Assessing the Impact of Oil Prices and Interest Rate Policies : The Case of Indonesian Cocoa[1)]

Muhammad ARSYAD[2)]
Syarifuddin YUSUF[3)]

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Abstract

Indonesia is the third largest cocoa producer in the world after Ivory Coast and the Ghana. Cocoa is strongly considered as an essential commodity. It plays two strategic roles in Indonesian economy. Firstly, cocoa provides export earnings, and secondly, it gives a source of employment for millions of rural smallholders household. However, a number of such policies are implemented by the Indonesian government as oil prices and interest rates, as a controversial issue in the country. These policies are strongly debated and hypothesized to affect the Indonesia cocoa exports and production. By employing an Econometric Time Series Model, this research part analyzes (1) the factors responsible for the Indonesia cocoa demand, (2) assessing the impact of oil prices and interest rates policies on Indonesia cocoa exports and production. To end up, the estimation of the model used 2SLS Method by disaggregating the cocoa production regions into four provinces, namely South Sulawesi, West Sulawesi, Center Sulawesi and East Java. The main findings of the research reveals that; (1) Indonesia cocoa demand is influenced by the Indonesia cocoa price, wage in industrial sector, per capita income and oil prices, (2) an oil prices increasing

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2) **Muhammad ARSYAD** is an Agriculture Faculty Member at the Department of Socio-economic of Agriculture, Hasanuddin University, Makassar-INDONESIA and a Doctoral Student at the Graduate School of Economics, Ryukoku University, Kyoto-JAPAN [arsyad_uh@yahoo.com].

3) **Syarifuddin YUSUF** is a Senior Lecturer at the Faculty of Economic, Muhammadiyah University of Parepare, INDONESIA and he has been a President of the university since 2007.

policy indeed has substantially negative impacts to decrease the Indonesia cocoa exports and production, while interest rates decreasing policy could be expected in increasing the export and production. This is a principal reason why we are offering a subsidy policy on both oil prices and interest rates for the cocoa smallholders in the country.

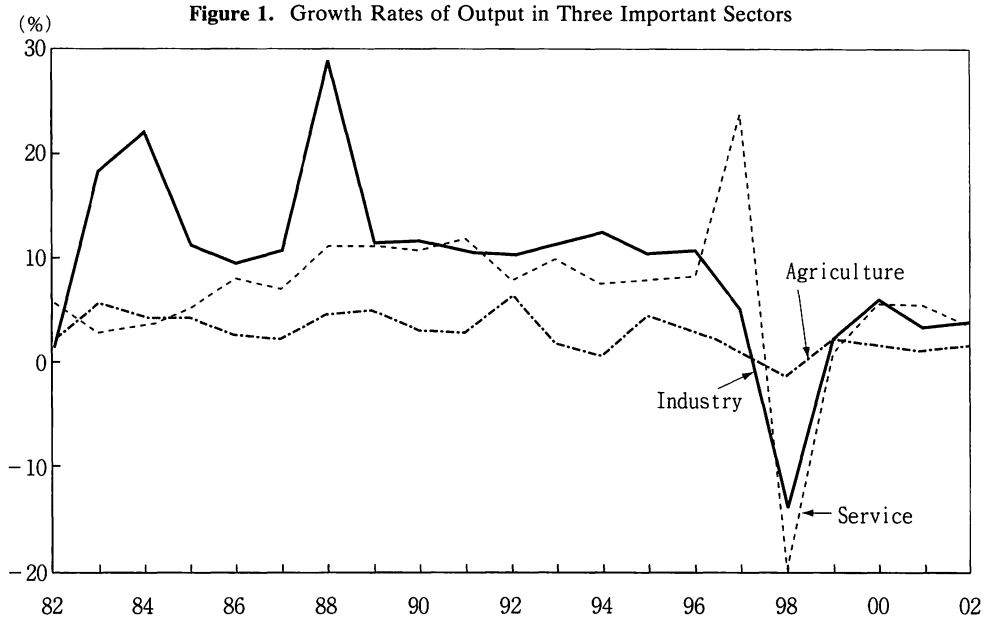
1. Current Issue and Objectives

After 30 years (1966-1996) of rapid economic growth on average 7% a year, controlled unemployment and inflation rate, under the political stabilization, industrial transformation, rapid technological progress, and steady food security, Indonesia was suddenly hit by an Asian financial crisis in mid 1997. It has become the general secret that the crisis indeed has remarkably negative impact on Indonesian economy, particularly manufacturing, construction and finance sectors. As Abimanyu (2008) calculated that the domestic currency depreciated by about 67% against the U. S dollar between July and December 1997 and it depreciated an additional 118% between December 1997 and January 1998. Even though the currency recovered about 27% of its value from January to April 1998, it depreciated about 83% from April until June 1998. After that, the exchange rate began to recover somewhat. In a year, between June 1998 and June 1999, the exchange rate appreciated about 41%. Within that period, the exchange rate appreciation averaged about 6% per month.

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 agriculture products grew quickly and income of cocoa smallholder also soared rapidly (Arsyad, 2008). Those situations were affected by not only production side, but also the consequence of Indonesian *rupiah* depreciation which was an increasing demand for Indonesian agricultural exports products. Hence, the agriculture sector is believed as a leading sector and the way out of the crisis in the country. Tambunan (2007) explained that soon after the end of 1997, the currency depreciation became a financial crisis as the banking sector collapsed, and in 1998, it ended in an economic crisis as productions in many sectors declined leading to the fall in the country's GDP by 13.4%. Surprisingly, among three important factors, agriculture was the least affected by the crisis, as its output declined by less than 2% [**Figure 1**].

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), including Tree Crop Production such as cocoa. Then, it should be noted here that

Figure 1. Growth Rates of Output in Three Important Sectors



Source: BPS (SI) in *Agricultural and Poverty Reduction in Indonesia* (Tambunan, 2007)

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 for millions of rural smallholder families (Arsyad, 2002b). This also could be the engine of growth for plantation cocoa area in Indonesia. The above phenomenon, however, show that agriculture sector [including cocoa] has been remarkably contributing to the Indonesia's GDP.

Therefore, it is not so surprising that a number of policies are addressed by the government to the cocoa regulation, including monetary policy (Arsyad, 2002a, 2004), not only to guarantee its domestic supply, but also to contribute to economic recovering. Our previous study as the first evaluation (see Arsyad, 2007) on the impact of fertilizer subsidy and export tax policies on Indonesia cocoa exports and production persuasively reveals that; (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 exports and production, whereas the imposition of export tax policy indeed has substantially negative impacts to decrease the export and production.

This research part as the second evaluation sticks an impact assessment of oil prices and interest rates policies on Indonesian cocoa. The government rationale for launching the oil price increasing policy relies on the following arguments. The highest world oil price in 2005 (more than US$ 70 per barrel) and US$ 110 in the end of March 2008 is a

considerable increasing for Indonesian economy, including agriculture sector, can not avoid the skyrocketing oil prices. Therefore, in order to avoid the budget state [APBN] deficit, the Indonesian government launched the oil increasing prices under the assumption that the high domestic oil prices can create a positive impact on Indonesian macroeconomic structure. Similarly, for the interest rate regulation, the Central Bank (in Indonesia called *Bank Indonesia*) still meets difficulties to decrease the interest rates for smallholders due to several reasons.

For instance, on the side of monetary policy, through August 2005, Indonesia was slow to raise key policy of interest rates in line with rising world rates, causing depreciation of the Indonesian Rupiah, a loss in reserves, and sharply higher long-term interest rates. Beginning in September 2005, administered rates were increased aggressively [up by 5 percentage points in a series of moves] which restored stability to the rupiah and allowed a buildup in reserves which are now higher than a year ago (World Bank, 2006). Given those unique arguments, these two policies (oil and interest rates) are lively debated and strongly hypothesized to affect the Indonesia cocoa exports and production, as controversial issues in Indonesia. Based on these issues, the specific objectives of this research part are two : (1) analyzing the factors responsible for the Indonesian cocoa demand, (2) assessing the impact of oil prices and interest rates policies on Indonesia cocoa exports and production.

2. Indonesian Cocoa Development : A Brief Overview

2. 1. Area, Production and Export

The government policy accelerated cocoa development particularly through the national projects. At the time (1993) the total area of Indonesia cocoa was recorded 535,285 ha. Then, the total area in 2000 covered 754,336 ha and 1,167,046 ha in 2005. Within this period, the growth rate of cocoa area in Indonesia was ranging 4.68%-12.10% and its average by 8.32% or around 951,155 ha, a substantial growth for Cocoa Tree Crop in land competition. Regionally, in 2005 the cocoa area expansion in Indonesia mainly occurred in Sulawesi Island reached 63.98% with the biggest composition in South Sulawesi of 19.26%, Southeast Sulawesi of 16.85%, Center Sulawesi of 14.96%, West Sulawesi of 11.32%, North Sulawesi of 0.91% and Gorontalo of 0.68% [**Table 1**]. This indicates that Sulawesi Island has the highest contribution of 63.98% of the total cocoa area in Indonesia. It also conveys a message that if the government consider an economic policy for cocoa, it should be noted here that Sulawesi Island must be given priority to think. Another ways, if the

Table 1. Indonesia Cocoa Area by Province (Hectare), 2000-2005

Nu	Province	2000	2001	2002	2003	2004	2005 & Its %	
1	Aceh Darussalam	22,550	19,850	22,166	18,099	28,505	36,309	3.11
2	North Sumatera	61,150	61,813	61,858	59,991	64,043	70,160	6.01
3	West Sumatera	10,087	12,411	13,560	12,912	18,539	22,828	1.96
4	Riau	5,462	4,458	4,460	4,498	4,868	4,904	0.42
5	Jambi	1,001	2,965	2,971	1,791	1,354	1,220	0.10
6	South Sumatera	383	290	260	347	641	2,325	0.20
7	Bengkulu	20,867	12,651	16,477	12,305	11,535	13,371	1.15
8	Lampung	14,917	21,217	22,639	28,892	29,278	34,965	3.00
9	Bangka Belitung	282	322	326	325	264	160	0.01
10	Riau Kepulauan	0	0	0	0	1,454	979	0.08
11	West Java	13,030	13,661	9,658	10,427	10,402	10,215	0.88
12	Center Java	5,569	7,157	7,218	6,894	7,115	6,911	0.59
13	D. I. Yogyakarta	3,008	3,108	2,957	3,014	3,079	3,188	0.27
14	East Java	30,748	34,040	34,190	34,431	18,919	26,041	2.23
15	Banten	4,044	5,184	5,184	3,402	4,759	5,020	0.43
16	Bali	6,564	6,692	7,070	7,660	8,783	9,500	0.81
17	NTB	3,907	3,971	3,870	3,948	4,047	4,319	0.37
18	NTT	31,595	34,585	39,449	33,946	37,882	39,996	3.43
19	West Kalimantan	8,199	8,675	9,821	8,710	10,345	8,617	0.74
20	Center Kalimantan	1,615	600	896	676	1,148	1,441	0.12
21	South Kalimantan	2,511	653	678	3,515	2,181	2,144	0.18
22	East Kalimantan	32,444	34,274	31,697	32,927	36,722	37,948	3.25
23	North Sulawesi	5,536	7,310	7,310	10,084	10,569	10,566	0.91
24	Center Sulawesi	83,462	83,850	119,678	142,577	173,065	174,592	14.96
25	South Sulawesi	205,150	250,019	284,981	296,039	217,399	224,743	19.26
26	Southeast Sulawesi	117,415	121,228	131,974	136,345	175,349	196,626	16.85
27	Gorontalo	3,095	4,090	4,194	4,864	7,000	7,886	0.68
28	West Sulawesi	0	0	0	0	132,100	132,100	11.32
29	Maluku	6,060	10,204	10,204	18,623	9,918	11,341	0.97
30	Papua	27,103	27,156	29,396	30,695	18,807	19,575	1.68
31	North Maluku	26,582	29,015	28,992	31,070	32,570	33,972	2.91
32	West Irian Jaya	0	0	0	0	8,319	13,084	1.12
	INDONESIA (Growth in %)	754,336	821,449 (8.17)	914,134 (10.14)	959,007 (4.68)	1,090,959 (12.10)	1,167,046 (6.52)	100.00

Source: Ministry of Agriculture [Basis Data]; Total [Indonesia], percentage by province in 2005 and growth rate of area per year were calculated by the Author. Number 23-28 are provinces in Sulawesi Island.

cocoa area in Sulawesi Island is going down, we may say that the cocoa area in Indonesia is also decreasing quickly. However, there is also a contribution of the other provinces namely North Sumatra of 6.01%, East Kalimantan of 3.25%, Nusa Tenggara Timur of 3.43%, Aceh of 3.11%, Lampung of 3.00% and East Timur of 2.23%.

These areas were 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. The growth of smallholder area was higher with an average of 7.8 percent per year (CRIEC & World Bank, 2002).

The Indonesia cocoa production increased from 421,142 tons in 2000 to 748,828 tons in 2005. Within this period the average growth rate of production was 10.49% a year. Similarly, the cocoa production increasing followed the increasing of cocoa area. Up to 2005, the cocoa production expansion in Indonesia also mainly occurred in Sulawesi Island reached 71.73% with the biggest composition in Center Sulawesi of 20.35%, South Sulawesi of 19.94%, Southeast Sulawesi of 17.73%, West Sulawesi of 12.88%, North Sulawesi of 0.42% and Gorontalo of 0.41% [**Table 2**].

In other words, consistent to the cocoa area contribution that Sulawesi Island also has the highest contribution of 71.73% of the total cocoa production in Indonesia. It means that Sulawesi Island plays a crucial role in Indonesia cocoa trade (Arsyad et al., 2007). Therefore, if the government is considering the cocoa economic policy, it should be noted here again that Sulawesi Island must be priority to think. If the cocoa production in Sulawesi Island is disturbed, that might lead to Indonesia cocoa production unstability. This is the reason why in developing Indonesian cocoa, Sulawesi Island can not be neglected in policy decision making.

Another interesting point is the growth rate of production side. Even though the growth in 2001 was 21.55%, but one year later (2002), it significantly declined by 6.01% as we can check in **Table 2**. Similarly, although the growth of production in 2003 also increased by 18.07%, but it strongly contrast to 2004 which has negative growth (−0.79%), a substantially negative growth for Indonesian cocoa during over the past two decades of development cocoa process, whereas the growth rate of cocoa area increased at the time around 12.10%. However, the cocoa production growth persuasively shows that its increasing reached of 7.63% in 2005.

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 re-

Table 2. Indonesia Cocoa Production by Province (Ton), 2000-2005

Nu	Province	2000	2001	2002	2003	2004	2005 & Its %	
1	Aceh Darussalam	10,642	10,634	12,615	11,273	13,055	16,374	2.190
2	North Sumatera	45,718	49,566	49,690	48,190	48,084	53,734	7.180
3	West Sumatera	4,865	7,332	7,481	7,930	8,014	14,068	1.880
4	Riau	2,678	1,113	1,135	2,819	3,700	3,728	0.500
5	Jambi	232	622	619	370	286	330	0.040
6	South Sumatera	72	139	135	132	133	262	0.030
7	Bengkulu	1,821	2,121	2,977	2,229	4,999	5,200	0.690
8	Lampung	6,217	9,842	10,962	16,368	17,204	17,737	2.370
9	Bangka Belitung	47	53	44	45	47	36	0.004
10	Riau Kepulauan	0	0	0	0	214	214	0.030
11	West Java	3,649	4,220	3,620	4,710	5,478	3,861	0.520
12	Center Java	1,089	2,151	2,336	2,027	2,635	2,864	0.380
13	D. I. Yogyakarta	255	255	320	318	438	486	0.060
14	East Jawa	14,618	15,332	15,364	15,650	6,319	8,244	1.100
15	Banten	804	996	1,473	494	1,753	1,519	0.200
16	Bali	4,424	4,818	5,388	6,039	6,119	7,100	0.950
17	NTB	579	781	1,554	1,668	1,738	1,696	0.230
18	NTT	4,495	5,323	6,097	9,383	13,963	14,970	2.000
19	West Kalimantan	1,246	1,626	1,903	1,864	1,998	1,969	0.260
20	Center Kalimantan	44	9	11	24	232	288	0.040
21	South Kalimantan	201	121	129	294	428	333	0.040
22	East Kalimantan	12,247	21,214	21,888	22,013	18,554	25,072	3.350
23	North Sulawesi	2,376	1,060	1,488	4,798	3,194	3,141	0.420
24	Center Sulawesi	60,453	56,825	59,294	117,080	149,085	152,418	20.350
25	South Sulawesi	151,630	225,289	232,850	282,692	153,122	149,345	19.940
26	Southeast Sulawesi	70,291	80,946	94,843	99,471	100,966	132,740	17.730
27	Gorontalo	251	1,254	1,561	2,086	2,783	3,054	0.410
28	West Sulawesi	0	0	0	0	96,483	96,481	12.880
29	Maluku	848	4,764	4,764	7,264	6,276	4,947	0.660
30	Papua	13,596	13,596	15,495	18,068	9,237	11,362	1.520
31	North Maluku	5,754	14,802	15,119	11,867	12,267	11,879	1.590
32	West Irian Jaya	0	0	0	0	2,900	3,376	0.450
	INDONESIA (Growth in %)	421,142	536,804 (21.55)	571,155 (6.01)	697,166 (18.07)	691,704 (−0.79)	748,828 (7.63)	100.000

Source: Ministry of Agriculture [Basis Data]; Total [Indonesia], percentage by province in 2005 and growth rate of production per year were calculated by the Author. Number 23-28 are provinces in Sulawesi Island.

spectively (CRIEC & World Bank, 2002). ASKINDO[4] hoped, for the Indonesian government policy to shift the position and to make the country the biggest cocoa producer in the world.

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 (Panlibuton & Lusby, 2006).

Indonesian government also has been encouraging cocoa export capacity. If we look at Indonesian export development, there is a 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 destinations also soared. Up to 1996, number of export destination was only recorded of 28 countries, and in May 2007 reached 49 countries. The Indonesia primary cocoa export increased from 393,000 tons in 2001 to 612,000 tons in 2006. Within this period the average growth rate of export was 11.30% per year [**Table 3**]. While the export value of cocoa was ranging US$ 320-855 millions during 2001-2006 with the average growth was 31.24% per year, a substantial growth for Indonesian cocoa exports [**Table 4**].

In national level, the average growth of Indonesian primary export commodity was 18.97% during 2001-2006. Then, the total export value of the commodity reached by 12,044 US$ millions in 2006. From this figure, cocoa export value was the third largest contributor (7.09%) or around US$ 855 millions after rubber (35.88%) or around US$ 4,322 millions and crude palm oil (40.00%) or around US$ 4,818 millions. However, another interesting point is if we look at the average growth of export volume [see **Table 3**], cocoa growth was larger by 3.09% than rubber, although still smaller by 10.12%

4) 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 the farmers and government. For instance, when the Indonesian Government planned the imposition of export tax on cocoa, the association has reiterated its opposition to the planning. The reason is that the tax would be an additional burden to the smallholders.

Table 3. Export of Estate Primary Commodity (000 Ton)

Commodity	2001	2002	2003	2004	2005	2006	Growth (%/year)
Rubber	1,551	1,496	1,650	1,866	2,025	2,287	8.21
Coconut Oil	395	493	365	447	752	502	11.74
Coconut Dregs/Bungkil	259	305	271	267	323	238	−0.04
Crude Palm Oil	4,903	6,334	5,743	8,662	10,376	12,101	21.42
Nucleus Palm Oil	582	738	582	904	1,043	1,274	19.70
Palm Dregs	810	816	717	1,367	1,638	1,560	18.87
Coffee	251	325	324	344	446	414	11.56
Tea	100	100	88	99	102	95	−0.67
Pepper	54	63	52	34	35	37	−5.35
Tobacco	43	43	41	46	54	52	4.25
Cocoa	393	469	358	367	464	612	11.30
Cashew	41	52	60	59	69	69	11.50
Others	302	423	433	367	614	613	18.87
TOTAL	9,688	11.657	10.684	14.829	17.941	21.378	18.18

Source : Statistik Perkebunan Indonesia 2004-2006, Renstra Pembangunan Perkebunan 2005-2009.

Table 4. Export Value of Estate Primary Commodity (US$ Millions)

Commodity	2001	2002	2003	2004	2005	2006	Growth (%/year)
Rubber	787	1,038	1,494	2,165	2,584	4,322	41.47
Coconut Oil	112	112	154	265	414	271	26.25
Coconut Dregs/Bungkil	15	22	20	24	25	16	5.15
Crude Palm Oil	1,081	2,092	2,185	3,442	3,756	4,818	38.58
Nucleus Palm Oil	146	256	233	503	588	616	40.78
Palm Bungkil	24	28	40	77	69	68	28.04
Coffee	186	224	259	294	504	589	27.57
Tea	101	103	96	116	121	135	6.38
Pepper	100	81	93	56	58	77	−1.53
Tobacco	91	77	63	67	107	103	5.75
Cocoa	391	701	622	320	668	855	31.24
Cashew	29	35	43	58	81	69	20.65
Others	92	149	108	119	150	105	8.14
TOTAL	5,156	6,920	7,413	9,510	11,130	12,044	18.97

Source : Statistik Perkebunan Indonesia 2004-2006, Renstra Pembangunan Perkebunan 2005-2009.

than crude palm oil.

2. 2. Advantage and Disadvantage

Although, most of smallholder cocoa bean categorize as unfermented bean, it need improvement in quality. The quality of cocoa bean have produced by the farmers are very poor. Water contain cocoa bean in the farm level is still high around 15-27%, foreign matter of 5%, moldy bean 4-5% (CRIEC & World Bank, 2002). This is the reason why the Indonesia cocoa beans are hit by an automatic detention in export destination countries around US$ 50/Ton.

Therefore, the quality of Indonesia's cocoa especially that is produced by smallholder is considered an important issue by ASKINDO[5] and the government. A large proportion of cocoa produced 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[6] (Akiyama & Nishio, 1996).

Dealing with Indonesian cocoa, Akiyama & Nishio has also identified the 'adding-up' problem[7] on Indonesian cocoa. They explained that the government concerned to Indonesia's

5) See foot note 4 on page 8.

6) Much of the world's cocoa is traded commercially on contract terms with standards of "Good Fermented" (up to 5 percent unfermented/slaty and 5 percent of other defects permitted) or "Fair Fermented" (up to 10 percent of each defect permitted. Sulawesi cocoa often has levels of unfermented/slaty beans in excess of 10 percent. Most West African cocoa has zero levels of unfermented beans on these same commercial contracts (Akiyama & Nishio, 1996).

7) 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 ↗

rapid increasing cocoa production will depress world cocoa prices, which would be detrimental to the welfare of Indonesian cocoa producers. Furthermore, because lower world cocoa prices would hurt other cocoa producing countries which are concerned about the future of Indonesia's cocoa production. The 'adding-up' problem, i.e., 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 (see Akiyama & Larson 1994) could become an important issue for Indonesia in the near future (Akiyama & Nishio, 1996) unless we do not identify the way out of the problem. As a next result, Indonesia farm gate price become lost significantly due to low beans quality issue. 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.

However, Indonesia's biggest competitive advantages include its low cost, high production capacity or availability of supply, efficient infrastructure and open trading/marketing system or 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 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 poverty in the country.

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 sup-

↘ Development Economics Vice Presidency of The World Bank, No 13, 1996. Does the "adding-up problem" add up ?].

port as no export tax and the devaluated exchange rate for keeping competitive ; and (9) high motivated entrepreneur of Bugis Tribal 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 plantation, together with a plentiful supply of labor (Gray, 2001).

3. The Model

In order to get the research objectives, an Econometric Model is used in the research. There are three subsequent steps are undertaken in modeling. They are (1) model construction, (2) model identification and estimation, (3) model validation and simulation. However, the model reconstruction has been repeated until the results of estimation are generally applied to the economic theory. This condition is aimed to fulfill the economic, statistic, and econometric criterions in constructing the relationship between variables in the model. Then, 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, while cocoa production in other provinces are a residual and they are formed as an identity equation [see $QKPL_t$ on Equation (13)]. Considering cocoa as a market commodity in which strongly related to the changes of another factors simultaneously, such as demand, supply, price, income, etc., we construct the simultaneous equation model in the research.

3. 1. Model Construction

The model has been constructed based on the economic theory which is expected to show the economic phenomenon of Indonesia's cocoa clearly. Hypothetical relationship between variables in the model can be seen in **Figure 2** [page 14] whose arrows which indicates the influence direction among variables.

Cocoa Harvested Area

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

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

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

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

Cocoa Yield

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

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

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

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

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

$$PMIN_t = j_0 + j_1 HKINt + j_2 UPSI_t + j_3 PKAP_t + j_4 HBBM_t + j_5 PMIN_{t-1} + U_{10} \quad \cdots\cdots (16)$$

World Cocoa Export

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

World Cocoa Import

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

World Cocoa Price

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

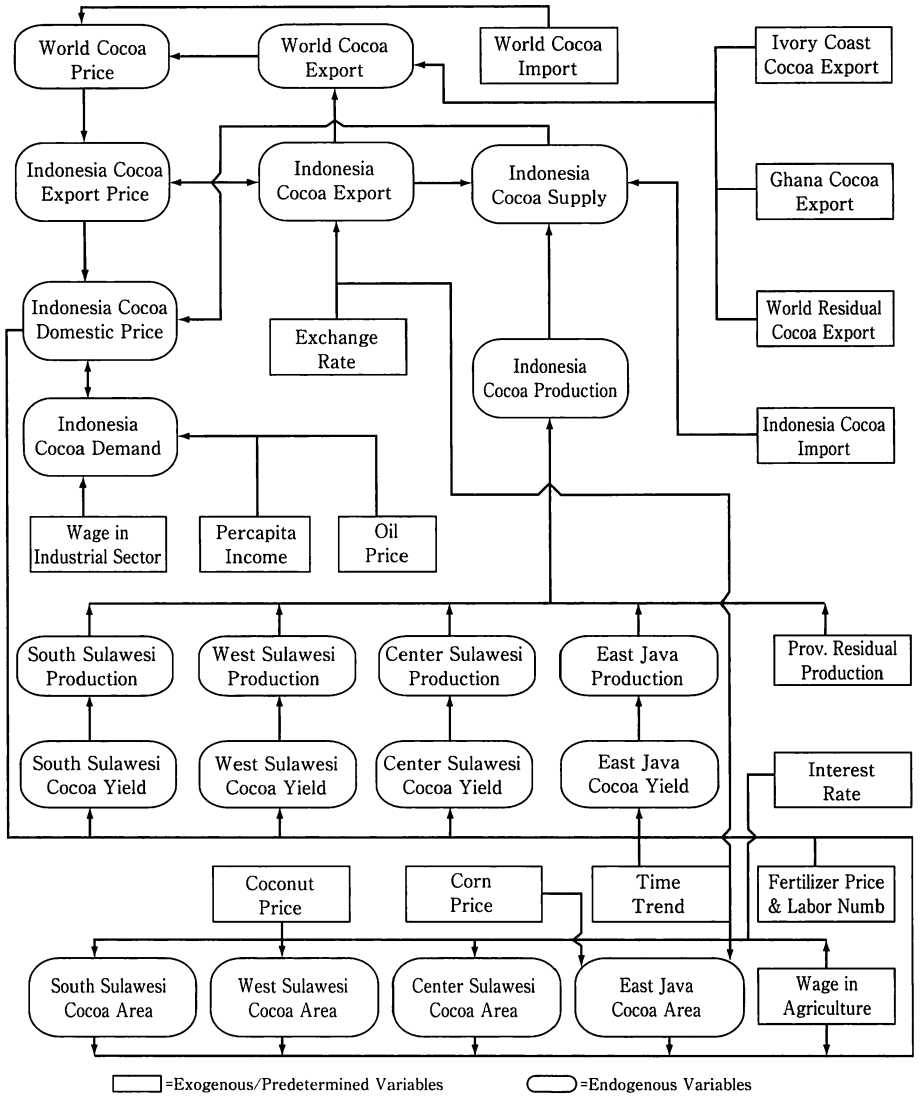
Indonesia Cocoa Export Price

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

Indonesia Cocoa Domestic Price

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

Figure 2. Hypothetical Relationship between Variables in the Model



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 provinces/residual (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 in 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 countries/ world residual (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

The term "identification" was originally used to denote a possibility of deducing the values of structural parameters from the reduced form parameters (Sinaga, 1989). 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. Sinaga (1989) emphasized that identification is logi-

cally 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 the research, 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 can 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 is, as Sinaga (1989) explained, that 3SLS method is sensitive to the specification changes, since a change of specification anywhere in the system affects all the parameter estimates. Moreover, 2SLS provides a very useful estimation procedure for obtaining the values of structural parameters in overidentified equations (Pindyck & Rubinfeld, 1998).

3. 3. Model Validation and Simulation

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 phenomenon in the real world, particularly to construct the policy simulation process.

In the research, the validation criterion formulas are RMSPE and U-Theil from Pindyck & Rubinfeld. U-Theil values always falls between 0 and 1. If $U=0$, $Y_t^s=Y_t^a$ for all t and there is a perfect fit, but if $U=1$, the predictive performance of the model is as bad as it could be possibly be (Pindyck & Rubinfeld, 1998). Then, the smaller both $RMSPE$ and U values, the estimated model is valid for simulation process.

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

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

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

The last stages for the analysis is policy simulation. The simulation can help to explain the cocoa economic behavior and its response to an economic shock or policy. As we explained in the objectives part, there are two policies are simulated in the research i.e. oil prices on Equation (16) and interest rates on Equations (1), (2), (3) and (4). We do it respectively into policy simulation process by changing the magnitude of exogenous variables [oil and interest rates], until we get the dynamic impact of both policies. Unfortunately, we do not simulate the magnitude of policy gradually, but stick one point [oil price policy by 30% and interest rate decreasing policy by 20%] with considerations below :

1. Firstly, by March 01,2005 the Indonesian government issued the increasing of domestic oil price by 30%, and in May 2008, the goverment replanned the same increasing rate (around 30%). The impact of the policy has been properly emphasized in this paper. In the research, we simulate the diesel fuel price increasing. The reason is that the fuel is strongly used by the trucks to transport the cocoa from the rural agriculture area (smallholders and/or brokers) to urban area (wholesalers and/or exporters), and it should be noted here that they can not avoid the skyrocketing oil prices.
2. Secondly, the Indonesian government also has been providing the farming credit as a financial support in order to accelerate the domestic production of agriculture. This policy, however, became lively debate in Indonesia due to the credit payback failures by the farmers for the last view years. In this paper, for giving an academic reason into debate, we also explained the dynamic impact of interest rates policy on cocoa export and production as well as the best policy alternative by sticking the simulation magnitude of 20%.

4. Results and Discussion

4. 1. An Overall Picture of the Model

In this part, we are going to present an overall picture of the model by using standard

statistics criterion to make sure that the results of estimates are generally applied to the economic theories or hypothesis. Firstly, the estimation results shows that the coefficient of determination [*hereafter,* R^2] reached of 0.981. This figure tells us that 98.10% of the total variance of the endogenous variable, in general, can be explained so fairly robust by the all explanatory variables. In other words, there is no large space (only 1.90%) for adding the additional variables in order to explain the cocoa economic behavior in the country. Secondly, the result of estimates also shows that all variables of the behavioral equations indeed have an expected both sign and magnitude from the economic theory side. What we have been emphasizing in developing model is regard to the economic theory. The principal reason is that even if the constructed model is statistically quite satisfactory but it violates the economic theory, we may say that its results would not have the meaningful explanation from the economic viewpoint, whereas the economic relationship between variable in the model are necessary [see **Figure 2** on page 14].

Thirdly, the t-test presents 75.81% of the explanatory variables significantly influenced. Besides of 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 institutional. Then, both the Short and Long run Elasticities are calculated by using mean values of the variables.

Fifthly, another essential criterion is Root Mean Squares Percent Error (RMSPE) and U-Theil Coefficient (U-Theil) as validation criterion in order to know the predictive performance of the model in **Table 4**. These criteria shows that among 21 of the endogenous variables, only one variable has RMSPE of more than 50%. 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 Indonesia.

4. 2. Indonesia Cocoa Demand

If we look back on Equation (16), it shows that there are five explanatory variables which significantly influence Indonesia cocoa exports. They are Indonesia cocoa price, wage in industrial sector, per capita income, oil price and lag cocoa demand. These five variables could explain 98.59% of Indonesia cocoa demand behavior [R^2 in **Table 5**]. This percentage believes us that around 98.59% of the total variance of cocoa demand were co-

Table 4. 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

vered by these five explanatory variables. From that situation, practically, there is very little chance (only 1.41%) for adding another explanatory variable in order to deeply study the cocoa demand behavior and coefficient of determination as well as to decide a policy direction.

An interesting point is elasticity values. Both short run and long run period, Indonesia cocoa demand [consumption] is inelastic to the changes of those five explanatory variables [**Table 6**]. For instance, based on the magnitude of Indonesia cocoa price, clearly, we could explain that a 1.00% of cocoa price increase will only decrease in cocoa demand of 0.30% in the short run and 0.35 percent in the long run.

These findings support the Indonesian cocoa economic fact today. Firstly, Indonesian government, Research Institute for Cocoa, Non—Government Organization and ASKINDO[8] are promoting cocoa downstream industries in order to create an added value and new source of employment in the country. Secondly, Indonesia cocoa exports (raw beans) are slowly diverted to processed cocoa products including powder, paste/liquor, cake and butter. The principal reason is that Indonesia cocoa beans are hit by an automatic detention

8) See foot note 6 on page 8 for this.

Table 5. Parameter Estimates for Indonesia Cocoa Export[9] and Its Demand

No	Endogenous and Explanatory Variables	Parameter Estimates	t for H_0	
1	$XKIN_t$=Indonesia cocoa exports			
	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			
2	$PMIN_t$=Indonesia cocoa demand			
	Intercept	47.968296	4.211	
	$HKIN_t$	−0.000014673	−3.304	(A)
	$UPSI_t$	−0.011889	−2.099	(A)
	$PKAP_t$	12.850361	4.032	(A)
	$PMIN_{t-1}$	0.165903	0.0770	(D)
	R^2=0.9859 ; F-value=228.20 ; DW=2.51			
3	$PNIN_t=QKIN_t-XKIN_t+MKIN_t$			
4	$XKKD_t=XKIN_t+XKPG_t+XKGA_t+XKNL_t$			
5	$MKKD_t=MKBL_t+MKUS_t+XKNL_t$			
(A) at α=0.10 and (D) at 0.25, required for another equations				

around US$ 50/Tons in export destination countries or main importer countries due to low beans quality.

Similarly, wage in industrial sector and per capita income. The changes of wage in industrial sector can not strongly influence cocoa demand by downstream industries [**Table 6**]. This is a logic finding. Demand linkage of the community to cocoa in the country is processed cocoa (not beans). Another ways, cocoa demand (consumption) by the society is through cocoa downstream industries in which need employees. Therefore, even if the wage in industrial sector is going up by 1%, it can only decrease cocoa demand by industries of 0.43% in the short run and 0.53% in the long run [see elasticity coefficient in **Table 6**]. Then, although our hypothesis expect that per capita income influence the cocoa demand, but Indonesia cocoa demand is inelastic to the changes of per capita income [short run elasticity =0.67 and long run elasticity =0.80]. This finding is supported by PPSEP (1998) and Muharminto et al. (1996). PPSEP calculated that Indonesia cocoa consumption [per capita] is still very low about 0.1 kg per year, compared to Western Europe and USA reached respectively 1.9 kg per year and 1.0 kg per year, while Muharminto et

9) Indonesia cocoa exports performance and its economic behavior have been intensively discussed in Arsyad (2007).

Table 6. Elasticity of Cocoa Export and Demand Equations

No	Endogenous and Explanatory Variables	Elasticity	
		Short Run	Long Run[10]
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 in industrial sector ($UPSI_t$)	−0.437	−0.523
	Per capita income ($PKAP_t$)	0.668	0.800

al. pointed out that those downstream industries products are generally consumed by middle and higher income society. However, if we compare those explanatory variables in the equation model i.e. cocoa prices, wages in industrial sector and per capita income, we may say that the changes of per capita income is more strongly influence to the Indonesia cocoa demand than both price and wage. This indicates that if the government decides to make policy dealing with cocoa demand, it should be concerned to the society income. Another ways, both price and wage can not be strongly expected yet to stick a policy direction in order to push cocoa demand in the country.

4. 3. Cocoa Price Linkage

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. One of the most important structural equations in the model is price behavior, as can be seen at Equation (19) up to Equation (21) whose parameter estimates clearly shown in **Table 7**. 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% 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

10) Long run Elasticity is Short run Elasticity divided by the coefficient of adjustment. The author did not able to calculate the Long Run Elasticity Coefficient for some behavioral equations due to those equations has not the lag endogenous variables in the model.

Table 7. 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 8. Elasticity of Cocoa Price Equations

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

value in **Table 8**].

Meanwhile Equation (21) shows that domestic price is mainly influenced by export price, and ratio of supply to demand (R^2 = 78.43%). If we look at its elasticity value [**Table 8**], one thing could be recognized is that unlike export price, domestic price is more responsive to the changes of cocoa export price. Besides, on the side of elasticity, we may say that the increasing of export price by 1.00% resulted in the increasing of domestic price

11) See footnote 10 on page 21 for this.

1.97% in the short run and 3.11% in the long run period.

These findings indicates that the 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 or 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 8**]. This empirical result persuasively shows that domestic price is dominantly influenced by the export price and exchange rate, compared to the changes in 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% of its value), followed by remarkable inflation (also reached 80%), 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 (Gray, 2001). What we can know 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 the cocoa smallholders got a booming profit from the economic crisis in Indonesia.

4. 4. Impacts of Oil Price and Interest Rate

In this section, we are going to emphasize the impact of oil price and interest rate policies after doing the simulation procedure. In order to get the research objective, we did policy simulation by increasing oil prices of 30% on Equation (16) and decreasing interest rates of 20% on Equations (1), (2), (3) and (4) respectively. 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 impacts simulation are shown as follows :

i) **Impacts of oil price increasing policy of 30%.** The policy decreased domestic cocoa demand. In other words, oil price increasing can be expected to decrease domestic cocoa demand. As a result, domestic cocoa price depressed of 0.16%. Another ways, oil price increasing policy or price subsidy decreasing on oil can be expected to depress

the price domestic even if the percentage is relatively low. This finding is consistent to Astana's study (2003) on Indonesian plywood. He pointed out that the price subsidy decreasing on oil can be expected to decrease plywood price in the country, although with small percentage around 0.75%.

However, it should be noted here that the cocoa price decreasing has negative impact to alleviate cocoa harvested area in the research regions i.e. West Sulawesi of 0.03%, Center Sulawesi of 0.31% and East Java of 0.02% due to the farmers did not interested to expand the area. Furthermore, this situation also has substantial impact to depress cocoa yield in West Sulawesi of 0.02%, Center Sulawesi of 0.01% and East Java of 0.15%. Its next implication is cocoa production in all research regions also depressed, except for South Sulawesi.

Put it in national way, oil prices increasing policy indeed has strongly negative impact to decrease Indonesia cocoa production by 1.04% per annum or around 1,725 Ton per annum which is contributed by smallholders of 88% or around 1,518 Ton (data in 2000). Similarly, the policy also has depressed cocoa exports by 1.03% per annum or around 2,247 Ton per annum. Then, if we convert it to the export value by using mean of world price, the policy is strongly losing by US$ 3.73 million per annum, a potential loss of foreign exchange components. This could be direction that if we are constantly expecting to maintain the export and production sustainability, the government should avoid this type of policy in the future.

ii) **Impacts of interest rate decreasing policy of 20%.** Unlike oil price increasing policy, this policy (interest rates decreasing) can stimulate the cocoa farmers to expand their cocoa plantation area in all research regions, namely South Sulawesi of 0.66%, West Sulawesi of 1.58%, Center Sulawesi of 0.04% and East Java of 0.05%. Then, it strongly push cocoa yield in each region or province. Therefore, cocoa production substantially increases of 7.14% in South Sulawesi, 0.82% in West Sulawesi and 0.03% in Center Sulawesi. In the macro level, this situation has potential impact to increase the national cocoa production by 0.48% per annum or around 1,047 Ton per annum. Another impact possibility by pushing production is that the national cocoa exports also soar by 0.08% per annum or around 133 Ton per annum whose value about US$ 221,046. This finding is very strongly supported by some researchers. Firstly, it is consistent to Kariyasa's conclusion (2003) on corn commodity. By using time series data and dynamic model, he found that an interest rates declining through subsidy can be expected to increase corn yield in Indonesia.

Secondly, Mellor (2004) says that interest rates are particularly important to high

rates of agricultural growth. Credit is needed to finance the agric-businesses that are vital to growth in the high value agricultural commodities. High interest rates inhibit that growth. Credit is also important to farmers to finance the high operating capital requirements for purchased inputs in horticulture and for animals in livestock production. Particularly if the government expenditure is substantially deficit the burden falls on the Central Bank to contain inflation with high interest rates. International organizations, perhaps with foreign capital flows in mind, generally favor high interest rates. That conjunction of pressures is deleterious to high rates of agricultural growth. It appears that macro policy in Indonesia is in fact moving quickly to lower interest rates.

Thirdly, Salam & Abbas (2004) in their research used Working Capital term. They pointed out that working capital is a cash used by farmers to run the rice farming; for example cash for buying chemicals, fertilizer, hired-labor costs, etc. In actual situation the farmers in the research sites get their working capital by various sources such as capital accumulation from the previous season, borrowing from other farmers, neighbors, and relatives or borrowing fertilizer, for instance from 'Toko Tani'. Other forms of lending institution are government-supported credit and commercial credit issued by private and state banks. Their research also substantially supports Mellor's statements (2004) that competition among credit institutions is also important. Many institutions with many branches lead to lack of scale economies. That must be managed by credit institutions offering a wide range of service, certainly including both lending and deposit mobilization in order to increase the scale of business. Again, the public sector, most likely the Central Bank needs to understand these rapid rising needs for financial institutions in the rural sector, and act to encourage the needed offering of competitive services. Government also has an important role in monitoring operation of the credit system and may need to take special steps to ensure a full range of credit institutions.

What is made clear by these above findings are that the farming credit with lower interest rates can be expected to increase a national cocoa exports and production in order to shift the position and to make the country the biggest cocoa producer in the world.

5. Conclusion Remarks and Policy Response

Indonesia cocoa demand is strongly influenced by the Indonesia cocoa price, wage in industrial sector, per capita income, oil price and lag cocoa demand. An interesting point

is that both in the short run and long run period, Indonesia cocoa demand is inelastic to the changes of those five explanatory variables. Then, Indonesia cocoa exports (raw beans) are slowly diverted to processed cocoa products including powder, paste/liquor, cake and butter. The principal economic reason is that Indonesia cocoa beans are hit by an automatic detention in export destination countries due to low beans quality. Demand linkage of the community to cocoa in the country is processed cocoa (not beans). Another ways, cocoa demand by the society is through downstream industries in which need employees. Therefore, even if the wage in industrial sector is going up, it can not strongly decrease cocoa demand by industries. However, the changes of per capita income are more strongly influence to the Indonesia cocoa demand than both cocoa prices and wages. In other words, if the government decides to make a policy instrument dealing with cocoa demand, it should be concerned to the society income. Its implication response is that both price and wage can not be strongly expected yet to stick a policy direction in order to push cocoa demand in the country. To end up, this study already proves that an increasing oil price has brought about a substantially negative impact to decrease both Indonesia cocoa exports and production. Meanwhile interest rates decreasing policy could be expected to encourage both export and production. However, if the government is afraid to the lower interest rates due to it perhaps has a significantly negative impact to the other economic sectors, another possibility is, we are strongly offering a subsidy policy on both oil prices and interest rates for the cocoa farmers in order to increase Indonesian cocoa exports and production.

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