The Impact of Fertilizer Subsidy and Export Tax Policies on Indonesia Cocoa Exports and Production

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Key words : Fertilizer Subsidy, Export Tax, Cocoa, Indonesia

Abstract

After Ivory Coast and the Ghana, Indonesia is the third largest cocoa producer in the world, where Sulawesi region as a main contributor in the country. As a part of the strategy for quick economic recovery, the government tried to take such policies as fertilizer price subsidy and export tax, and they are strongly debated and hypothesized to affect the Indonesia cocoa export and production, as a puzzling issue. We employed an Econometric Model in analyzing (1) the factors responsible for the cocoa export, (2) the dynamic impact of fertilizer subsidy and export tax polices on Indonesia cocoa export and production. The estimation of the model used time series data 1983-2002 by 2SLS Method. The key findings of the research discloses ; (1) Indonesia cocoa export is very strongly determined by the export price, cocoa production growth, exchange rate and time trend, (2) fertilizer price subsidy policy could be very strongly expected in increasing the Indonesia cocoa export and production, whereas the imposition of export tax policy indeed has substantial negative impacts to the decreasing of export and production.

1. Backdrop, Issue and Objectives

Over the past three decades, Indonesian economy has performed impressively. In 1996, per capita income in Indonesia reached US$1,100, substantially higher than in Sri Lanka ($750) and Kenya ($320), and almost the same as in the Philippines ($1,160) and Egypt ($1,080), though still lower than in Thailand ($2,930). Indonesia's economic growth was not as robust as Thailand's, but exceeded that of the Philippines and was much better than that of many developing countries in South Asia and Africa (Kawagoe, 2004), under

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the condition of real economic growth average 7 percent a year. From this phenomenon, the 1993 World Bank report on the 'East Asian Miracle', recognized Indonesia as one of the High Performing Asian Economies (Kawagoe, 2004). Agencies like the World Bank, the International Monetary Fund and the United Nations Development Program were celebrating Indonesia's overall economic performance as a model of sustained development (Daryanto, 1999), under the political stabilization, industrial transformation, rapid technological progress and steady food security.

Unfortunately, unexpected economic situation was occurred. Asian economic crisis hit Indonesia in mid 1997. It becomes the general secret that the crisis indeed has substantial negative impact on Indonesian economy, particularly manufacturing and finance sectors. Those situations were exacerbated by the regional economic disparity in the country. As Daryanto (1999) reported the crisis of 1997 changed all that. Indonesia witnessed a dramatic reversal of fortune. The nominal value of the Indonesian *rupiah* fell by 80 percent, annual inflation reached almost 80 percent, the economy swung from rapid growth to even more rapid contraction, unemployment and underemployment climbed, poverty incidence rose, and the US dollar equivalent value of the stock exchange fell by more than 90 percent.

Needless to say, during the peak of the crisis, no economic sector had the best performance in the country, except the agriculture sector and its sub-sector. At the time, the export value of the agriculture products grew quickly and income of cocoa smallholder[2] also rapid soared. Those situations were affected by not only production side, but also the consequence of the *rupiah* depreciation. Hence, the agriculture sector is believed as a leading sector[3] and the way out of the crisis in the country.

It is important to note that the cocoa sub-sector plays, at least, two important roles in Indonesian economy, even more so during the economic crisis. Firstly, cocoa provides export earnings, and secondly, it gives a source of employment not only for millions of rural smallholder families, but also for urban families as estate owner. This could be the engine of growth for plantation cocoa area. Therefore, it is not so surprising that a number of policies are addressed by the government to the cocoa regulation, including monetary policy

2) Although the author kept the consistency in using smallholder terminology, but in this paper he also put another terminology for smallholders such as smallholder farmers, household farmers, smallholder agricultural producers, rural smallholder families due to some writers, however, used the different terminology but the same meaning which was referred into this paper, too.

3) Despite the Indonesian economy's contraction by 13.7 percent in 1998, the agriculture sector did not decline. This draws attention to the expansion of agriculture as one of the main ways to overcome the crisis. The agricultural sector functions as a 'social safety valve' (Daryanto, 1999).

(Arsyad, 2002a), not only to guarantee its domestic supply, but also to contribute to economic recovering.

As a part of the strategy for quick economic recovery, the government tried to take such policies as fertilizer price subsidy and export tax, and they are strongly debated and hypothesized to affect the Indonesia cocoa export and production, as a puzzling issue in Indonesia. Based on these issues, the specific objectives of the research are two : (1) analyzing the factors responsible for the cocoa export, (2) analyzing the dynamic impact of fertilizer price and export tax policies on Indonesia cocoa export and production.

2. An Overview of Indonesian Cocoa

Area, Production and Export

The expansion of Indonesia's cocoa production in recent years has been phenomenal : during the period 1980-94, cocoa production per annum, from 10,284 tons to 271,127 tons. Indonesia is now the world's third largest cocoa producer, after Cote d'Ivoire and Ghana. Exports of cocoa beans reached $ 166 million in 1993, placing cocoa as one of Indonesia's major agricultural exports. This rapid expansion took the world cocoa market by surprise. It has two notable features : the engine of growth has been smallholders ; and the farmers have come to enjoy a high proportion of the returns from cocoa exports (Akiyama & Nishio, 1997) due to the government policy concerned to the cocoa development through the national projects. At the time (1993) the total area of Indonesia cocoa and its production were recorded 535,285 ha and 258,059 tons, respectively, that is the reason why Arsyad (2002b) emphasized that cocoa sub-sector could be strongly expected as a leading sector in the country.

Then, the total area of Indonesian cocoa covered 668,642 ha in 2000. Most of this area was cultivated by smallholders who contributed to 77 percent of the total area. The remaining shares, 10.3 percent and 12.8 percent are Government Own Estate (PTPN) and Private Estate, respectively. In the period 1990-1999 the growth of cocoa area in Indonesia was 6.5 percent per year. The growth of smallholder area was higher with an average of 7.8 percent per year. The expansion of smallholder area in that period mainly occurred in Sulawesi, especially in Central, South and Southeast Sulawesi (CRIEC-World Bank, 2002). With over 450,000 metric tons (MT) of cocoa beans produced in 2005/06, Indonesia is the third largest producer of cocoa in the world after Ghana and the Ivory Coast, and the most significant cocoa bean supplier in East Asia. In addition, to raw cocoa beans, Indonesia also produces and exports a small volume of processed cocoa products including

powder, paste/liquor, cake and butter. Total Indonesian cocoa exports (cocoa beans and processed cocoa products) are valued at approximately $600-700 million per year and provide the main source of income for over 400,000 smallholder farmers and their families. Smallholder farmers working on plots ranging from 0.5 to 1.5 hectares grow over 85 percent of Indonesia cocoa beans on the island of Sulawesi[4] (Panlibuton & Lusby, 2006).

The Indonesia cocoa production increased from 142,347 tons in 1990 to 374,086 tons in 2000, with a 10.1 percent growth rate per year. The growth of production was higher than the growth of area due to increasing yield, especially in smallholder plantation. The contribution of smallholders in total production was the biggest, achieving 88 percent of total production, while the contribution of Government Estate and Private Estate were only 11 percent and 1 percent of total production respectively (CRIEC-World Bank, 2002). ASKINDO[5] hoped, for the Indonesian government policy to shift the position and to make the country the biggest cocoa producer in the world.

Indonesian government also has been pushing cocoa export capacity. If we look at Indonesian export development, there is its progressiveness due to the increasing of export, not only in volume but also diversification of the products such as powder, paste, cake and butter. Moreover, the export destination also soared. Up to 1996, number of export destination country was recorded of 28 countries. Dradjat et.al (2001) concerned to this matter by linking downstream industries. They pointed out that 79 percent of Indonesia cocoa beans are exported. The export value from the bean reached US$ 266,131 (around 12.8 percent from the total world market value), with main destination are US (almost 71 percent), Malaysia (17 percent) and Germany (6.5 percent).

Competitiveness

The quality of Indonesia's cocoa, especially produced by smallholders is considered an important issue by ASKINDO and the government. A large proportion of cocoa produced

4) CRIEC-World Bank (2002) calculated that Sulawesi Island has the highest contribution of 81.2 percent of the total cocoa production in Indonesia. The contribution of the other island is very small namely Sumatra (6.6 percent), Maluku and Irian (6.3 percent), Kalimantan (3.5 percent), Nusa Tenggara (1.9 percent), and Java (0.5 percent).

5) ASKINDO is *Asosiasi Kakao Indonesia*, the Indonesian Cocoa Association, has members as local traders and exporters. ASKINDO facilitates horizontal linkages among cocoa traders in the industry and provides a variety of technical and advocacy support services including : extension research and dissemination, model cocoa bean production pilots, and quality management techniques (Panlibuton & Lusby, 2006). Beside that, the association also broadcast the cocoa price and plays role in linking farmers and the government. For example, when the Indonesian Government plans the imposition of export tax, the association has reiterated its opposition to the planned imposition of export tax on cocoa. The reason is that the tax would be an additional burden to the farmers.

by smallholders is unfermented or partially fermented—fermented for 1-2 days—instead of the 5 days needed to achieve the high quality typical of cocoa from Ghana and some other countries (Akiyama & Nishio 1997). As a result, farm gate price become lost significantly. Moreover, the declining of cocoa price in domestic market is also affected by the declining of price in world market, then in turn, it causes Indonesia cocoa dilemma.

Akiyama & Nishio (1997) identified the 'adding-up' problem.[6] The government is concerned that Indonesia's rapidly increasing cocoa production will depress world cocoa prices, undermining the welfare of Indonesian cocoa producers. Other producing countries too are worried about the effect of Indonesia's expanding production on world prices. The 'adding-up' problem—the phenomenon whereby incremental growth in the production of commodity by a country or group of countries results in an increase in export revenue proportionally much less than the rise in volume of production (Akiyama & Larson 1994)—could become an important issue for Indonesia in the near future.

However, Indonesia's biggest competitive advantages include its low cost, high production capacity (availability of supply), efficient infrastructure and open trading/marketing system (business environment). As the largest producer of unfermented bulk cocoa beans, Indonesia currently occupies a strong position with few competitors in this segment of the global market (Panlibuton & Lusby, 2006). Moreover, the larger area of cocoa planted, the more cocoa production will increase, and the more cocoa produced, the more income

6) The adding-up problem occurs when a country or group of countries significantly increases production of a commodity with a low price elasticity of demand relative to world production. In such a case the price of the commodity drops. For countries that expand production, the price decline could be large enough that the percentage increase in export revenues is considerably less than the percentage increase in production. When the problem is serious, export revenues could even decline. Thus the adding-up problem creates real welfare losses for producers when marginal production increase lead to declining net revenues. In theory, the adding-up problem is not unique to commodity markets. However, it is found mostly in commodity markets because of the rare circumstances that give rise to the problem. In general, the adding-up problem is more severe when demand and supply price elasticities are low and when production is concentrated in a few countries—features common to commodity markets. First, primary commodities must be processed and transported before they are ultimately consumed, and frequently the cost of the underlying commodity is a small share of the final product's price. For example, changes in the price of wheat may have little effect on the price of bread. As a result demand for commodities varies little with a change in price (the price elasticity of demand is low). Second, where large investments in physical structures are required (for example, mining equipment or palm oil factories), supplies are relatively unresponsive to price in the short run. The same is true for tree crops, since new plants must mature to be useful. By contrast, farmers growing crops that are planted annually can respond quickly to price changes. Finally, nature often has restricted commodity production to particular climates or locations, so production is often concentrated in a handful of countries (Extracted two paragraphs from DEC notes, Research Findings. From the Development Economics Vice Presidency of The World Bank, No 13, 1996. Does the "adding-up problem" add up ?).

per capita of the household will be gained, then in turn, the better situation to alleviate the poverty will be created. This is a logic of fact finding that a larger area of cocoa garden will produce more than smaller one (Salam, 2006), that is, cocoa could be strongly expected to alleviate the poverty.

Smallholders are the engine of cocoa economic in Indonesia. The yield of smallholders is higher than those in government or private estate. In 1998, the yield of cocoa smallholders achieved 1,299 kg/ha, while the yield of cocoa of Government Estate and Private Estate were merely in the level 840 kg/ha and 876 kg/ha, respectively (CRIEC-World Bank, 2002). Furthermore, the Bank reported that according to Akiyama & Nishio (1995) some reasons for high competitiveness of Indonesian cocoa smallholders as follows: (1) low cost of labor; (2) abundant of suitable land and climate; (3) benefit of proximity to Malaysia (close to Sabah) allowing for technology transfer; (4) high competitive marketing net work in Sulawesi; (5) extensive coconut plantation being ready to receive cocoa trees as inter crops; (6) relatively good transport and infrastructure (in Sulawesi); (7) relatively low government intervention (research and development); (8) such macroeconomic support as no export tax and the devaluated exchange rate for keeping competitive; and (9) high motivated entrepreneur of Bugis Tribal[7] as the pioneer of cocoa development in Sulawesi.

Indonesian smallholder yields are considerably higher than their West African counterparts, reaching levels as high as 2,000 kg per hectare in areas in case of a low incidence of pests and disease. A major factor is the age of the tree stock, with as much as half under ten years old, thus providing sufficient potential for the further expansion of production. On average, however, yields are much lower, at 1,000 kg per hectare. There are substantial areas of suitable land still available for new planting, together with a plentiful supply of labor (Gray, 2001). The last explanation in this part is competitiveness characteristics of cocoa beans in the global market which is extracted from Panlibuton & Lusby (2006). They described the characteristics or qualities that global cocoa bean buyers tend to seek in their suppliers (i.e., characteristics that determine the global competitiveness of the cocoa bean value chain). Global buyers have stated that suppliers of cocoa beans in every country have their relative strengths and weaknesses regarding the characteristics, so there is no ideal combination of the factors that all suppliers or countries should strive to possess.

7) In the context of Bugis Cocoa Smallholder, when the Bank constructed the Study on Cocoa Smallholders Tree Crop Production, the Bank also says Bugis Tribal is very famous as wanderer having high motivation and more access in term of market information, technology as well as business opportunity. Bugis Tribal dominated in trading business.

Table 1. Competitiveness Characteristics of Cocoa Beans in the Global Market

Competitiveness Characteristics	Description
Consistency Of Quality	—This is based on generally accepted parameters and indicators of cocoa bean quality used in the trade, including bean count (number of beans per 100 grams ; 〈110 beans), moisture content (〈7.5 percent), and percentage of waste materials (〈10 percent).
Fat Content	—Percentage of fat content refers to the amount of fat or cocoa butter that can be extracted from the beans during processing. A high fat content is preferable
Flavor	—Flavor can be accentuated with proper fermentation but is primarily a genetic trait of the cocoa bean itself. —Stronger flavor beans are required for higher quality food and pharmaceutical cocoa products.
Price	—The price per MT of cocoa beans is a strong determinant of value chain competitiveness (though not one that can be looked at in isolation). —Cocoa beans from Sulawesi are globally traded as "Sulawesi FAQ" on the New York Commodities Exchange —Price often reflects other characteristics (i.e., a lower price may reflect inconsistency of quality, low fat content, etc.), and is not considered in isolation by global buyers.
Availability Of Supply	—The availability of cocoa bean supply depends to a large extent on the amount of land in production and the production yield. Farmers in Sulawesi have some of the highest cocoa bean yields in the world and one of the largest areas under production. —The reliability of cocoa bean exporters is also an important aspect of supply that global buyers appreciate.
Infrastructure and Logistics	—Efficiency and availability of transportation and infrastructure moves beans from producers to the global buyer. —This also includes the efficiency of port operations, inspection services, and other logistical export services.
Legal/Policy Environment	—This includes government and public sector policies and regulations (taxation, support and/or interference, standards, contracts, certification, etc). The legal and policy environment can have a positive or negative influence on competitiveness.

Source : Panlibuton & Lusby (2006).

Nonetheless, it is useful to look at these aspects (Table 1) to understand where Indonesian cocoa beans are competitively positioned.

3. Research Methodology

The research used an Econometric Model consists of three main steps. The three steps are (1) model construction, (2) model identification and estimation, (3) model validation and its application, but the model reconstruction has been tried iteratively. This condition is aimed to fulfill the economic, statistic, and econometric criterion by constructing the relationship between variables in the model. By using the time series data 1983-2002,

we divided the cocoa production regions into four regions in Indonesia, namely ; South Sulawesi, West Sulawesi, Center Sulawesi and East Java Provinces.

3.1. Model Construction

The model has been constructed based on the economic theory which is expected to show the economic behavior of Indonesia's cocoa clearly. The stages of building up the model and its application procedure follows the Figure 1 (*page 9*).

Cocoa Harvested Area

$$AKSS_t = a_0 + a_1 HKIN_t + a_2 (HKSS_t - HKSS_{t-1}) + a_3 UPAH_t + a_4 TSBR_{t-1} + a_5 TW + a_6 AKSS_{t-1} + U_1 \quad \cdots\cdots (1)$$

$$AKSB_t = b_0 + b_1 HKIN_t + b_2 HKSS_t/(HKSS_t - HKSS_{-1}) + b_3 (UPAH_t - UPAH_{t-1}) + b_4 TSBR_t + b_5 TW + b_6 AKSB_{t-1} + U_2 \quad \cdots\cdots (2)$$

$$AKST_t = c_0 + c_1 (HKIN_t/UPAH_t) + c_2 HKSS_t + c_3 (TSBR_t - TSBR_{t-1}) + c_4 TW + c_5 AKST_{t-1} + U_3 \quad \cdots\cdots (3)$$

$$AKJT_t = d_0 + d_1 (HKIN_t - HKIN_{t-1}) + d_2 HJJT_{t-1} + d_3 (TSBR_t - TSBR_{t-1}) + d_4 TW + d_5 AKJT_{t-1} + U_4 \quad \cdots\cdots (4)$$

CocoaYield

$$YKSS_t = e_0 + e_1 (HKIN_t/HPUP_t) + e_2 JPSS_t + e_3 AKSS_t + e_4 TW + e_5 YKSS_{t-1} + U_5 \quad \cdots\cdots (5)$$

$$YKSB_t = f_0 + f_1 HKIN_{t-1} + f_2 (JPSB_t/JPSB_t - JPSB_{t-1}) + f_3 AKSB_t + f_4 TW + f_5 YKSB_{t-1} + U_6 \quad \cdots\cdots (6)$$

$$YKST_t = g_0 + g_1 (HKIN_t/HPUP_t) + g_2 (JPST_t/AKST_t) + g_3 TW + g_4 YKST_{t-1} + U_7 \quad \cdots\cdots (7)$$

$$YKJT_t = h_0 + h_1 HKIN_t + h_2 HPUP_t + h_3 JPJT_t + h_4 AKJT_t + h_5 TW + h_6 YKJT_{t-1} + U_8 \quad \cdots\cdots (8)$$

Cocoa Production

$$QKSS_t = AKSS_t * YKSS_t \quad \cdots\cdots (9)$$

$$QKSB_t = AKSB_t * YKSB_t \quad \cdots\cdots (10)$$

$$QKST_t = AKST_t * YKST_t \quad \cdots\cdots (11)$$

$$QKJT_t = AKJT_t * YKJT_t \quad \cdots\cdots (12)$$

$$QKIN_t = QKSS_t + QKSB_t + QKST_t + QKJT_t + QKPL_t \quad \cdots\cdots (13)$$

Indonesia Cocoa Export

$$XKIN_t = i_0 + i_1 HXIN_{t-1} + i_2 QKIN_t/(QKIN_t - QKIN_{t-1}) + i_3 EXCR_{t-1} + i_4 TW + U_9 \quad \cdots\cdots (14)$$

Indonesia Cocoa Supply

$$PNIN_t = QKIN_t - XKIN_t + MKIN_t \quad \cdots\cdots (15)$$

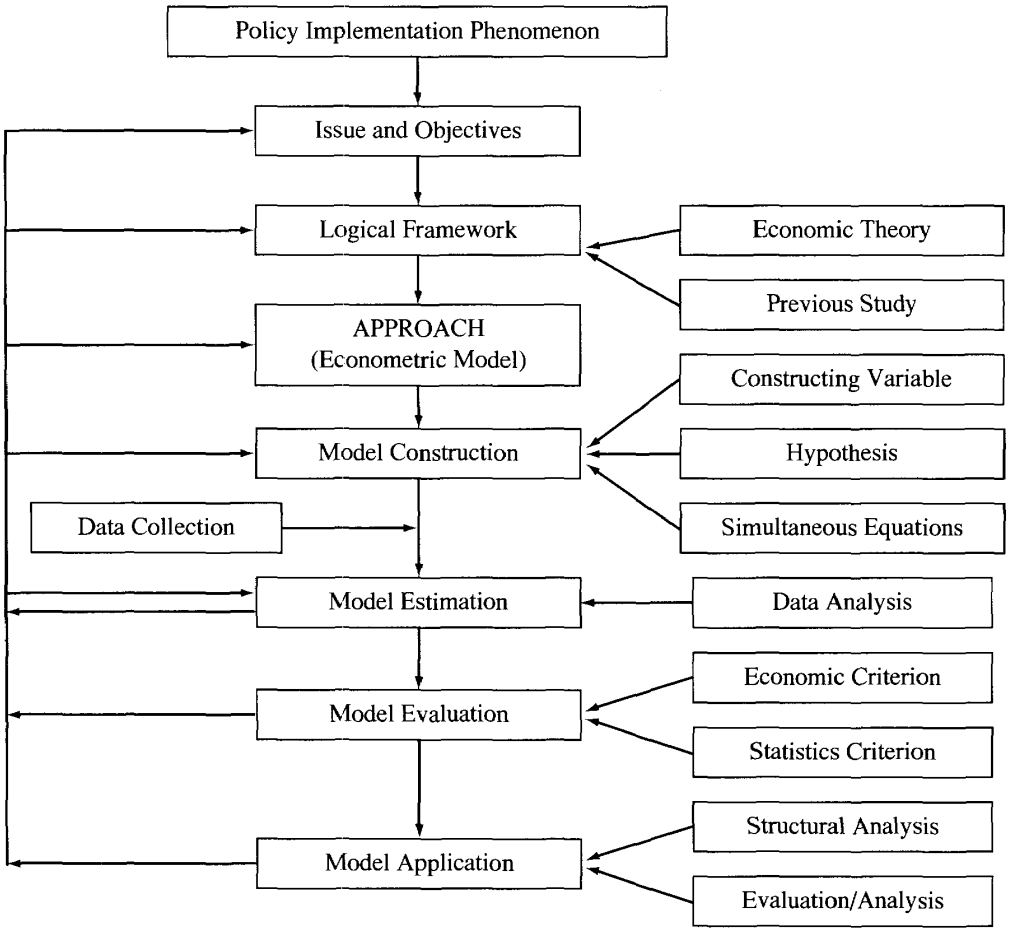
Indonesia Cocoa Demand

$$PMIN_t = j_0 + j_1 HKIN_t + j_2 UPSI_t + j_3 PKAP_t + j_4 PMIN_{t-1} + U_{10} \quad \cdots\cdots (16)$$

World Cocoa Export

$$XKKD_t = XKIN_t + XKPG_t + XKGA_t + XKNL_t \quad \cdots\cdots (17)$$

Figure 1. Stages of Building up the Model and Its Application Procedure



Sources : adapted from Sinaga (2005) & intensive modified from Arsyad, et.al (2007)

World Cocoa Import

$$MKKD_t = MKBL_t + MKUS_t + MKNL_t \quad \cdots\cdots (18)$$

World Cocoa Price

$$HKKD_t = k_0 + k_1 XKKD_t/(XKKD_t - XKKD_{t-1}) + k_2 MKKD_t + k_3 HKKD_{t-1} + U_{11} \quad \cdots\cdots (19)$$

Indonesia Cocoa Export Price

$$HXIN_t = l_0 + l_1 HKKD_t + l_2 XKIN_t + U_{12} \quad \cdots\cdots (20)$$

Indonesia Cocoa Domestic Price

$$HKIN_t = m_0 + m_1 HXIN_t + m_2 (PNIN_t/PMIN_t) + m_4 HKIN_{t-1} + U_{13} \quad \cdots\cdots (21)$$

where :

$AKSS_t$ = Harvested area in South Sulawesi (Ha)
$AKSB_t$ = Harvested area in West Sulawesi (Ha)
$AKST_t$ = Harvested area in Center Sulawesi (Ha)
$AKJT_t$ = Harvested area in East Java (Ha)
$AKPL_t$ = Harvested area in other province (Ha)
$HKIN_t$ = Real price of Indonesia cocoa (Rp/kg)
$HKSS_t$ = Real price of South Sulawesi coconut (Rp/kg)
$HJJT_t$ = Real price of East Java corn (Rp/kg)

$HBBM_t$ =Real price of diesel fuel (Rp/lit)
$UPAH_t$ =Real wage of estate crop labor (Rp/HOK)
$TSBR_t$ =Real interest rate (%)
$YKSS_t$ =Cocoa yield in South Sulawesi (Ton/Ha)
$YKSB_t$ =Cocoa yield in West Sulawesi (Ton/Ha)
$YKST_t$ =Cocoa yield in Center Sulawesi (Ton/Ha)
$YKJT_t$ =Cocoa yield in East Java (Ton/Ha)
$HPUP_t$ =Real price of fertilizer (Rp/kg)
$JPSS_t$ =Number of estate crop labor in South Sulawesi (Person)
$JPSB_t$ =Number of estate crop labor in West Sulawesi (Person)
$JPST_t$ =Number of estate crop labor in Center Sulawesi (Person)
$JPJT_t$ =Number of estate crop labor in East Java (Person)
$QKSS_t$ =Cocoa production in South Sulawesi (Ton)
$QKSB_t$ =Cocoa production in West Sulawesi (Ton)
$QKST_t$ =Cocoa production in Center Sulawesi (Ton)
$QKJT_t$ =Cocoa production in East Java (Ton)
$QKPL_t$ =Cocoa production in other province (Ton)
$QKIN_t$ =Indonesia cocoa production (Ton)
$XKIN_t$ =Indonesia cocoa export (Ton)
$HXIN_t$ =Indonesia cocoa export price (US$/Ton)
$EXCR_t$ =Exchange rate (Rp/US$)
$PNIN_t$ =Indonesia cocoa supply (Ton)
$PMIN_t$ =Indonesia cocoa demand (Ton)
$HKIN_t$ =Indonesia cocoa domestic price (Rp/kg)
$UPSI_t$ =Wage of industrial sector (Rp/HOK)
$PKAP_t$ =Per capita income in Indonesia (Rp/capita)
$XKPG_t$ =Ivory Coast cocoa export (Ton)
$XKGA_t$ =Ghana cocoa export (Ton)
$XKNL_t$ =Cocoa export from other country (Ton)
$MKBL_t$ =Netherlands cocoa import (Ton)
$MKUS_t$ =US cocoa import (Ton)
$HKKD_t$ =World cocoa price (US$/Ton)
$XKKD_t$ =World cocoa export (Ton)
$MKKD_t$ =World cocoa import (Ton)
TW =Time trend
T =1983-2002
t-1 =Lag
$U_{1,2,3,4.....13}$ =Error term

3.2. Model Identification and Estimation Method

Model identification is aimed to clarify whether or not the simultaneous equations model are identified in order to determine the best estimation method. There are several criterions for model identification in an econometric approach, where these criterions are

very strongly dependable on the research objective. As Sinaga (1989) emphasized that identification is logically prior to estimation, since it is not only closely related to the choice of estimation method, but also to the specification of the simultaneous equation model. It can be said that a system of equations is identified if it is in a unique statistical form, enabling unique estimates of its parameters to be subsequently made from sample data. A model is underidentified if one or more equations in the model are underidentified. If an equation is underidentified, it is impossible to estimate all its parameters with any econometric estimation method. If the equation is identified, either exactly identified or overidentified, its parameters can be statistically estimated by an appropriate method.

In this research, model identification criterion followed the order and rank condition which is developed by Koutsoyiannis (1977). This criterion leads us to specify the model as overidentified. If all of the structural equations are overidentified, we could use Two-Stage Least Squares (2SLS) or Three-Stage Least Squares (3SLS) as an estimation method. Since we found the structural equations are overidentified in the model, we choose 2SLS as estimation method rather than 3SLS. The consideration comes from Sinaga (1989) that 3SLS method is sensitive to the specification changes, since a change of specification anywhere in the system affects all the parameter estimates.

3.3. Model Validation and Its Application

One of the most important stages is model validation. It is a necessary to test the validation before applying the model. This is aimed to diagnose whether or not the model can persuasively reflect the economic behavior in the real world, particularly to construct the policy simulation process.

In this research, the validation criterions are U-Theil and RMSPE (Pindyck dan Rubinfeld, 1998). U-Theil Value always falls between 0 and 1. If $U=0$, $Y_t^s = Y_t^a$ for all$_t$ and there is a good fit, but if $U=1$, the predictive of the model is not recommended. The smaller the *RMSPE* value and U, the estimated model is valid for simulation constructing.

$$RMSPE=\left[\frac{1}{T}\sum_{T=1}^{T}(Y_t^s-Y_t^a)/(Y_t^a)^2\right]^{0.5}$$

$$U=\frac{\left[\frac{1}{T}\sum_{T=1}^{T}(Y_t^s-Y_t^a)^2\right]^{0.5}}{\left[\frac{1}{T}\sum_{T=1}^{T}(Y_t^s-Y_t^a)/(Y_t^a)^2\right]^{0.5}}$$

where :

RMSPE =Root Mean Squares Percent Error

U =U-Theil coefficient

Y_t^s =Simulated values

Y_t^a =Actual values

T =Number of periods in the simulation

After following the model application procedure (Figure 1, *page 9*), the last stages for the analysis is policy simulation. As we explored in objectives part, there are two policies which are simulated in the research i.e. fertilizer subsidy and export tax. Since we have no fertilizer subsidy and export tax variables in the model, we do it by decreasing price fertilizer and cocoa export price, respectively into policy simulation process, until we get the dynamic impact of both policies. Unfortunately, we do not simulate the magnitude of policy gradually, but it sticks one point (fertilizer subsidy policy of 15% and export tax policy of 5%) by consideration as follows :

1. Firstly, by May 17, 2006 the Indonesian government issued the increasing fertilizer price by 15% after subsidy withdrawal at the last few years. The impact of the subsidy policy has been properly emphasized in this paper. Even though the government chose the increasing fertilizer price, but in this study we rather simulate the price decreasing as another way for the subsidy than vice versa.
2. Secondly, the Indonesian government also planned the export tax imposition on cocoa. This planning, however, became lively debate in Indonesia. For example, ASKINDO has reiterated its opposition to the planned imposition of export tax on cocoa. The reason is that the tax would be an additional burden to the farmers. Moreover, the tax would reduce their income. In this paper, for giving the academic reason into debate, we also explained the dynamic impact of export tax on cocoa export and production as well as the best policy alternative by sticking the simulation magnitude of 5 %.

4. Results and Discussion

4.1. Performance of the Model

Before continuing the discussion, in this part we are going to delivery the general performance of the model by using statistics criterion to make sure that the results of estimation are generally applied to the economic theories or hypothesis. Firstly, the estimation result shows that the coefficient determination (*hereafter*, R^2) reached of 0.981. This figure tells us that 98.10 percent of the total variance of the endogenous variable, in general, can be explained so fairly robust by the all explanatory variables. In other word, there is no so

Table 2. Predictive Performance of the Model

Endogenous Variables	RMSPE		U-Theil	
	1992-1996	1998-2002	1992-1996	1998-2002
$AKSS_t$	14.008	9.5137	0.0788	0.0426
$AKSB_t$	7.545	17.6049	0.0297	0.0910
$AKST_t$	3.996	9.3990	0.0178	0.0459
$AKJT_t$	10.511	9.8003	0.0514	0.0394
$YKSS_t$	48.633	32.1466	0.2413	0.1664
$YKSB_t$	15.150	19.5097	0.0701	0.0830
$YKST_t$	6.831	15.3323	0.0370	0.0635
$YKJT_t$	13.438	14.9380	0.0619	0.0818
$QKSS_t$	41.596	25.4952	0.1838	0.1381
$QKSB_t$	16.569	7.6147	0.0728	0.0341
$QKST_t$	5.376	19.9380	0.0267	0.0842
$QKJT_t$	8.961	10.0413	0.0451	0.0525
$QKIN_t$	1.573	2.0160	0.0080	0.0092
$XKIN_t$	8.238	9.0217	0.0406	0.0407
$PMIN_t$	6.263	12.8543	0.0259	0.0422
$PNIN_t$	26.233	42.7073	0.0997	0.2132
$XKKD_t$	1.237	1.6745	0.0061	0.0081
$MKKD_t$	4.96	3.4847	0.0242	0.0184
$HKKD_t$	10.164	3.4917	0.0524	0.0169
$HXIN_t$	99.991	99.9845	0.9998	0.9995
$HKIN_t$	19.420	18.5911	0.0846	0.1191

large space (only 1.90 percent) for adding the additional variables in order to explain the cocoa economic behavior in the country.

Secondly, all variables of the behavioral equations[8] have indeed the expected both sign and magnitude from the economic theory side. What we have been emphasizing in developing model is regard to the economic theory. That is, we constructed the model (non verbal hypothesis). The principal reason is, even if the model is statistically quite satisfactory but it violates the economic theory, we may say that its results would not have the meaningfull explanation from the economic viewpoint.

Thirdly, the t-test presents 75.81 percent of the explanatory variables significantly influenced. Besides these three points, fourthly, the lag endogenous coefficient (β) for all of the behavior equations in terms of both signs and magnitude also are expected ($0<\beta<1$), ranging from 0.00001 to 0.9170. This means that all of the endogenous variables expectation influences the changes of phenomenon, technology and economic institution.

Fifthly, another important criterion is our, Root Mean Squares Percent Error

8) The behavioral equation in this paper refers to the structural equation in the model in order to make clearly their differences with the identity equations model. For deeply discussion, see for example Koutsoyiannis (1977), Pindyck & Rubinfeld (1998).

Table 3. Parameter Estimates for Indonesia Cocoa Export

No	Endogenous and Explanatory Variables	Parameter Estimates	t for H_0	
1	$XKIN_t$=Indonesia cocoa export			
	Intercept	−25761438	−8.024	
	$HXIN_{t-1}$	9756.401609	0.673	(D)
	$QKIN_t$/(QKINt-$QKIN_{t-1}$)	126.686403	0.685	(D)
	$EXCR_{t-1}$	2.103388	0.776	(D)
	TW	12976	8.038	(A)
	R^2=0.9473 ; F-value=62.83 ; DW=2.22			
(A) at α=0.10 and (D) at 0.25, required for another equations				

(RMSPE) and U-Theil Coefficient (U-Theil) as validation criterion in order to know the predictive performance of the model in Table 2. These criteria show that among 21 of the endogenous variables, only one variable has RMSPE of more than 50 percent. At the same period, its U-Theil coefficient is relatively small and close to zero. What is made clear by these criterions as described above is, however, that the model in the research is more than adequate in explaining the cocoa economic phenomenon and valid for policy instrument simulation, especially dealing with the cocoa economic policy in the country.

4.2. Indonesia Cocoa Export Performance

If we look back on Equation (14), it shows that there are four explanatory variables which significantly influences Indonesia cocoa export. They are export price, cocoa production, exchange rate and time trend. These four variables could explain 94.73 percent of Indonesia export behavior (R^2 in Table 3). This percentage believes us that around 94.73 percent of the total variance of the export behavior were covered by these four explanatory variables. Of course, from that situation, practically, there is very little chance (only 5.27 percent) for adding another explanatory variable in order to deeply study the cocoa export behavior and coefficient determination as well as to decide a policy direction.

However, if we concern to the elasticity value, we can say that in the short run period, Indonesia export is inelastic to the changes of those four explanatory variables (Table 4). For instance, based on the magnitude of export price, clearly, we could explain that a 1.00 percent of export price increase will only cause 0.067 percent increase in cocoa export. We do believe that this phenomenon is very strongly associated with the contract system (given time period) between a number of the Indonesian exporter to the US companies as cocoa buyers (customer themselves). It does mean that the cocoa in the export market (except for the customer themselves) might not be so much decided from the Indonesia production.

Table 4. Elasticity of Cocoa Export and Demand Equations

No	Endogenous and Explanatory Variables	Elasticity	
		Short Run	Long Run[9]
1	Indonesia cocoa export : $XKIN_t$		
	Indonesia cocoa export price ($HXIN_{t-1}$)	0.067	—
	Indonesia cocoa production : $QKIN_t/(QKIN_t-QKIN_{t-1})$	0.015	—
	Exchange rate ($EXCR_{t-1}$)	0.064	—
2	Demand for Indonesia cocoa : $PMIN_t$		
	Domestic cocoa price ($HKIN_t$)	−0.300	−0.354
	Wage of industrial sector ($UPSI_t$)	−0.437	−0.523
	Per capita income ($PKAP_t$)	0.668	0.800

Therefore, even if the export price had been already changed in the short run period, but it could not strongly influence Indonesia cocoa export.

4.3. Cocoa Price Transmission

Since the cocoa price variable had been assigned to be a linkage in the model, in this section we are going to explore its role in doing transmission. In other word, one of the most important structural equations in the model should be concerned with price behavior, as could be seen at Equation (17) up to Equation (21) whose parameter estimates clearly shown in Table 5.

The important findings on price behavior is that Indonesia export price is significantly influenced by world cocoa price and Indonesia cocoa export with R^2 of 0.91 in Equation (20). These two variables could explain around 91 percent of export price variation. Indeed Indonesian export price is inelastic to the changes of both of them, but this is in the short run situation (see elasticity value in Table 6). Meanwhile Equation (21) shows that the behavior domestic price is mainly influenced by export price, and ratio of supply to demand ($R^2=78.43$ percent). If we look at its elasticity value (Table 6), one thing could be recognized is that unlike export price, domestic price is more responsive to the changes of cocoa export price. From that elasticity side, we may say that the increasing of export price by 1.00 percent resulted in the increasing of domestic price 1.97 percent in the short

9) The author did not calculate the Long Run Elasticity Coefficient for some behavioral equations due to those equations has not the lag endogenous variables.

Table 5. Parameter Estimates for Cocoa Price

No	Endogenous and Explanatory Variables	Parameter Estimates	t for H_0	
1	$HKKD_t$=World cocoa price			
	Intercept	−153.624028	−0.449	
	$XKKD_t$ /($XKKD_t$-$XKKD_{t-1}$)	−0.004299	−0.036	
	$MKKD_t$	0.000000138	1.299	(B)
	$HKKD_{t-1}$	0.920499	7.717	(A)
	R^2=0.8137 ; F-value=21.836 ; DW=1.353			
2	$HXIN_t$=Indonesia cocoa export price			
	Intercept	0.000009292	0.461	
	$HKKD_t$	7.1859182E-8	6.511	(A)
	$XKIN_t$	−3.36118E-10	−10.076	(A)
	R^2=0.9099 ; F- value=30.839 ; DW=1.669			
3	$HKIN_t$=Cocoa domestic price			
	Intercept	512317	2.248	
	$HXIN_t$	3173359658	2.285	(A)
	$PNIN_t/PMIN_t$	−61.106770	−0.827	(D)
	$HKIN_{t-1}$	0.361988	1.616	(A)
	R^2=0.7843 ; F-value=18.176 ; DW=2.494			
	(B) at α=0.15			

Table 6. Elasticity of Cocoa Price Equations

No	Endogenous and Explanatory Variables	Elasticity	
		Short Run	Long Run[10]
1	World cocoa price : ($HKKD_t$)		
	World cocoa import ($MKKD_t$)	0.168	2.113
2	Indonesia export price : ($HXIN_t$)		
	World cocoa price ($HKKD_t$)	1.79E-10	—
	Indonesia cocoa export ($XKIN_t$)	−9.31E-11	—
3	Cocoa domestic price : ($HKIN_t$)		
	Indonesia export price ($HXIN_t$)	1.974	3.110
	Ratio of supply to demand ($PNIN_t/PMIN_t$)	−0.058	−0.092

run, and 3.11 percent in the long run period.

These findings indicate that world price which is transmitted to export price, influences domestic price. Therefore, Indonesia domestic price very strongly depends on the changes of export price. In other words, there is a price link (price transmission) among the world price, export price, and Indonesia domestic price. Then, in the short run period, Indonesia (domestic) cocoa price is inelastic responsive to the changes of the supply (Table 6).

10) See footnote 9

This empirical result persuasively shows that domestic price is dominantly influenced by the export price and exchange rate, compared to the changes in the cocoa supply. This finding supports the field fact. Firstly, when the peak of economic crisis occurred in 1997-1998, Indonesian *rupiah* per US$ hardest downwards (reaching 80 percent of its value), followed by remarkable inflation (also reached 80 percent), cocoa smallholders enjoyed to these crisis impacts situation due to their income soar, even though Indonesian economy stopped growing in general.

Secondly, the devaluation of the *rupiah* in mid 1997 provided a massive boost to the local producer prices, providing further impetus to the expansion of output. Producer prices in local currency terms rose from an average of less than 2,500 Rp/kg in 1996/97 to more than 9,000 Rp/kg in 1997/98 and even reached 19,000 Rp/kg in June 1998, coinciding with the peak harvesting period (Ann, 2001). What we could pick up from these phenomenon is that the rapid increasing of cocoa smallholder income not only comes from the supply or production side, but also it comes from a positively consequence of depreciation itself. That is the reason why cocoa smallholders got a booming profit from the crisis. Therefore, we do believe that devaluation policy could be expected to increase the cocoa export and production rather than export tax policy.

4.4. Impacts of Fertilizer Subsidy and Export Tax

In this section we are going to emphasize the impact of fertilizer subsidy and export tax policies after doing the simulation procedure. As we already introduced in the methodology part, we have no fertilizer subsidy variable in the model, and in order to get the research objective, we did simulation policy by decreasing fertilizer price of 15 percent on the Equation (5), (7), and (8) as a set of cocoa yield structural equations. We also did the same way for export tax simulation by declining export price of 5 percent on the Equation (20) and (21). Then, by using actual and predicted values (before and after simulation), we started to carefully calculate the impact of both policies on the variables. The results of the policies impact simulation are shown as follows ;

i) **Impacts of fertilizer subsidy policy of 15 percent.** The policy increased the cocoa yield in all regions of the research (South Sulawesi of 3.10 percent, Center Sulawesi of 0.34 percent and East Java of 8.30 percent), except for West Sulawesi. The increasing in productivity causes cocoa production increasing on the range 0.38 percent −8.63 percent. This phenomenon pushed the national production by 1.93 percent. Furthermore, this condition will increase the national export by 1.00 percent. These positive impacts convey a message that a fertilizer subsidy as one of the inputs for agri-

cultural practice could be very strongly expected in increasing the cocoa export and production in the country. This finding is consistent to Kariyasa's conclusion (2003) on corn commodity. By using time series data and dynamic model, he found that the fertilizer price declining through subsidy will increase corn yield in Indonesia. One year later (2004), Arsyad, Sanim & Sinaga disclosed the same dynamic impacts (in sign, not magnitude) of the policy on the cocoa, too. Even though by picking up South Sulawesi Province only[11], they had very strongly suggestion to choose fertilizer subsidy policy rather than the others in improving cocoa export and production in Indonesia.

ii) **Impacts of export tax policy of 5 percent.** The policy decreased Indonesia export price for the exporter, then it strongly depressed domestic price (2.51 percent). As a result, domestic price had a negative impact to the cocoa harvested area which is cultivated by smallholders, as the price does not fully satisfy the farmers to expand their plantation area. Therefore, cocoa production began to decrease its value, losing 0.14 percent for South Sulawesi, 4.25 percent for West Sulawesi, 2.98 percent for Center Sulawesi, and 2.76 percent for East Java. Finally, these production decreasing has substantial negative impact to decrease the Indonesia cocoa production about 0.14 percent. Next implication of this condition is Indonesia cocoa export declined 0.63 percent.

There are several previous efforts that very strongly support these findings. Firstly, comes from Hasan, Reed & Marchant (2001). They are very persuasively showed that the imposition of an export tax has long-lasting, negative effects on competitiveness of Indonesian palm oil industry. In fact, the effect of an export tax was not immediate ; it appears in the second month and reaches a peak in the fourth month after the export tax of Indonesian palm oil is imposed ; and the effects remain long

11) But during 1997-2000 this province has biggest contribution both total cocoa area and production in Indonesia. Since they calculated its share, for instance in 2000, they found that around 23.5 percent of national cocoa area and 32.83 percent of production were located in the province. It does mean the province plays a very important role in Indonesian cocoa regulation, not only supply side but also its trade. That is the reason why the research deals with Indonesian cocoa, especially in selecting the research site always consider the province, whatever method are being used, and this is not only for domestic researchers but also foreign researchers and their association. Without discrediting another researcher, see, for example Jamal and Pomp (1993) ; Akiyama & Larson (1994) ; Akiyama & Nishio (1997) ; Martadinata (1998) ; PPSEP (1998) ; Dradjat, Suprihatini & Wahyudi (2001) ; CRIEC-World Bank (2002) ; Panlibuton & Lusby (2006) ; Arsyad, Yusuf, Hasnah, Sinaga & Siregar (2007). The author did not put the completely the title of all those studies into References except for substantially quoted, referred, and compared one in this paper. In other word, the author is not able to refer the contents of those studies into this paper.

after that time.

Secondly, we appreciate Susila's study (2004) which is very clearly focused on evaluation and projection of the impacts of CPO-export tax. Susila found that this export tax policy has had significant impact on industry. Within the time horizon 1994-1999 when the effective tax rate was around 13.33 percent, the mature area of oil palm plantation had been reduced by 2.56 percent per annum or around 37,000 ha per annum. This indicates that this policy had a substantial negative effect on investment in the industry. As a result of this negative investment effect, CPO production had also been depressed by the policy. It is estimated that the policy had caused a loss of around 0.81 percent of the total production or around 36,000 t CPO per annum. The same impacts possibility (in sign) are suggested by Arsyad (2004) and Arsyad, Yusuf, Hasnah, Sinaga & Siregar (2007) concerning on all the cocoa commodities in Indonesia, even if the research region aggregation is quite different.

Thirdly, export taxes on palm oil products also affected the coconut oil market. The major sources of cooking oil in Indonesia are copra (raw material for coconut oil) and crude palm oil. Palm cooking oil is used more than any other cooking oil in Indonesia, accounting for about 75 percent of the domestic market, and it is also exported. Coconut oil covers about 17 percent of the local market. The tax on palm oil has diverted the supply of palm oil from exports to the local market, thus putting downward pressure on the price of coconut oil. Under this competitive pressure, many coconut factories closed down (Piermartini, 2004).

By considering this research findings and those threes studies above, it could be a guidance to the research suggestion that, from the viewpoint of production side, the export tax policy indeed reduces cocoa smallholder welfare. What we made clear by knowing the empirical result discussed above is, that if the government stands up at smallholder side, we should avoid the export tax policy on cocoa.

5. Conclusion Remarks and Policy Implication

Indonesia cocoa export is very strongly determined by the export price, cocoa production growth, exchange rate and time trend. Meanwhile, Indonesia export price is significantly influenced by the world cocoa price and the Indonesia cocoa export. The world price is transmitted to export price, and it influences domestic price. Therefore, Indonesia domestic price very strongly depends on the changes of export price. In other words, there is a price transmission among the world price, export price, and Indonesia domestic price.

Then in the short-run period, Indonesia cocoa price is inelasticly responsive to the changes of the supply. This empirical result persuasively shows that domestic price was dominantly influenced by the export price and exchange rate, compared to the changes in the cocoa supply.

At the same time, although the Indonesian government does not implement the export tax on cocoa yet, it has been strongly debate in Indonesia today. This study already proves that the export tax policy indeed has substantial negative impact to the decreasing of Indonesia cocoa export and production. Then, the rapid increasing of cocoa smallholder income not only comes from the supply or production side, but also it comes from a positively consequence of depreciation itself even more so during the economic crisis. Therefore, we are offering devaluation policy in order to increase the cocoa export rather than export tax policy. The fertilizer price policy implementation has had important impacts on both cocoa production and export. This research finds that this policy of fertilizer price decreasing could be very strongly expected in increasing the Indonesia's cocoa export and production for the cocoa smallholders.

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