Factor affecting the palm oil boom in Indonesia: a time series analysis

D. Bentivoglio[1]; G. Bucci[2]; A. Finco[2]

1: Università Politecnica delle Marche - UNIVPM, Department of Agricultural, Food and Environmental Sciences - D3: A, Italy, 2: Università Politecnica delle Marche, Department of Agricoltural, Food and Environmental Sciences (D3: A), Italy

Corresponding author email: d.bentivoglio@univpm.it

Abstract:

Over the past decade, the demand for palm oil has been increasing worldwide. The multi-purpose use combined with a market price below makes palm oil an attractive product. Consequently, a significant change in palm oil industry has taken place. Since 2006, Indonesia has been the biggest producer of palm oil in the world, replacing Malaysia as a chief producer. Thus, the rise of Indonesia palm oil is only a relatively recent phenomenon. This study develops a simple theoretical model that integrates some of the factor that could influence the production of palm oil in Indonesia in order to establish the issue of cointegration and causality patterns. In particular, this analysis examined the relationships among Indonesian palm oil production, soybean oil price, area harvested for palm oil production in Malaysia and palm oil consumption. The finding shows that soybean oil price, area harvested for palm oil production in Malaysia and palm oil consumption positively and significantly affect Indonesian palm oil production. However, the ascent of the Indonesian palm oil industry is the result of a combination of several factors, some of which are relating to the palm oil plant itself, others to policy.

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JEL Codes: Q02, Q18

#1063

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Keywords: Indonesia palm oil, Soybean oil price, Malaysian palm oil, Palm oil consumption, Time series analysis

JEL classification: C32, Q11, Q12, Q18

1. Introduction

Palm oil (botanical classification as *Eleaeis guineensis*) comes from the fruit of the oil palm tree, a tropical species that originated in West Africa. In the twentieth century, the tree was exported to countries in Central America and Southeast Asia, notably Malaysia and Indonesia. Palm fruit contains two types of oil: palm oil, which comes from the mesocarp or fleshy part of the fruit, and palm kernel oil, which comes from the seed in the fruit. Finally, Palm kernel shells are the shell fractions left after the nut has been removed after crushing in the Palm Oil mill.

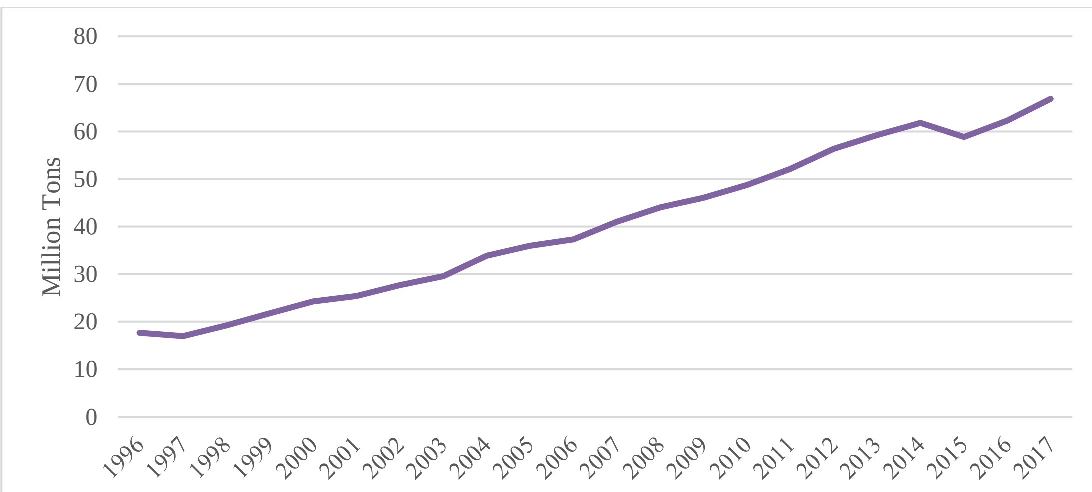
In the past decade, palm oil has risen to become the most produced and consumed vegetable oil in the world. The diverse range of uses in food, cosmetics and other commodities, as well as biofuels, combined with a market price below that of its competitors, makes palm oil an attractive commodity (Mukherjee and Sovacool, 2014; Rival and Levang, 2014; Mba et al., 2015; Azhar et al.,2017; Pacheco et al., 2017). To date such rapid growth in palm oil production can be mainly explained by an expansion of the plantation area (May-Tobin, et al., 2012; Gerasimchuk and Koh, 2013) that is associated with a number of sustainability concerns including direct and indirect land-use change, deforestation infringement of land rights and labour standards (Basiron and Weng, 2004; Fitzherbert et al., 2008; Tan et al., 2009; Choong and McKay, 2014; Aikanathan et al., 2015; Hansen et al., 2015; Saswattecha et al., 2016; Afriyanti et al., 2016).

Palm oil production is fairly concentrated. Currently, more than 85% of the world palm oil productions are from Malaysia and Indonesia. However, a significant change in oil palm industry has taken place, during the past season, as the Indonesia surpassed Malaysia in production of palm oil and now is the world leader. In Indonesia two major phases of palm oil development can be distinguished: first, the government-led phase and, second the marked oriented phased (Euler et al.,2017; Gatto et al., 2017). Since the 1970s, the Indonesian government has stimulated oil palm expansion in various ways, initially in the form of plantations. For a considerable time, the government played a direct role in stimulating investments in oil palm plantations through state agencies (Budidarsono et al., 2013). The policy was not implemented for solely plantation development; it was linked and integrated with other policy objectives: population redistribution through resettlement schemes or transmigration, socio-economic progress and political consolidation. Since the 1999 to presently the government changed its policy by seeking to encourage private sector. During this period the door for foreign direct investment in large-scale plantations was opened. Given that the production are increasing rapidly especially in Indonesia, the objective of this study is to investigate the relationship between the supply of Palm oil in Indonesia and its determinants by using cointegration technique and error correction model. This paper is organized as follows. Section 2 describes the palm oil market and trends. After a brief literature overview in section 3, Section 4 introduces the methodology and the case study. Section 5 then discusses the results. Finally, section 6 presents our conclusions.

2. Palm oil market and trends

Palm oil has expanded significantly over the past few years. The global palm oil production has increased from 17.64 million tons in 1996 to 66.87 million tons in 2017 with an increase of 279%. (Figure 1). This is the highest production volume of all vegetable oils, exceeding the second biggest oilseed crop, that is soybean, by more than 10 million tons (USDA, 2017).

Figure 1: Global palm oil production



Source: USDA, 2017

Nowadays, Indonesia and Malaysia account for 85% of world production. Although Indonesia and Malaysia being the largest producer by far (36 and 21 million tons respectively), there has also been a marked increase in palm oil production in other parts of the world. Most of the additional volume is produced by Thailand (about 2.2 million tons), Columbia (about 1.3 million tons) and Nigeria (about 1 million tons) (Table 1).

Table 1: Top 5 palm oil producers in 2017

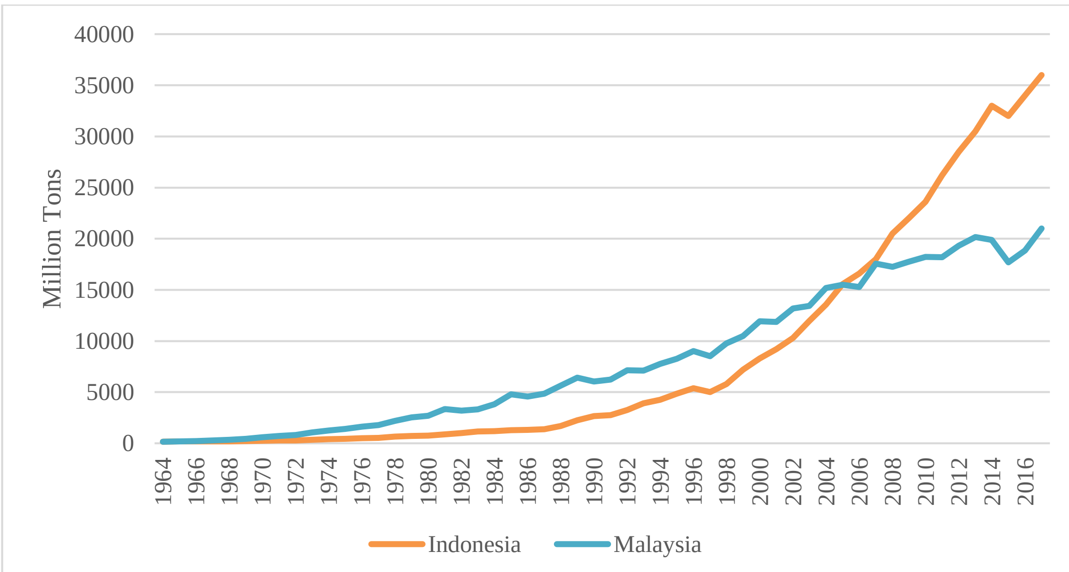
Country	Production (1000 Tons)	Share %
Indonesia	36000	54

Malaysia	21000	31
Thailand	2200	3
Colombia	1320	2
Nigeria	970	1

Source: Index mundi, 2017

Focus on Malaysia and Indonesia palm oil production, figure 2 shows how a significant change in the oil palm market has taken place during the past decade.

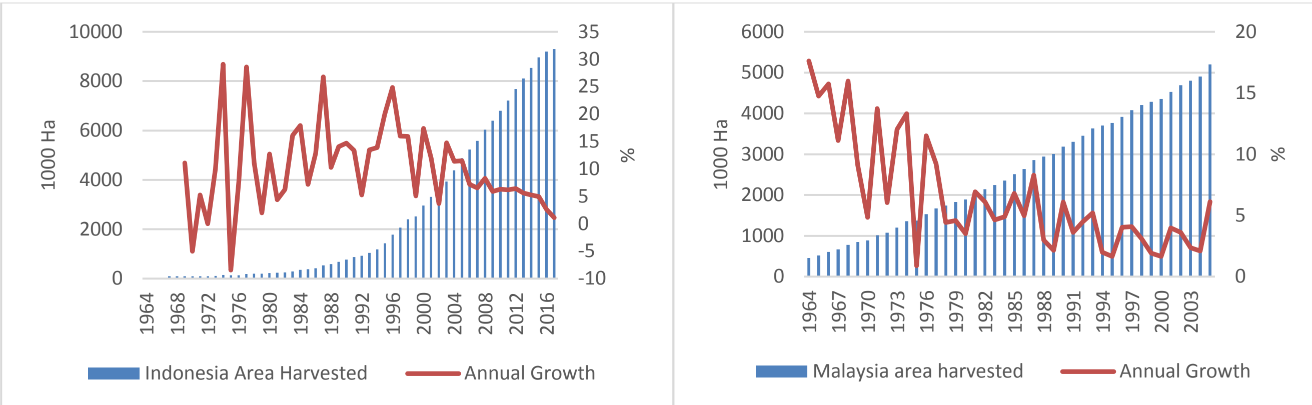
Figure 2: Malaysia and Indonesia palm oil production (1964-2017)



Source: Index Mundi, 2017

Malaysia was the world's biggest palm oil producer in the 1970s. In the 1980s, Indonesia set a target to overtake Malaysia. To achieve this goal, Indonesian government introduced a set of policy measures in order handed out vast areas of land for oil palm plantations to both foreign investors and domestic business groups (Santosa, 2008). As a result, the plantation area expanded. In 2006, the plantation area reached 5.23 million ha or more than ten times greater than in 1985. Consequently, from 2006, Indonesia has overtaken Malaysia and now it became the world’s biggest palm oil producer with a produced of 36 million tons. In detail, in Indonesia the production has more than doubled from 2006 to 2017 (+117%) and the harvested area of palm oil increased from 5.2 million of hectares in 2006 to 9.3 million of hectares in 2017 (+78%). While in Malaysia palm oil production grew more than 37% and the harvested area of palm oil increased from 3.7 million of hectares to 5.2 million of hectares over the same period (+40%) (Figure 3).

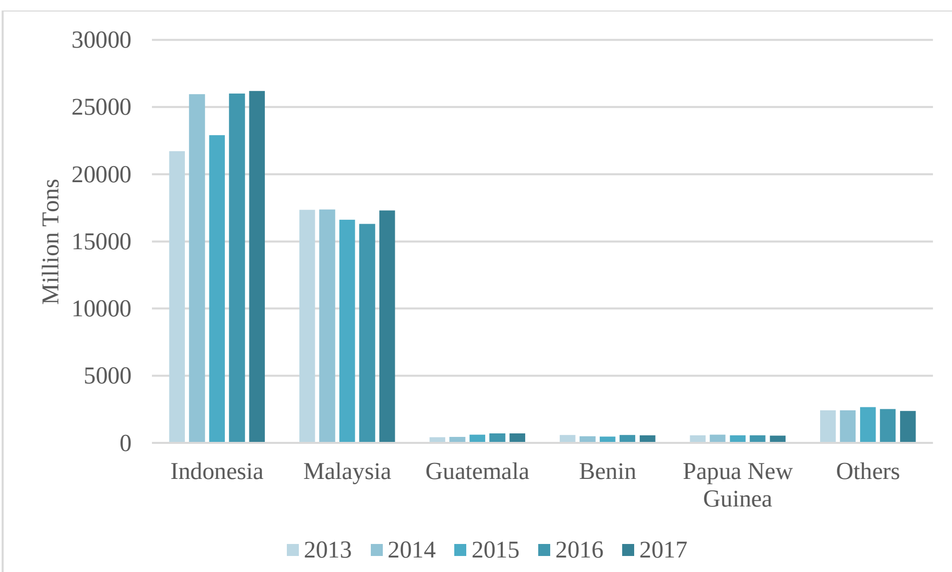
Figure 3: Expansion and annual growth of palm plantation area in Indonesia and Malesya



Source: Index Mundi, 2017

The expanding of palm oil production and the growing palm oil area coincides with increasing palm oil trade. International palm oil trade is very dynamic. In the early 1960s, Africa was the world's largest exporter. From the mid-60s the market is dominated by Asia in both imports and exports. As shown in figure 4, Indonesia (26,200,000 tons) and Malaysia (17,300,000 tons) are the largest palm oil exporters by far and together accounted for 91% of exports in 2017. Far behind, in third position, there is Guatemala (700,000 tons) followed by Benin (505,000 tons) and Papua New Guinea (550,000 tons).

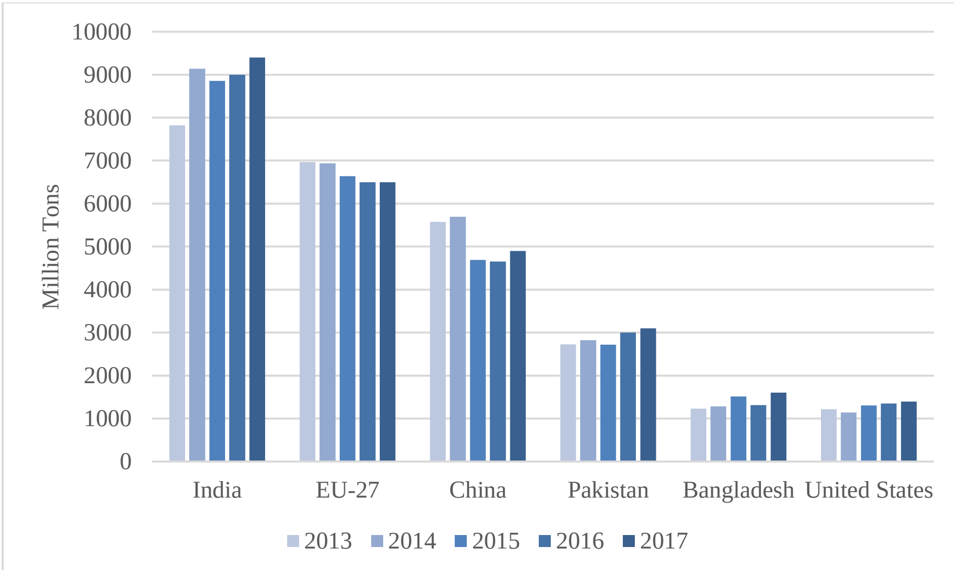
Figure 4: The top palm oil exporters (1000 Tons)



Source: Index Mundi, 2017

The imports are distributed over different countries. In 2017, India is the main palm oil importer (9,400,000 tons) in the world, followed by European Union (6,500,000 tons), China (4,900,000 tons) and Pakistan (3,100,000 tons) (Figure 5). These countries cover the 55 per cent of global imports.

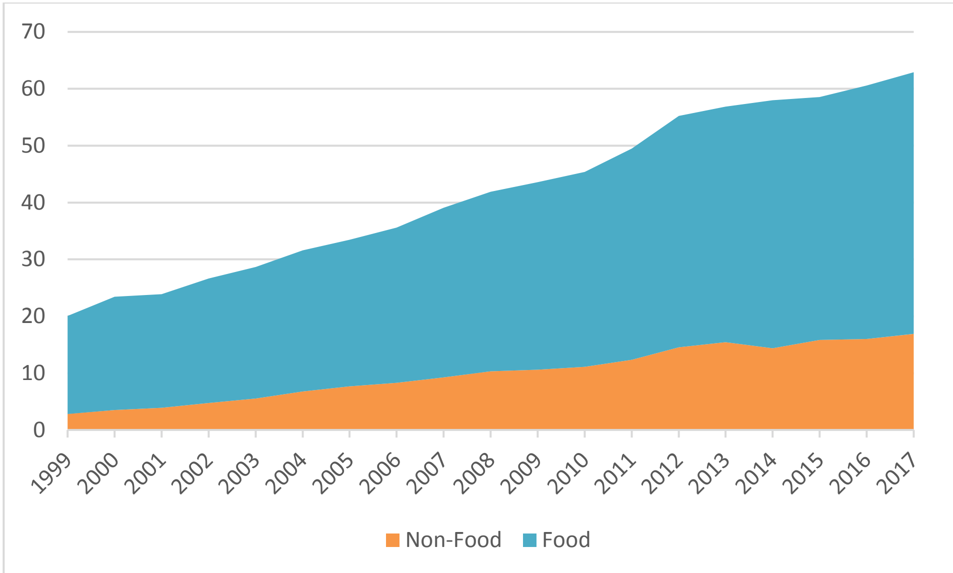
Figure 5: The top palm oil importers (1000 tons)



Source: Index Mundi, 2017

The world demand for palm oil has soared in the last two decades, first for its use in food and more recently as the raw material for biofuels. Nowadays, as shown in figure 6, despite the growth in non-food use (consumption growing from 14% to 27%), palm oil has remained primarily used for food consumption.

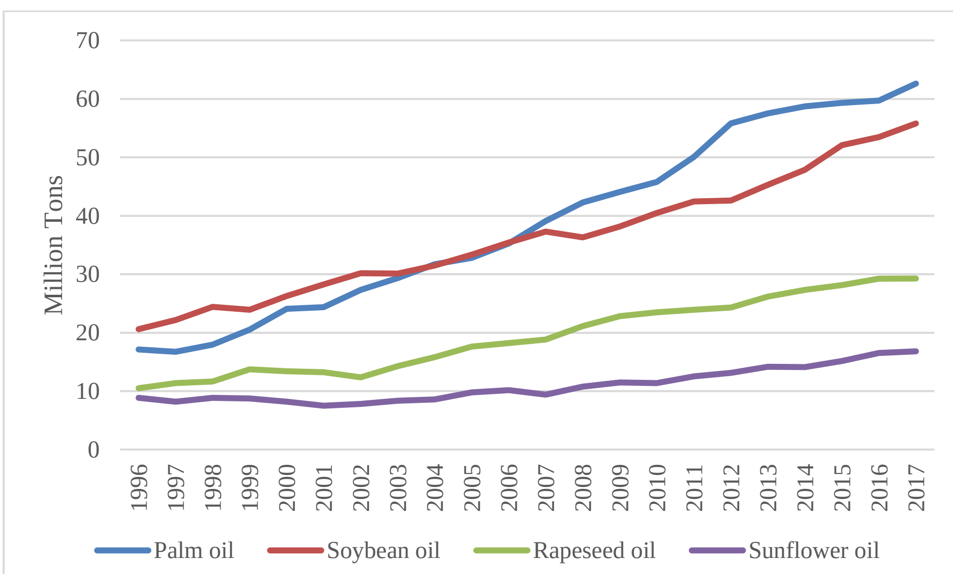
Figure 6: Global consumption of palm oil: Food versus no-food uses



Source: USDA-FAS (2017)

The global palm oil consumption rose from 17 million tons in 1996 to 63 million tons in 2017, making it the most consumed oil in the world. In particular, in 2017, palm oil made up 33% of the global total vegetable oil consumption, ahead of soybean oil (30%), rapeseed oil (16%) and sunflower oil (9%) (Figure 7).

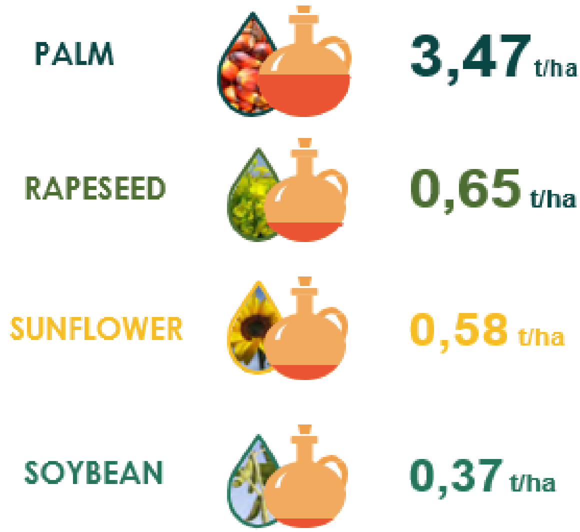
Figure 7: Word consumption of vegetable oil from 1996 to 2017



Source: USDA, 2017

These tables and figures illustrate the transnational character of palm oil production and trade, underlining that the palm oil industry has become a global one. Among the reasons for this rapid expansion are the high yield oil palm delivers per hectare compared with other oil crops (Figure 8) against low costs. Oil palm is the highest oil yield crop producing on average about 4 tons of oil/ha annually and 10 times as much soybean and 5 times rapeseed.

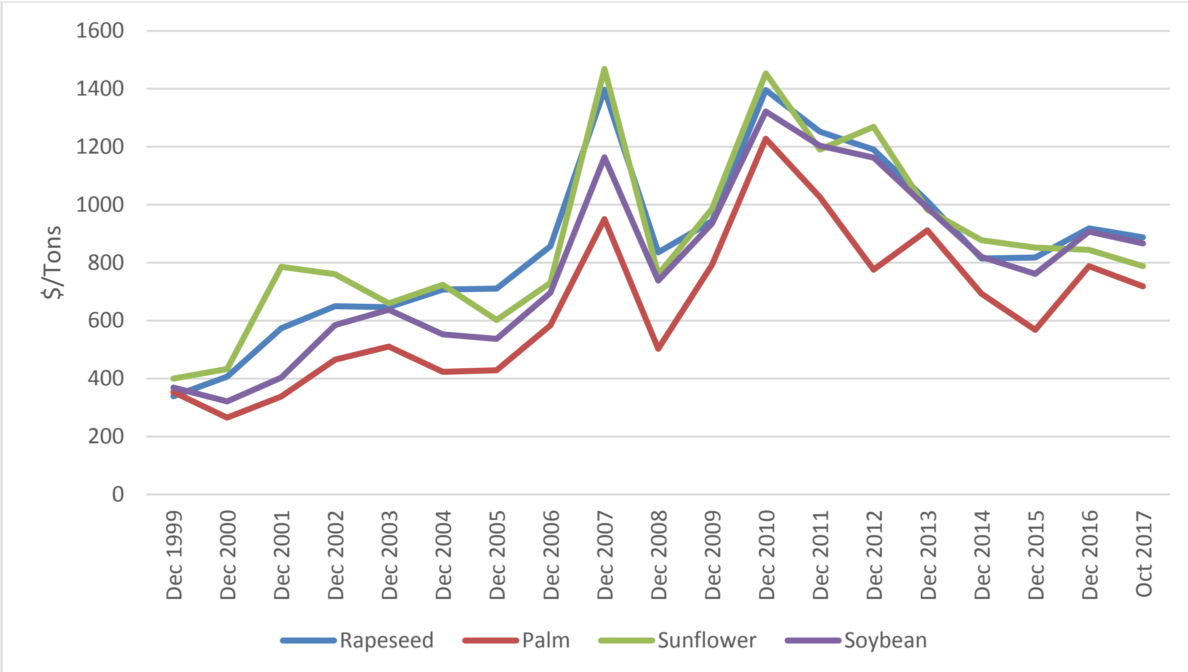
Figure 8: The most productive oil crops



Source: AIDEPI, 2017

In addition, palm oil is by far the cheapest vegetable oil on the world market (Figure 9). In fact, the figure shows that the sunflower oil has the highest price in the market, while palm oil price registers the cheaper price. Looking at the last year, the sunflower oil has registered an average price of $/tons, while palm oil has recorded an average price of $/tons

Figure 9: Vegetable oil price



Source: Index Mundi, 2017

Finally, in terms of production cost, palm oil stands out as the least expensive oil to be produced per ton compared with other major vegetable oils. According to Lam et al, (2009), the production cost of palm oil is about 200 euro per ton while for rapeseed oil in Europe, the price is more than double. Consequently, palm oil represents a more suitable and attractive candidate as the source of both energy and food compared to other vegetable oils.

3. A brief literature review

Several researchers have examined the impact of various variables on palm oil price, export and production. Most of previous researchers study factors affecting palm oil prices and palm oil export (Lubis, 1994; Hasan et al., 2001; Sulistyanto and Akyuwen, 2009; Ab Rahman, 2012; Hassan and Balu, 2016;). While, in the previous literature, there are relatively few studies, which focus on the main reason that contributed to the increase in the palm oil production, and most of the existing studies are related to Malaysia palm oil industry. Thus, the objective of this paper is to investigate the relationship between palm oil production and its determinants in the Indonesian palm oil industry using times series analysis. From 1980s to the year 2000s, Malaysia produced about half of the world palm oil production thus, making Malaysia as world’s largest producer and exporter of palm oil during this period. In 2006, even though Malaysia continued to produce a large amount of palm oil, Indonesia became the world's largest producer and exporter of palm oil, replacing Malaysia as a chief producer. Nowadays, the growth of palm oil production can be attributed to many factors. In the following lines, we review some of the most recent articles that study the factors influencing the production of palm oil. With different analytical methods and approaches, these studies attempt to explain the factors behind the return and growth of palm oil production. The findings are mixed, but they are complementary and mutually supportive. According to Casson (1999) the palm oil growth was caused by several factors, especially the efficiency and high yield of the harvest combined with low production cost, a promising domestic and international market and government policy, which supports the development of the palm oil industry. According to Chuangchid et al. (2012) the growth of palm oil production can be attributed to the demand of the local consumers as well as a price that is affordable to buy. Asari et al. (2011) used a time series analysis method to examine the influence of total area planted and the price of palm oil on the production of palm oil in Malaysia. They found that the production of palm oil in Malaysia can influence its price level. On the other hand, there is no causality relationship between total area planted and the production of palm oil in Malaysia. As a result, the total area planted and palm oil production does not influence each other in the short run. In the long run, there is negative relationship between the production of palm oil with the total area planted and the palm oil price. Alias et al. (2005) examined the relationship between the supply of Malaysian palm oil and its determinants by using Johansen cointegration technique and error correction model. The results show that the palm oil production is responsive to its relative price, government's support and interest rate, both in the long run and short run. Egwuma et al. (2016) adopted the ARDL estimation technique to study the determinants of palm oil demand in Nigeria. The authors found that palm oil price and the income lever are important determinants of palm oil demand. Abdullah (2015) shows that maturity of area planted, total area planted, replanting and yield influence the supply of palm oil in Malaysia. Concerning with Carter et al. (2007), the demand for palm oil and its products increases quite steeply, partly due to emerging demand as a relatively cheap biofuel, and partly due to its price advantages in edible applications. Zuikarnain (2008) studies the factors affecting the demand of Malaysian palm oil by using the Ordinary Least Square method (OLS) and Multiple Regression model (MR). The results showed that palm oil prices, population and soybean oil prices are significant.

4. Methodology and data

An extensive literature has applied econometric methods for analyzing time series data to establish the relationships among variables (Banerjee et al., 1993; Peri and Baldi, 2010). The main objective of the article is to investigate whatever there are long-run and short-run relationships among Indonesian palm oil production and its determinants by using cointegration technique, error correction model and Granger causality test. The variables, selected for this study, were based on the factors that could affect palm oil production in Indonesia. For our analysis, we used annual data from 1987 to 2017 for Indonesian palm oil production (POP_{ind}), soybean oil price (SOPRICE), area harvested for palm oil production in Malaysia (POMAREA) and palm oil consumption (POCONS). In particular, soybean oil is selected because of it is the most important edible oil on the market, and leading competitor with palm oil on the global market. On the other hand, Malaysia is the main competitor with Indonesia in terms of palm oil production. Finally, palm oil consumption is taken due the rapidly increase to fill both food and energy market demand. Despite the growth in the non-food uses over the last decade, palm oil has remained primary used for food consumption. The food industry is responsible for 72% worldwide usage of palm oil. Palm derived ingredients used in personal care and cleaning products are responsible for 18% of worldwide usage (USDA-FAS, 2017). Biofuel and feedstock is responsible for 10% of worldwide palm oil usage.

Data were gathered from Index Mundi database. The general long-run model can be written as follows:

$$POP_{ind} = f\,(SOPRICE, POMAREA, POCONS) \qquad (1)$$

These variables are then transformed into the linear logarithm form. To explore our issues, four stages of analysis are involved in this paper: stationary tests, cointegration test, VECM estimation and Granger causality. In details, the unit root tests are the test for stationarity in a time series. During the last 30 years, the units root test in both the statistics and the econometric literature have received considerable attention (Pierse and Snell, 1995; Chan, 2009; Romano et al., 2010). A time series has stationarity if a shift in time does not cause a change in the shape of the distribution; unit roots are one cause for non-stationarity. If a series is proven to be non-stationary series, it needs to be transformed into stationary series by using a method of differentiation. Statistical theory offers a wide range of tests where the most common are Dickey and Fuller's DF-test and ADF test (Dickey and Fuller, 1979), Phillips-Perron test (Phillips and Perron, 1988), KPSS test (Kwiatkowski et al., 1992), also less frequently used ADF-GLS test (Elliot et al., 1996) and NGP test (Ng and Perron, 1995 and 2001). These tests utilize two different approaches. Stationarity tests, such as the KPSS test, that consider as null hypothesis H0 that the series is stationary, and unit root tests, such as the Dickey-Fuller test and its augmented version the augmented Dickey-Fuller test (ADF), or the Phillips-Perron test (PP), for which the null hypothesis is on the contrary that the series possesses a unit root and hence is not stationary. In this study, we will apply the standard augumented Dickey and Fuller test that is one of the best known and most widely used unit root tests

(Fedorová, 2016). After completing the stationary test for each variable, the level of cointegration need to be investigate. The purpose of the co-integration test is to determine whether a group of non-stationary series is co-integrated or not. The cointegration technique was pioneered by Engle and Granger (1987), Hendry (1986) and Granger (1986). The variables are said to be cointegrated, i.e. they exhibit long-run equilibrium relationship, if they share common trends. As long as the set of variables have a common trend, causality must exist at least in one direction, either unidirectional or bidirectional (Granger, 1986, 1988). In brief, a set of variables are cointegrated if they are individually non-stationary and integrated of the same order, and yet their linear combination is stationary. Statistically, the presence of cointegration rules out non-causality between the variables. In contrast, the absence of cointegration suggests there might be only short-run interactions between the variables. In this case, all variables need to be expressed in first differences to avoid spurious regression (Mohammad and Masih, 2016). There are several estimations of cointegration relations, such as, OLS (Engle-Granger, 1987), Augmented Least Squares (Bewley, 1979; Hendry and Richard, 1982), Instrumental Variables (Phillips and Hansen, 1990), Fully Modified Estimator (Park and Phillips, 1988), Non-Parametric Canonical Cointegration (Park, 1989), Three Step Estimator (Engle and Yoo, 1991), Canonical Cointegration (Bossaerts, 1988), Spectral Regression (Phillips, 1991), Principal Components (Stock and Watson, 1989), Maximum Likelihood (Johansen, 1988), Modified Box-Tiao (Bewley et al., 1991). Engle-Granger and Johansen procedures are the most commonly used approach among others for cointegration analysis (Bilgili, 1998). Between these two procedures, Johansen cointegration technique is more powerful (Sjö, 2011). This method is based on two steps procedure, where one selects first the lag, then the cointegration rank depending on the lag chose in the first step. In fact, a critical element in the specification of VEC models is the determination of the lag length of the VECM. The lag is determined using information matrices based on Akaike (AIC) (1973), Hannan and Quinn (1979) and Schwarzs (1978) information criteria (IC). Then, together with the lag order, the cointegration rank is determined by using some test-based procedures. The concept of co-integration can be defined as a common stochastic trend among two or more economic variables over the long run. The trace test and maximum eigenvalue test are used to ascertain the existence of co-integration, and whether the method of estimation used is the ordinary least squares (OLS) or maximum likelihood, both return the same results (Chang, 2010). If the results show evidence of a co-integrating relationship within the variables, this indicates that the research variables enact a systematic co-move-ment in the long-run. Such a long run causality relationship requires testing by a vector error correction model (VECM). VECM is the cointegrated coinstaint vector auto regression model, introduced by Sargan (1964), developed by Engle and Granger and is apply to deal with the cointegration relationship between the non-stationarity time series modelling. VECM can reflect the long-term equilibrium and short-term fluctuations. Formally, the VECM can be written as:

$$\Delta z_t = \Pi z_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta z_{t-1} + d + \varepsilon_t, \qquad t = 1,2,\dots,T \tag{2}$$

where Zt is a p x 1 vector of endogenous variables, Γ_i, i = 1, 2… are (p x p) matrices of short run parameter, Π is a (p x p) matrix of lung run parameters; d is a vector of deterministic terms (a constant, a linear trend, seasonal dummies, intervention dummies, etc.); and ε_t is a vector of errors that are assumed to be independently and identically Gaussian distributed, such that $E(\varepsilon_t \varepsilon_t') = \Sigma$ for all t, where Σ= $\{\sigma_{ij}, i, j = 1,2,\dots,p\}$ is an (p x p) positive definite matrix. In the I (1) system Zt is said to be integrated if the following rank condition are satisfied: Hr: Π = αβ' of rank 0 < r < p, where α and β are matrix of dimension p x r. β is a matrix representing the cointegrating vectors which are commonly interpreted as long-run equilibrium relations between the Zt variable, while α gives the weights of the cointegration relationship in the VECM equation. The cointegration rank is usually tested by using the maximum eigenvalue (λ-max) and the trace test statistic proposed by Johansen (1988) (Ben-Kaabia and Chebbi, 2002). Finally, the study further investigates the direction of causality between variables using the Granger Causality analysis of VECM. Granger causality (or "G-causality") was developed in 1960s and has been widely used in economics since the 1960s. Granger causality is a statistical concept of causality that is based on prediction. According to Granger causality, if a variable x "Granger-causes" (or "G-causes") a variable y, then past values of x should contain information that helps predict y above and beyond the information contained in past values of y alone (Granger 1969). In brief, it states that a variable x is the cause of another variable y if the past values of x are helpful in predicting the future values of y.

5. Empirical Results

In this section we presented the results of our analysis. Statistical analyzes were performed using the statistical software Rats32s (Regressions Analysis of times series). We started our study pretesting all series for stationarity. The stationarity is tested using the Argumented Dickey-Fuller (ADF) test. The ADF specifies the null hypothesis of non-stationarity and assumes that the errors are independent and homogeneous. The unit root test results are given in Table 2.

Table 2: **Results for unit root test**

Variables	ADF
POP_{Ind}	0,586 (1)
SOPRICE	-0,287 (8)
POMAREA	0,826 (0)
CONS	0,233 (1)

Notes: all variables are in natural logs. ADF regressions include a constant and a time trend. Lag lengths are in parentheses. The 1% critical value for ADF test is −2.58

As shown in table 2, ADF test fails to reject the null hypothesis of unit root, suggesting that all variables are non-stationarity at the 1% significance level.

The second step in this methodology is to test for the existence or absence of co-integration. The main goal of a co-integration test is to examine if two or more series are linked to form an equilibrium relationship. The Johansen procedure was applied to the series in order to estimate the number of co-integrating relationships. Moreover, it is essential at the onset of cointegration analysis, that we should solve the problem of optimal lag length. A lag- structure analysis based on the Schwarz criterion (SC) and Hannan Quinn information criterion (HQ) was conducted yielding a consistent estimate of the lag length. The results suggest an optimal lag order of 5. The following table reports our cointegration test using Johansen's maximum likelihood method.

Table 3. Johansen cointegration test

p-r	r	Eig.Value	Trace	Trace*	Franc95	P-Value	P-Value*
4	0	0.979	185.747	38.895	53.945	0.000	0.532
3	1	0.897	85.272	19.573	35.070	0.000	0.752
2	2	0.529	26.138	5.973	20.164	0.006	0.944
1	3	0.223	6.564	1.923	9.142	0.156	0.788

According to the finding in table 3, the value of trace statistics is smaller than 5% critical value when r is three. It implies that three cointegrating relations exist between all variables. However, our focus was only on POP_{ind} as the dependent variable. Thus, we present only one Vector Error Correction Model (VECM). By normalizing with respect to the Indonesian palm oil production, this statistical co-integration relationship can be estimated with the following equation:

$$ln\,POP_{ind} = +0.330\,lnSOPRICE + 1.058\,lnPOMAREA + 0.678\,lnPOCONS - 6.027 \quad (3)$$

All the parameter coefficients appeared to be statistically significant at the 1% confidence level. The parameters indicate that the Indonesian palm oil production (POP_{ind}) is positively related to soybean oil price (SOPRICE), area harvested for palm oil production in Malaysia (POMAREA) and palm oil consumption (POCONS) in the long run. As all variables are logarithmic, we may interpret coefficients in term of elasticity. So we may say that 1 percent increase in soybean oil price is associated with 0.330 percent increase in Indonesian palm oil production. The positive relationship between palm oil production and soybean oil prices is plausible, given that palm oil has become one of the leading vegetable oils in the world market, sharing this role with soybean oil. Besides, the increased demand of these oils for biofuels production brings on a new source of demand for both oils in the international market. Therefore, according to Hassan and Balu (2016), when the price of soybean oil rises, demand for palm oil will increase in tandem. The coefficient of area harvested for palm oil production in Malaysia is also significant, and its value is 1.058 showing that 1 percent increase will increase Indonesian palm oil production by 1.058 percent. Malaysia is the main competitor with Indonesia in terms of palm oil. Palm oil has been a key contributor to the Malaysian economy for the many decades. Malaysia used to be the largest palm oil exporter in the world before being displaced by Indonesia in the past few years. Finally, 1 percent increase in the consumption of palm oil is associated with 0.678 percent increase in Indonesian palm oil production. In particular, palm oil is a feedstock for food and biofuel. As a result, global consumption has been increasing. In summary, Indonesian palm oil production elasticity with respect to palm oil production in Malaysia is more elastic as compared to palm oil production elasticity with respect to soybean oil price and palm oil consumption.

The third stage involves constructing standard Granger-type causality tests augmented with a lagged error-correction term where the series are cointegrated. The existence of a cointegrating relationship among variables suggests that there must be Granger causality in at least one direction, but it does not indicate the direction of temporal causality between the variables. The null hypothesis that x does not Granger-cause y is tested with the use of the F-statistic. The results from the Granger causality tests are presented in Table 4. We test for all possible directions of causality. The arrow indicates the direction of Granger Causality.

Table 4: Granger causality tests

Direction of casuality	p-value
$POP_{ind} \rightarrow$ SOPRICE	0.1327
SOPRICE $\rightarrow POP_{ind}$	0.2919
$POP_{ind} \rightarrow$ POMAREA	0.0129
POMAREA $\rightarrow POP_{ind}$	0.7823
$POP_{ind} \rightarrow$ POCONS	0.0272
POCONS $\rightarrow POP_{ind}$	0.8566

Table 4 presents the p-value (significant at the 5% level) for Granger Causality tests. We find that the direction of causality was from Indonesian palm oil production (POP_{ind}) to both palm oil production in Malaysia (POMAREA) and palm oil consumption (POCONS). While, it is found that soybean oil price (SOPRICE), palm oil production in Malaysia (POMAREA) and palm oil consumption (POCONS) does not granger cause Indonesian palm oil production (POP_{ind}). Thus, we can conclude that Indonesia palm oil production influence the level of palm oil production in Malaysia and palm oil consumption in the short run and not vice versa.

6. Discussion and Conclusion

The production, trade, and market share of palm oil have grown dramatically in the last two decades. From 1996 to 2017, the global production of palm oil grew from 17.64 million tons to more than 66 million tons, with an increase of 279%. Nowadays, Indonesia is the bigger producer of palm oil in the word. On average, more than 70% of Indonesia's palm oil and palm oil products are exported. However, the rise of Indonesia palm oil is only a relatively recent phenomenon. This study develops a simple theoretical model that integrates some of the factor that could influence the production of palm oil in Indonesia in order to establish the issue of cointegration and causality patterns. In particular, this analysis examined the relationships among Indonesian palm oil production, soybean oil price, area harvested for palm oil production in Malaysia and palm oil consumption. In the long-run, the finding shows that soybean oil price, area harvested for palm oil production in Malaysia and palm oil consumption positively and significantly affect Indonesian palm oil production. Furthermore, we may say that Indonesian palm oil production is relatively more elastic with regard palm oil production in Malaysia than with regard both soybean oil price and palm oil consumption. In addition, the causality test suggest that Indonesia palm oil production influence the level of palm oil production in Malaysia and palm oil consumption in the short run and not vice versa. However, more studies are need to improve the information reported in this paper by integrating other factors that might move the production of palm oil. This study focused on only three variables. Indeed, the ascent of the Indonesian palm oil industry is the result of a combination of several factors, some of which are relating to the palm oil plant itself. Thus, oil palm is an exceptionally productive crop, yielding 10 times as much soybean and 5 times rapeseed. In addition, palm oil is highly versatile. It can be used in either food or non-food applications for a wide variety of products. Other factors are more closely related to the Indonesian domestic and also import policy. Finally, against this backdrop, it is also worth noting that Palm-oil boom raises sustainability concerns. Although the emerging palm oil sector in Indonesia offered opportunities to rural economic development, the palm oil industry progress has serious consequences for biodiversity, climate change and natural resources. So, identifying strategies for sustainable palm oil production represents an important and necessary step forward.

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