By analyzing those factors can help us to understand rightly the overview of characteristics of the industrial market conduct whether it supports efficiently or not the creation and development of FFB, CPO and PKO derivative products in Solok City.

### 4.1. Pricing Efficiency Analysis

Pricing efficiency is important to know to understand rightly the existing characteristics of market structure permitting to decide what the strategy should be augmented in order to create the better pricing efficiency of certain commodity. To determine the characteristics of the pricing efficiency of a particular commodity, a price relationship equation model (PREM) can be used. The functional relationship between the dependent variable and the independent variables in PREM can be written as follows:

$$P_p = f(p_a, p_b, p_e, p_k, K, Z) \dots\dots\dots (1)$$

Where: **P<sub>p</sub>** is considered as a dependent variable, i.e: the realization of buying price of FFB received by farmers<sup>5</sup> from first-level intermediary traders or small collectors; whereas the independent variables are consisted of several related variables, i.e: **P<sub>a</sub>** = realization of buying prices received by first-level intermediary traders from big collectors; **P<sub>b</sub>** = realization of buying prices received by the second-level of intermediary traders or big collectors from exporter-producer of CPO at the factory; **P<sub>e</sub>** = the selling price of CPO in the world market; **P<sub>k</sub>** = the selling price of PKO<sup>6</sup> in the world market. **P<sub>e</sub>** and **P<sub>k</sub>** are measured according to the standard price of free on board (f.o.b.)<sup>7</sup>. Thus, the functional price relationships of PREM can be formed as follows:

<sup>5</sup> Term of "a farmer" in this study is an independent smallholder estates who does not have a special contract agreement directly with any factories of CPO, they sale FFB to factories all the way through middlemen traders. However, they are numerous in number and dominate the economic activities of population in the village areas. In rural areas there are large private and state-owned plantations, both of which have their own factories supported with vast areas of plantation

<sup>6</sup> Palm Kernel Oil (PKO) is edible vegetable oil derived from palm oil. Unlike the orange-red palm oil (CPO), yellow palm kernel oil (PKO) comes from further processed palm kernel.

$$D(\log Pp_t) = \alpha_0 + \alpha_1 D(\log Pa_t) + \alpha_2 D(\log Pb_t) + \alpha_3 D(\log Pe_t) + \alpha_4 D(\log Pk_t) + \alpha_5 D(\log K) + \alpha_5 ECT_t + \varepsilon_t \dots (2)$$

Assuming that alternative income and any costs do not change, meaning marketing margins and production costs are constant, hypothesis testing for this function are: HO:  $\alpha_n = 1$ ; Ha:  $\alpha_n < 1$ . If the parameter coefficient  $\alpha_n$  equals to unity ( $\alpha_n = 1$ ) or is significantly close to unity, it implies that the pricing system is more efficient or in theoretical language says that market condition is closely related to the perfect market competition condition, it indicates the pricing of FFB is in an efficient condition<sup>8</sup>. In vise versa, if  $\alpha_n < 1$ , it indicates that the price system across the marketing chains from exporter-producers all the way through middlemen traders to oil palm farmers is not in an efficient condition. Especially if  $\alpha_n < 1$  and very close to zero, indicating that pricing from exporter-producers to oil palm farmers in the system of a vertical integrated market is very inefficient or unfavorable for palm farmers, and therefore there is a possibility of strong monopsony power and oligopsony power happened in buying FFB along the marketing chains from exporter-producers of CPO to farmers of palm oil. Before conducting PREM regression, several statistical tests must be carried out to determine whether the selected independent variables are solid or not to control the dependent variable. In this context, it is necessary to run the following tests, i.e: classical assumptions, unit root, integration and cointegration tests (William and New York University, 2012)

## 4.2. RCA Indices (RCAs) Analysis

$$RCA_{ij}^1 = \frac{\frac{X_{ij}}{X_i}}{\frac{X_{wj}}{X_w}} \dots\dots\dots (3)$$

Where:  $X_{ij}$  shows the value of commodity exports  $j$  in region  $i$  or in country  $i$ . Then  $X_i$  denotes the total value of all exports of the region  $i$  or the country  $i$ .  $X_{wj}$  shows the value of commodity exports  $j$  in the world market and  $X_w$  shows the value of overall total exports in the world.

If the value of RCA of a particular commodity in a particular country or region is greater than one or equal to one (RCA index  $\geq 1$ ) thus the commodity is said to have the favorable market condition in that country or region compared to other countries or regions that produce the same commodity. In many studies, it is also interpreted that the commodities with  $RCA \geq 1$  or far greater than one indicate that commodity in question has stronger competitiveness than its competitors, meaning the region or country producers can act as a "price leader" or "price maker" for the commodity traded. Otherwise, as a price follower in case of  $RCA < 1$  or far smaller than one. To capture the degree of trade specialization of a country, Balassa and Noland (1989) suggested to use revealed comparative advantage (RCA). Comparative advantage is the superiority of a country or a region in producing a certain commodity with alternative costs incurred lower than the cost for the same commodity in another country or in another region, measured by the RCA indices (Lisa and Firwan, 2017a;2017b)

## 4.3. LQ Indices (LQs) Analysis

$$LQ = \frac{Si/Ni}{S/N} = \frac{Si/S}{Ni/N} \dots\dots\dots (4)$$

Where:  $S_i$  = The amount of revenue of sector  $i$  in Solok City;  $S$  = Total revenue of all economic sectors in Solok City;  $N_i$  = The amount of revenue of sector  $i$  in West Sumatra Province;  $N$  = Total revenue of all economic sectors in West Sumatra Province

**LQ** is one way to find out whether the sector or sub sector which form the GRDP can or cannot take the role as an engine of economic growth in the regions and surrounding area. If the LQ value of a sector or sub sector is greater or equal to one ( $LQ \geq 1$ ) then the sector or sub sector concerned is said to be the main sector or the sub sector basis in the development of regional economy, which means market opportunities opened and there are the favorable conditions to support the development of those sectors. On contrary, if the **LQs** in average of a sector or sub sector is less than one (**LQs**  $< 1$ ) during a certain number of years, then the sector is said as a non-base sector or non-base subsector. This implies that the sector is not yet efficient to be functioned as an engine of mover to accelerate the economic growth of the region itself and the surrounding area.

## 4.4. HDI (HDIs) Analysis

The Human Development Index (HDI) is an important indicator to measure the effort to build the quality of life of people (communities). HDI consists of three main elements, i.e: income, life expectancy, and education. The values of HDIs for a certain period of time can be used to determine the readiness and the capability of people to accept the changes and the policy breakthroughs. According the Background study on the development of underdeveloped regions in Indonesia, a research report of the Ministry of Lagging Regions Development of Indonesia (2018), the value of HDI for Indonesia today is graded as follows:  $HDI < 60$  = Low;  $60 \leq HDI < 70$  = Moderate;  $70 \leq HDI < 80$  = High;  $HDI \geq 80$  = Very high (Ministry of Finance of the Republic of Indonesia, 2018)

<sup>7</sup> f.o.b. is abbreviation from "free on board", to indicate that the sale price covers all charges, including delivery of goods free on board truck, car, or vessel at a designed point, either at the origin or the destination of a shipment.

<sup>8</sup> The efficient condition is the condition where the increasing or decreasing in term of price at higher level of marketing chains in vertical integrated market of a certain commodity is derivated proportionally to the lower levels below it.



#### 4.5. Location of Industrial Project Analysis

From point of view industrial organization theory mentioned that in the case of industries that are oriented to raw materials will be better placed the location of these industries at the location of raw materials, and vice versa, industries that are oriented to the market will be better placed the industry at the market location. Therefore, the location of Solok City in its relation with surrounding areas producing raw materials (Cq.FFB) is necessary to study in order to evaluate whether the location of industry in Solok City is strategic and favorable place or not as the location selected for transforming CPO and PKO, included FFB as the main raw material in making CPO? The industrial location is analyzed by using the primery data taken from our observations in the fields during the survey and the secondary data on the city map published by the Solok City government. The location of a city in relation with the regions surrounding will be analyzed (Denis and Jeffrey, 2015; Lisa *et al.*, 2018a; Mary, 2007; Ulrich and Christian, 2007)

#### 4.6. Industrial Tree Analysis

The industrial tree of FFB is essential to understand well in order to get the inspiration on the possibilities of the derivative product creations and development. For this purpose, the data primier are used, taken from field observation conducted during the survey in March and July 2018. Those data are adapted to the data provided by Ministry of Industry of The Republik of Indonesia. By synchronizing those both data we will be able to illustrate the possibilities of product derivative that have been produced and those are not yet able produced by Indonesian in the domestic market (Lisa *et al.*, 2018a; Mary, 2007; Ulrich and Christian, 2007)

### 5. Findings and Analysis

#### 5.1. Pricing Efficiency

Table-1. Pricing Efficiency: The Results of PREM Regression

Dependent Variable: D(Log(Pp))	Values			
Independent Variables	Coefficient ( $\alpha_n$ )	Std. Error	t-Statistic	Probability
C	0.000145	0.000701	0.207436	0.8362
D(Log(Pa))	0.633242	0.030941	20.46603	0.0000
D(Log(Pb))	0.113264	0.017573	6.445280	0.0000
D(Log(Pe))	0.100177	0.030494	3.285081	0.0015
D(Log(Pk))	0.039868	0.016543	2.409927	0.0182
D(K)-dummy variable	0.005063	0.006780	0.746778	0.4573
ECT(-1)	-0.730590	0.095458	-7.653546	0.0000
R-squared	0.952956	Mean dependent var		0.001758
Adjusted R-squared	0.949514	S.D. dependent var		0.029246
S.E. of regression	0.006571	Akaike info criterion		-7.136820
Sum squared resid	0.003541	Schwarz criterion		-6.941084
Log likelihood	324.5885	Hannan-Quinn criter.		-7.057924
F-statistic	276.8422	Durbin-Watson stat		1.960521
Prob(F-statistic)	0.000000			

Source: Data processed (2010-2018)

By using time series data for the observation period (2010-2018), the PREM regression results are shown completely by Table-1, and it can be written in form an equation (5) as follow:

$$D(\log Pp_t) = 0.000145 + 0.533242 * D(\log Pa_t) + 0.113264 * D(\log Pb_t) + 0.100177 * D(\log Pc_t) + 0.039868 * D(\log Pk_t) + 0.005063 * D(\log Yt) - 0.730590 * ECT_t(-) \dots\dots\dots (5)$$

After conducting classical assumption tests, i.e: multicollinearity, heteroscedasticity, autocorrelations, normality, and linearity test, then completed by testing of stationarity of data, integration and cointegration of data as seen in appendix (1 and 2). By using time series data for the period of observation 2010-2018, the results confirm that there is no doubt to say that independent variables can be believed to have a strong relationship with dependent variable, with assumption the other factors are ceteris paribus.

Table-1 shows the results of PREM regression. It is marked by the prob(F-statistic) which is equal to 0.000000 and R-squared is equal to 0.952956 or is almost close to one. Moreover, the value of each parameter coefficient of all independent variables is marked by positive sign at real level 5% except for ETC variable. However, in term of parameter coefficient of constant variable (C), even though its values is marked by positive sign but not really significant because of its absolute values is considerable too small. Since the value of ECT is marked by negative sign and significant at the real level of 5%, with its probability is equal to 0,0000 indicating that all independent variables (Pa, Pb, Pe, Pk, K) influence significantly the dependent variable Pp in the short and long term. It is supported by R-Squared value which is equal with 0.952956 implying that all those independent variables are strongly able to explain the dependent variable at degree of confident 95 percent, while the rest will taken over by the other factors.

The economic implication of one by one of parameter coefficient of independent variables can be interpreted as follows:

The constant variable (**C**) = 0.000197 is considered as a very small value, implying less significant effect to the realization of buying price of FFB at the market level of palm oil farmers. It is supported by the value of probability that is relatively big or equal to 0.8362 or almost equal to 1 (one).

The value of parameter coefficient of the variable **Pa** is marked by positive sign and equal to 0.633242, smaller than one ( $\alpha_1 < 1$ ) which indicates an increasing hundred percent in buying price of FFB at the first-level of intermediary traders or at small collector level, then the realization price transmits to farmers of FFB is less than one hundred percent. It means that the transmission price imposed is not proportional or a farmer of palm receives only the increasing of purchasing price of FFB equal to 63 percent of hundred percent increasing prices at the first-level of intermediary.

The value of parameter coefficient of the variable **Pb** is marked by positive sign and equals to 0.113264, far smaller than one ( $\alpha_2 < 1$ ) which indicates a hundred percent increase in buying price of CPO or PKO on the world market. The buying price that is transmitted to palm farmers through the second level intermediary trader or big collector is far less than one hundred percent. Or it can be said that the increase in buying price of big collectors in selling FFB to exporter-producers is not proportional to the increase in export prices. The purchase price of FFB at palm farmers increases only 11 percent, far less than the increasing price at the big collectors and at the exporter level.

The value of parameter coefficient of the variable **Pe** is marked by positive sign and equals to 0.100177 and is considered too small ( $\alpha_3 < 1$ ) which indicates that if there is an hundred percent of increasing in the CPO buying price at the world market, then the increasing of buying price of FFB transmitted to palm famers through middlemen traders is far less than hundred percent. The increasing of purchase price at farm level is not the same proportion as percentage of increasing price at exporter level. It can be said that the increasing price received by the palm farmers tends to be lesser than 10% of hundred percent of increasing price at the world market.

Almost the same manner with the case of the variable **Pe**, the value of parameter coefficient of the variable **Pk** is marked by positive sign and equals to 0.039868, is too small ( $\alpha_4 < 1$ ) which indicates that if there is an hundred percent of increasing in the export price of PKO, it will create the increasing in buying price of FFB at palm farmers far less than 100%. In the other word, the increasing price received by the palm farmers is not proportional with the increasing price received by exporter of PKO at the world market. It can be said that a palm farmer receives the increasing of buying price transmitted all the way through middlemen traders tends to be lesser than 4%.

The year of 2013 is considered important because the government of Indonesia launches the pricing intervention policy in the Palm Oil market in order to set the minimum price of FFB. It is known as the regulation of Minister of Agriculture No14/Permentan/OT.140/2/2013 regarding the Guidelines of Determining the Purchasing Price of Farmer's FFB of Palm Oil. Therefore this regulation is added in PREM as a specific independent variable, symbolized by **K** = a dummy variable. The value of the variable **K** is equal to zero before 2013 (**K=0**) and after 2013 is equal to one (**K=1**). It is helpful to detect whether the government intervention policy was workable or not during the period of study (2010-2018). The test of each variable using t-test, the results show that all independent variables are marked by positive sign and significant at the real level  $\alpha = 5\%$ , the government policy variable **K** which is too small in value ( $\alpha_4 = 0.005063$ ), with a probability value of 0.4573 and **R**<sup>2</sup> value obtained by 95%. It implies that the regulation has not yet fully in function in order to improve the price of FFB and the welfare of farmer's palm oil in West Sumatra.

The Coefficient of **ECT** is marked by negative sign (**ETC** = -0.730590) states that there is around 73% disequilibrium happened in the short-term of relation between the dependent variable (**Pp**) with independent variables (**Pa**, **Pb**, **Pe**, **Pk**, **K**). Therefore, in economic point of view, this condition explains that it is needed 73% degree of adaptation in order to reach the point of equilibrium in the long term, or in the other word it is needed 73% of efforts to correct disequilibrium in each period of time.

**In short:** All independent variables are marked by positive sign excepted **ETC**, and almost of parameter coefficient magnitudes are in average significantly smaller than one at S.E of regression is equal to 0.006571., considered too small value. Whereas R-squared value is 0.952956, almost approach to 100% and the Durbin-Watson stat is equal to 1.960521 which is greater than one with F-statistic is quite big equal to 276.8422., and prob(F-statistic) is equal to 0.000000., All of those figures signify that monopsonistic pricing behavior in purchasing FFB all the way through middlemen traders in this vertical integration market possibly practiced strongly by buyers during the period of 2010-2018 in West Sumatra. It proves that pricing behavior in buying FFB was significantly inefficient. Therefore the purchasing price of FFB at the farmer's market level is not a faire price, still so cheap. This is the main reason that we found during the field survey why FFB produced by farmers often over supply at the palm farmers' market.

## 5.2. RCA Indices (RCAs)

**Table-2.** The Results of Calculation of RCAs of CPO in Domestic Market of West Sumatra (2004-2018)

Years	CPO Export Values of West Sumatra	Total Export Values of West Sumatra	CPO Export Values of Indonesia	Total Export Values of Indonesia	RCA Indices
	USD	USD	USD	(000 USD)	
2004	26.026.130	208.180.000	1.326.398.000	62.124.000	5.86
2005	86.611.008	307.849.000	1.227.165.000	56.320.900	12.91
2006	130.213.755	377.277.000	2.348.638.000	57.158.800	8.40
2007	219.559.755	594.956.000	2.719.304.000	61.058.200	8.29
2008	200.074.610	731.189.000	3.944.457.000	71.584.600	4.97
2009	345.204.890	1.074.134.000	4.344.303.000	85.660.000	6.34
2010	400.691.326	1.512.799.000	4.139.286.000	100.798.600	6.45
2011	608.800.714	2.384.568.000	8.866.445.000	114.100.900	3.29
2012	608.400.180	1.344.257.000	14.110.229.000	137.020.400	4.39
2013	624.675.222	2.214.774.000	11.605.431.000	116.510.000	2.83
2014	804.095.951	3.031.815.000	15.413.639.000	157.779.100	2.71
2015	803.179.353	2.363.583.000	19.753.190.000	203.496.600	3.50
2016	654.718.937	2.209.012.000	22.451.089.000	190.020.300	2.51
2017	596.414.714	2.105.610.000	17.667.471.000	182.551.800	2.93
2018	508.810.248	1.748.010.000	19.555.633.000	175.980.000	2.62
<b>Total</b>	<b>6.617.476.793</b>	<b>22.208.013.000</b>	<b>149.472.678.000</b>	<b>1.772.164.200</b>	
<b>Average Value of RCAs</b>					<b>5.20</b>

Source: BPS. Data processed (2004-2018)

From Table-2 and Table-3, there are several economic implications that explain the characteristics of industrial market conduct of CPO included PKO in the domestic market of West Sumatra. The value of RCAs of CPO in each year during the period of study (2004-2018) in West Sumatra in its relation with Indonesia as a whole is greater than one. The value of RCAs during the 15 years period of observation in average equals to 5.20, it is quite far greater than one ( $RCA > 1$ ), see Table-2. Such condition implies that the commodity of CPO is said to have the comparative advantage produced in West Sumatra in comparing to other regions which produce the same

The value of RCAs of CPO in West Sumatra in its relation with the world market as a whole shows that the average value of RCAs during the 15 years period of observation is equal to 0.99 which is almost close to one, see Table-3. Therefore, it can be said that the CPO still having the comparative advantages if it is manufactured in West Sumatra compared to other regions outside of Indonesia that produce the same commodity. In many studies, are also interpreted that a certain commodity in the certain regions where it's RCA is greater than one or close to one, thus that commodity in question can be said to have stronger competitiveness compared to its competitors. commodity.

In brief, it can be said that the values of RCAs indices in Table-2 and Table-3 determine the comparative advantages owned by West Sumatra (cq. Solok City) as the centre of creation and to development the derivative products of CPO and PKO, included FFB.

**Table-3.** The Results of Calculation of RCAs of CPO in International Market (2004-2018)

Years	CPO Export Values of West Sumatra	Total Export Values of West Sumatra	CPO Export Values in World Market	Total World's Export Values	RCA Indices
	USD	USD	USD	USD	
2004	26.026.130	208.180.000	16.793.000	47.355.807	0.352
2005	86.611.008	307.849.000	18.438.000	49.382.508	0.753
2006	130.213.755	377.277.000	19.910.000	59.401.306	1.029
2007	219.559.755	594.956.000	22.201.000	75.849.333	1.260
2008	200.074.610	731.189.000	24.545.000	87.090.000	0.971
2009	345.204.890	1.074.134.000	29.000.000	101.310.000	1.122
2010	400.691.326	1.512.799.000	30.048.000	100.230.000	0.883
2011	608.800.714	2.384.568.000	37.143.000	131.600.000	0.904
2012	608.400.180	1.344.257.000	38.243.000	100.550.000	1.189
2013	624.675.222	2.214.774.000	38.854.000	123.010.000	0.892
2014	804.095.951	3.031.815.000	39.024.000	143.380.000	0.974
2015	803.179.353	2.363.583.000	45.530.000	144.960.000	1.082
2016	654.718.937	2.209.012.000	43.269.000	149.480.000	1.023
2017	596.414.714	2.105.610.000	46.569.000	149.950.000	0.912
2018	508.810.248	1.748.010.000	47.616.000	134.820.000	0.824
<b>Total</b>	<b>6.617.476.793</b>	<b>22.208.013.000</b>	<b>497.183.000</b>	<b>1.598.368.954</b>	
<b>Average Value of RCAs</b>					<b>0.987</b>

Source: BPS. Data processed (2004-2018)

### 5.3. LQ Indices (LQs)

**Table-4.** The Results of Calculation LQs for Each Business Field Forming GRDP of Solok City Compared with Three Regencies Largest Producers of FFB, CPO and PKO in West Sumatra (2013-2018)

No	Business Fields/ Industry	Solok City (Kota Solok)		Three Regencies Largest Producers of FFB, CPO, PKO in West Sumatra					
		LQs in average	Rank	Pesisir Selatan		Dharmasraya		Pasaman Barat	
				LQs in average	Rank	LQs in average	Rank	LQs in average	Rank
1	Agriculture, Forestry and Fishery	0.26		1.64	1	1.37	2	1.29	3
2	Mining and Excavation	0.15		1.28	2	1.81	1	3.40	1
3	Processing industry/Manufacturing	1.73	4	0.51		0.54		0.31	
4	Procurement of Electricity and Gas	0.63		0.24		0.22		0.35	
5	Water Supply, Waste Management, Waste Recycling	2.52	1	0.59		0.50		0.42	
6	Construction, Wholesale and Retail Trade	1.46		0.91		1.28	3	1.37	2
7	Car and Motorcycle Repair	1.63	5	0.66		1.20	4	0.76	
8	Transportation and Warehousing	1.39		0.98	3	0.53		0.64	
9	Provision of Availability and Drinking	1.93	2	0.70		0.69		0.62	
10	Information and Communication	1.15		0.97	4	0.75		0.57	
11	Financial Services and Insurance	1.45		0.59		0.74		0.80	
12	Real Estate	1.37		0.41		0.42		0.65	
13	Company Services	0.04		0.16		0.03		0.04	
14	Administration Government, Defense, Social Security	1.57		0.95	5	0.78		0.82	
15	Educational Services	1.37		0.79		0.57		1.05	5
16	Health Services and Social Activities	1.13		0.93		0.84	5	1.23	4
17	Other Services	1.78	3	0.59		0.67		0.93	

Source: BPS of West Sumatra and BAPPEDA of Solok City (data processed)

Table-4 describes the results of calculation LQs of each business field/industry in forming GRDP<sup>9</sup> of Solok City compared with three regencies largest producers of FFB, CPO and PKO in West Sumatra (2013-2018). The value of LQs in average for each business fields/industry is one way to find out whether the sector or sub sector can take the role as an engine of economic growth in the region and surrounding areas. Almost of all business fields/industry forming GRDP of Solok City found its value of LQs greater than one (LQs>1) except for certain sectors such as Agriculture, Forestry and Fishery, Mining and Excavation, Procurement of Electricity and Gas, Company Services. According to the theory of economic development mentioned if the LQ value of a sector or sub sector is greater or equal to one (LQ ≥ 1) thus the sector or sub sector concerned is said as a sector or sub sector base in economy of the region. Therefore, the sector can be considered as an engine of economic growth of the region and the region of surrounding areas.

The economic activities in secondary (secondeaire) sector and tierce (tiers) sector dominate the economic activities of Solok City. It is indicated by the average value of LQs for all of 17 sectors of Business Fields/Industry forming GRDP of Solok City are greater than one (LQs > 1), except in case of business field related to Procurement of Electricity and Gas with LQs=0.63 and Company service with LQs=0.04 which are smaller than one (LQs<1).

While the three regencies largest producers of FFB, CPO, PKO in West Sumatra located close enough to Solok City are dominated by economic activity in the premier sector. The business fields on agriculture, forestry and fishery, and mining included excavation are dominated the economic activities in the regency of Pesisir Selatan, Dharmasraya and Pasaman Barat (see Table 4). However, it is found in regency of Dharmasraya that the construction, wholesale and retail trade; the car and motorcycle repair have the LQs are greater than one. In Pasaman

<sup>9</sup> GRDP=Gross Regional Domestic Product. It is the money value of total output of goods and services within a region in a given period of time, usually a year, before allowance for depreciation and consumption of capital goods. From point of views the composition of sectors forming GRDP of Pasaman Barat, Pesisir Selatan, and Dharmasraya, seen that the sector of processing industry/manufacturing is still far smaller in values, indicated by LQs is far smaller than 1 (one).



Barat, found three business fields which have the LQs greater than one, i.e.: the construction, wholesale and retail trade; educational services; health services and social activities.

In short, from the values of LQs can be stated that Solok City is more workable and marketable if it concentrates more on industrial activities while the surrounding areas are more profitable if they concentrate on non-industrial activities such as in the business fields related to agriculture, forestry, fishery, plantation, and mining, etc.

#### 5.4. HDI Indices (HDIs)

**Table-5.** Human Development Index of Solok City Compared to Other Regencies/Municipalities in West Sumatra 2014-2018

Regency / Municipality		Years					Rank
		2014	2015	2016	2017	2018	
	Regency						
1	Kep. Mentawai	56.33	56.73	57.41	58.27	59.25	
2	Pesisir Selatan	67.31	67.75	68.07	68.39	68.74	
3	Solok	66.15	66.44	67.12	67.67	67.86	
4	Sijunjung	64.48	64.95	65.30	66.01	66.60	
5	Tanah Datar	68.12	68.51	69.49	70.11	70.37	
6	Padang Pariaman	67.15	67.56	68.04	68.44	68.90	
7	Agam	68.73	69.32	69.84	70.36	71.10	
8	Lima Puluh Kota	66.30	66.78	67.65	68.37	68.69	
9	Pasaman	62.91	63.33	64.01	64.57	64.94	
10	Solok Selatan	65.86	66.29	67.09	67.47	67.81	
11	Dharmasraya	68.71	69.27	69.84	70.25	70.40	
12	Pasaman Barat	63.92	64.56	65.26	66.03	66.83	
	Municipality						
13	Padang	79.23	79.83	80.36	81.06	81.58	1
14	Solok	75.54	76.20	76.83	77.07	77.45	4
15	Sawah Lunto	69.07	69.61	69.87	70.67	71.13	
16	Padang Panjang	74.54	75.05	75.98	75.50	77.01	5
17	Bukittinggi	77.67	78.02	78.72	79.11	79.80	2
18	Payakumbuh	76.34	76.49	77.42	77.56	77.91	3
19	Pariaman	74.51	74.66	74.98	75.44	75.71	
West Sumatra		68.91	69.36	69.98	70.73	71.24	

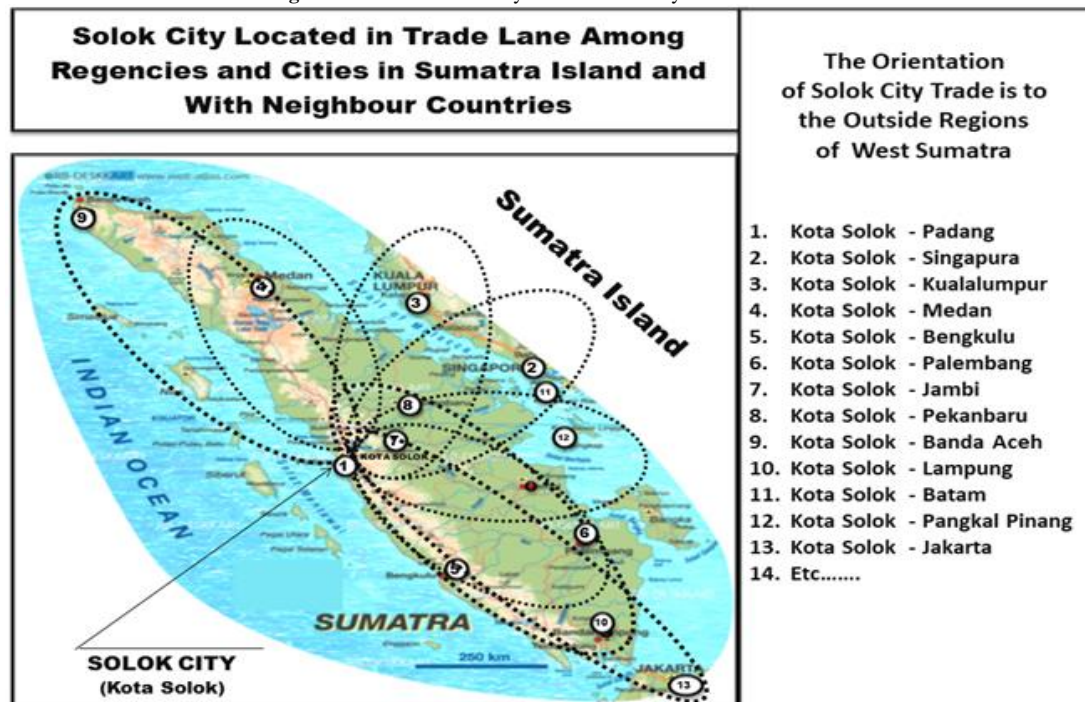
Source: BPS - Statistics of West Sumatra Province, data processed

Table-5 describes the value of human development index (HDI) of Solok City compared to other regencies/municipalities in West Sumatra (2014-2018). The HDI was created with the purpose of measuring the success of a country or a region and its people through the dimensions of wealth, education, and long life. Prior to the creation of the HDI, economic growth was the primary factor of deciding how successful a country was, and thus failed to look at the more personal aspect of development, namely how healthy the people were and how well they were educated. The average value of HDIs during a certain period of time can be used to determine the readiness and the capability of people to innovate and to accept the breakthrough programs. From the Table-5, it can be seen that the HDIs of Solok City in average during the five years observation (2014-2018) is approximately equal to 76.62., it is quite greater than 70 ( $70 \leq \text{HDI} < 80 = \text{High}$ ) which is considered as the high value, signifying the the better condition of human knowledges and skills in Solok City. If it is compared with the 18 other regions (regencies and municipalities) thus Solok City is at ranking four in West Sumatra.

From economic point of view, the greater values of HDIs during a certain periode of time imply the better condition of human knowledge and skills, better wealth and welfare. These conditions of course needed to support the accelaration of industrialization in the regions.

## 5.5. The Location of Solok City

Fig-1. Location of Solok City Palm Oil Industry in Sumatra Island



Source : Field Survey

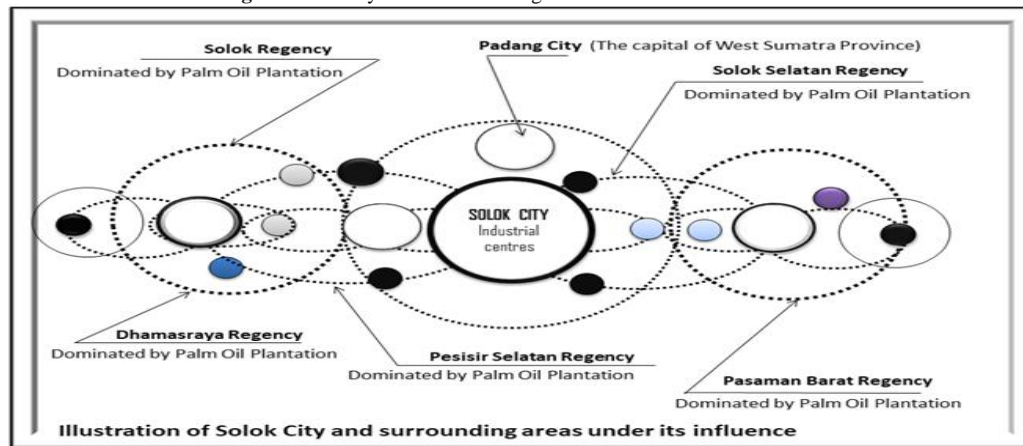
Fig-1 describes the geographical position of Solok City in Sumatra Island. Solok City (*Kota Solok*) can be said located at strategic place at the intersection of economic activities across regions and cities in Sumatra Islands. For example to Padang with a distance only 64 Km. In Padang where is located Teluk Bayur as a largest International Harbour in the western part of Indonesia, here is also located the Minangkabau International Airport, and Andalas University as the oldest university outside of Java Island. To the south of Solok City as a crossing lane from Padang to Jambi (the capital of Jambi Province), to Palembang (the capital of South Sumatra Province) and Bandar Lampung as the capital of Lampung Province, a city closes to Jakarta as the capital of the Republic of Indonesia. To the north is quite close to Bukittinggi as a city of the main tourism destination of Indonesia in West Sumatra which is about 71 Km away from Solok City. From Bukittinggi can continues to Pekanbaru a capital city of Riau Province. It is a province which is rich with mining and plantation resources, and to Medan the largest city in the Sumatra Islands where the trading and industrial activities are more developed. In ASEAN<sup>10</sup>, Solok City is closer to Johor Baharu the second largest city in Malaysia. Solok City is also closer to Singapore; by flight from Padang to Singapore is around 25 minutes. It is a more modern city with high quality of life in ASEAN.

Fig-2 describe the location of Solok City surrounded by the regency's largest producers of FFB, CPO and PKO in West Sumatra, i.e: Dharmasraya, Pesisir Selatan, Solok Selatan, Pasaman Barat, and Kabupaten Sijunjung. Solok City is very close to Padang as the capital of West Sumatra Province. Between Solok City and Padang is connected by road which is in very good condition, approximately 45 minutes by road from Solok City to Padang.

In short, it can be said that the position of the Solok City is quite strategic as a center for the creation and development of CPO and PKO derivative products included the derivative products of FFB because besides being very close to its raw material sources, it is also very close to Padang the third largest city in Sumatra so that through Padang can save on marketing costs and make it to be easier to get better quality of human resources, then easier to get more international networks.

<sup>10</sup> ASEAN is a abbreviation of Association South East Asian Nation, consisted 10 countries, i.e: Indonesia, Malaysia, Singapore, Philipines, Brunaidarusalam, Vietnam, Camboja, Loas, Myamar, Thailand. The focus of ASEAN is in term of economic and business cooperation.

Fig-2. Solok City and Its Surrounding Areas in West Sumatra Province



Source : Field Survey

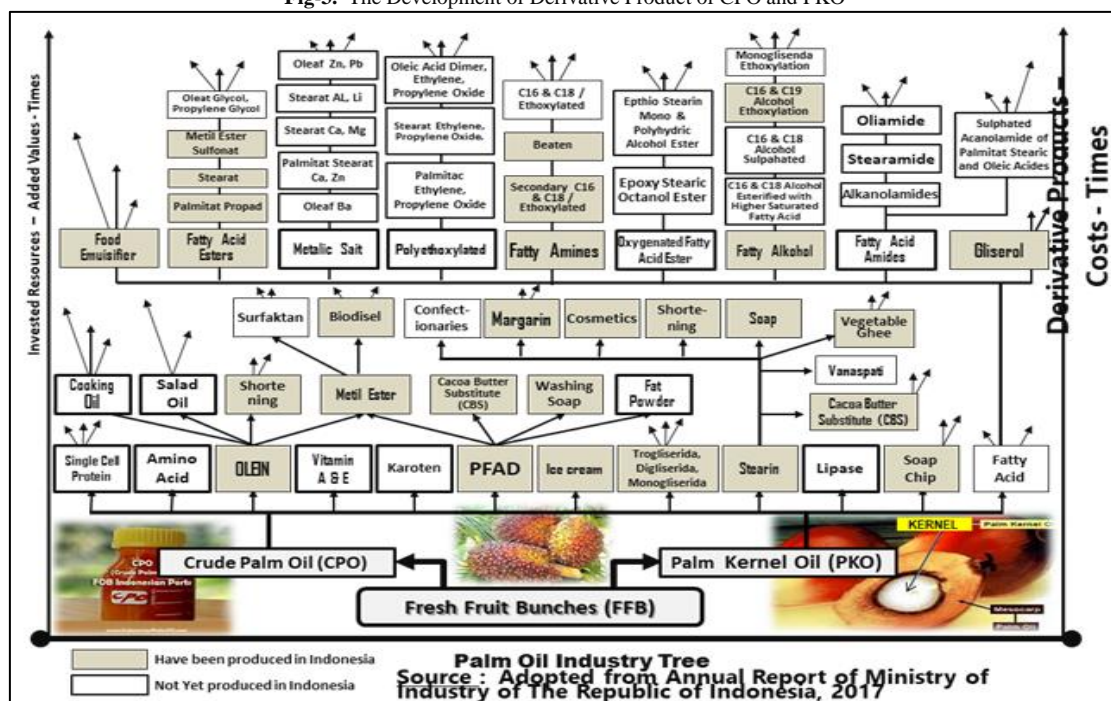
## 5.6. The Industrial Trees

The Palm Oil Industry Tree in Fig-3 is adopted from the research results of the Directorate of Downstream Product Development at the Ministry of Industry Republic of Indonesia in 2017. This Fig-3 describes a lot of possibilities that can be created and developed in order to make the derivative products of CPO and PKO, included FFB. It is a signal indirectly the better prospective if Indonesia does not export anymore the palm oil in form of CPO and PKO but to produce its end products in the domestic market. The industrialization in Indonesia must be able to make finished goods for their own demand in the country. This Palm Oil Industrial Tree opens the inspiration to Indonesian entrepreneurs to initiate the creation and development as many as possible of derivative products of CPO and PKO in domestic market to fulfill the local demand beside for export. The considerable added value provided by finished products of CPO and PKO can be enjoyed by the Indonesian people themselves if end products produced domestically, moreover it can reduce as well the dependency of the people to the import of end products of CPO and PKO which still dominate Indonesian local market.

FFB is manufactured by exporter-producers as the main raw material to get CPO as principal product and its side product is PKO. By further manufacturing of CPO and PKO can create many kinds of end product such as cooking oil, soap, margarine, shampoo, medical goods and services, solar energy, biomass energy, etc. Viewed from the proportions, the industry that has absorbed the most CPO is the cooking oil industry (79%), then the oleo chemical industry (14%), the soap industry (4%), and the rest is margarine industry (3%).

Separation of CPO and PKO can produce basic chemical compounds consisting of fatty acids and glycerol. Overall the process of producing CPO can produce 73% Olein, 21% Stearin, 5% Palm Fatty Acid Distillate (PFAD), and 0.5% waste. Fig-3 describes many kinds of derivative products that are possible to derive from further manufacturing CPO and PKO. Those all can be realized of course if and if supported by better human knowledge and skill, better technology, then better marketing strategy, better facilities and services with strong support provided by local government

Fig-3. The Development of Derivative Product of CPO and PKO



## 6. Conclusion and Recommendation

1. All independent variables of PREM are solid to explain the FFB price of sales realization at the market level of palm farmer, except for government policy variable which determines that the pricing intervention policy is not so effective.
2. The PREM testing shows that price transmission from exporter-producers all the way through middlemen to the market level of palm farmers is not efficient. Such condition signifies the existency of monopsony power in buying FFB. This market condition supports policy makers to promote an action plan of developing CPO and PKO derivative products to create more added value and end product types, to expand market networks and then to create price efficiency.
3. The average value of RCAs for CPO in the domestic market during the period of 2004-2018 is far greater than one but it is very close to one in international market. It indicates that West Sumatra has a comparative advantage in producing CPO including PKO that can act as a "price leader" or "price maker" for the commodity. Such condition signifies better market conduct to support an action program of developing CPO and PKO derivative products.
4. The palm oil industry tree shows that there are a lot of possibilities to inspiring Indonesian entrepreneurs to initiate the creation and development of derivative products of CPO and PKO to fulfill the local demand and for export. Since the business fields/industry are dominated by the secondary sector and the tertiary sector in Solok City while the regions of surrounding area tend to be more profitable working in the premier sector, implying that Solok City has a comparative advantage as a center for industrial growth and as an industrial mover for the surrounding regions. This is also supported by human resource of Solok City which is more developed in terms of knowledge and skill. Moreover, Solok City is also located in a strategic place at the intersection of economic activities across regions and cities in Sumatra. Such conditions would support the development of CPO and PKO derivative products.
5. Overall, there exists a great opportunity to develop the derivative products of CPO, included PKO derivative products industries. Solok City provides a favorable economic environment as a strategic place for derivative product development. The characteristics of market conduct based on this research finding, supports the action plan to create and to develop the derivative products for increasing added values of CPO and PKO. To realize this opportunity, Solok City has to have at least one "enterprises zone" (EZ) as a growth center of industrial enterprise development. SMTEs is the type of firm which are considered better to be created and to be developed in EZ. This EZ should have special functions, as a place for processing raw materials, as a place to conduct the innovation training and services, as a place of technology transfer, etc. Without such facilities, it is difficult for Solok City to play an optimal role as the engine of regional economic growth.

## Acknowledgment

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## Appendices

There are two main kinds of statistical testing required, i.e.: (i)Test of Classical Assumption, and (ii)Test of Unit Root, Integration and Cointegration Test.

### 1. Testing Classical Assumptions

This test is used to evaluate whether PREM faces the problem of deviations from classical assumptions. For this reason, the following tests must be carried out, i.e.: multicollinearity test, heteroscedasticity test, autocorrelation test, normality test and linearity test.

#### A). Multicollinearity Test

**Table-A1.** The Results of Multicollinearity Testing

Variables	Log(Pa)	Log(Pb)	Log(Pe)	Log(Pk)	Log(Pp)
Log(Pa)	1	0.0019	-0.0076	0.0008	0.0015
Log(Pb)	0.0019	1	-0.0025	-0.0004	0.0025
Log(Pe)	-0.0076	-0.0025	1	-0.0001	0.0045
Log(Pk)	0.0008	-0.0005	-0.0001	1	0.0032
Log(Pp)	0.0015	0.0025	0.0045	0.0032	1

Source: Data processed (2010-2018)



The results of multicollinearity testing by using the program **EViews** obtained the results as shown by Table-A1. It illustrates that the value of the correlation coefficients of independent variables is relatively low and far smaller than 0.80. It indicates that no symptoms of multicollinearity among independent variables.

## B). Heteroscedasticity Test

**Table-A2.** The Results of Heteroskedastisitas Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	2.700890	Prob. F(3.86)	0.0506
Obs*R-squared	7.749412	Prob. Chi-Square (3)	0.0515
Scaled explained SS	66.90308	Prob. Chi-Square (3)	0.0000

Source: Data processed (2010-2018)

By using the **Breusch-Pagan-Godfrey** test obtained that Obs \*R-square value of 7.749412 is greater than  $\alpha = 5\%$ . Therefore, it can be concluded that the regression model used does not have an heteroscedasticity problem (see Table-A2).

## C). Autocorrelation Test.

**Table-A3.** The Results of Autocorrelation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.733815	Prob. F (2.84)	0.1829
Obs*R-squared	3.568026	Prob. Chi-Square (2)	0.1680

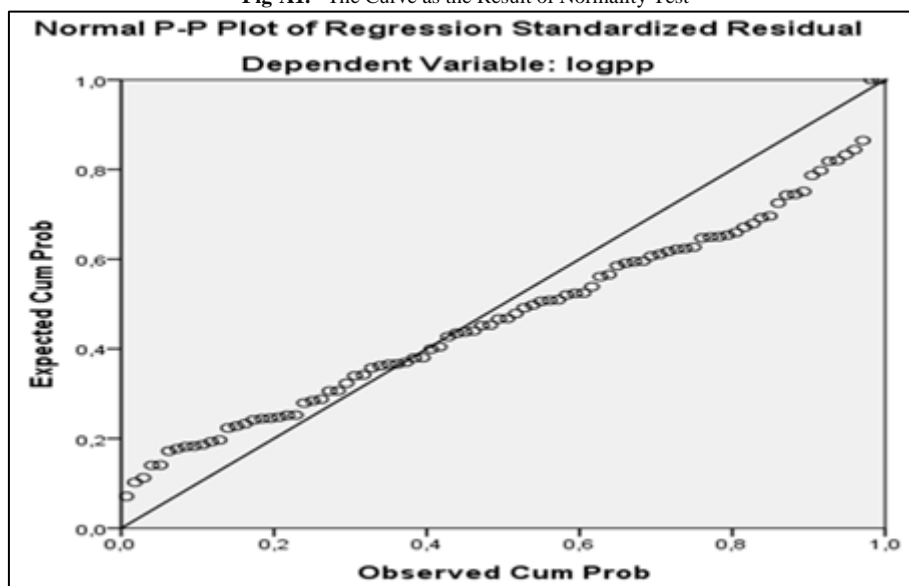
Source: Data processed (2010-2018)

The autocorrelation test results shown in Table-A3, by using the Chi-Square probability of  $0.1680 < \text{real level}$  ( $\alpha = 5\%$ ) implying that the model is not to contain autocorrelation

## D). Normality Test

The result of normality test shows a normal distribution of data during the period of study (2010-2018). It implies that the functional price relationship model can be used to explain the performance of production and market of FFB, CPO and PKO in domestic market of West Sumatra (see Fig-A1)

**Fig-A1.** The Curve as the Result of Normality Test



## E). Linearity Test

**Table-A4.** The Results of Linearity Test

Ramsey RESET Test:			
	Value	df	Probability
t-statistic	0.427028	85	0.6704
F-statistic	0.182353	(1, 85)	0.6704
Likelihood ratio	0.192872	1	0.6605

Source: Data processed (2010-2018)

The results of linearity test by using Ramsey RESET Test can be seen through [Table-A4](#). It shows that the F-statistic of 0.6704 is greater than the real level of 5%, indicating the model used presents correctly the effect of CPO and PKO export prices on FFB purchasing prices all the way through middlemen traders to palm farmers.

## 2. Test of Unit Root, Integration and Cointegration Test

After conducting the testing of the classical assumptions, it is essential to conduct the following statistical tests, i.e.: Unit Root Test, integration and cointegration tests.

### A). Unit Root Test

**Table-A5.** Unit Root Testing for Each of Variables in the Model

Variables	Unit Root Test			
	Level		1 <sup>st</sup> Difference	
	ADF	Prob	ADF	Prob.
Log(Pa)	-3.80	0.0041	-11.76	0.0001
Log(Pb)	-3.60	0.0031	-11.16	0.0001
Log(Pe)	-3.13	0.0278	-9.97	0.0000
Log(Pk)	-2.35	0.1581	-8.74	0.0000
Log(Pp)	-2.37	0.1520	-8.09	0.0000

Source: Data processed (2010-2018)

This testing is for the purpose to find out whether the variables used are stationary or not stationary. The root test unit is used with the Augmented Dick Fuller (**DF**) method. If the data is stationary, thus OLS regression (Ordinary Least Square) can be directly used. But if it is not stationary then the data must be stationary first. This study uses **ECT** (Error Correction Term) in order to perform the model as perfect as possible so that each parameter coefficient in equation can describe significantly the value of price elasticity as an indicator of the price efficiency and at once explains the supply potentialities of FFB, CPO and PKO in West Sumatra. By using the **EViews PROGRAM**, the results of stationary testing with the Augmented Dick Fuller method can be seen in [Table-A5](#).

Root unit testing is started at the first level of differentiation, it turns out that the CPO and PKO selling price variables and selling price of FFB at the farm's market level ( $\alpha > 0.05$ ) are not stationary. Therefore, it must be repeated testing by using the Augmented Dickey Fuller method of 1<sup>st</sup> Difference. After all it turn out that all variables became stationary at the 5% real level, so it was stated that the data was stationary on the first differentiation, and then the test can be continued with the Cointegration test.

### B). Integration and Cointegration Test.

**Table-A6.** OLS Regression for Forming Residuals

Dependent Variable: Log(Pp)	Values			
Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.168173	0.075044	-2.241005	0.0276
Log(Pa)	0.664444	0.041826	15.88573	0.0000
Log(Pb)	0.146543	0.028944	5.062972	0.0000
Log(Pe)	0.159667	0.041383	3.858235	0.0002
Log(Pk)	0.030731	0.012675	2.424584	0.0174
R-squared	0.987181	Mean dependent var		3.170926
Adjusted R-squared	0.986578	S.D. dependent var		0.065186
S.E. of regression	0.007552	Akaike info criterion		-6.880027
F-statistic	1636.440	Durbin-Watson stat		1.473101
Prob(F-statistic)	0.000000			

Source: Data processed (2010-2018)

Cointegration test is used to give an initial indication that the model used has a long-term relationship. OLS regression results forming residuals can be seen in [Table-A6](#). From the regression equation, then take the residuals and give the name ECT (Error Correction Term), then run the root test unit with the Augmented Dickey Fuller method at the level, thus the residual must be stationary at the level to be said to have cointegration. The results of unit root testing at the level of ECT can be seen in [Table-A6](#).

From the results of unit root testing for ECT ([Table-A7](#)) are found that stationary residuals at the level expressed by the value of prob <5% can thus be stated that the data is cointegrated. If it has been proven that ECT has been stationary at the level, thus the formation of the regression equation using ECT can be continued.

**Table-A7.** Root Test of ECT Units

Null Hypothesis: ECT has a unit root				t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic				-7.135118	0.0000
Test critical values:	1% level			-3.506484	

	5% level		-2.894716	
	10% level		-2.584529	
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
ECT(-1)	-0.929554	0.130279	-7.135118	0.0000
D(ECT(-1))	0.244614	0.109135	2.241399	0.0276
C	0.000103	0.000827	0.124269	0.9014
R-squared	0.409013	Mean dependent var		3.88E-05
Adjusted R-squared	0.395108	S.D. dependent var		0.009975
S.E. of regression	0.007758	Akaike info criterion		-6.846666
Sum squared resid	0.005116	Schwarz criterion		-6.762211
Log likelihood	304.2533	Hannan-Quinn criter.		-6.812641
F-statistic	29.41361	Durbin-Watson stat		1.986535
Prob(F-statistic)	0.000000			

Source: Data processed (2010-2018)

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