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Dominant Factors Affecting Economic Decisions in Rubber Farm Households in Kampar Regency, Riau Province: The Simultaneous Equation Model

Heriyanto[a]*, Asrol[b], [a,b]Department of Agribusiness, Universitas Islam Riau, Jl. Kaharuddin Nasution No.113 Pekanbaru, 28284. Indonesia, Email: [a*]heriyanto@agr.uir.ac.id

Rubber farming is the main livelihood of the people in Kampar Regency, Riau Province. Most of the rubber farming in Kampar Regency is managed independently by households. This study generally aims to analyse the economic decision making of rubber farmers' households in Kampar Regency, Riau Province. Specifically, this study was conducted with the aim of analysing the dominant factors that influence the household economic decisions of rubber farmers and to formulate alternative policies that can be taken to increase the income of rubber farmers in Kampar Regency, Riau Province. This research was conducted using a survey method and was located in Kampar District. The data used in this study consisted of primary data, obtained using the interview method. Samples were taken through the simple random sampling method involving 60 rubber farmers. To answer the purpose of this study, the decision making of the rubber farming household economy used the simultaneous equation model approach with the Two Stages Least Square (2SLS) analysis method. It was analysed with SAS software version 9.4 for Windows. The results showed that only internal factors of farm households are responsive to household economic decisions. No external factors were included in the model that was responsive to the economic decisions of rubber farming households in Kampar District. This was in terms of production aspects, allocation of working time, income and expenditure of rubber farming households. From the aspect of production, no responsive internal or external factors were found, but the biggest effect was the number of productive rubber stems. From the aspect of work time allocation, internal factors that

are responsive to influence are the total outpouring of farmer work, the outpouring of farm family work in businesses and the workforce of farmer households. Furthermore, in the aspect of farmer's household income, the responsive internal factors that influence it are the farmer's household income in the business. What influences household expenditure is an outflow of work in business, farmer education, wife education and total rubber farmer income. The policy implications of increasing rubber prices and the outpouring of family work in the business have the most positive impact. The increase in wages for workers outside the family has a negative impact on the household economy.

Key words: *household economy, production, income, expenditure, rubber farmers.*

Introduction

The agricultural sector in Indonesia continues to be demanded to play a role in the national economy through the formation of Gross Domestic Product (GDP), foreign exchange earnings, the supply of food and industrial raw materials, poverty alleviation, employment provisions and increases in people's income. At the provincial level, Riau does not differ greatly from the national level. In 2016, the area of rubber was ranked second after oil palm with an area of 504,553 ha. In the last five years (2012-2016), the total area, production and the number of farmers cultivating rubber plants in Riau Province tended to decrease. In 2012, the area of rubber plantations was 128,520 ha with a production of 392,781 tons, decreasing to 90,877 ha with a production of 333,155 tons. The number of farmers cultivating rubber plants also declined from 276,210 households to 244,560 households (Badan Pusat Statistik, 2017). The level of Kampar Regency is not much different from the provincial level. In 2012, the largest plantation area was occupied by oil palm plants with an area of 190,486 Ha. The rubber plant is in second place with an area of 92,509 Ha. In the period of 2012-2016, the area of rubber plantations decreased. In 2012 the area of rubber plantations was 91,328 hectares and in 2016 the area of rubber plants was 91,143 hectares (Badan Pusat Statistik, 2018). The decreasing area and production of rubber plants, as well as farmers who are working on rubber plants, are thought to be due to the conversion of rubber land to oil palm land.

Various problems that occur will affect production acquisition, allocation of work time, income and the level of welfare of farmers. The level of welfare of farmers can be seen in expenditure resulting from household consumption. In other words, households are faced with the problem of allocating work time, income and expenses. The economic decisions of rubber farming households in relation to the allocation of work time, household income and expenditure, are theoretically influenced by internal and external factors. A rubber farming

household that uses labour from outside the household expects workers with high productivity but with low wages. Instead, a worker tends to expect a job with a high level of wages.

Comparison in the price of rubber also determines the decision of rubber farmers to keep their rubber plantation businesses or not. If the price of rubber products is quite high and the price of inputs is relatively cheap (so that production costs are less than the gross income obtained), then the business is profitable. The higher the level of profits obtained, the greater the increase in the rubber plantation business' development. Various external shocks that affect the production process will affect the allocation of work time. In turn, this will affect the acquisition of income and ultimately it will affect the amount and pattern of household expenditure.

Based on the background description and problems above, in general, this research objective is to analyse the household economy. This includes the allocation of working time, income and expenditure of rubber farmer households on mineral land. Specifically, the objectives of this study are to focus on (1) internal and external dominant factors that affect the allocation of working time, income and expenditure of households, (2) the impact of changes in economic policy regarding the development of smallholder rubber gardens in household economic decision making.

Literature Review

Agricultural development concepts

Some economists claim that agricultural development is believed to be able to drive economic growth, while at the same time helping to reduce income inequality, poverty and unemployment (Poonyth, D, R. Hassan & Calcaterra, 2001; Romeo, M, 2000, 2001; Warr, 2006). Some agricultural development strategies that are expected to achieve this are Agricultural-Led Growth strategies (Poonyth, D, R. Hassan & Calcaterra, 2001), the Agriculture-Based Development strategy by (Poonyth, D, R. Hassan & Calcaterra, 2001; Romeo, M, 2000, 2001) and strategic Agricultural Demand Led Industrialisation (ADLI) by (Adelman, 1984).

Agricultural Led Growth strategy (Poonyth, D, R. Hassan & Calcaterra, 2001) emphasises that the agricultural sector is a leading sector in economic development because the agricultural sector is a driver for economic growth. Therefore, the agricultural sector needs to get the main attention compared to other sectors because of its potential in driving economic growth and job creation. Development of a productive agricultural sector and better rural areas is the key to the growth of the agricultural sector and is a precondition for successful economic development.

The Agriculture-Based Development strategy (Romeo, M, 2000, 2001), is based on the consideration that in many low-income countries the majority of the population is in rural areas, where the agricultural sector is the main source of life. This strategy is more effective than the import substitution strategy or the export-led industrialisation strategy, based on the consideration that it provides opportunities for income generation, directly or indirectly, for rural populations. Through this strategy, public resources to be allocated to the agricultural and rural sectors are increased and are expected to increase the agricultural productivity and income of rural populations.

Research on the household economy of farmers (such as rice farmers), has been done by researchers. Paddy farming households' productivity are determined by labour in the family, the number of seeds, fertilisers and pesticides. The difference between households is that households of paddy rice farmers use more labour in the family (Elinur, Asrol, & Heriyanto, 2017).

Next, Heriyanto (2017) has conducted research on the analysis of the efficiency of rubber production factors in Kampar Regency, Riau Province. The results of his study showed that the dominant factors affecting rubber production in Kampar District were the number of plants, age of plants, number of workers and investment. The production factor is the number of plants. The number of workers is technically inefficient, allocative and economically. The use of fertilisers tends to be technically and economically efficient but allocatively inefficient. Rubber farm household economic research analyses investigates the aspects of production, farm household work time allocation, the use of non-family labour, non-farm income as well as household expenditure that includes food and non-food expenditure. This research will produce a comprehensive economic model of smallholder farmers' households that have not been studied by researchers before. This study also recommends policies relating to the development of smallholder rubber in the context of increasing the household income of rubber farmers.

Review of previous studies on home economics

Studies of the household economy have been carried out both partially and simultaneously. These include (Chuzaimah, 2006; Elinur, 2004; Heriyanto, 2017; Husin & Sari, D, 2011; Koestiono, 2004; Siti & Erna, 2005,Heriyanto, 2016, 2017; Heriyanto, Asrol, Karya, & Yarda, 2018; Heriyanto et al., 2019). They analyse policy simulations of the household economy of agriculture. The results of the policy simulation imply that the policy of increasing output prices is not effective in increasing the amount of produce that can be sold to the market. This is due to additional benefits which occur due to rising prices of agricultural output and technological improvements that are allocated as labour costs.

(Priyanti, B.M, Y.Syaukat, & S.U, 2007) conducted a Farmer Household Economy Model Study on Crop-Livestock Integration Systems. the results of the study found that the farm household economic model is able to explain reciprocal farm household income obtained by maximising satisfaction with production constraints, time allocation and income distribution. This includes allocation of the use of family labour, inputs and production costs, income, farm household expenses and other aspects of production. This model is very useful in identifying the factors that influence the decisions of farm households, especially regarding simultaneously increasing income and integration between crop and livestock businesses.

(Husin & Sari, D, 2011), conducted a study on the economic behaviour of rubber farm households in Prabumulih regarding the allocation of workers, production and consumption. The result was that the behaviour of farmer households' working time allocation was influenced by the total household expenditure, rubber land area, non-rubber farmland area, rubber farming income and number of children under five. Farmer household production behaviour is influenced by the area of rubber land, non-rubber farming land area, outpouring of family labour in rubber farming, use of fertilisers and use of pesticides. Farmer household consumption behaviour is influenced by the total household income, time spent working by household members on rubber farming and number of household members. Several variables that were responded to elastically by the variable of work time spent were the rubber farming income, total household expenditure and non-rubber farming land area. The variable which was responded to elastically by household expenditure was the total household income and expenditure for food consumption.

Research was conducted by (Elinur & Asrol, 2015) regarding the economic decisions of oil palm farmer households in the village of Garuda Sakti Tapung sub-district, Kampar Regency. The economic model of the household that he built includes aspects of production, location of work time, use of labour within and outside the family, household expenses consisting of food and non-food expenditure. The research did not include expenditure on clothing, housing, education, health and recreation. Overall expenditure is aggregated in food expenditure. This research is still in the scope of the village.

(Khaswarina, 2017), conducted research on the household economies of ex-UPP TCSDP rubber farmers in Koto Damai Village, Kampar District. The economic model of the built household included the production equation, allocation of work time, income within and outside farming, food expenditure, education expenditure, non-food expenditure and household savings. The model does not yet accommodate the demands for workers outside the family, clothing, housing, health and leisure expenses. This research is still in the village scope.

Research Methods

The location of the study was determined proportionally, namely in the Kampar District. The Kampar District was chosen with the consideration that the Kampar Regency was the second-largest rubber plantation area after Kuantan Singingi Regency in Riau Province. To achieve optimal results, this research is expected to be funded within one year.

Sampling in this study was conducted using a multi-stage purposive sampling method. The criteria have an area of 1-3 hectares with a rubber plant age of 13-25 years. Samples were taken in 3 districts, namely Kampar Kiri Hulu Subdistrict, Kampar Kiri Hilir Subdistrict and XIII Koto Kampar Subdistrict because the three districts are rubber production centres in Kampar Regency. Each sub-district took 20 rubber farmers for a total sample of 60 rubber farmers. The type of data collected is cross-section data. Primary data was obtained from direct interviews with respondents, namely rubber farming households, using a prepared questionnaire. Besides that, secondary data from a number of related institutions was also collected, such as the Plantation Agency, the Central Statistics Agency and other sources. Secondary data is used to sharpen and support the analysis in this study.

Analysis data

To answer the objectives of the household economic model (namely to analyse the internal and external dominant factors that influence the allocation of work time, household income and expenditure along with the impact of changes in government policy on household economic decision making), the analysis used the simultaneous equation approach with the Two Stages Least Square (2SLS) analysis method. The data analysis process was carried out using the help of the Statistical Analysis System Econometric Time Series (SAS/ETS) program version 9.4.

The data analysis of this study was an analysis of the econometrics of simultaneous equations, which were carried out to answer the research objectives. Econometric analysis of simultaneous equations has procedures. These include the specification of the rubber farm household economic model. Econometric models are special patterns of algebraic models. They are stochastic elements that include one or more disturbing variable ((John, 2017)(Intriligator, 1978)). This model is an abstract diagram that represents a real phenomenon as a system or process ((Verbeek, 2004)(Gujarati, 2011)(Koutsoyiannis, 1977a)(Thomas, 1997)(Verbeek, 2004)). Therefore, the model can represent actual phenomena that are expressed in the form of symbols and formulated in the form of equations. The specification of the model consists of interconnected equations grouped into eleven blocks. They are (1) production, (2) outflow of work in business, (3) labour outside the family, (4) outflow of out-of-business work, (5) rubber farm household income outside the business, (6) rubber farm household food consumption, (7) rubber farm household non-

food consumption, (8) educational investment, (9) business investment, (10) rubber farm household recreation expenditure and (11) savings. The eleven blocks of the equation are interconnected to form a system equation.

After the model specifications are carried out and before the estimation of the model is done, it is necessary to first identify the model in each equation in the model. Model identification is determined, based on order conditions, as ranking requirements and conditions to complement predetermined conditions. (Koutsoyiannis, 1977b and Gujarati, 2003, 2008, 2011) argue that predictable parameters in the simultaneous equation model must be identified. The model identification formula, based on order condition, is as follows:

$$(K–M) \geq (G – 1)$$

Where:

K = the total variables in the model (endogenous variables and predetermined variables);
M = the number of endogenous and exogenous variables entered into a particular equation in the model; and
G = the total equation (number of endogenous variables).

Criteria for identifying models using order conditions are stated as follows: (1) if K-M = G-1, then the equation in the model is declared as exactly identified, (2) if K-M < G-1, then the equation in the model is said to be unidentified, (3) if K-M > G-1, then it is identified as excess (overidentified) (Gujarati, 2003, 2008, 2011; Koutsoyiannis, 1977b; Pindyck & Rubinfeld, 1998, 2014; Verbeek, 2004).

Both statistical tests F and t are used in causality analysis. The statistical test F is used to test whether, together, exogenous variables have important effects on endogenous variables in each equation. Next, statistical tests are used to test whether each individual exogenous variable has an important effect on endogenous variables in each equation.

The effects on and reactions of exogenous variables in relation to endogenous variables can be measured in terms of elasticity. In the concept of elasticity, coefficient values can be generated or calculated to measure the response of variables to the factors that influence it. In short, elasticity is a measure of the sensitivity of endogenous variables in the equation to changes in exogenous or exogenous variables. Dynamic models can be used to calculate short-term and long-term elasticity. Both elasticity values can be calculated using the following formula (Gujarati, 2008; Pindyck & Rubinfeld, 2014; Sukirno, 2011):

$$E_{SR} = \frac{\partial Y_t}{\partial X_t} * \frac{\bar{X}}{\bar{Y}} = a \frac{\bar{X}}{\bar{Y}}$$

$$E_{LR} = \frac{E_{SR}}{1 - b_{lag}}$$

di mana:

ESR = short-term elasticity;
ELR = long-term elasticity;
a = presumptive parameters of exogenous variables;
b = parameters of the lag variable;
X = average exogenous variables; and
Y = the average endogenous variable.

Results and Discussions

Internal and external dominant factors that affect work time allocation, income and expenditures of rubber farm households (Table 1). Table 1 shows the results of the estimation of the rubber production equation. These are that rubber production is not responsive to the outflow of household work in the business (positive) and the number of productive rubber rods (positive). Although the elasticity values are not responsive, rubber production is more sensitive to changes in the number of productive rubber stems than changes in the flow of family rubber farm work in the business.

Variations in the workflow of rubber farming families in the rubber farming business, labour outside the family and the number of productive rubber stems have a positive effect on production. This illustrates that if the outflow of a rubber farming family works in the rubber farming business, labour outside the family exists and the number of productive rubber stems increases, then rubber production will tend to increase.

The aspect of work time allocation shows that the outflow of family work in the business is not responsive to household income in the business (positive) and the outflow of family work outside the business (negative). Furthermore, the outflow of family work outside the business is responsive to the outflow of household work outside the business (negative) and the number of workers in the household labour force (positive) (Table 1).

The results of the estimation of the equation are that the use of workers outside the family show this factor is not responsive to changes in the household income of rubber farmers outside the business (positive). However, the use of labour outside the family of rubber farmers in business is responsive to changes in the total outpouring of farmer work (negative).

Furthermore, according to the estimation of results of the household income equation, it can be stated that the household income of rubber farmers outside the business is responsive to changes in household income of rubber farmers in the business (negative). However, the household income of rubber farmers outside the business is not responsive to changes in the outflow of family rubber farm work outside the business (positive) (Table 1).

Furthermore, the results of estimating the expenditure of rubber farm households show that the food consumption of rubber farm households is not responsive to changes in the number of rubber farm family members (positive), rubber farm household recreation expenses (positive) and the education of rubber farm wives (negative). The equation of non-food consumption of rubber farm households shows that non-food consumption of rubber farm households is not responsive to changes in the total income of rubber farmer households (positive), the number of rubber farm family members (positive), education of rubber farm wives (positive) and investment of farm household education (negative).

Table 1

Dominant internal and external factors affecting the allocation of work time, income and expenditure of rubber farm households

Variabel	Parameter Estimate	t Value	Pr > |t|	Elasticity
1. Prodution				
Intercept	-3481.0400	-2.6600	0.0100	
Workflow in business	1.6465	3.9400	0.0002	0.4018
External family labor	1.4665	0.9600	0.3404	
Number of productive rubber stems	10.9694	21.5900	<.0001	0.9356
R2 =0.91199, Fvalue =193.44, Pr > F <.0001, Dw = 1.929889				
2. Workflow in business				
Intercept	1917.9570	6.6000	<.0001	
Rubber farm household income in the business	0.0000	3.4500	0.0011	0.2279
Outflow of work outside the business	-0.6661	-5.4400	<.0001	-0.2162
Rubber farm household work force	118.2826	1.3100	0.1956	
R2 =0.47965, Fvalue =17.21, Pr > F <.0001, Dw = 1.923857				
3. External family labor				
Intercept	313.7619	3.5700	0.0008	
Rubber farmers household income outside the bus	0.0000	11.7200	<.0001	0.6274
The total outpouring of farmers' work	-0.0617	-1.8900	0.0634	-1.4268
Rubber farm household work force	-13.6572	-0.8400	0.4023	
Rubber farmer work experience	-1.2138	-0.4600	0.6476	
R2 =0.47965, Fvalue =17.21, Pr > F <.0001, Dw = 1.923857				
4. Outflow of work outside the business				
Intercept	1486.3600	1.7500	0.0852	
Workflow in business	-0.8648	-3.5500	0.0008	-2.6644
Rubber farm household work force	369.6034	3.2000	0.0023	1.7351
R2 =0.4022, Fvalue =19.18, Pr > F <.0001, Dw = 1.650385				
5. Rubber farmers household income outside the business				
Intercept	6229224.0000	3.5500	0.0008	
Rubber farm household income in the business	-0.0520	-4.0200	0.0002	-2.0195
Outflow of work outside the business	4300.1760	5.0000	<.0001	1.0484
R2 =0.38478, Fvalue =17.82, Pr > F <.0001, Dw = 1.558858				
6. Rubber farm household food consumption				
Intercept	9100771	10.58	<.0001	
Total income of rubber farmer household	0.0009	0.2600	0.7947	
Number of family members	1159123.0000	7.3000	<.0001	0.3642
Recreational expenditure of rubber farmers' housel	4.8413	5.9000	<.0001	0.0979
Wife's education	-204663.0000	-2.0800	0.0426	-85103.4607
R2 =0.68107, Fvalue =29.36, Pr > F <.0001, Dw =1.342588				
7. Non-food consumption of rubber farming households				
Intercept	-219881.0000	-0.3000	0.7622	
Total income of rubber farmer households	0.0030	1.3900	0.1714	
Number of family members	841287.8000	5.2900	<.0001	0.9657
Farmer Education	38506.8700	0.7800	0.4366	
Wife's education	70762.1500	1.4600	0.1504	
R2 =0.41041, Fvalue =7.52, Pr > F <.0001, Dw = 1.554068				
8. Educational investment				
Intercept	274738.0000	0.2600	0.7948	
Total income of rubber farmer households	0.0024	0.4900	0.6256	
Number of school children	2749502.0000	10.9600	<.0001	0.8670
Wife's education	17597.3800	0.1900	0.8495	
R2 =0.76172,Fvalue =59.67, Pr > F <.0001, Dw = 1.522326				
9. Business investment				
Intercept	48000314.0000	1.8000	0.0768	
Total income of rubber farmer households	0.3015	2.4000	0.0197	0.2623
Workflow in business	9396.2280	0.9100	0.3684	
Number of school children	-3478493.0000	-0.6400	0.5249	
Business scale	56847237.0000	4.4900	<.0001	0.2945
R2 =0.47231, Fvalue =12.31, Pr > F <.0001, Dw =1.426565				
10. Recreational expenditure of rubber farmers' households				
Intercept	578960.6000	1.5000	0.1399	
Total income of rubber farmer households	0.0009	0.8300	0.4079	
Workflow in business	-541.0220	-3.4300	0.0012	-4.7125
Outflow of work outside the business	-310.4160	-3.1100	0.0030	-0.8776
Farmer Education	50376.3100	2.5500	0.0135	1.8117
Wife's education	63828.4600	3.4500	0.0011	1312289.7143
R2 =0.55386, Fvalue =13.41, Pr > F <.0001, Dw =1.605136				
11. Savings				
Intercept	-6376491.0000	-1.8600	0.0688	
Total income of rubber farmer households	0.0754	10.4900	<.0001	1.5748
Total consumption of rubber farmers	-0.1290	-0.5800	0.5643	
Interest rate	2657819.0000	5.2700	<.0001	0.8489
R2 =0.7665, Fvalue=61.28, Pr > F <.0001, Dw =1.300045				

Note: significant at the 10 percent level.

Table 1 shows that the education investment of rubber farmer households is not responsive to changes in the number of school children of rubber farmer households (positive). Several studies on farm household economics show that household education expenditure is significantly influenced by the number of school children and total household income of farmers. Both variables are positively related to education expenditure (Adevia, Bakce, & Hadi, 2017; Asrol & Heriyanto, 2019; Husin & Dwi Wulan, 2011; Khaswarina, 2017; Putra, Bakce, & Rifai, 2012). Thus, the results of this study are in accordance with the results of previous studies.

In the equation regarding rubber farm household business investment, it can be stated that rubber farm households' business investments are not responsive to changes in the total income of rubber farm households (positive) and the outflow of rubber farm family work in businesses (positive). The results of the study [33] show the variables of rubber farming investment are influenced by the total income of rubber farming households, and this is positively related to the number of school children. Both variables are not responsive to investment in rubber farming. Thus, this research is similar (Adevia et al., 2017; Putra et al., 2012), and the income variable in farming is part of the total income of farm households.

From the estimation results in the equation of rubber farm household recreation expenditure, it can be stated that rubber farm household recreation expenditure is responsive to changes in the outflow of rubber farm family work in businesses (negative), rubber farmer education (positive) and the education of rubber farm wives (positive). It is not responsive to changes in the outflow of rubber family work outside the business (negative). Based on the estimation results of the rubber farmer household savings equation, it can be stated that the amount of rubber farmer household savings is responsive to changes in the total income of rubber farmer households (positive) but not responsive to changes in the total consumption of rubber farmer households (negative) and changes in interest rates (positive).

Conclusion

Based on the results of the previous analysis and discussion, conclusions can be drawn. The conclusions of this research are

1) Internal dominant factors of farm households are responsive to household economic decisions. There are no external factors included in the model that are responsive to the economic decisions of rubber farming households in Kuantan Singingi Regency. This is in terms of the aspects of production, work time allocation, income and expenditure of rubber farming households. From the aspect of production, no responsive internal or external factors were found. The biggest effect was the number of productive rubber stems. From the aspect of work time allocation, internal factors that are responsive to influence are the

total outpouring of farmer work, the outpouring of family farm work in businesses and the workforce of farmer households. Furthermore, from the aspect of farmers' household income, the responsive internal factors that influence it are the farmers' household income in the business. What influences household expenditure is an outflow of work in business, farmer education, wife education and total rubber farmer income.

2) The policy to improve the household economy of rubber farmers turned out to be the policy of increasing rubber prices and the outpouring of family work in an effort to have the most positive impact. The increase in wages for workers outside the family has a negative impact on the household economy.

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