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Analysis of Food Expenditures of Rice Farmers in Flooding Prone Region in South Lampung District, Lampung Province

Analysis of Food Expenditures of Rice Farmers in Flooding Prone Region in South Lampung District, Lampung Province

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Abstract. Flooding frequently happened in South Lampung District between January and February which caused loss of production significantly to rice farmers. This study aims at analysing model of food expenditures of paddy farmers using survey method. The study involved 120 farmers who were randomly selected from flooding prone area and was carried out in July-September 2020. Data were analysed using regression model where dependent variable is food expenditures, and independent variables include rice production, corn production, loss of production due to flooding, family income, number of owning livestock, price of rice, price of cassava, and number of family member. Before regression analysis was run, the study did standard test for ordinary least- squares (OLS) such as multicollinearity, heteroscedasticity, and autocorrelation tests. The data passed all the required tests. The study suggests that factors affecting food expenditures include rice production, corn production, family income, price of cassava, loss of production due to flooding, and price of rice. The model concludes R2 is 0.543 suggesting that there is still about 45% of other factors that were not included in the model. The t-test suggests that rice production, family income, and price of cassava have a highly significant influence in affecting the farmers' food expenditure in South Lampung District.

1. Introduction

The Food and Agriculture Organization in 2016 [1] has warned about the serious impacts of climate change, as stated in the FAO Report on the State of Food and Agriculture in 2016. In this report, all countries in the world have been and will be seriously affected, not only in countries. developing, but also in developed countries. Tropical developing countries, such as in Africa, Oceania and Asia, will experience the greatest losses [2]. This is exacerbated by the low economic capacity of these countries in dealing with the impacts of climate change independently. Furthermore, the impact of climate variability and change could reduce the production of food crops (serelia) in the Southeast Asian region by 2.5 percent to 7.8 percent.

Meanwhile, according to [3], variability and climate change with all its impacts have the potential to cause loss of food crop production of rice by 20.6 percent, corn by 13.6 percent, and soybean by 12.4 percent.

Lampung Selatan district is one of the districts that produce important food crops, especially rice, but it is vulnerable to floods and drought. On the other hand, according to [4], the South Lampung Regency Food Security Index is relatively low, which is ranked 172 out of all districts in Indonesia. The flood and drought disasters that occurred in South Lampung Regency resulted in a lot of agricultural land, especially rice fields, which were submerged in water during the rainy season and experiencing

drought during the dry season, resulting in crop failure. On the other reason, decrease in rainfall intensity and changes in rainfall are the main reasons that cause a decrease in agricultural production, especially in dry land agriculture [5].

Several sub-districts in South Lampung Regency which are the main rice producers, namely Palas, Sidomulyo and Candipuro Districts, are very vulnerable to flood and drought disasters due to changes in rainfall. Palas, Sidomulyo and Candipuro Sub-Districts are areas that are centers of rice production in South Lampung District. Due to low rainfall in 2018, Palas District experienced a decrease in the harvested area of paddy fields covering 4,179 hectares and paddy fields covering 50 hectares [6]. But in 2019-2020, heavy rain has caused flooding in the study area So, even though the area is rice producer, due to various climate changes, the production of rice is uncertain. In second planting season of 2020, some farmers suffer a loss of production up to 60% due to combination of rat attack and insect of Wereng coklat. With production risk increases recently, it could seriously affect food expenditures of farmers living in the area. Further, it also seriously influences food security of farmers.

1.1. Previous study on food expenditure

Problem with food expenditure of rice farmers could also risks to future generation in terms of malnutrition as a study by [7] in Bangladesh has proved it. In their study, effect of price to food expenditure has cause malnutrition such as stunting.

Other study undertook by [8] in Ghana identified factors in determining vegetable expenditures which include farm income, non-farm income, and other socio-economic characters in rural food expenditure.

In South Sulawesi [9] examines the determinants of household food expenditure in the cassava development area. They use multiple linear regression model. The results showed that household income, household head education, rice prices, sugar prices, edible oil prices, kerosene prices, fish prices, cassava prices, household size, and cassava production affected household food expenditures. Food expenditure is close to 90% of household expenditure per year. The regression model used is not very robust because the R2 value is 0.669.

In Trinidad, [10] were using multiple linear regression analysis in order to analyse socio-economic factors on household food expenditure. The use of multiple linear regression analysis with independent variables, namely gender (dummy), marital status (dummy), educational level (dummy), Ethnicity (dummy), Monthly household income, food security index (ordinal), household size, and age. The results of the study show that all of these independent variables affect food expenditures for rural communities in North Trinidad.

A study organized by [11] in Iran further explored the impact of climate change on household food expenditures. The study uses secondary data such as weather data, food security, food expenditure throughout Iran. Data were analysed with Dynamic Model. The results of the study show that all variables, namely a decrease in rainfall, an increase in temperature, an increase in the retail price index of food and household income reduces the cost for food consumption but it is a trade off with food security.

From the exploration of the research mentioned above, this research has a novelty in terms of household expenditure issues on the main food producer, namely rice. So far there is an opinion that rice farmers, because they produce the main food ingredient, they are relatively secure in food expenditure. However, rice farmers are actually food consumers. Thus, this study intends to investigate rice farmers' expenditure model, especially in areas that are often hit by flooding.

This research aims at (1) identifying food family expenditure, and (2) analysing model in affecting food expenditure of the farmers living in prone flooding region.

2. Methodology

2.1. Type of study

This study uses survey method with study locations in Way Gelam Village, Candipuro Sub-District and Sidorejo Village, Sidomulyo Sub-District. All of them are in South Lampung District. The location determination was purposively chosen with the consideration that the two sub-districts are rice-producing areas and often experience flooding during the rainy season and drought during the dry season. Since the two villages shared the same lowland paddy field watershed, the study will refer both villages as study area.

2.2. Sample size

The sample or respondent is defined as farmers who reside in watershed of Way Gelam River in Candipuro and Sidomulyo sub-districts. The respondent is determined using Slovin method [12] with formula is as follows:

$$n = \frac{N}{Nd^2 + 1} \quad \dots\dots (1)$$

where:
n = sample size
N = population which was 4113 farmers who cultivate rice in the watershed of Way Gelam river
d = precision at 10% (d = 0,1)

Using the above formulae, the sample size is then computed at 99,64 respondent or 100 respondents. However, the study determined to expand sample size to 120 respondents for improving data distribution. The respondents consist of 60 respondents from Way Gelam and the 60 from Sidorejo village. Who were selectively using simple random sampling.

The research was carried out in July-September 2020. The respondents in this study were irrigated and rainfed rice farmers who experienced the impact of climate change as many as 120 people, namely 60 respondents from Sidorejo Village and 60 respondents from Way Gelam Village. Respondents were selected using simple random sample method.

2.3. Analysis

To estimate model of food expenditure of farmers, the study employs multiple regression analysis as formulated in the following

$$Y = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni} \dots\dots (2)$$

Where,
Y denotes to monthly food expenditures (rupiahs)
β_0 denotes to intercept
β_1, β_2 ....., β_n are regression coefficient
X_1 = rice production (kg/season)
X_2 = corn production (kg per season)
X_3 = decrease of rice production due to flooding
X_4 = family income (Rp/season)
X_5 = number of animal husbandry owned (unit)
X_6 = price of rice (Rp/kg)

X_7 = price of cassava (Rp/kg)
X_8 = number of family member (person)

3. Results and Discussions

3.1. *Study area*

The study site is located in Way Gelam Village of Candipuro Sub-district and Sidorejo Village of Sidomulyo Sub-District of South Lampung District, Lampung Province. Both villages are adjacent to each other and shared lowland paddy area surrounding Way Gelam watershed. Furthermore, the study site is located around 25 km from Kalianda, capital sity of South Lampung District and about 65 km from Bandar Lampung, capital city of Lampung Province.

Most families in the area are migrant from Jawa, back in around 1970s when the government-initiated transmigration program combined with land reclamation project in Rawa Sragi swamp land, just near of Way Gelam village.

The study area is considered accessible from outside. Road infrastructure is already well developed and since 2019, government has built access to road to this area that make the study site is growing rapidly in terms of population and land prices. It also has big market place nearby. Communication facilities are also well developed such as mobile network, internet, and cable and internet television.

3.2. *Characteristic of respondent*

The following table summarizes characteristic of farmers in the research site.

Table 1. Summary of respondent characteristic

Characteristics			
Age	Average: 42,4 years	Youngest: 34 years	Oldest: 73 years
Education	Elementary school (24%)	Senior high school (30%)	Junior high school (46%)
Size of paddy area (m2)	Average: 7125	Lowest: 1250	Highest: 35000
Ethnicity	Java (94%)	Lampungnese (4%)	Sundanese (2%)
Farm experience	Average: 23 years	Lowest: 20 years	Highest: 52 years
Members of family (person per family))	Average: 3,32	Lowest: 2	Highest: 5
Non-farm activities	No (94%)	Yes (6%)	

The above table suggests that in terms of education, the majority of farmers have earned junior high school and senior high school degrees. Those numbers suggest that farmers are quite well in terms of education. With regard to size of paddy land, there is discrepancies because some farmers owned large land (3,5 ha) and other farmer owned very small land (0,125 ha). Farmer who owned large land usually obtained from purchasing neighbour land while farmer who owned small parcel because they sell their property for various reasons, mostly due to economy reason.

In terms of ethnicity, majority of farmers in the study area are Javanese and only very small number of farmers are Lampungnese and Sundanese. This is, as explained above, because the majority of respondent are second generation of transmigration back in 1970s. In terms of farm experience, on average respondent already endured long experience in farming, especially paddy. On average, they have cultivated paddy for more than 23 years. In last, only 6% of farmers has non-farming activities such as: working in construction, owned small business, and transportation services. The most majority of respondent rely on farm activities.

3.3. Family expenditures

Household expenditure is divided into food and non-food expenditures. The structure of household expenditure is influenced by changes in expenditure according to time, differences in tastes, differences in income and the environment [13]. The components of food expenditure consisted of staple foods, side dishes, nuts, vegetables, fruits, sources of fat, beverages, sugar, spices, cigarettes, and fried foods. Non-food expenditure components consist of fuel, education, health, social gathering, recreation, public transportation, personal hygiene, beauty, social, communication, taxes, clothing, and jewellery expenditures. The following is summary of family monthly expenditures.

Table 2. Average family monthly expenditure

Description	Expenditures (Rp/month)	Percentage (%)
A. Food		
Staple food	302.292	13,59
Side dish	187.793	8,44
Beans	30.063	1,35
Vegetable	113.078	5,08
Fruits	15.879	0,71
Fat	36.692	1,65
Beverages	51.596	2,32
Sugar	43.213	1,94
Spices	214.430	9,64
Cigarette	262.383	11,79
Fried foods	13.125	0,59
Subtotal A	**1.270.543**	**57,11**
B. Nonfood		
Fuel	274.188	12,33
Education	268.557	12,07
Health	1.142	0,05
Community sharing	13.917	0,63
Tourism	5.625	0,25
Public transport	0	-
Body wellness	94.468	4,25
Cosmetic	44.026	1,98
Social	57.900	2,60
Communication	97.492	4,38
Tax	21.953	0,99
Clothing	41.515	1,87
Jewellery	33.289	1,50
Subtotal B	**954.069**	**42,89**
Total monthly expenditures	**2.224.613**	**100,00**

The above table suggests that food expenditures are bigger than non-food expenditures. That number is consistent with data of South Lampung District which suggests that food expenditures was in around 55% [14]. According to [15], for rural family or low-income family, food expenditures are usually larger than non-food expenditures. Furthermore, the table also suggests that expenditure for staple food contributes the highest. This is to suggests that fulfilling carbohydrate is the main contributor for food consumption. Purchasing cigarette is the second largest expenditure of paddy farmers. Indonesia Statistics Agency or [16] has included cigarette expenditure as food component. Recent study suggests that cigarette expenditure contributes to poverty in Indonesia. This is also consistent with [17] study which concluded that spending for cigarette is bigger than that of for vegetables, meat, milk, and other nutritious food.

Top three non-food expenditures included for fuel, education, and communication. This is to suggests that expenditure for mobility is very significant for family in the study area. In addition, during pandemic, communication expenditure for student in the area increases as school use online system for education.

3.4. Expenditures and poverty line

Poverty line can be determined by the level of expenditures in Indonesia using basic need approach. This approach suggest that poverty is defined as inability of people to satisfy basic necessities such as food and non-food needs. In short people is considered poor if he/she is unable to meet expenditure set by BPS. For South Lampung district, poverty line is drawn at monthly expenditure at Rp 389.236 per capita per month [18].

Using that benchmark, the study calculated further and found out the number of family living and above poverty line as suggested in the following table.

Table 3. Poverty status according to monthly per capita expenditure

No	Status	Number of families	Percentage (%)
1	Not ppoor (>Rp389.236)	108	90,00
2	Poor (<Rp389.236)	12	10,00
	Jumlah	120	100,00

The table suggests that around 10 percent of farmers are considered poor, the family who are unable to spend more than Rp. 389,236 per capita per month. This is also consistent with BPS Labupapten Lampung Selatan 2021.

3.5. Factors affecting food expenditures

As mentioned n methodology, we estimated 8 independent variables that are affecting food expenditure. The following is description of variables.

Table 4. Description of each variable

Variables	Description	Value
Food expenditures (Y)	Monthly expenditures spent by farmers for food consumption every month	Average: Rp 1,270,543.5 Minimum: Rp 704,000 Maximum: Rp 241,0000
Rice production (X_1)	Rice production in harvest season 1 and 2 of 2019/2020	Average: 9,460 kg Minimum: 2,900 kg Maximum: 42,000 kg

Corn production (X_2)	Corn production in dry season 2019/2020	Average: 41 kg Minimum 0 kg Maximum: 2500 kg
Production lost due to flooding (X_3)	Rice production lost as an impact of flooding that occurred in 2020	Average: 516 kg Minimum 20 kg Maximum: 7350 kg
Family income (X_4)	Family income obtained from various farming, off farming, and non-farming monthly	Average: Rp 4,323,517 Minimum: Rp 1,086,333 Maximum: Rp 12,723,750
Number of animal husbandry (X_5)	Number of animal husbandry owned by family	Average: 6 Minimum: 1 Maximum: 50
Price of rice (X_6)	Price of rice received by farmers per kg in planting season 1 and 2	Average: Rp 8,250 Minimum: Rp 8,000 Maximum: Rp 10,000
Price of cassava (X_7)	Price of cassava received by farmers per kg	Average: Rp 2,375 Minimum Rp 900 Maximum: Rp 3,000
Number of family member (X_8)	Number of family member living in respondent home (Person)	Average: 3 Minimum: 2 Maximum: 5

Before data was run in regression, the study team undertook several requirement tests, such as: multicollinearity, heteroscedasticity, and multicollinearity tests as required in Ordinary Least Square (OLS) procedure [19].

1. Multicollinearity test
   Multicollinearity occurs by analysing simple correlation between variables. Multicollinearity occurs ff VIF value is greater than 10 found in independent variables. The study found that there was no evidence of multicollinearity occurs in our data as all VIF values are less than 10 (Table 6). Hence, it passes the regression requirement.
2. Heteroscedasticity test
   Heteroscedasticity test is intended to investigate whether there is certain clear pattern of data. Using SPSS, the study analysed the scatterplot graph to check if there is a pattern in relation to data. Using scatterplot output as shown in the following graph, the study concluded there was no indication of heteroscedasticity violation within the data. Therefore, it passed regression analysis requirement.

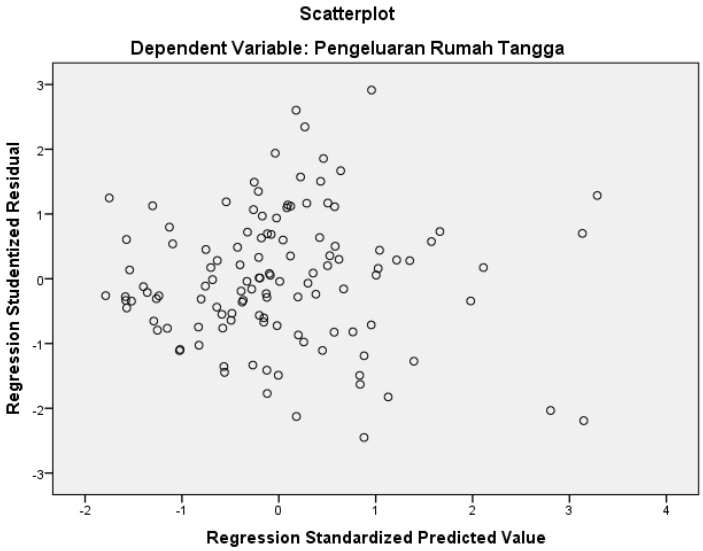

Figure 1. Analysis scatterplot of food expenditures

3. Autocorrelation test
   Durbin-Watson test was employed to estimate if there is violation on autocorrelation. Using SPSS, the study obtained the DW value was 2,129. The DW table for α = 0,05 with n = 120 and k = 10 is as follows:

   dL = 1,5262; 4 – dL = 2,4738
   dU = 1,8852; 4 – dU = 2,1148

Since DW value is less dan dL table, 2,4738, henceforth there is no autocorrelation vilation within the data. The following figures summarizes the Durbin-Watson test of the data.

+ Correlation	No correlation.	- correlation
1,5162 2,1148		1,8852 2,1148
(dL) (4-dU)		(dU) (4-dL)
	2,129	

Figure 2. Durbin-Watson test to investigate autocorrelation

Therefore, the data has passed all three requirement tests for OLS. Henceforth, the study proceeded with regression analysis model to estimate factors affecting food expenditures of farmers in the study area.

Using SPSS Statistic 22.0, the study reveals the regression summary as stated in the following table.

Table 5. Summary of regression analysis of factors affecting food expenditures in South Lampung District

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.737[a]	.543	.510	262557.85924	.543	16.461	8	111	.000	2.129

The above table suggests that 54% of the model can be explained by the independent variables while 45% is explained by others not included in this model. Furthermore, however, F test suggests that all independent variables affect the food expenditures of farmers in the study site. This means that the model is enough to explain effect of all independent variables to dependent variables.

Furthermore, to investigate the power of each independent variable to dependent variables, the study uses t test where the results is summarized in the following table.

Table 6. Regression analysis of factors affecting family food expenditures in South Lampung District, 2020

Model		Unstandardized Coefficients		T	Sig.	Collinearity Statistics	
		B	Std. Error			Tolerance	VIF
1	Constant (B_o)	390714,679	444670,836	-,879	,381		
	Rice production (X_1)	-13,776	7,786	-1,769	,080**	,240	4,160
	Corn production (X_2)	109,742	89,081	1,232	,221	,964	1,037
	Production lost due to flooding (X_3)	45,524	31,702	1,436	,154*	,700	1,429
	Family income (X_4)	,124	,023	5,412	,000***	,265	3,773
	Number of animal husbandry (X_5)	2847,865	3118,308	,913	,363	,884	1,131
	Price of rice (X_6)	92,418	56,088	1,648	,102*	,812	1,232
	Price of cassava (X_7)	162,791	29,008	5,612	,000***	,886	1,128
	Number of family member (X_8)	44801,494	35688,393	1,255	,212	,820	1,219

Note:
***= significance at 99%
** = significance at 90%
* = significance at 85%

Of the eight factors, there are five variables that have significant impact on food expenditures including rice production (X_1), lost of production due to flooding (X_3), household income (X_4), rice prices (X_7), and price of cassava (X_8).

Rice production (X1) has a significant negative effect on family food expenditure (Y) with a regression coefficient of -13.776 at a 90 percent confidence level. This means that every 1 percent increase in rice production will affect a decrease in household spending by 13.776 percent, ceteris paribus.

The loss of rice production due to flooding (X_3) has a significant positive effect on family food expenditure (Y) at the 80 percent confidence level with a regression coefficient of 45,524. This means that every 1 percent increase in loss of rice production due to flooding will increase household food expenditures by 45.524 percent. This is because farmers must spend more money for food expenditures as they expect less rice production due to flooding. This will eventually threaten food security of rice farmers. In Nigeria, [20] study effects of flooding on rural food security. They suggest that flooding risks farmers to experience food insecurity.

Household income (X_4) has a significant positive effect on family food expenditure (Y) at the 99 percent confidence level with a regression coefficient of 0.124. This means that every increase in household income by Rp 100,000 will increase household expenditures by Rp 12,400. The results of this study are in line with the results of research by [21] that household income partially has a significant effect on household food expenditure.

The price of rice (X_7) has a significant positive effect on family food expenditure (Y) at a confidence level of 90 percent with a regression coefficient of 92.418. This means that every 1 percent increase in the price of rice will affect an increase in family food spending by 92.418 percent. This in line with [22] study which suggests that increase in price of rice will increase farmer's spending of substitute commodity hence it increases food expenditures.

The price of cassava (X_8) has a significant positive effect on household spending at the 99 percent confidence level with a regression coefficient of 162,791. This means that every 1 percent increase in the price of cassava will have an effect on an increase in household expenditure of 162,791 percent. Cassava is substitute commodity for rice in rural areas. Therefore, when the price of cassava is up, the spending on food will also go up too.

Food expenditure is important indicator to food security and welfare. Study by [23] suggests strong positive relationship between food expenditures and food security. The more farmers spend for food, the more secure their food security status. However, please keep in mind that proportion of food expenditure as compare to non-food expenditures must take into account. If food expenditures are higher than that of non-food expenditure, it suggests farmers welfare is low.

This study reveals that rice farmers are also consumers of rice. During the flood, they had to spend more money to buy rice due to crop failure. Thus, flood control mitigation will help rice farmers to maintain prosperity.

4. Conclusion

1. The average proportion of food expenditure to total household expenditure is 57.11% which is consistent with data of South Lampung District. This means that food expenditures still make up the majority of respondents' household expenditures. This shows that the food security status of the rice farmers is still classified as not prosperous.
2. Factors that significantly affect food expenditures (Y) include rice production (X_1), decreased production due to flooding (X_3), household income (X_4), rice prices (X_7), and cassava prices (X_8).

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