

THE IMPACT OF CRUDE PALM OIL PRICE ON RUPIAH'S RATE

*Hilda Aprina*¹

Abstract

Indonesia is a largest producer of Crude Palm Oil in the world, with increasing production and export from time to time. Since Indonesia now adopts a floating exchange rate regime, the export of such commodity may influence the real exchange rate, and this is the aim of this paper. By applying simultaneous equation model on data from 1984 to 2011, we conclude that the increase in CPO price will lead to an appreciation of Rupiah's real exchange rate. As a major producer of CPO, the authority should be able to control the world price of crude palm oil to help controlling the stability of Rupiah's rate.

Keywords: CPO, simultaneous equation, real exchange rate.

JEL Classification: E2

¹ Hilda Aprina, SST is graduated from Sekolah Tinggi Ilmu Statistik

I. INTRODUCTION

Indonesia has been widely-known as an agriculture country since it depends much on the agriculture sector. The horticulture is one of major contributor in agriculture sector, and performs a rapid growth of GDP by 4.47%² in 2011. According to the General Directorate of Horticulture, the crude palm oil (CPO) is at the top rank among the nine primary horticulture commodities in terms of export; 53.37% in 2011, or equivalent to USD 17.23 billion. The CPO, which is one of the horticulture commodities, has significantly contributed to Indonesia's foreign exchange with its high economic value on producing vegetable oil.

According to Susila in BPS (2008), the CPO performs strategic contribution on Indonesia's economy through export, poverty reduction, and a more job creations. Furthermore, the CPO is the primary substance of an alternative energy to substitute fossil fuel; widely recognized as important biodiesel energy. It may eventually affect the size of world demand on CPO.

Table 1
The Main Producers of Crude Palm Oil (CPO) Period 2005-2011 (000 Tons)

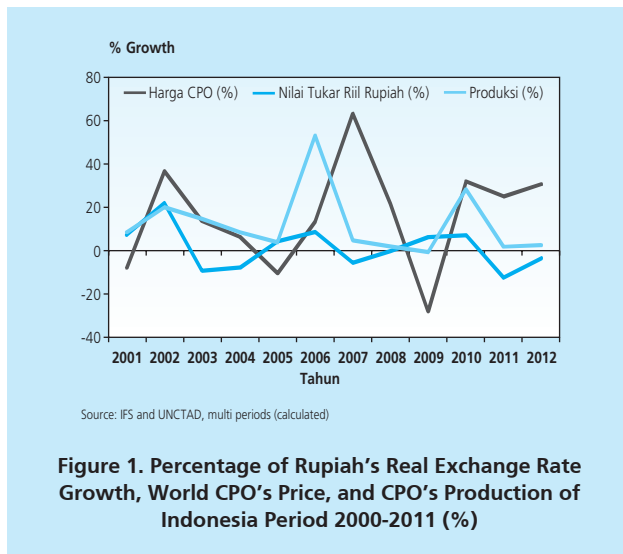
Tahun	Volume (000 Ton)						
	2005	2006	2007	2008	2009	2010	2011
1	2	3	4	5	6	7	8
Indonesia	14070	14962	16800	19200	21000	22100	23900
Malaysia	14962	15881	15823	17735	17566	16993	18800
Thailand	680	860	1020	1300	1310	1380	1830
Nigeria	800	815	835	830	870	885	900
Columbia	661	713	780	778	802	753	765
Equador	319	345	385	418	448	380	460
Other countries	2559	2478	2905	3045	3107	3367	4159

Source: BPS, multi periods (calculated)

Since 1984, the output of Indonesia's CPO has been stable and continuously increasing afterwards. Nevertheless, Malaysia remained at the top rank regarding the market share for export at that moment. In the beginning of 1990, both Indonesia's and Malaysia's export share simultaneously increased. However in 1995, Malaysia's export declined, while Indonesia's export had been continuously growing until Indonesia declared its position as the major CPO producer in the world, surpassing Malaysia's position. The CPO production of Indonesia reached 23.9 tons in 2011 which was the highest in the world.

2 BPS (2013). Gross Domestic Product on the Basis of Current Price Based on the Economic Sectors

With a largest market share for export, Indonesia should have become the standard of world CPO price. For this reason, the world price of CPO may affect the Rupiah's real exchange rate. Considering since 1977 Indonesia has embraced the floating exchange rate system, thus the role of export commodities becomes urgent on the volatility of Rupiah. Figure 1 exhibits the relationship between the Rupiah's real exchange rate and the growth of CPO's international price.



According to Edwards (1986), change in price of leading export commodities usually affects the behavior of exchange rate both directly or through monetary transmissions. Some of the previous literatures focused on the impact of Rupiah's exchange rate on export of CPO. On this paper, we will deeply focus on the impact of the CPO's domestic and international price on the Rupiah's real exchange rate. The paper limits its scope to only focus on the CPO commodity with HS code 1511110000, during the period of 1984 to 2011.

This paper will focus on analyzing if the change in CPO's world price will affect the real exchange rate. The paper attempts to analyze the magnitude of CPO's world price on the real exchange rate through the change in money supply and the inflations. Moreover, the paper will also provide a comprehensive description on CPO.

The next section of this paper outlines the theory and related empirical literature. Section three discusses the data and the methodology, while section four presents the result and its analysis. Section five present the conclusion and the implication of this study.

II. THEORY

The price change of export commodity has significant impact on the dynamics of its real exchange rate (Edward, 2011). In a certain condition such as in the case of commodity boom, a country's exchange rate will likely appreciate. The change in the price of the export commodity may also affect the monetary sector.

Chen and Rogoff (2003) analyzed the real exchange rate of Australia and New Zealand, and argued that the relationship between the exchange rate and the export commodities was driven by the world price of this commodity. This finding is in accordance with Cashin, Cespedes, and Sahay (2004), which found similar evidences in developing countries. In the case of South Africa, Frankel (2007) showed that the mineral was one of important export commodities with significant price impact on the real exchange rate of corresponding country. Ngandy (2005) also argued that the relationship between the export commodity price and the real exchange rate are mostly evident in developing countries.

CPO is the leading horticulture commodity and plays an important role with its great contribution for Indonesian economy on foreign exchange, enlarging the market share, and employment³. Trade of CPO and its derivatives is the second largest income source from the non-oil and gas sector, which eventually increases the money supply. According to Boediono (1993), with a surplus balance of payment, there will be more incoming foreign exchange, hence an increase in money supply. Accordingly, an increase of CPO's world price will raise the national income as well as the money supply.

When the money supply increases, the price of goods will also increase. This is in line with the quantity theory of money, which shows a direct relationship between the money supply and the change in price of goods in linear form (Dornbush, 2001, page 373).

$$M \times V = P \times Y \quad (1)$$

Where M is money supply; P is price rate; V money circulation; and Y is output.

To measure the average price, economists formulate an index of average prices of distinctive commodities based on their contribution; we recognize it as Consumer Price Index or CPI, (Lipsey, 1995). Inflation is driven by the cost push and demand pull inflation, (Samuelson and Nordhaus, 2004); an increase in money supply will lead to demand pull inflation. Demand pull inflation initially occurs when the aggregate demand increases and creates excess demand within the market. If the full employment condition is already in place, then the subsequent demand will only increase the price (frequently said as pure inflation). The shift up of aggregate demand may be driven by a monetary expansion, including the increase of government expenditure and

3 BPS (2008), Primary Commodities Discussions, Jakarta: BPS.

money supply. Meanwhile, the expected inflation depends more on the economic agent's behavior, which tends to be either adaptive or forward looking.

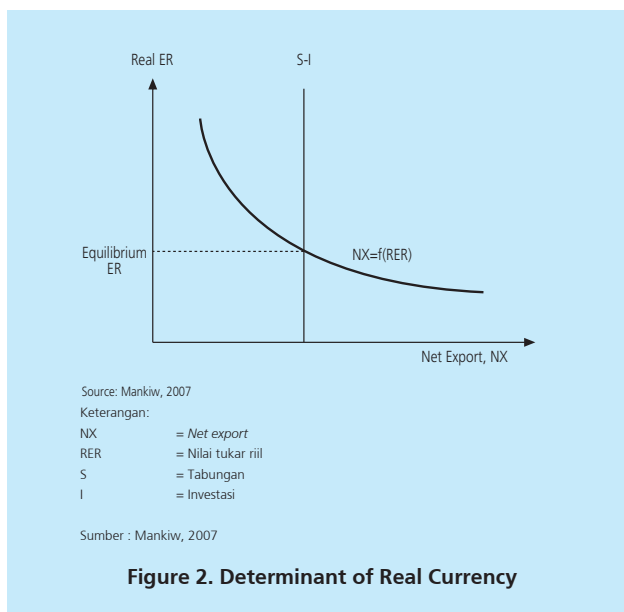
According to Muqrobi (2011), inflation will lower the growth of the output that is going to subsequently decline the import and the demand for foreign currency. This in turn will appreciate the domestic currency. The relationship between the inflation and the exchange rate has been subject to analysis widely. Khodier (2012) argued that there is a strong bidirectional relationship between the inflation and the exchange rate. The statement is in line with Imimol (2011) who argued the inflation depends on the depreciation of nominal exchange rate, the money supply, and the economic growth. The value of the exchange rate can be in nominal and real term. A common nominal exchange rate is bilateral exchange rate between two countries, i.e. Rupiah per US Dollar. Meanwhile the real exchange rate is the nominal exchange rate adjusted to price rate. In detail, the relationship between nominal and real exchange rate can be shown by the following equation.

$$\mathbf{RER} = \mathbf{e} \times \frac{\mathbf{P}^*}{\mathbf{P}} \quad (2)$$

where *RER* is real exchange rate; *e* is nominal exchange rate; *P** is the rate of international price; and *P* is the rate of domestic price.

The above equation implies when real exchange rate is appreciating, the relative domestic prices will be higher, while the price of international goods and services decline. On the other hand, if the real exchange rate depreciates, the price of domestic goods and services will be lower and the price of foreign goods and services will relatively be more expensive. On this regard, the real exchange rate is a benchmark for a country's competitive advantage of their export commodities in the global market.

The following figure shows that the relationship between the net export and the real exchange rate is negative; the lower the real exchange rate, the cheaper the domestic goods and services. The curve showing the savings and investment gap is vertical, since it is independent from the exchange rate (Mankiw, 2007, page 131). The currency exhibited on the figure is US Dollar to foreign currency, so that the direction will be different in this research. If the currency is depreciating, then foreign currency will be appreciating. It drives higher export and lower import. Thus, foreign currency has a linear relationship with export volume while domestic currency has a linear relationship with import volume.



where NX is net export, RER is real exchange rate; S is savings; and I is investment.

III. METHODOLOGY

3.1. Simultaneous Equation Model

The basic principle of simultaneous equation model is its bidirectional (simultaneous) causality across explanatory variables, and makes difficult to distinguish between the dependent variable and the independent variables (Gujarati, 2004). Thus, it is better to pool a number of variables that can be explained simultaneously by other explanatory variables. The simultaneous model contains more than one equation. In contrast to single equation model, the parameter estimation of certain equation in simultaneous model should consider all information provided by other equation inside the system.

In a simultaneous equation model, there are two types of variables: the endogenous, which is determined inside the model; and the predetermined variable, where its value is determined outside the model. Predetermined variables may consist of exogenous variables, both present and lag, and the lag of endogenous variables, (Gujarati, 2004).

Equation constructed based on economic model is known as structural equation or behavioral equation as it reflects the structure of economic behavior. The general structure of simultaneous equation model can be expressed as follow, (Gujarati, 2004):

$$\begin{aligned}
 Y_{1t} &= \beta_{11}Y_{1t} + \beta_{12}Y_{2t} + \dots + \beta_{1M}Y_{Mt} + \gamma_{11}X_{1t} + \gamma_{12}X_{2t} + \dots + \gamma_{1k}X_{kt} \\
 &\quad + u_{1t} \\
 Y_{2t} &= \beta_{21}Y_{1t} + \beta_{22}Y_{2t} + \dots + \beta_{2M}Y_{Mt} + \gamma_{21}X_{1t} + \gamma_{22}X_{2t} + \dots + \gamma_{2k}X_{kt} \\
 &\quad + u_{2t} \\
 Y_{3t} &= \beta_{31}Y_{1t} + \beta_{32}Y_{2t} + \dots + \beta_{3M}Y_{Mt} + \gamma_{31}X_{1t} + \gamma_{32}X_{2t} + \dots + \gamma_{3k}X_{kt} \\
 &\quad + u_{3t} \\
 Y_{Mt} &= \beta_{M1}Y_{1t} + \beta_{M2}Y_{2t} + \dots + \beta_{MM}Y_{Mt} + \gamma_{M1}X_{1t} + \gamma_{M2}X_{2t} + \dots + \gamma_{Mk}X_{kt} \\
 &\quad + u_{Mt}
 \end{aligned} \tag{3}$$

where:

- Y_1, Y_2, \dots, Y_M = independent or endogenous variables by M units,
- X_1, X_2, \dots, X_K = exogenous variables (predetermined) by K units,
- U_1, U_2, \dots, U_M = disturbance variables by M units
- $t = 1, 2, \dots, M$ = the number of observations,
- β = coefficient of endogenous variables,
- γ = coefficient of exogenous variables.

Determining exogenous and endogenous variables may depend on the researcher's set up but should base on certain theoretical guidelines. The model in this paper refers to Edward (1987). We treat the real exchange rate as endogenous since it depends on the domestic and the international inflation rate, and the world's price of CPO. Some prior studies also assume the real exchange rate to be endogenous due to its rapid response towards shocks.

3.2. Data and Model Specification

We use nominal exchange rate of Rupiah against US Dollar (E), money supply (M_2), Gross Domestic Product (GDP), Consumer Price Index (CPI), and Producer Price Index (PPI). The data are accessed from the International Financial Statistics (IFS). For the CPO price, the source is accessed from UNCTAD, while the budget deficit is accessed from the Ministry of Finance, Republic of Indonesia.

Following Sebastian Edward (1987), we construct an econometric model based on theoretical framework and empirical facts, to investigate the impact of the world price of CPO on money supply, domestic inflation, and the real exchange rate. The structure of the equation system is below.

Money Supply Growth Function:

$$\begin{aligned} \ln(M_t) = & \alpha_0 + \alpha_1 \ln(M_{t-1}) + \alpha_2 \ln(DEH_t) + \alpha_3 (\ln(RER_t) + \ln(P_t^{c*})) \\ & + v_{1t} \end{aligned} \quad (4)$$

Inflation Rate Function:

$$P_t = \delta_0 + \delta_1 \ln(M_t) + \delta_2 y_t + \alpha_3 (\ln(RER_t) + P_t^*) + v_{2t} \quad (5)$$

Real Exchange Rate Function:

$$\ln(RER_t) = \mu_0 + \mu_1 P_t + P_t^* + \mu_3 \ln(P_t^{c*}) + v_{3t} \quad (6)$$

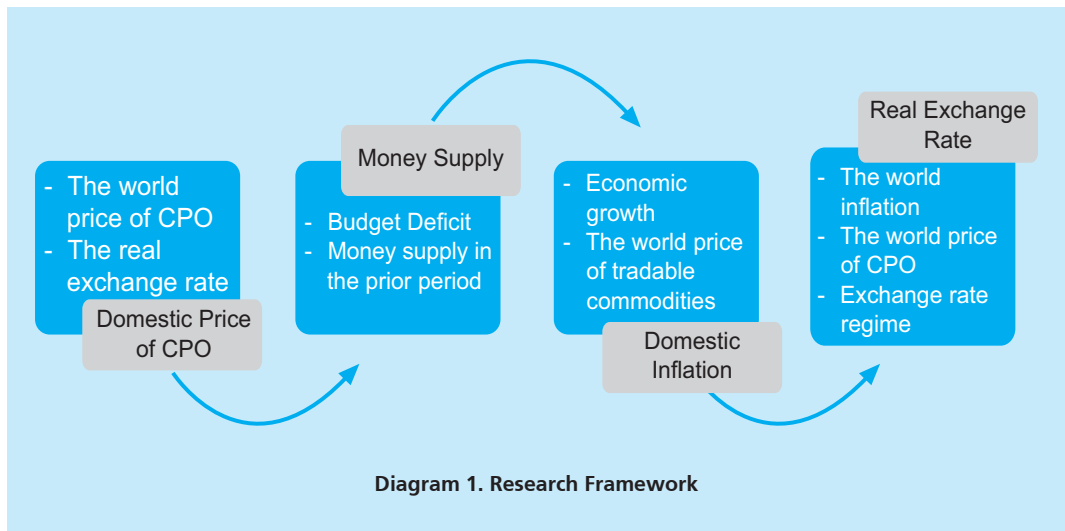
The expected sign are : $\alpha_1 > 0$, $\alpha_2 > 0$, and $\alpha_3 > 0$; $\delta_1 > 0$, $\delta_2 > 0$, and $\delta_3 > 0$; and $\mu_1 < 0$, $\mu_2 > 0$ and $\mu_3 < 0$.

M_t shows the number of money supply in period t ; while M_{t-1} shows the number of money supply in the period $t-1$ (lag 1 period); DEH_t is budget deficit of period t ; P_t^{c*} is world CPO price; P_t is domestic inflation in period t ; Y is output growth; P_t^* is international inflation rate period t ; and v_{it} represents the error terms on the respective equations. The above model also contains dummy crisis variables, where 1 is the periods after 1997, and 0 for the periods before 1997.

3.3. Model Simulation

Simulation is a part of model validation and is a test for its reliability (Sitepu and Sinaga, 2006). We use simulation to identify the best model, including how the endogenous response to the change of exogenous variables, and the precision of the model.

Having the best model in hand, we can then use it to simulate and to forecast the endogenous variables, given a set of exogenous variable values. On this paper, we simulate the impact of an increase of the CPO world price (by 10% and 20%).



The fluctuation of CPO price may affect the export value. The higher the world price of CPO, the higher the foreign exchange generated. On the other hand, the increase in domestic price of the CPO will affect the money in circulation. The budget deficit also affects the inflation as expressed by Oladipo and Akinbobola (2011). On certain condition, a high growth may also trigger inflation (Umaruand Zubairu, 2012). This argument was supported by Ramli (2012) who argued that the economic growth has a strong impact on money supply and inflation. The existing inflation in turn may eventually lead the Rupiah to appreciate.

IV. RESULT AND ANALYSIS

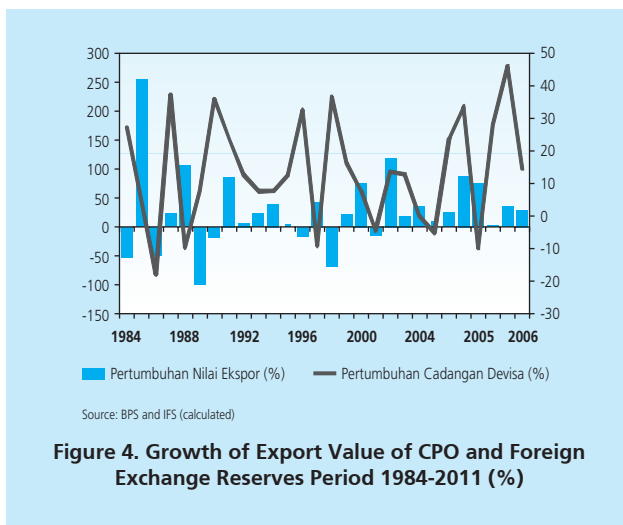
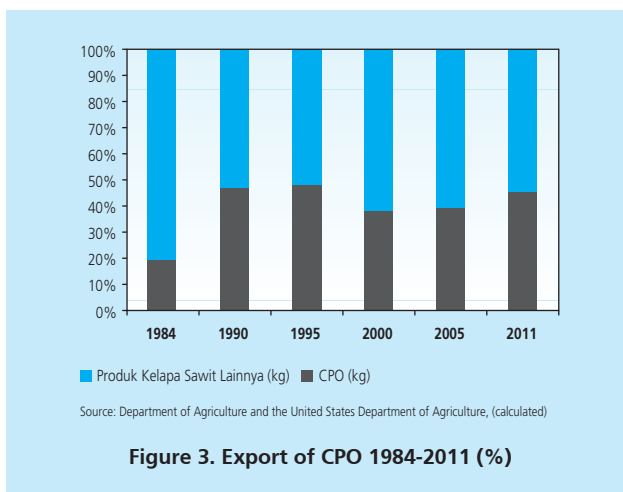
4.1. CPO as the Leading Export Commodities

Palm oil is the primary commodity of horticulture sector and is one of the Indonesia's leading commodities, with significant contribution on generating foreign exchange, enlarging potential market share, and also employment (BPS, 2008). According to Susila (2008), the main role of palm oil commodity is to drive rapid economic growth, to reduce poverty, and to improve the condition of open economy.

The CPO is the main substance of biodiesel; the alternative energy to substitute petroleum. The growth of this alternative energy potentially affects the world's CPO demand. The share of Indonesia's palm oil within the total international trade is large. Figure 4 below exhibits the total trade of palm oil products.

CPO has been dominating since 1990 with about 40% share of the total palm oil trade. Indonesia majorly exports crude palm oil rather than processed product (about 50%).

The imbalances of production structure within the palm oil industry in Indonesia result in a low value added.



The growth of CPO export coincides with the growth of foreign exchange reserves (see Figure 5). In 1985, the growth of export reached up to 225% compared to previous year. In 1991, a spike had doubled the value of CPO export. The abundance production became one factor that triggered the rapid growth of export over the past few decades.

4.2. Estimation Result

Table 2 present the estimation result. Most of the coefficients are as expected and fit the theory. Statistically, the model is valid (significant F-statistic), indicating all explanatory variables in the model can simultaneously affect the dependent variable. The adjusted R-squared of each equation is high, showing the ability of the set of explanatory variables to explain the variation of dependent variable.

The model also passes the series of classical assumption tests. We estimate the model with the Weighted Two Stage Least Square (WTLS). Using Lagrange Multiplier test, the model exhibits heteroscedastic variance and covariance of the residuals. The WTLS estimation technique accommodates the problem of heteroscedasticity in the model. The structural equation within the system has also passed the normality test. To test the possibility of autocorrelation, we use the Breusch-Godfrey serial correlation test and LM test. The result shows the model does not suffered from autocorrelation. Table 2 present the model estimation.

Persamaan Struktural	Variabel Dependen	Variabel Independen	Koefisien	Ringkasan Statistik	
(1)	(2)	(3)	(4)	(5)	
I	\widehat{LnM}	C	-1,735475* (0.0297)		
			0,875031* (0.0000)	R-Squared	0,996899
		LnDeh	0,063493 (0.3400)	Adjusted R-Squared	0,996512
		(LnRER+LnPc)	0,184368* (0.0082)	Prob(F-statistic)	0,000000
II	\widehat{P}	C	-18,33213* (0.0010)		
		LnM	0,263076* (0.0076)	R-Squared	0,947881
		Y	3,922524* (0.0152)	Adjusted R-Squared	0,941366
		(LnRER+Pw)	1,385982* (0.0053)	Prob(F-statistic)	0,000000
III	\widehat{LnRER}	C	0.834307 (0.7688)		
		P	-0,402487* (0.0451)	R-Squared	0,868839

Persamaan Struktural	Variabel Dependen	Variabel Independen	Koefisien	Ringkasan Statistik
		P*Dummy	-1,100307* (0.0000)	Adjusted R-Squared 0,839030
		Pw	2,352700* (0.0057)	Prob(F-statistic) 0,000000
		LnPc	-0,149984* (0.0232)	
		Dummy	5,334751* (0.0000)	

Note: *) significance at 5% level of significance

The impact CPO's World Price on the Growth of Money Supply

The increase of world demand on CPO and its processed product affect the economy of CPO producing countries, i.e. Indonesia and Malaysia. The increase of international demand on CPO, both for food consumption and biodiesel production, increase the export of CPO from Indonesia.

As explained earlier, since CPO is a leading commodity for Indonesia, we suspect the change in world price of this commodity will affect the monetary sector and will eventually result in a change of the real exchange rate. The following model will explain the mechanism on how CPO's price changes affect the monetary sector through the increasing money supply. The model explains the variance of money supply growth by 99.68%, while the rest 0.32% is affected by other factors beyond the model.

In Table 2, the growth of money supply in previous period significantly affects the growth of money supply with estimated coefficient of 0.87. This means a previous 10% increase in money supply will increase the current money supply by 8.75%. Similar finding occurred in Columbia (Edwards, 1987) who argued the positive impact of the first three lags of the money supply growth on the present one.

The impact of budget deficit on money supply is not statistically significant; however the coefficient sign is in accordance with the theory. Similar coefficient direction is in line with Adrian (2010). The Indonesian government promulgated UU No.17/2003 that restricted the budget deficit to accumulatively not exceed the threshold of 3% of the GDP. Furthermore, the UU No. 23, 1999 restrict the Bank Indonesia neither to bailout the government expenditure nor to provide any financial support for to the government (Maryatmo, 2004).

The model estimation conform the significant effect of the growth of real exchange rate and the world price of CPO on money supply. A 10% growth of CPO's world price will increase the money supply by 1.84%. Indonesia's export on crude palm oil and is one of the largest sources of national income. The government income in the form of foreign exchange will be

converted to Rupiah, and the process will eventually increase the reserve and money supply, (Nosihin in Prayitno, 2002). On this case, there is a strong relationship between the foreign exchange reserve and the level of money supply.

The depreciation of Rupiah's against foreign currency increase the CPO's price in foreign currency, thus provide incentive for producer to sell their CPO on international market. Moreover, as the price of domestic goods becomes relatively cheaper, people will buy less-imported goods, resulting in an increase of net export. The fact is in accordance with Zuhroh and Kaluge (2007), arguing that the real exchange rate depreciation will improve the trade balance in the long-run. The improvement of current account will increase the foreign exchange, which eventually increases the number of money supply in the public.

The real exchange rate and the world price are two primary determinants of the domestic commodity price; therefore the accumulation of these two variables may reflect the growth of domestic price (Edward, 1987). Our estimation also shows the significant effect of domestic price of CPO, on money supply, and with a positive sign. The increase in domestic price on CPO will increase public demand on nominal money.

A fair growth of money supply will positively affect the economic growth; however a drastic increase in money supply will generate inflation and may harm the economy. For this reason, it is important to stabilize any variables that may affect the money supply, including the real exchange rate and the budget deficit.

Meanwhile, the world price of CPO cannot be stabilized by the government since the world trade uses the Malaysian and Rotterdam standardized price. To limit the high export of CPO in the case of world price hike, a specific export tax is required. The use of high export tax will reduce the export while ensuring the CPO supply for domestic needs.

The Impact of Money Supply Growth on Inflation.

According to table 2, inflation is significantly affected by the growth of money supply, the economic growth, and the international price growth of the tradable goods (significant at 5%). The model explains 94.13% of the inflation variation, while the rest 5.87% is explained by other variables.

The growth of money supply positively affects the inflation by 0.263. A ten percent increase in money supply will drive inflation by 2.63 percent. The quantity theory of money argues that the increase in money supply may lead to three possible outcome; increase in price, increase in output quantity, and the decline in money circulation. This is in line with the study of Yusni, Maulida, Mardiana, and Mayes (2010), who found a positive relationship between the money and the inflation. When the central bank changes the money supply (M), it will drive a proportional change in the nominal output value (PY) and the changes will be reflected on price rate change (P). For this reason, the increase in money supply will drive inflation.

The economic growth performs a significant effect on inflation with positive coefficient of 0.0392. It indicates that 1% increase in economic growth will drive the inflation rate by 3.92%. The result is in line with the author's expectation that inflation is required to drive more rapid economic growth. These findings are in line with Murobi (2011) who argues that economic growth and inflation have two-way positive directions.

Furthermore, the exchange rate depreciation and inflation share similar impact on inflation. The two variables have the same coefficient in the model which is 1.385982. It indicates that 1% increase in the world's exchange rate depreciation or inflation will lead to domestic inflation by 1.385982%. Edward (1987), the accumulation of these two variables may reflect the change in price of the world's tradable commodities, leading to domestic inflation of 1.3198. The fact is rational considering the increase in price of imported goods is one of inflation determinants.

In monetary policy transmission, the Rupiah's exchange rate is one of explanatories on the change of price rate in a period beyond the growth of money supply. The exchange rate dynamics will affect aggregate supply and demand which eventually affects the output and the price. The magnitude of the impact from exchange rate movement on the price rate is primarily determined by the exchange rate regime in a country. In a managed floating exchange rate system, an expansive monetary policy by the central bank drives the depreciation of domestic currency and increases the price of imported goods that subsequently drives the increase in price of domestic goods; even without expansion on the aggregate demand. This is commonly termed as the direct impact of exchange rate movement (direct pass-through) while the impact of exchange rate through aggregate demand changes is indirect (indirect pass-through).

By source, inflation is divided into: (1) inflation driven by domestic inflation, and (2) inflation driven by foreign inflation. Domestic inflation is usually caused by budget deficit funded by printing new money, crop failure, disaster, changes in price policy by the government, cyclical factors such as religious festivities, speculations such as hoarding that disrupts goods stock, and public expectation on future inflation. Meanwhile inflation driven by foreign inflation is caused by the increase in international commodity prices (trading partner countries) or by depreciation rate. The increase of imported goods directly drives the increase in cost of living index as those imported goods is included within as well as indirectly drives the increase in price index through the increase in production cost of any products in which the raw materials and machineries are imported.

By identifying some variables that have impact on inflation rate, then managing the inflation can be done through those variables. As previously explained, the money supply can be maintained, while other inflation determinants such economic growth can be stabilized by the government. The primary determinant of economic growth of Indonesia is household consumption, so it is necessary to control the domestic consumption. Indonesia currently embraces the free floating exchange rate regime, thus the government cannot directly interfere

it. The government can indirectly control the macroeconomic variables which are determinant of real exchange rate.

The Impact of Inflation of Rupiah's Real Exchange Rate

The estimation reveal the growth of Rupiah real exchange rate is significantly influenced by inflation, world inflation, growth of CPO price, implemented exchange rate system, and inflation. Furthermore, the model is able to explain 83.76% variation of the exchange rate growth, while the rest 16.24% is beyond the model.

The negative relationship between the real exchange rate and the inflation meet the logic of economics. According to Muqrobi (2011), inflation will slow down the economic growth. The slowing down output growth will subsequently reduce the imports and the foreign exchange demand. As the result, the Rupiah is appreciated. According to the estimation result, a 1% increase in inflation will depreciate the exchange rate by 0.34327%. The result is supported by finding of Oriawwote and Eshanake (2012) who express that inflation will lead to the appreciation of real exchange rate.

Inflation that occurred when Indonesia embraced the free floating exchange has a significant and negative impact on exchange rate growth. Moreover, the impact is much stronger than the prior inflation. When the inflation occurred in the free floating exchange rate regime, the exchange rate would be appreciated with slowing down growth by 1.39102%. It indicates the strong impact of inflation on the change in exchange rate during the free floating exchange rate system. The transformation of exchange rate regime from managed floating to free floating brings a huge impact on Indonesia's economy. Besides, Rupiah becomes very vulnerable to changes in economy such as the rise of inflation.

In contrast to domestic inflation, the world inflation has a positive impact on exchange rate by 2.8947%; a 1% increase in world inflation will depreciate Rupiah by 2.8947%. Similar finding was proposed by Edward (1987) who argued that the world inflation would lead to depreciation of the domestic real exchange rate.

Using Fisher equation, a 1% increases in inflation drives an increase in nominal interest rate by 1%. As pointed by Mankiw (2007), as inflation rises, the nominal interest rates will also increase (Mankiw, 2007). The changes in interest rate will eventually affect the exchange rate; this mechanism is frequently called as the exchange rate channel. The raise of domestic interest rate will widen the interest rate differential between the domestic and foreign. With the widening differentials, it will encourage the Indonesia investors to invest in foreign financial instruments as they will earn higher yield. The capital outflow will in turn drive the depreciation of Rupiah.

Our estimation shows the world price of CPO negatively affect the exchange rate by 0.2048%. This indicates a 10% increases in the world price of CPO will appreciate the Rupiah by 2.048%. The increase in price of CPO will raise demand on Rupiah from the importing countries, so that the Rupiah will be appreciated. The result is in line with Edward (1987) who argued that the increase in export commodity price (coffee in Columbia) would lead to the appreciation of domestic real exchange rate.

Related to the exchange rate regime, this paper use data from 1984-2011, and there has been twice turnover of exchange rate system from managed floating embraced until 1997 to free floating regime to date. The model estimation show the dummy variable is statistically significant. The estimated parameter show that the moment the free floating regime is applied; the real exchange rate will grow by 6.4456%. In free floating regime, the exchange rate may fluctuate freely to respond the changing of economic situations (Mankiw, 2007).

In the free floating system regime, the exchange rate is determined by market mechanism without any intervention from the government. Within this regime, the exchange rate may fluctuate freely. Moreover, the monetary authority does not have to maintain a certain rate of domestic currency against foreign one. For this reason, the exchange rate becomes more sensitive to the changes of international commodity price.

International Price of CPO and the Real Exchange Rate

We estimate three structural equations on this paper. The result shows that the world price of CPO may directly affect the real exchange rate directly, an also indirectly through the monetary sector. In third equation, the effect of the growth of CPO price on real exchange rate is negative and significant.

In the first structural equation, the growth of CPO world price will increase the growth of money supply, which will drive an increase of inflation. Estimation of the second structural equation shows a 1% increases in money supply drives the inflations by 0.263%. However, the growth of money is not the only determinant of inflation. Changes in other macroeconomic variables such as economic growth may also affect the inflation.

Table 3 below shows the simulation result with a 10 percent increase of the CPO world price. The simulated impact is a reduction on the real exchange rate by 1.2025% (appreciate). When the world price of CPO increase, the export value will also increase. As the result, the foreign reserve will also increase. The swelling of foreign exchange will increase the money supply by 0.68%. The money supply growth may exceed the real economic capacity and trigger inflation by 0.973%. The inflation occurring on free floating exchange rate regime will eventually appreciate the exchange rate.

No	Endogenous	Baseline	Simulation Result	$\Delta\%$
(1)	(2)	(3)	(4)	(5)
1	LnM	12.7668	12.8539	0.68224
2	P	3.8111	3.8482	0.97347
3	LnRer	8.9899	8.8818	-1.2025

Source: Calculated.

Simulation of the growth of CPO world price by 20% shows ambiguous impact for Indonesia's economy, particularly on the exchange rate and the inflation. A 20 percent CPO price increase will appreciate Rupiah by 2.949%. Thus, the higher the CPO price, the stronger Rupiah's will be.

On the other hand, the 20 percent growth of CPO price leads to an increase of money supply by 1.4025%. As previously explained, the price hike will increase the export of CPO, and increase foreign exchange reserve, resulting higher money supply. As the money supply increase, the domestic commodity price will also increase and drive domestic inflation by 1.611%.

No	Endogenous	Baseline	Simulation Result	$\Delta\%$
(1)	(2)	(3)	(4)	(5)
1	LnM	12.7668	12.9462	1.4052
2	P	3.8111	3.8725	1.6111
3	LnRer	8.9899	8.7657	-2.494

Source: Calculated.

V. CONCLUSIONS

This paper identified the CPO as a leading commodity of horticulture subsector as for Indonesia. This paper conclude that the international price of CPO affect the exchange rate directly, indirectly through monetary sector; higher CPO price leads to appreciation of Rupiah's real rate. Furthermore, this paper also found the higher the growth of CPO world price, the higher the domestic inflation, which will also appreciate the Rupiah's rate.

Considering the significant impact of the international price of CPO on Rupiah's rate, the Indonesian government should attempt to relocate the future market of CPO from Malaysia to Indonesia. This will ensure the role of Indonesia as international benchmark for CPO price. Moreover the government may attempt to provide incentives on downstream industry of CPO to produce derivative products of CPO such as biodiesel. This will encourage the entrepreneurs to export the CPO's derivative products with higher value-added.

REFERENCES

- Andrian, Nanang. 2011. *Defisit Anggaran, Pertumbuhan Uang dan Inflasi di Indonesia* [Skripsi]. Bogor :Institut Pertanian Bogor.
- Boediono. 1993. *Ekonomi Makro.Edisi ke-4*. Yogyakarta : BPFE UGM.
- BPS. 2008. *Kajian Komoditas Unggulan*. Jakarta: BPS.
- BPS. 2013. *Produk Domestik Bruto Atas Dasar Harga Berlaku Menurut Lapangan Usaha (Miliar Rupiah), 2004-2012*. http://www.bps.go.id/tab_sub/view.php?kat=2&tabel=1&daftar=1&id_subyek=11¬ab=1. [1 Juli 2013].
- B. Imimole, A. Enoma. 2011. *Exchange Rate Depreciation And Inflation In Nigeria*. Nigeria: Ambrose Alli University.
- Cashin, Paul, Luis F. Cespedes and Ratna Sahay (2004. *Commodity Currencies and the Real Exchange Rate*. Journal of Development Economics, Elsevier, 75(1).
- Chen, Yu-chin and Kenneth Rogoff. 2003. *Commodity Currencies*. Journal of International Economics, Elsevier, 60(1).
- Direktorat Jederal Perkebunan. 2008. *Lintasan Tiga Puluh Tahun Pengembangan Kelapa Sawit*. http://ditjenbun.deptan.go.id/budtanaman/images/bagian_%200ii.pdf. [9 Juli 2013].
- Dornbush, Fischer &Startz, Richard. 2001. *Makroekonomi. 8th Edition*. Jakarta : PT. Media Global Edukasi.
- Edward, Sebastian. 1987. *Commodity Export Price and the Real Exchange Rate in Development Country : Coffee in Columbia*. Economic Adjustment and Exchange Rates in Developing Countries.12 Februari 2013. <http://www.nber.org/books/edwa86-1>.
- E. Oriawote, Victor and J. Eshanake, Samuel. 2012. *Real Exchange Rate and Inflation: An Empirical Assessment of the Nigerian Experience*. Mediterranean Journal of Social Sciences, 3(3). [2 Mei 2013].
- Frankel, Jeffrey (2007. *On The Rand: Determinants Of The South African Exchange Rate*. South African Journal of Economics, Economic Society of South Africa, 75, 3.
- Gujarati, Damodar. 2004. *Basic Econometrics. 4th Edition*. New York: The McGraw-Hill Companies, Inc.
- Khodeir, Aliaa Nabil. 2012. *Towards Inflation Targeting in Egypt: The relationship between Exchange Rate and Inflation*. Egypt: Helwan University.
- Lipsey, R. G., et al. 1995. *Pengantar Makroekonomi. Edisi ke-10. Jilid 1*. Wasana, Kirbrandoko, dan Budijanto [editor]. Jakarta : Bina Rupa Aksara.

- Mankiw, N. Gregory. 2007. *Teori Makro Ekonomi Terjemahan: Edisi Keenam*. Jakarta : PT. Gelora Aksara Pertama.
- Maryatmo, R. 2004. *Dampak Moneter Kebijakan Defisit Anggaran Pemerintah dan Anggaran Pemerintah dan Peranan Asa Nalar dalam Simulasi Model Makro-Ekonomi Indonesia (1983:1-2002:4)*. Buletin Ekonomi Moneter dan Perbankan. 12 Juni 2013 www.bi.go.id/NR/rdonlyres/2C2A167B-06E1.../fdampakmon1.pdf.
- Maulida, Yusni, Merdiana dan Mayes, Anthonio. 2010. *Pengaruh Defisit Anggaran, Jumlah Uang Beredar dan Independensi Bank Indonesia terhadap Inflasi*. Pekanbaru : Universitas Riau.
- Muqrobi, Syaiful dan Pujiati, Amin. 2011. *Inflasi dan Pertumbuhan Ekonomi :Uji Kausalitas*. Jurnal Dinamika Keuangan dan Perbankan, 3(1).
- Ngandu, S. 2005. *Mineral Prices and the Exchange Rate: what does the Literature say*. HSRC: Mimeo.
- Oladipo, S. O. and Akinbobola, J. O. 2011. *Budget Deficit and Inflation in Nigeria: A Causal Relationship*. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS)*.
- Prayitno, Lily et al. Maret 2002. *Fakto-Faktor Yang Berpengaruh Terhadap Jumlah Uang Beredar di Indonesia Sebelum dan Sesudah Krisis: Sebuah Analisis Ekonometrika*. *Jurnal Manajemen dan Kewirausahaan*, 4(1).
- Ramli, Rumana. 2012. *Inflation, Money Supply And Economic Growth: A Causality Analysis For Malaysia*. Malaysia: Department of Statistics.
- Samuelson, Paul. A. dan Nordhaus, William D. 2004. *Makroekonomi Edisi ke 17*. Jakarta : Erlangga.
- Sitepu, Rasidin Karo-karo dan Bonar M. Sinaga. 2006. *Aplikasi Model Ekonometrika: Estimasi, Simulasi, dan Peramalan Menggunakan Program SAS*. Program Studi Ilmu Ekonomi Pertanian. Sekolah Pasca sarjana. Bogor : Institut Pertanian Bogor.
- Umaru, Aminu and Zubairu, Anono Abdulrahman. 2012. *Effect of Inflation on the Growth and Development of the Nigerian Economy (An Empirical Analysis)*. *International Journal of Business and Social Science*, 3(10).
- UNCTAD. 2013. *Free Market Commodity Price, Annual*. <http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx>. [3 Juni 2013].
- Zuhroh, Idah dan Kaluge, David. 2007. *Dampak Pertumbuhan nilai Tukar Riil terhadap Pertumbuhan Neraca Perdagangan Indonesia*. *Jurnal of Applied Indonesia Aconomic*, 191;(1).