THE INFLUENCE OF RUBBER PRICE FLUCTUATION ON THE PERFORMANCE OF SMALLHOLDER RUBBER PLANTATION IN CENTRAL KALIMANTAN, INDONESIA

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Abstract: The fact is that today the price of rubber in the international market fluctuates every year. These conditions indicate the magnitude of the risks faced by rubber farmers. This research relates to the symptoms implementation of the Clean Bokar Program, as well as its impact on the household economic behavior of rubber farmers. The purpose of this study is to identify the profile of rubber plantation business in Central Kalimantan, to assess the performance of the farmers as a result of international rubber price fluctuations, and to analyze the policy simulation of bokar (pre-processed rubber) price enhancement at the farm level on the economic performance of rubber farmer households. The samples were determined by using the disproportionate stratified random sampling method. The data was processed with SAS program (Statistical Analysis System). The results show that the plantation sub-sector has a relatively large contribution to the agricultural. This fluctuating international rubber prices have a significant effect on the activity and production decisions of both rubber farmer groups and rubber farmer households. In addition, the obvious effects are the reduction in the type of products produced, in the working time of the head of the households, and in the type of farming input. The 30 percent increase in bokar price policy simulation (at the farm level) has increased the rubber latex productivity by 22,504 percent in which the total bokar production increased by 25,383 percent. This means that a 30 percent increase in bokar price (at the farm level) increase.

*Key-Words***:** *Rubber Price, Farmer Performance, Households Economy, Production Decision.*

1 Introduction

Rubber is a plantation commodity that has a very important role in Indonesian economic activities. This commodity is a source of employment for around 1.4 million households (*Kepala Keluarga* or KK). Rubber also provides a significant contribution as one of the non-oil and gas foreign exchange revenues, rubber raw material suppliers which plays an important role in driving the growth of new economic centers in rubber development areas. As foreign exchange revenues, rubber has a big contribution to farmers' households and the country in general [1].

Based on its development, since and up to 1998, rubber was the largest foreign exchange revenues in the plantation sub-sector with a value of US $ 1.1 billion. However, it dropped to the second position after the palm oil valued by US $ 1.4 billion (the export value of palm oil reached US $ 2.4 billion) in 2003. In 2005, the foreign exchange revenues from rubber commodities reached US $ 2.6 billion or around 5% of non-oil and gas foreign exchange revenues. Besides that, large companies who engaged in the rubber sector also contribute to the country in the form of various types of corporate taxes and levies [2].

Even though nationally the roles and responsibilities of the rubber plantation sub-sector provide a large income contribution to the state's foreign exchange, the development of the rubber agribusiness still does not seem to provide an adequate income and welfare for the people. Its great economic potential and strengths have not been able to be managed properly by contributing to national development and improving the standard of living and welfare of the people, especially rubber farmers who are predominantly managed by the people itself. This also affected and caused economic disparities for farmers in Central Kalimantan. This gap is a big responsibility to realize an economic prosperity especially for rubber farmer households.

Recently, the rubber price in the international market is very fluctuating. For farmers, the price of rubber is an economic factor which determines their decision-making to produce. Based on the data of the rubber price survey obtained from the Central Kalimantan Plantation Agency for the last 10 (ten) years, it is known that the rubber prices from 2005 to 2014 are varied up and down, both in the production of smoke sheet/RSS, slabs, and bowl lumps. Therefore, the purpose of this study is to (1) to identify the profile of rubber plantation business in Kapuas, Central Kalimantan, (2) to assess the

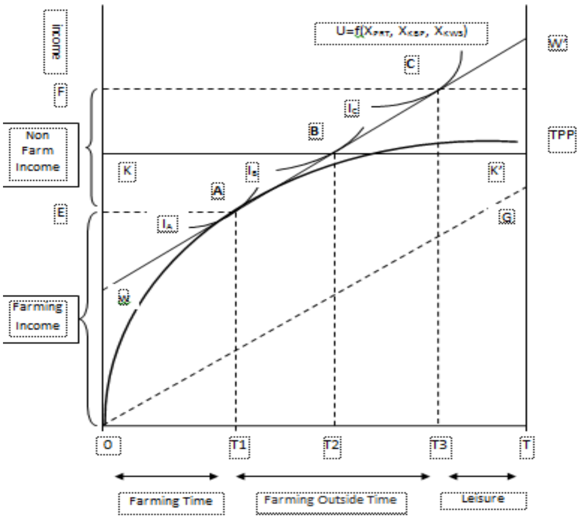
performance of the farmers as a result of international rubber price fluctuations, and (3) to analyze the policy simulation of *bokar* (pre-processed rubber) price enhancement at the farm level on the economic performance of rubber farmer households.

2 Theory

The household of rubber farmers as an economic unit has a pattern of decision making that is simultaneously related to decisions in production and decisions in consumption [18]. Therefore, the study of farm household economic behavior due to product price fluctuations does not only use a conventional economic approach that examines production and consumption activities partially but also uses a basic model of economic analysis of agricultural households [18]-[19].

The research framework to answer the problems faced by rubber farmer households is to approach the agricultural household models (agricultural household models). The model was put forward by Becker [6] as the basis for the formation of the household model, followed by the assumption that the determinant of household decisions was determined by the head of the household. In general farm households maximize utility by constraints of production functions, constraints on the amount of time available, and income constraints [32].

The household economic model of rubber farmers is developed based on the concept of utility maximization with the constraints of total time available, production functions, and income constraints. The conceptual framework of the household economic model of rubber farmers is an interrelated system as presented in Figure 1.



Based on Figure 1, farmer household utilization in maximizing satisfaction is obtained from the combination of household-produced goods (XPRT), consumption of market-bought goods (XKBP), and casual time consumption (XKWS). The total time for farmer households is allocated to work in farming, work outside farming, and time to rest (leisure time). The farming production function (TPP) is a transformation of work time to produce output in farming.

The Becker household model [6], [18] describes the household in maximizing utility functions with the equation:

$$U = U\,(X_1, X_2, \ldots .\, X_n) \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (1.1)$$
$$\sum_{i=1}^{m} p_i\, X_i = CI = W + E,\ for\ i = 1, 2, 3, \ldots m$$

Where:

$p_i\, X_i$ = Price and product to i
CI = Cash income
W = Wages or income
E = Other source income

Associated with one of the determining components above, which is related to product prices. Given that the product price or selling price of rubber that is a mainstay of farmers' products is an economic factor that greatly affects economic behavior, especially rubber farmer households, because if the price of bokar (rubber ingredients) is high then the prospect of family income will be good and farmers will be eager to tap the rubber . But once the bokar price suddenly drops, the rubber economy of the rubber farming household changes. It is clear that a decrease in income as a result of a decrease in bokar prices requires farmers to think hard or rationally how to cover their household economic needs almost every day or every month must be fulfilled.

3 Material and Methods

The study was conducted in Kapuas Regency, Central Kalimantan Province, Indonesia. It is important to note that this study is a follow-up to the previous sub-research [13]. The location of the research was determined *purposively* [14], [21]. The method of determining the sample was performed by using the *disproportionate stratified random sampling* method. The respondents were chosen with *random sampling* method and consisted of 30% UPPB members (farmers) and 10% non UPPB members. As a result, a total of 134 households were obtained as respondents . The data used in this study was the *cross section* data.

The first research objective was analyzed by using *descriptive statistics*. Meanwhile, the second research objective was assessed by using the *two-stage least squares* (2SLS) or *maximum likelihood* method. The data processing was done by using the SAS program (*Statistical Analysis System*) in 9.1 *for windows* version [33]. As for the policy simulation, the model was validated by using the *Theil's Ineequality Coeficient* (U-Theil) criteria along with its decomposition [29]. The size used for the model validation in this study includes the *Root Mean*

Square Error (RMSE) and *Root Mean Square Percent* Error (RMSPE).

4 Results and Discussion

4.1 Research Area Identification

Kapuas Regency is one of the 14 districts/municipalities in Central Kalimantan, Indonesia [4]. The total area of Kapuas Regency is 14,999 Km^2 or around 9.77 percent of the total area of Central Kalimantan Province. The geographical map of Kapuas Regency in Central Kalimantan can be seen in Figure 1 below.

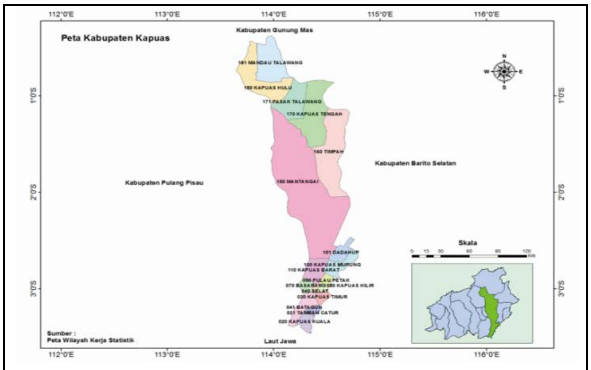


Figure 1. Map of Research Area

The region of Kapuas Regency is divided into two large regions. The southern area is known to have the potential for agricultural crops while the northern region is a non-tidal area that has a potential for smallholder rubber plantations and large private plantations. One of the businesses in the rapidly growing agricultural sector in Central Kalimantan is plantation sub-sector. Plantation is a sub-sector that has a relatively large contribution to the agricultural sector in Central Kalimantan [5].

4.2 Smallholder Rubber Plantation Business Profile

In Central Kalimantan Province, one of the potential plantation commodities in the plantation sub-sector is rubber. Central Kalimantan is one of the rubber producing provinces in Indonesia. In 2003, the total area of Smallholder Rubber Plantation, Private Plantation (*Perkebunan Besar Swasta* or PBS), and the State Plantation (*Perkebunan Besar Negara* or PBN) in Central Kalimantan was amounted to 269,700 ha with a production potential of 227,042 tons [Central Bureau of Statistics of Central Kalimantan, 2014].

The pattern of rubber plantation development planted by farmers including smallholder rubber plantations with traditional and subsistence pattern has an important role for regional economic income especially for rubber farmer households. The dominant types of rubber clones planted by farmers come from local rubber clones in which there are also clones that are suitable for the recommended clones such as IRR 112 and PB 260 according to the specific locations in the study area obtained from rubber rejuvenation assistance from the Local Plantation and Forestry Service. The number of rubber trees in farm households varies from around 333-457 trees per hectare. The total rubber production of households in the study is illustrated in the following Appendix in Table 1.

4.3 Farmer Performance as an Influence on Rubber Price Fluctuation

Output price is a very important factor for farmer groups and farm households in the production. According to Soekartawi (1989), the prices can cause changes in production. These changes can cause an increase or a decline. Price stimulation of a product tends to influence the decision of farmers in the production as well as the business of rubber plantation cultivated by farmers in the study area.

The effect of this fluctuating international rubber price on the research location has a significant effect on the activities and production decisions of rubber farmer groups and households. At the farm level, rubber prices are very low compared to the prices on FOB (*Free on Board*) level. The fluctuating effect of rubber prices on the international market has a major impact on the economic performance of rubber farmer households especially if the prices received by farmers are very low.

The fluctuating prices of *bokar* (pre-processed rubber) have an effect on farmer household performance that is to reduce the type of products produced. If the prices increased, farmers or farmer groups tend to add products in the form of sheet such as wind sheet and smoke sheet that are used as savings for rubber farmer households.

The second impact occurs on the reduction of work time for the head of the households which causes the absorption of labor in rubber businesses to decrease. By that, the process of rubber tapping is usually done by the wife or other members of the households and as a result, it affects the economic performance of the farmer's household.

Besides that, there is a tendency to reduce the needs of farming such as fertilizer and drugs. They also tend to look for cheaper rubber freezing agents which resulted in the decrease of rubber quality. The socioeconomic factors of this phenomena are the tendency of farmers to compare the rubber prices with the prices of other farming outputs such as the output of palm oil and rice commodities at the research area where recently, the products experienced an increase in price compared to the rubber commodities. There is also an indication that the farmers offer the rubber tapping process to other farmers who do not have a plantation with a system of profit sharing, especially to farmers who have large plantation area.

4.4 Increasing Rubber Price Policy Simulation

The factor of output price influences the activities of the farmers in production thus many farmers expect a guaranteed price that at least can cover the production costs. Therefore, there is an attempt to simulate an increase in rubber prices (at the farmer level) by 30 percent which could cover the production costs of *bokar*. The results of the simulation scenario of the increasing *bokar* prices by 30 percent are referred to Appendix and presented in Table 2.

Based on the Table 2 above, the increased *bokar* prices at the farm level as much as 30 percent has caused the productivity of rubber latex (PRDVTLT) to be increased amounting to 22.504 percent and a total production by 25.383 percent. This means that the increase in *bokar* prices can improve the tendency of the farmers to apply the recommended farming components. Therefore, it is believed to improve the quality of *bokar* produced.

Likewise, the impact on the use of farming inputs increases along with the increase in *bokar* prices because the farmers aware that the use of farming inputs is actually quite large for the continuity and fertility of the plants. The allocation of the use of labor, both men and women is also increased where the workforce in the plantation increased by 11.0 percent. It is seen that the maintenance of the plantation becomes maximal and consequently, the labor for other activities (*off-farm* and *non-farm*) is reduced by 15.550 percent because farmers are able to focus more on managing their farms. By that, it can be said that the total household workforce is reduced by 2.754 percent. With the increasing *bokar* revenues, there is a significant effect on the farmers' income from rubber farming which increased by 32.287 percent. Certainly, this encourages the farmer households. The reduced use of labor for activities outside rubber farming also caused the external costs of rubber farming to decrease by 3.392 percent.

The total household income is the cumulative income of farmers from the main business (*on farm*) and non-principal business (*off-farm* and *non-farm*). Thus, the total household income is obtained from total *bokar* income coupled with income from rubber farming. The impact of the increase in rubber prices caused the total household income to also increase by 19.309 percent. This means that the economic welfare of farmer households is improved.

The increased income enable the farmer households to spend more income especially for food and non-food in daily needs. The largest portion of food expenditure occurs on the consumption of main dishes, cooking oil, and other necessities while the largest portion of non-food expenditure can be found on the education of the farmers' children so that the expenditure of the farmers also experienced an increase.

The excess satisfaction or value obtained by households from rubber farming activities and/or outside rubber farming is realized in the form of household economic surplus. The household economic surplus is known to increase by 24.650 percent. Consequently, the increase in surplus of rubber farmers households resulting from the rubber price simulation is relatively higher compared to the surplus from the simulation of increased rubber latex productivity.

5 Conclusion

Plantations are a sub-sector that have a relatively large contribution to the agricultural sector in Central Kalimantan. It is known that the pattern of rubber plantation development planted by farmers including smallholder rubber plantations with traditional and subsistence patterns has an important role for regional economic income especially for rubber farmer households.

The effect of the fluctuating international rubber prices on the location of the research has a significant effect on the activities and production decisions of rubber farmer groups and rubber farmer households such as (1) reducing the type of product produced; (2) reducing the work time of the head of the households; and (3) the tendency to reduce farm input needs. Besides that, the socioeconomic factor is the tendency of farmers to compare the prices of their product with the prices from other fams; there is also an indication to offer the rubber tapping process to other farmers who do not have a farm.

The increasing *bokar* price policy simulation (at the farm level) as much as 30 percent had an impact on the increased productivity of rubber latex by 22.504 percent with a total *bokar* production by 25.383 percent. This means that the increased price of *bokar* (30 percent) is able to improve the tendency of the farmers to apply the recommended farming components. As a result, it is believed to improve the quality of *bokar* produced and also the household income of the farmers.

6 Recommendation

At the level of the rubber farmers, price simulation is likely to affect the performance and economics decision of rubber farmer households in the production activity, so that it indirectly affects the household economy of rubber farmers. This also happens in the rubber plantation cultivated by farmers in the research area. Considering that the output price of *bokar* is a very important factor for rubber farmer groups and rubber farmer households in production, it is necessary to have a joint commitment as an effort to improve the quality of *bokar* by producing an output that has a higher value

such as sheet products, both in the form of wind sheet and smoke sheet.

To all policy makers, in order to help rubber farmers and groups improve the quality of the *bokar* which has an impact on the output price of rubber products, it is recommended to: (1) have an accompaniment by giving more intensive counseling, especially in the management of rubber plantation products; (2) provide the adequate supporting facilities and infrastructure as a complement to the *bokar* processing technology package in both production and processing level to improve the quality of *Bokar* produced by farmers; (3) have a rejuvenation with the superior rubber trees at the upstream level to replace the old rubber trees that are not productive anymore.

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Appendix:

Table 1. The Total Rubber Production of Farmer Households in Three Villages

Number.	Description	Anjir Serapat Tengah		Tamban Luar		Sekata Bangun	
		UPPB	Non UPPB	UPPB	Non UPPB	UPPB	Non UPPB
1.	Latex:						
	a.Dry Season (Ltr/Thn)	22,101,90	27,809,00	23,720,80	15,221,07	28,751,00	14,036,30
	b.Rainy Season (Ltr/Thn)	33,152,85	41,122,14	35,581,20	32,364,90	32,619,00	16,849,70
2.	Lump						
	a.Dry Season (Kg/Thn)	16,965,10	20,848,50	18,339,00	16,909,98	19,822,00	10,385,23
	b.Rainy Season (Kg/Thn)	25,447,65	32,193,58	27,508,90	25,364,97	24,321,00	12,694,61

Source: Primary Data, 2017.

Table 2. The Impact of Policy Simulation on the Changes of Endogenous Variables within the Model

Variables	**Basic Simulation Value**	**Simulation Scenario (%Δ)**	**Label**

ADOPB	22,5002	2.694	Farmer's Adoption
PRDVTLT	1517,8	22.504	Rubber Latex Productivity
TPLT	2462,8	21.126	Latex Total Production
TPBR	1925,9	25.383	*Bokar* Total Production
TPBRMS1	818,3	25.108	*Bokar* Total Production in Dry Season
TPBRMS2	1107,6	25.595	*Bokar* Total Production in Rainy Season
TQLUK	682,1	0.000	Total Production Outside Rubber
QPD	657,0	0.000	Rice Production
QTK	24,017	0.000	Cattle Production
NPUKKR	159365	7.724	Fertilizer Usage for Rubber
JREAKR	22,1401	4.990	Urea Fertilizer Usage for Rubber
JNPKKR	37,9783	5.182	NPK Fertilizer Usage for Rubber
NBEKU	218980	5.227	Freezing Agents Usage
NPUKPD	122387	0.000	Fertilizer Usage for Rice
JREAPD	5,8817	0.000	Urea Fertilizer Usage for Rice
JNPKPD	38,4785	0.000	NPK Fertilizer Usage for Rice
JPTK	37,0120	0.000	Total Livestock Feed
TKKR	192,8	11.000	Rubber Labor
TKPKR	140,1	13.096	Rubber Man Labor
TKWKR	52,7881	5.227	Rubber Woman Labor
TKPD	48,2949	0.045	Rice Labor
TKTK	36,4867	0.000	Livestock Labor
TKLN	59,8796	-15.550	Labor from Other Business
TTKLUK	144,6612	-6.424	Use of Labor outside Rubber
TTKRT	338,5	-2.754	Total Use of Labor
CTUBR	1052349	6.882	Total Households Cost from Rubber
CSAR	519985	4.091	Rubber Marketing Cost
TRBR	11989779	30.000	Household Income from *Bokar*
TIBR	10937430	32.287	Total Income from *Bokar*

Source: Analysis Results, 2018

Table 2. Continuation

Variables	Basic Simulation Value	Simulation Scenario (%Δ)	Label
CUTPDBS	575987	0.000	Total Income from Rice
TCLUK	912756	0.000	Cost from non-Rubber Business
ILUK	6090781	-3.392	Income from non-Rubber Business
TIRT	17028211	19.309	Household Total Income
KPGN	3581373	10.440	Household Food Consumption
KNPGN	3085794	12.130	Household Non-food Consumption
ERT	6667167	11.222	Household Spending
SPLUS	10361044	24.650	Household Surplus

Source: Analysis Results, 2018

Table 3. Referral of the 30% *Bokar* Price Increase Policy Simulation Results

The SAS System

The SIMNLIN Procedure
Simultaneous Simulation
Descriptive Statistics

			Actual		Predicted	
Variable	N Obs	N	Mean	Std Dev	Mean	Std Dev

ADOPB	134	134	22.4328	6.5312	23.0371	6.5312
PRDVTLT	134	134	1517.5	119.2	1698.528	98.70
TPLT	134	134	2460.7	755.5	2980.538	682.7
TPBR	134	134	1862.7	572.5	2335.51	491.2
TPBRMS1	134	134	811.7	259.5	1015.502	207.1
TPBRMS2	134	134	1051.0	383.0	1320.008	324
TQLUK	134	134	679.4	609.5	679.4	567.2
QPD	134	134	656.0	606.4	656	581.3
QTK	134	134	23.985	18.7871	23.985	18.7165
NPUKKR	134	134	159157	73421.4	171451	73335.4
JREAKR	134	134	22.1203	36.2604	23.2240	36.1902
JNPKKR	134	134	37.9699	33.0578	39.9375	33.0405
NBEKU	134	134	218340	69481.7	229752	69275.1
NPUKPD	134	134	122168	115324	122168	114524
JREAPD	134	134	5.8722	13.9618	5.8722	13.9132
JNPKPD	134	134	38.6729	42.9269	38.6729	42.9043
JPTK	134	134	36.9450	29.1139	36.945	29.1049
TKKR	134	134	192.900	58.7726	214.119	58.7217
TKPKR	134	134	141.512	41.7084	160.0451	41.7032
TKWKR	134	134	51.3881	32.6491	54.0739	32.6187
TKPD	134	134	48.1729	22.2538	48.1945	22.2406
TKTK	134	134	36.4391	22.9825	36.4391	22.9801
TKLN	134	134	59.7893	30.6180	50.492	30.431
TTKLUK	134	134	144.4013	38.0560	135.1256	38.0002
TTKRT	134	134	337.3	64.9955	328.0137	64.9301
CTUBR	134	134	1052118	445269	1124523	444818
CSAR	134	134	509406	344431	530245	344102
TRBR	134	134	11687900	4277481	15194270	4277011
TIBR	134	134	10635782	3890963	14069747	3790427
CUTPDBS	134	134	574980	493804	574980	493751
TCLUK	134	134	910988	971775	910988	971621
ILUK	134	134	6080628	4018999	5874372	4016539
TIRT	134	134	16716410	4617894	19944119	4617184
KPGN	134	134	3572450	2508652	3945414	2508548
KNPGN	134	134	3076681	2110057	3449882	2108147
ERT	134	134	6649131	2613532	7395296	2513434
SPLUS	134	134	10067279	5399339	12548823	4322310

Source: Analysis Results, 2018

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