Increasing Farmer's Resilience Through Marketable Surplus

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Abstract. One of the main attributes for building farmer resilience in facing climate change is access to resources. To deal with the negative impacts of climate change requires quite a lot of resources. Previous research shows that the weakness of farmers is their low level of income. Income is the main access to obtain resources, the main source of income for farmers is the amount of product sold to the market or marketable surplus. Based on this, this research aims to analyze the factors that influence marketable surplus. The target population for this research is farmers affected by climate change and uses multiple linear regression analysis tools. The research results show that the factors that influence marketable surplus are the amount of production and income. Farmers who produce food use their produce for their own consumption and sale, so that if the production produced is greater, the greater the marketable surplus. Income will increase access to obtain resources, including food, so that the greater the income, the greater the marketable surplus. These results show that to increase resilience farmers must have access to resources such as land, large land will increase the potential for high production thereby increasing marketable surplus.

Keywords: Farmer, Resilience, Marketable Surplus

1. Introduction

Farmers are one of the parties most affected by climate change. This is because agriculture is a sector that is very dependent on natural conditions such as weather and climate. Climate change results in an increase in the frequency of extreme weather such as hurricanes, floods, droughts and causes the spread of agricultural pests and weeds in crop fields, as well as increasing the ability of pests to survive. [1–4]. Apart from that, climate change also causes a decrease in food access due to decreasing income in the agricultural sector which is experiencing contraction and increasing food prices [2].

Banyumas Regency is one of the rice producers in Central Java Province which is affected by climate change and is one of the disaster-prone areas. Based on [5]; [6]; [7] [8] that 14 sub-districts in Banyumas Regency, including Sumbang Sub-district and Kemranjen Sub-district, are flood-prone, drought-prone areas and have the potential to be attacked by pests (plant pest organisms) and are prone to landslides.

The vulnerability of Banyumas Regency to the impact of climate change is not accompanied by farmers' understanding of climate change. Based on [9] Farmers' understanding of climate change and its impact on agricultural change is still low, this will increase the potential for farming business failure. Farming failures are due to a lack of knowledge about climate change so that farmers' awareness of taking adaptation and mitigation measures to climate change is low. Adaptation actions are a must so that farmers can minimize the impact of climate change and increase production and food security [10].

To carry out adaptation actions, adaptation capacity is needed. Adaptive capacity performance will decrease when farmers do not take action to reduce the sensitivity of farming [11,12]. Farmer capacity will also determine the vulnerability and sensitivity of farming to the impacts of climate change [13]. Based on this, increasing adaptive capacity is very important. Adaptive capacity determines farmers' resilience in facing climate change. Resilience is the ability to recover after an adverse event occurs [11]. The concept of resilience can help to understand the factors that enable farmers to protect livelihoods from the consequences of climate change and climate variability.

The three main attributes that build farmer resilience are ownership and access to resources, second is institutional, and third is the ability to learn. [14]. Based on [15] shows that farmers have several strengths related to resource ownership, namely farmers have resources to support farming as well as easy access to production factors due to the close distance to input markets and output markets. However, farmers have a weakness, namely the low level of farmer income, especially when compared with the regional minimum wage, farmer income is still lower than the regional minimum wage.

One of the main sources of farmer income is marketable surplus. Marketable surplus is the result of production that is sold to the market after production has been reduced by farmers' needs. Marketable surplus is an important component and is a determining factor in the level of economic development [16]. In reality, not all farmers will sell all their production, especially to food farmers and marginal farmers. The main goal for marginal food farmers is to meet family needs, especially for food production. According Agarwal (1970) in [16] that the factors that influence marketable surplus are grouped into 2, namely factors that influence production and factors that influence consumption at a certain production volume. Based on this, the aim of this research is to analyze the factors that influence marketable surplus as an effort to increase access to resources.

2. Materials and Methods

This study used a survey method with the analysis units being rice farmer households in Banyumas Regency, Central Java Province. The study was conducted in two sub-districts, which were taken purposively based on the level of land fertility, with the consideration that the level of land fertility has an impact on the adaptation behaviour of farmers, namely encouraging adaptation activities [30] and inhibiting adaptation activities [31]. Farmer households are taken from selected villages from each sub-district based on rice productivity and rice field area. The sub-districts taken are Sumbang District which represents fertile areas and Kemranjen District which represents infertile areas and affected by climate change.

Marketable Surplus is the difference between production results and the amount of production consumed or used for other purposes such as seeds for the next period. or mathematically it is:

$$MS = QP - QC$$

MS shows marketable surplus (kg/year), QP shows production (kg/year) and QC shows the amount of production consumed (kg/year). Multiple linear regression is used to examines price of rice, production, members of households, household income and education of wife to marketable surplus. Econometric model for marketable surplus is as follows:

$$\ln MS = \alpha + \beta_1 \ln PRC + \beta_2 \ln PROD + \beta_3 \ln MH + \beta_4 \ln INC + \beta_5 \ln EDUC + e$$

Where:

MS = Marketable Surplus (kg/year)

α = Constant

$\beta_1 - \beta_5$ = Coefficient of explanatory variable
PRC = Price of Rice (Rupiah / kg)

PROD = Production (kg)

MF = Members of Household (Number)

INC = Household income (Rupiah / year)

EDUC = Education of wife (years)

3. Results and Discussion

Marketable surplus is the production that is sold by farmers. The farmers in this research are rice farmers, which is a food ingredient, so the produce is not only for sale but also consumed, rice is a staple food for the majority of the population in Indonesia. Marketable surplus is one of the main sources of income for farmers, especially when farming is the main source of income. Even though the sales of production are a source of income, in reality not all of the production will be sold by farmers, especially when the production is the main need for farmers, in this case staple food. Farmers generally have two roles, namely as producers and consumers. Farmers are producers when farmers produce products and sell their products. Farmers are consumers when farmers use their production for consumption. Average production, consumption and marketable surplus for each village are presented in Table 1.

Table 1. Average production, consumption and marketable surplus for each village

Village	Average	Min	Max	%
Banteran Village				
Production	6780.43	1350	12000	100
Consumption	487.50	150	1500	7.2
Marketable Surplus	6292.93	1200	10500	92.8
Sumbang Village				
Production	4926.92	900	18000	100
Consumption	1073.68	150	4500	15.8
Marketable Surplus	4180.77	100	16500	84.2
Sibalung Village				
Production	5146.15	2400	12000	100
Consumption	634.62	150	3000	8.3
Marketable Surplus	4719.23	1500	11550	91.7
Sirau Village				
Production	2113.04	800	10500	100
Consumption	1213.04	600	9000	57.41
Marketable Surplus	900	50	9000	42.49

Source: Primary data processed (2023)

Marketable surplus analysis shows that not all production is sold by farmers, there is a small portion of production that is used for own consumption. In contrast to the other 3 villages, the lowest average marketable surplus is in Sirau Village, Kemranjen District, namely 42.29 percent. This is because the average farmer has a small land area, the main livelihood is farming with a side income being casual laborers, household income is very dependent on the head of the family because the average wife does not work. This condition causes farmers in Sirau Village to first choose to use their production to secure food needs, then sell the other part. Factors influencing marketable surplus require further analysis.

Analysis is needed so that marketable surplus becomes optimal and becomes the main source of income for farmers. Farmers who have high incomes will have access to resources. Access to resources is one of the main attributes for building farmer resilience in facing climate change. The next attribute is how farmers have the ability to learn and adjust and adapt [17]. These two main attributes will be easier to implement if farmers have sufficient income from marketable surplus. Before further analysis is carried out, a table is first presented regarding the characteristics of the variables used.

Table 2. Independent Variable and Dependent Variable Conditions

Information	Min	Max	Average
MS (kg/year)	50	16,500	4,084.18
Price of Rice (Rupiah/kg)	1,700	5,000	4,506.12
Production (kg/year)	800	18,000	4,769.90
Members of Household (numbers)	2	5	2.64
Household Income (Rupiah/year)	8,400,000	141,000,000	41,265,306.12
Education of wife (year)	3	12	8.06

Table 2 shows that the average marketable surplus is quite large, namely 4,084.18 kg per year, but with quite a large difference between the minimum and maximum, this is because based on Table 2 there are villages that have a lower average marketable surplus compared to other villages. the other is Sirau Village in Kemranjen District. For the price variable, there is quite a large difference between the lowest price received and the highest price received. This is because most farmers after harvest will immediately sell their produce without paying attention to the price offered, thus allowing for quite wide price differences. The production yield variable is not too different from other variables, namely the difference is quite large between minimum and maximum, this is because there are several areas that are prone to being affected by climate change, such as in the Kemranjen District, these areas are prone to disasters such as drought or floods, which causes production harvest is not optimal. The number of household members is relatively not large, this is because the average age of respondents is quite high, namely 56 years, so there are several children of respondents who are married and separated from their parents. Household income has a relatively similar pattern to the other variables, namely having a fairly wide difference between minimum and maximum, this is because there are some respondents who have more than one livelihood, and are supported by wives who also work, while there are others who depends on his livelihood as a farmer and his wife does not have a livelihood. The education of the mother or wife is also quite surprising because there is a wide difference between the years of education taken, a minimum of 3 years and a maximum of 12 years with an average of 8 years. These results show that the average wife's educational level is still low, only graduating from junior high school or not even graduating from junior high school, with the highest level of education being graduating from high school. Furthermore, there is an analysis of the factors that influence marketable surplus.

To find out the factors that influence marketable surplus, it is analyzed using ordinary least squares (OLS) regression. The factors used in this research are the price of rice, production quantity, number of family members, household income and wife's education. Complete regression results are presented in Table 3.

Table 3. Results of Analysis of Factors Affecting Marketable Surplus

Independen Variable	Coefisien	Standard Error	t- stat	Prob
Constanta	-3,990	4,201	-0,950	0,345
Price of Rice (HRG)	-0,532	0,372	-1,431	0,156
Production (PROD)***	1,403	0,073	19,218	0,000

Members of Household (ART)	-0,025	0,073	-0,342	0,733
Household Income (PRT)*	0,274	0,141	1,948	0,054
Education of Wife (PDDIS)	-0,002	0,024	-0,079	0,937

Information:

*Significant at α = 10%

*** Significant at α = 1%

Source: Primary Data Analysis (2023)

Based on Table 4, the equation can be written, namely:

Ln MR = -3,990 – 0,532 ln HRG + 1,403 ln PROD – 0,025 ln ART + 0,274 ln PRT – 0,002 ln PDDIS

Next, classical assumption tests and statistical tests were carried out. Tests include autocorrelation test, heteroscedasticity test and multicollinearity test. Statistical tests include the F test, goodness of fit (R^2) and t test. The classical assumption test aims to test that the model used meets the BLUE criteria (best, linear, unbiased, estimated). This research tested autocorrelation using the Breusch – Godfrey Serial Correlation LM test. testing shows that the equation does not suffer from autocorrelation problems. To test whether the model has heteroscedasticity or not, this research uses the White test method. White's test shows that there are no symptoms of heteroscedasticity. To test multicollinearity, this research used the VIF method. Based on the calculations, it shows that there are no symptoms of multicollinearity.

After testing the classical assumptions and showing that there are no problems with the classical assumptions, statistical testing is then carried out to test that the model can be used to estimate. There are three tests carried out in statistical testing, namely the F test, coefficient of determination or goodness of fit (R^2) and t test.

The F test is used to test the influence of rice price, production quantity, number of household members, household income and wife's education together on marketable surplus. Based on calculations in Eviews, the calculated F value in the regression was 127.718 with an F table of 4.431 at a probability of 5 percent. These results show that the calculated F is greater than the F table, so H_0 is rejected and H_1 is accepted. These results show that the price of rice, production quantity, number of household members, household income and wife's education together have a significant effect on marketable surplus at a significance level of five percent.

The goodness of fit measure reflects the large variations in marketable surplus that can be explained by the price of rice, the amount of production, the number of household members, household income and wife's education. The calculation results show that adj R^2 is 0.867. This value shows that variations in the marketable surplus value can be explained by the price of rice, production amount, number of household members, household income and wife's education amounting to 86.7 percent, while the other 13.3 percent is explained by factors that are not in the model.

To determine the influence of each factor, the t test is used. Based on the results of the analysis of 5 factors, there are two factors that have a calculated t that is greater than the t table, namely the amount of production and the amount of household income. These two factors statistically significantly influence marketable surplus. Three factors that have a calculated t that is smaller than the t table are the price of rice, number of household members and wife's education. Each analysis of the influence of production factors on production is presented below.

The price of rice does not statistically significantly affect marketable surplus (Table 3). The results of this research are not in accordance with the proposed hypothesis. The results of this research are because farmers must immediately sell the harvest they obtain in order to earn income to meet household needs. Most of the farmers in this research are farmers with limited land ownership and do not have a representative warehouse to store their production, so whatever the prevailing price does not affect the marketable surplus. The absence of a representative warehouse will be very risky for farmers to store their harvests for too long to wait for higher market prices. Harvest is a product that spoils quickly, so farmers prefer to sell their harvest immediately. This research is in line with research [18] which states that due to lack of storage facilities there is a gap between the marketable and marketed surplus. The type of product produced in this research is staple food for farmers, so farmers still save a small portion of their production to meet their household's food needs.

The amount of production statistically has a positive and significant effect on marketable surplus. A coefficient value of 1.403 means that an increase in production of 1 percent will increase the marketable surplus by 1.403 percent. This result is because on average only a small portion of the production is used for consumption, the majority of the production is sold, so that when the amount of production increases it will be more profitable for farmers to sell it. This decision is not only to avoid the risk of damage to production results when stored for too long in an unrepresentative warehouse, but also to increase income. This research is in line with research [16,19] which states that The higher the production, the larger will be the marketable surplus. In this case, when farmers have large enough land, the potential to produce high production will increase and increase opportunities for farmers to have access to greater resources.

The number of household members does not statistically significantly influence marketable surplus (Table 3). The results of this research are not in accordance with the proposed hypothesis. The results of this research are because the number of members in farming households is not too large, namely a minimum of 2 people and a maximum of 5 people with an average of less than 3 people. The average respondent in this study is not young, namely 56 years. The number of household members is relatively constant so that food needs do not change relatively so it does not affect the marketable surplus. In addition, farmers prefer to sell most of their production each harvest. This result is different from research [20] which states that the larger the family members, the more rice consumed, thereby reducing MS.

Total household income statistically has a positive and significant effect on marketable surplus. A coefficient value of 0.274 means that an increase in household income of 1 percent will increase the marketable surplus by 0.274 percent. This result is because when household income increases, the opportunity for households to access food will increase, thereby increasing the marketable surplus. When household income is high, farmers do not have to worry about meeting the food needs of family members, so they will prefer to increase the production they sell. This research is in line with research [16] which states that when income is low, they are forced to sell food saved for their family at low prices to be able to meet other needs and in the future need more funds to buy food. When marketable surplus increases, it will also increase opportunities for farmers to increase their income so that access to resources will also increase.

The wife's education level does not statistically significantly influence marketable surplus (Table 3). The results of this research are not in accordance with the proposed hypothesis. The results of this research were because the respondent farmers were subsistence farmers whose wives' education was still low, namely elementary school graduates. Most of the respondents' wives are also housewives and follow the decisions of the head of the household in determining the amount of production to be sold or

consumed. This means that the wife's education does not statistically significantly affect marketable surplus.

4. Conclusion

One of the main attributes for increasing farmer resilience in facing the impacts of climate change is access to resources. Efforts that farmers can make to increase access to resources are increasing marketable surplus. The research results show that factors that have a statistically significant positive effect on marketable surplus are the amount of production and household income. The amount of production will determine the marketable surplus because when the amount of production increases, farmers can increase the amount of production that can be sold after deducting the production for consumption. Farmers have two roles, namely as producers and consumers. Household income has a positive effect because when income increases, the potential for households to access food will increase, thereby increasing the marketable surplus. The price of the product has no effect because of the limited resources owned by farmers, namely the unavailability of representative warehouses, so farmers must immediately sell their harvest so that it does not spoil without taking into account the prevailing price level. This is because the average farmer's land ownership is less than one hectare so access to resources to provide a representative warehouse is limited. The number of household members and wife's education do not have a significant effect on marketable surplus, most farmers act more as producers than consumers due to limited representative warehouses. The average education of wives is still low, so business decisions are mostly held by the head of the family.

The implication of the conclusions of this research is that efforts are needed to increase access to resources through land expansion, this is because when land area increases, the potential to increase production results will be greater and also the potential for increasing income will increase. When income increases, farmers' ability to be resilient to climate change will increase through the implementation of adaptation. Implementing adaptation requires sufficient resources, understanding the impacts of climate change and appropriate technology to deal with it.

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