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Factors Influencing Farmer's Decisions to Switch Apple to Orange Farming in Bulukerto Village, Bumiaji Sub-district, Batu City

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ABSTRACT

The agricultural sector is a strategic sector and has an important role in national economic development and community survival. Each region certainly has different natural resource potential. Batu City is one of the apple-producing areas in East Java Province. Over time, there was a decline in apple productivity, which caused farmers to decide to transfer the commodity. This study aims to analyze the phenomenon of switching farms, identify influencing factors, and analyze the effect of commodity transfer on farmers' income. The determination of the location of the study was carried out by *simple random sampling*. The sampling method used the *Slovin formula*, and the sample used in this study was 60 farmers. Logistic regression analysis was used to analyze the relationship between one or more independent variables with categorical dependent variables, and *the Wilcoxon Signed Rank Test* is a method of non-parametric statistic that aims to determine whether or not there is a difference between 2 pairs of data on an ordinal or interval scale. The results showed that the impetus that made farmers switch commodities to oranges were: (1) climate, changes in market prices, changes in consumer tastes, decreased crop yields, decreased apple quality, pests and diseases of apple plants. (2) Factors that directly influence farmers' decision-making in transferring commodities are age, education, number of family dependents, farming experience, citrus farm income, and care/maintenance. (3) There is a significant difference between the income of farmers who farm apples and farmers who farm oranges. The average income of apple farmers is IDR 13,158,332/Year, while orange farmers have an average income of IDR 14,703,333/Year.

1. Introduction

Horticultural products are one of the commodities that have the potential and opportunity to be developed so that they become superior products that can improve the welfare of farmers in Indonesia (Pitaloka, 2017). One of the horticultural crops that can be cultivated in Indonesia is apples. Batu City is one of the apple-producing areas in East Java Province. Bulukerto Village is a village located in Bumiaji District. Districts in Batu City focus on apple farming activities, including Bumiaji, Junrejo, and Batu Districts. Based on data obtained from the Central Statistics Agency for 2018-2022. Bumiaji District is the area that always provides the most apple production, compared to Batu District and Junrejo District in Batu City. However,

since 2018-2022, apple production in the Batu City area tends to decrease in the amount of production. According to Bawindaputri, Astuti, and Lestari (2022), apple plants want low temperatures and not too high rainfall. Changes in temperature and rainfall in an area could decrease apple production in the region. In addition to climatic factors, land is one of the factors that can cause a decrease in the production of apples. Many residents of Bulukerto Village make a living as farmers. Seeing the results of apple harvests that are not like before and the results of apple farming are no longer able to meet daily needs. The decline prompted farmers to switch to other commodities, namely citrus commodities.

Hasan (2002) argues that for decision-making to be directed, it is necessary to know the elements/components of decision-making. These include: 1) Objectives of decision-making, 2) Identification of decision alternatives to solve problems, 3) Calculations of factors that cannot be known in advance or beyond human reach, and 4) Tools or tools to evaluate or measure the results of decisions. The basics that can be used in decision-making vary, depending on the problem. Decision-making is related to different human traits or Individual Differences. Individual differences are differences possessed by each individual, both physical and non-physical, which makes a person have different characters/characteristics from one another (Sari & Mudjiran, 2020). According to Pasolong (2023), each decision-making process has its assessment, depending on what is used as the basis for decision-making.

Commodity transfer is a change from the function of land that originally planted a farm to another that positively impacts the environment and the land itself (Miswati, Lestari, & Marlina, 2020). The occurrence of crop transfer in selected commodities can influence farmers' income (Kurnia & Syamsiyah, 2020). Farmers can do commodity transfer due to various factors; changes in environmental conditions, such as weather factors, continue to change every year, thus disrupting production and causing a decrease in crop quality (Hindarti, Muhaimin, & Soemarno, 2012). Research on farmer decision-making has been carried out a lot, such as research (Setiawan & Januar, 2021); (Fadiliya et al., 2021); (Pratiwi et al., 2022); and (Farida et al., 2023). This research is relevant to food security, economic development, and rural agricultural sustainability, focusing on the factors influencing farmers' decisions to switch from apple to orange commodities. The decision of farmers to replace commodities that have been cultivated for a long time, such as apples, with oranges, not only has an impact on the scale of individual agricultural businesses but can also have a broader impact on various social and economic aspects of the area. This research is important to understand whether oranges can make the same or better contribution to food security and how these changes can affect food supply and distribution at the local level. This research can also delve deeper into how this commodity transfer decision is related to increased income, farmers' economic stability, and new business opportunities in the agribusiness sector. In addition, this research also provides insight into the impact of commodity transfer on the regional economy.

The sustainability of agriculture in rural areas is greatly influenced by the choice of commodities grown by farmers. Switching commodities from apples to oranges can reflect farmers' search for alternatives that are more profitable or more resistant to changes in environmental conditions. The novelty of this study is the addition of several variables in decision-making carried out by farmers. Not only that, the analysis related to the difference in income of apple and orange farmers is also different. Based on this background, this study aims to find: (1) Analyse the phenomenon of switching apple to orange farming in Bulukerto Village, (2) Identify factors that influence farmers' decisions in transferring commodities in Bulukerto Village, (3) Analyse the effect of commodity transfer on the income of farmers who

transfer commodities in Bulukerto Village, Bumiaji District, Batu City.

2. Methodology

The study's location was determined deliberately (purposive method) based on the results of observations in the field. According to (Apriliana & Muslich, 2016), regional determination with the Purposive Method is a technique for determining the research location deliberately based on certain considerations, adjusted to the objectives of researchers to provide maximum data. The chosen research place was Bulukerto Village, Bumiaji District, Batu City. This study's population was apple farmers who have and have not transferred commodities in Bulukerto Village, Bumiaji District, Batu City. The sampling method used was simple random sampling. Sugiyono (2007) states that simple random sampling is a random sampling technique in a population. Based on the calculation of the Slovin formula, as many as 60 farmers were obtained for the research samples. The data collection process in this study was done through in-depth interviews designed to dig up information about the factors that affect farmers' decisions to switch commodities from apples to oranges. This interview was conducted with farmers involved in the commodity transfer process to understand their reasons, challenges, and expectations related to the changes in the commodities they grow. The interview process was arranged in the following steps: 1) Questionnaire Preparation: Interview questionnaires were prepared based on research objectives and variables to be analyzed. 2) Respondent Selection: The respondents interviewed were randomly selected farmers in Bulukerto Village. 3) The implementation of the interview was carried out face to face, depending on the condition and willingness of the farmer. During the interview, researchers dug up information related to the practical experience of farmers, the challenges they faced, and the factors that influenced their decision to switch to oranges.

Treatments Assessed Using Dummy Variables. This treatment was assessed by farmers based on the ease or difficulty in carrying out orange farming activities compared to apples. Category 0 (Ease): In this category, farmers consider the care of orange plants relatively easier than apples. Farmers who rate orange care as easier will be given a value of 0 on this dummy variable. Category 1 (Difficulty): Conversely, this category shows that farmers have difficulty caring for citrus plants. Farmers who rate orange care as more difficult are given a value of 1 on this dummy variable. The factors that do not affect farmers in making decisions are education and land area. Formal education of farmers in Bulukerto Village has no effect because farmers do more non-formal education through extension. Seeing the situation in the field, farmers are aware of the opportunities given by the orange commodity. Hence, farmers should consider switching from apple to orange commodities and ask the extension workers if possible. Farmers feel more confident in the knowledge they get from farming from generation to generation than in the knowledge gained from formal education (Pratiwi et al,. 2022).

Then, the Land Area variable has no real effect on the farmer's decision to switch from apple to orange commodities in Bulukerto Village. One of the facts is that no matter how much land is owned, it cannot affect the income received, but it can affect the farmer's income from the commodity that is harvested and sold. However, the land area is either large or small; if the selling price of the planted product itself is small or not expensive, the income received will not be sufficient for household needs. On the contrary, when the harvest is sold and has a high selling value, it can meet the needs of farmers.

Secondary data came from data from BPS Kota Batu, BPP (Agricultural Extension Center) Bumiaji District, relevant books and journals. The data analysis method used to achieve the first goal used descriptive analysis to explain what drives farmers to make decisions in transferring commodities from apples to oranges. Then, to answer the second objective regarding the factors influencing farmers' decisions in transferring apples to oranges, commodities were analyzed using logistic regression. According to (Gani & Amelia, 2015), the formulation of the logit equation is as follows:

$$Yi = \frac{e\beta 1 + \beta 1\, x1 + \beta 2\, x2 + \beta 3\, x3 + \beta 4\, x4 + \beta 5\, x5 + \beta 6\, x6 + \beta 7\, d1}{1 + e\beta 1 + \beta 1\, x1 + \beta 2\, x2 + \beta 3\, x3 + \beta 4\, x4 + \beta 5\, x5 + \beta 6\, x6 + \beta 7\, d1}$$

Remarks:
Yi = Farmer's decision
Y = 0, if farmers do not transfer commodities
Y = 1, if farmers transfer commodities
β0 = constant
β1-β7 = regression coefficient of independent variable
X1 = Farmer's Age (Years)
X2 = Education (Year)
X3 = Number of family dependents (Soul)
X4 = Land area (Ha)
X5 = Farm Experience (Years)
X6 = Orange Farm Income (Rupiah)
d1 = Treatment (*dummy*) (0 = Easy; 1 = Hard)

The data analysis method used to achieve the third goal regarding the difference in income between apple farmers and orange growers during one harvest period was income analysis. According to Soekartawi et al. (2006), the net income (profit) of farming uses the following formula:

$$\pi = TR - TC.$$

Information:
π : Net income of Apple / Orange farming (IDR / Year)
TR : Total Revenue of Apple / Orange farmers (IDR / Year)
TC : Total Cost of Apple / Orange farming (IDR / Year)

After knowing the income of apple and orange farmers, the *Wilcoxon Signed Rank Test* was used to determine the difference or comparison of the income level of apple and orange farmers with the condition that the population is not normally distributed. So, the formulation of the *Wilcoxon Signed Rank Test* is as follows (Gani & Amalia, 2015).

$$Z = \frac{T - \mu_T}{\sigma_T} = \frac{T = \frac{N(N+1)}{4}}{\sqrt{\frac{N(N+1)(2N+1)}{24}}}$$

Information:
Z = Normal test count
T = Number of Tiers or small ranks
μ_T = Average level / rank
σ_T = Standard deviation of level / rank

Hypothesis:
a. H_0 : The average income of apple farmers is equal to the average income of orange farmers.
b. H_1 : The average income of apple farmers is not the same as the average income of orange farmers.

Decision Making Criteria:

a. *Asymp* value. Sig (2-tailed) > value α (0,05) then H_0 accepted and H_1 rejected. This means there is no difference in the average income of apple and orange farmers.
b. *Asymp* value. Sig (2-tailed) ≤ value α (0,05) then H_1 accepted dan H_0 rejected. This means there is a difference in the average income of apple and orange farmers.

3. Results and Discussion

3.1. The Phenomenon of Apple to Orange Farming Transition in Bulukerto Village, Bumiaji District, Batu City

In recent years, there has been a decline in Batu Malang apple production; this has also happened in the Bulukerto Village area, which has changed over the past few years because of internal and external factors. The decline in apple production has led to farmers often failing due to climate change. Seasons that previously supported apple growth experienced increased temperatures, changing rain patterns, or other weather changes that affected apple productivity (Ruminta, 2015). Many farmers in Bulukerto Village are switching to other commodities, such as oranges, chilli, cut flowers, ornamental plants, etc. It is known that some of the problems faced by apple farmers in their farming, which are things that encourage farmers to transfer apple commodities to oranges, are as follows:

1) Rainfall

Apple plants need dry soil to grow well, and if it rains continuously, it can cause the soil to become too wet, inhibiting the growth and development of apple plants (Anggara et al., 2017). High rainfall can disrupt the flowering season by damaging existing flowers. Pests and plant diseases also emerge, which damage plants and apples. This is in line with the opinion of Herlina and Amarullah (2020), who state that changes in rain and temperature patterns cause apple plants' lack of fruiting ability. This will cause apples to reduce their yield and pose a high chance of pest attacks so that apple production will become low. The impact of climate change on agriculture is increasingly important as it affects the flowering time, bloom time, colour, size, and shape of apples. The decrease in productivity of apple crops is due to high rainfall. The higher rainfall will cause the flowering process in apple plants to be disrupted, and young apples will fall off (Ruminta, 2015).

2) Changes in market prices

Changes in market prices play an important role in farmers' decisions to transfer commodities. Changes in market prices can affect the price of apples, which can affect farmers' decisions to grow oranges. The occurrence of price fluctuations is due to the limited ability of farmers, traders and retailers to influence and set prices in the market. Information obtained from interviews in the field, farmers said that the price of apples sold could not be too high, which was only in the range of IDR5,000 – IDR8,000 / kg. The price applies to good apples because they do not experience the slightest damage. Unlike apples with damage, commonly known as BS apples (Sorting Goods), they are sold at IDR1,000 – IDR3,000 / kg. Although the apple harvest is quite large, this sometimes does not affect the price of apples, which can decrease from IDR2000 to IDR3,000 / kg.

3) Changes in consumer tastes

Changes in consumer tastes can also encourage farmers to transfer commodities from apples to oranges. Farmers are aware of increased consumer demand for oranges; whether for health reasons, flavours, or certain food trends, farmers will respond by increasing orange production. This could encourage farmers to switch from apples to oranges to meet growing market demand and seize opportunities for better incomes. Depending on quality, price, and

consumer preferences, local apples may or may not compete with imported apples. However, local apples may face some challenges when competing with imported apples. The reason is higher production costs. Local apple production often requires higher production costs.

4) Crop yields have decreased

Farmers in Bulukerto Village complained about the decline in apple yields they received. In the past, the apple harvest could reach at least 1 ton, but now it can only range from 500kg, and some do not produce. The decrease in harvest yields resulted in a decrease in the income earned by farmers. The income earned by farmers is insufficient to cover production costs and meet the needs of life. This encourages farmers to look for other, more profitable alternatives by switching to citrus commodities (Farida et al., 2023). The decreased production of old apple trees due to cell regeneration from plants begins to decrease, causing metabolic processes not to run normally, and the development of plant organs is not optimal (Farida et al., 2023). Farmers who cannot rejuvenate their apple trees prefer to leave the apple tree and switch to citrus plants, which are considered easier in terms of care. Of course, the costs needed are not as high as the cost of planting and caring for apple trees. The decline in apple yields made some farmers unable to survive planting apples, so farmers decided to transfer commodities to oranges.

5) Degraded quality of apples

The low quality of apples is one incentive that makes farmers in Bulukerto Village transfer commodities to oranges. Low quality can be caused by less than optimal care, ineffective fertilizers due to the fairly high price, and fruit blight attacks that cause many low-quality apples. If the quality of apples decreases and does not meet market standards, farmers may face price reductions or find it difficult to sell their crops (Farida et al., 2023). Farmers realize that the demand for citrus fruits is more stable or even increasing, making them turn to oranges to take advantage of better market opportunities to meet the needs of farmer households.

6) Pests and diseases of apple crops

Based on the results of interviews that have been conducted, pests that attack apple plants in Bulukerto Village are leafworms (*Spodoptera*). Diseases that often attack *apples are scales* (*Lepidosaphesbeckii*) and fruit rot (*Phyoptorapalmivora*). The disease that attacks and handles is quite difficult is fruit rot caused by the fungus *Gloesporium* SP. This fungus is common in winter; when the weather is cold or rainy, the fungus will grow and infect the blooming flowers, causing transmission to spread more easily. The fungus can spread through infected flowers, stems, and fruits. In line with research by Fauziyah et al. (2021), the initial symptoms caused by the fungal disease *Gloesporium* SP, apples will look to have light brown spots with blackish dots. The spots will widen and be dark brown, and the affected fruit can spread to other fruits so that it can cause overall rot.

3.2. Factors Influencing Farmers' Decision to Transfer Apple Commodities to Oranges InBulukerto Village, Bumiaji District, Batu City

The transfer of apple to orange commodities can occur not only from internal factors but also from external factors that have an influence, one of which is price fluctuations. Changes in market prices can affect the price of apples, which can affect the decision of farmers to grow oranges. The occurrence of price fluctuations is due to the limited ability of farmers, traders and retailers to influence and set prices in the market. The decrease in the selling price of apples certainly affects the economy of farmers in Bulukerto Village, so it

causes the price received by farmers to be low. When the price of apples is high, farmers will maintain their gardens optimally.

On the other hand, when the price of apples is low, the garden maintenance applied by farmers is not optimal. Most farmers are aware of the negative impact that will be experienced when the maintenance of the garden is not optimal. Several farmers in Bulukerto Village do not have enough capital and can experience several obstacles in optimizing their garden land. Based on the facts in the field, farmers in Bulukerto Village stated that the price of apples sold is not too high, namely only around IDR5,000 – IDR8,000/kg, which is sold directly to puffers. The price applies to good apples because there is no damage at all. Previously, apples, when sold, could be around IDR12,000/kg. Unlike apples, which are only priced at a low price, the price of oranges is higher than apples. Based on the interview, oranges are priced at IDR6,000 – IDR10,000/kg. BS oranges (Sorting Goods) are sold with a price range of IDR2000 – IDR3000/kg. Farmers who switch commodities see that the price of oranges tends to be more stable than apples.

The difference in income between apple and orange farming is often one of the main factors that affect farmers' decisions to switch commodities, especially in areas such as Bulukerto Village. In comparing the income between these two commodities, looking at the profitability of apples traditionally, one can see that apples are a superior commodity in many regions of Indonesia, including Batu City. However, although apples have a stable market and a fairly high demand, several factors can affect their profitability, such as relatively high production costs, especially in plant care, pest and disease control, and the need for excellent product quality to meet market standards. In addition, apple price fluctuations in the market can also be a challenge, especially if there is excessive supply, which can lower the selling price and affect farmers' income. The profitability of oranges, although not the main commodity in some areas, has the potential to provide more stable and profitable profits, especially if the market demand for oranges increases. The production cost of oranges is generally lower than apples, and orange plants are more resistant to climate change or extreme weather.

On the other hand, the orange market, especially related to the local market or the orange processing industry, can offer more stable price opportunities. Oranges' profitability can also be higher in the long run because orange plants have a longer lifespan and can be harvested more often. At the same time, apples require a longer cycle and are more sensitive to weather conditions.

From the point of view of sustainability, the sustainability of apple plants requires intensive care, both in terms of fertilization, pest control, and climate regulation (for example, sufficient irrigation). Apples are also very vulnerable to climate change, such as extreme temperature drops or droughts, which can affect the yield and quality of the fruit. In addition, if the price of apples drops, farmers highly dependent on this one commodity can face the risk of long-term losses. Meanwhile, the sustainability of orange plants is known to be more resistant to various weather conditions and more adaptive to climate variations. Oranges grow longer and are relatively easier to care for than apples. Orange plants also tend to be more resistant to certain pests and diseases. Thus, regarding sustainability, oranges have an advantage in terms of resistance to environmental changes and more efficient land utilization.

This study examines the factors that influence farmers' decision to transfer commodities. It is analyzed using the logistic regression method to make data analysis easier using the SPSS program version 25 for Windows. Variables that are assumed to be factors

that influence farmers' decisions in transferring apple commodities to oranges in Bulukerto Village, Bumiaji District, Batu City include Age (x_1), Education (x_2), Number of Family Dependents (x*3*), Land Area (x_4), Farm Experience (x_5), Orange Farm Income (x_6), Care (d_1). The determination of the variables used is based on references from several previous studies, namely research from (Setiawan & Januar, 2021); (Fadiliya et al., 2021); (Pratiwi et al., 2022); and (Farida et al., 2023). The purpose of logistic regression analysis is to determine what variables have an effect and do not significantly affect farmers' decisions in transferring apples to orange commodities in Bulukerto Village, Bumiaji District, Batu City. The results of the analysis regarding farmers' decision-making in transferring apple commodities to oranges are as follows.

a. Regression Model Test

Hosmer and Lemeshow's Goodness of FitTest test is a method to assess the compatibility of regression models by checking the compatibility between the classification predicted by the model and the classification observed at the research site. Evaluating the compatibility, the results of Hosmer and Lemeshow's Goodness of FitTest are compared to the established significance level. If the value of the test result exceeds the set level of significance, in this study 0.05, then the regression model is considered appropriate and feasible (Setiawan & Januar, 2021).

Table 1. *Hosmer and Lemeshow's Goodness of FitTest*

Step	Chi-square	df	Sig.
1	2.662	8	0,954

Source: Primary Data processed, 2024

Table 1 shows that the significance value of *Hosmer and Lemeshow's Goodness of FitTestis* is 0.954. This means that it is greater than the predetermined significance level (0.05). This shows that the logistic regression model used is feasible and appropriate for future analyses because there are significant differences between the model and its observation value.

b. Classification Table

A classification table is used to evaluate how accurate the model is in predicting the conditions at the research site, and it is expressed as a percentage. Based on the study results and the analysis in Table 2, the findings can be explained as follows: Some farmers stated that they did not switch commodities, but when analyzed using regression, only 17 out of 21 respondents were consistent with their statements. Meanwhile, four respondents who initially claimed not to transfer commodities were found to have actually switched. On the other hand, 37 respondents who claimed to have transferred commodities were confirmed to have done so based on statistical analysis. However, two respondents who stated they had switched commodities were found not to have made the change.

Table 2. *Classification Table*

Observed			Not Switching Commodities	Transfer of Commodities	Percentage Correct (%)
Step 1	Decision Farmer	Not Switching Commodities	17	4	81,0
		Transfer of Commodities	2	37	94,9
	Overall Percentage				90,0

Source: Primary Data processed, 2024

These findings indicate that the measurement accuracy in this study reached 90%, demonstrating a high level of reliability. Furthermore, the analysis confirmed that seven key factors significantly influenced farmers' decisions to transition from apple cultivation to orange cultivation. This highlights the importance of understanding the underlying determinants that drive farmers' choices in commodity switching.

c. Coefficient of Determination (Nagelkerke R Square)

Nagelkerke R Square is the coefficient of determination used in logistic regression analysis to determine how many independent variables can explain and affect dependent variables. The value of Nagelkerke R Square varies between 0 and 1, with a value close to 1 showing that the logistic regression model is very good at explaining dependent variables. A value close to 0 shows that the ability of free variables to explain related variables is very limited (Fadiliya et al., 2021).

Table 3. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	30,311	0,546	0,752

Source: Primary Data processed, 2024

Based on Table 3 above it is known that *Nagelkerke R Square* is worth 0.752 or 75.2%, meaning that the dependent variable can simultaneously be explained by independent variables, namely (farmer's age, education, number of family dependents, land area, farming experience, orange farm income, and care/maintenance) on the farmer's decision to transfer apple commodities to oranges by 75.2% while the remaining 24.80% is influenced or explained by other variables that were not included in this model study.

d. Simultaneous Test

Simultaneous *Test G or Omnimbus Test of Model Coefficient* is a statistical test used in logistic regression analysis to find out whether some or all independent variables have a significant effect on dependent variables (Setiawan & Januar, 2021).

Table 4. Omnimbus Test of Model Coefficient

Step	Chi-square	Df	Sig
1	47,382	7	0,000

Source: Primary Data processed, 2024

This test, called maximum likelihood testing, tests significance using chi-square values of the difference between -2 log-likelihood before the independent variable is entered into the model and -2 log-likelihood after the independent variable is entered into the model. Based on Table 4, above obtained the calculated Chi-square value is 47.382, and the table chi-square value with df 7 is 14.067 (47.382 >14.067) and can be obtained a significance value of less than α (0.000 < 0.05) with a confidence level of 95%.

e. Wald Test

Table 5. Output Variable in the Logistic Equation Model in Farmers' Decision-Making to Switch Commodities from Apples to Oranges

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)
Age (x_1)	4,079	1,586	6,617	1	0,010*	59,057
Education (x_2)	- 0,964	0,944	1,042	1	0,307	0,381
Number of Family Dependents (x_3)	3,768	1,670	5,089	1	0,024*	43,303
Land Area(x_4)	- 0,177	0,973	0,033	1	0,855	1,194
Farm Experience(x_5)	0,232	0,155	4,058	1	0,044*	0,793
Orange Farm Income (x_6)	1,001	1,856	4,891	1	0,027*	1,000
Care (d_1)	3,617	1,436	6,341	1	0,012*	37,224
Constant	-9,895	4,864	4,138	1	0,042	0,000

Source: Primary Data processed, 2024

Information:

B : Variable Coefficient
S.E. : Standart Error
Wald : Wald value
Df : Free Degree
Sig. : Significance Value
Exp(B) : Odd Ratio Value
*) : Significance at 95% confidence level

The Wald test is a method for testing the individual or partial significance of an independent variable against the dependent variable. The test method is by comparing the *value of the Wald* statistic with the comparison value of *Chi-square* at free (db) = 1 at α 0.05 or by comparing the significance value (*p value*) with a α of 5% where a p-value smaller than alpha indicates that the hypothesis is accepted or there is a significant influence of the independent variable on the dependent variable partially. The results of individual significance tests or Wald Tests using SPSS version 25 *for windows* can be seen in *the variables in the Equation* in Table 5.

For Farmers' decision-making in transferring apple commodities to oranges, there are five variables that affect significantly, namely Age (Number of Family Dependents x_1) (x_3), Farm Experience (x_5), Orange Farm Income (x_6), and Care / maintenance (d_1). Conversely, the variables of Education (x_2) and Land Area (x_4) did not have a significant effect on farmers' decisions in transferring apple commodities to oranges in Bulukerto Village, Bumiaji District, Batu City. The logistic regression equation model obtained is:

$$Y = \ln\left(\frac{P}{(1-P)}\right) = -9{,}895+4{,}079x_1 - 0{,}964x_2+3{,}768x_3 - 0{,}177x_4+0{,}232x_5+1{,}001x_6+3{,}617D_1+\mu_1$$

The following is an explanation of the logistic regression equation model to explain the influence of the independent variable on the dependent variable:

1) Age (x_1)

The Age variable has a significance value of 0.010 which means that the significance value is smaller than α (0.010 < 0.05) so it H_0 is accepted and rejected. This result shows that Age has a real influence on farmers' decisions in transferring apples to oranges in Bulukerto Village, Bumiaji District, Batu City. Respondents in this study were 60 respondents H_1 and this is in accordance with field conditions, where apple farmers who transfer commodities are mostly in the age range of 41-50 years. Farmers are 41-50 years old, which is completely transferred to orange commodities. The age variable affects farmers' decisions because it affects farmers' tendency to adopt innovation. Farmers who do not switch tend to be more conservative and less open to change. Farmers who do not switch tend to stick to the traditional practices they have known before. At the same time, not all older farmers have the same attitude towards change. Some older farmers have a high spirit to keep learning and growing. According to Fadiliya (2021), older farmers are not much different from young farmers who are curious about farming with large profit opportunities and more efficient practices. Although the physical ability of elderly farmers may have decreased, farmers can still have a strong drive to increase their family's income.

2) Education

Looking at the significance value of 0.307 which means that the significance value is greater than α (0.307 > 0.05) then H_1 accepted and rejected, this result shows that the Education variable does not have a real effect on farmers' decisions in transferring apple to orange commodities in Bulukerto Village. In this study, as many as 60 respondents, based on the results in the field, showed that the formal education that farmers have taken has not been able to shape the motivation of farmers to make decisions to transfer apple commodities to oranges. Farmers feel more confident in the knowledge they get from farming for generations than in the knowledge gained from formal education (Pratiwi et al., 2022).

3) Number of Family Dependents

The result of a significance value of 0.024 which means that the significance value is smaller than α (0.024 < 0.05) is H_0 accepted and rejected. This result shows that the number of family dependents has a real influence on farmers' decisions in transferring apples to oranges in Bulukerto Village. H_1 based on facts in the field, the average number of dependents of farming families in Bulukerto Village is in group 2 (4-6 people) per household. The number of family dependents is a factor that farmers consider in making decisions to transfer apple commodities to oranges because the more the number of family dependents will impact increasing household needs (Zulkarnain & Sukmayanto, 2019).

4) Land

The result of a significance value of 0.855 which means that the significance value is greater than α (0.855 > 0.05) is H_1 accepted and rejected. This result shows that the Land Area variable does not have a real effect on farmers' decisions in transferring apples to oranges in Bulukerto Village. One of the facts that no matter how much land is owned is not something that can affect the income received, but things that can affect the income of the farmer from the commodities harvested and to be sold H_0. So it can be said that no matter how much land owned by farmers does not affect the yield of apple crops obtained. So that the area of land to be cultivated for oranges does not affect farmers in making decisions (Fadiliyaet al., 2021).

5) Farm Experience

The Farm Experience variable (x_5), obtained a significance value of 0.044 which means that the significance value is smaller than α (0.044 < 0.05) is H_0 accepted and rejected. These results show that the Farming Experience influences farmers' decision-making in transferring apple commodities to oranges. Experienced farmers are prepared to face the risks when they choose to transfer citrus commodities. Farmers have learned from their past failures and successes when growing apples and can more rationally evaluate the risks of whether or not they can continue to grow apples. This experience allows farmers to make bolder decisions and take the necessary steps to switch to citrus. H_1 experience in farming will provide guidance for farmers in making decisions, because they can use past experience as a basis for planning farming with other commodities (Paratistha & Zebua, 2023).

6) Orange Farm Income

The variable of Orange Farm Income, obtained the result of a significance value of 0.027 which means that the significance value is smaller than α (0.027 < 0.05) then H_0 accepted and rejected, this result shows that Orange Farm Income has a real effect on farmers' decision making in transferring apple to orange commodities in Bulukerto Village. Orange farming income is influential because it is able to provide better / higher income than the average income of apple farming. Farmers will become more rational to carry out more profitable crop cultivation activities. This is in accordance with the facts in the field, where the average income of apple farmers is H_1 IDR13,158,332 / year, while the average income of orange farmers is IDR14,703,333 / year. The difference in average income may not be too far. However, when looking at the costs incurred for apple farming and orange farming, you will see a comparison of higher apple farming costs and different selling prices. The difference in selling prices provides benefits for farmers who grow oranges.

7) Maintenance/maintenance

The significance value of the treatment variable is 0.012 which means that the significance value is smaller than α (0.012 < 0.05) so it H_0 is accepted and rejected. This result shows that Orange Farm Income has a real effect on farmers' decision making in transferring apple commodities to oranges. Based on the fact that in the field of apple trees, many who have entered an unproductive age can reduce apple productivity. Based on the results of interviews that have been conducted, farmers said that apple plants in Bulukerto Village are on average hereditary plants inherited from previous families. Apple trees in Bulukerto Village have been around since the 1980s and are ≥ 30 years old. The age of apple trees that enter the age of 30 years and above and allows a decrease in production. Farmers have difficulty rejuvenating as proof of care for apple trees because the costs needed are not small (Herlina & Amarullah, 2020). And the ratio of care carried out by farmers to apples and oranges is 3:1. This means apple plants are sprayed thrice a week while oranges are longer, once every 15 days. Based on the fact that in the field, the care of citrus plants is considered more efficient or has a lower cost than apple plants, this can be a factor that encourages farmers to transfer apple commodities to oranges.

3.3. The Effect of Commodity Transfer on the Income of Farmers Who Transfer Commodities in Bulukerto Village, Bumiaji District, Batu City

Table 6. Total Cost, Revenue and Income of Apple and Orange Farming in Bulukerto Village per Average Farmer's Land Area

No	Description	Apple Farm	Citrus Farm
1.	Average Total Cost (IDR / Year)	35.229.354	5.133.461
	Tree Seed Fee (IDR)	4.260.000	875.000
	Fertilizer Cost (IDR)	5.000.000	850.000
	Pesticide Cost (IDR)	8.740.000	1.000.000
	Labor Cost (IDR)	6.000.000	1.000.000
	Alsintan Fee (IDR)	10.000.000	1.500.000
	Fixed Cost (IDR)	1.229.356	738.461
2.	Average Receipt (IDR / Year)	47.817.600	20.666.794
3.	Average Income (IDR /Year)	13.158.332	14.703.333

source: Primary Data processed, 2024

The comparison of income on a farm is an important factor to be considered by farmers in evaluating whether the business is profitable or detrimental. Income is the ultimate goal of every farming activity carried out by farmers. The farmer's income is calculated from producing apples and oranges in kilograms at selling prices. Profit is measured by comparing revenue and total cost; farming is considered profitable if the revenue obtained exceeds the total cost. However, if the revenue exceeds the total cost, the farmer will experience losses (Heryana et al., 2019). The costs incurred by farmers consist of variable costs and fixed costs. Variable costs in apple and orange commodity farming include fertilizers, pesticides, labour, and the cost of alsintan (agricultural tools and machinery). Apple farming is an activity that still exists and is applied by farmers in Bulukerto Village.

The farmer's income from apple farming refers to the net yield obtained by the farmer from (revenue – total costs incurred for one year). Apple farming revenue is obtained from the large amount of apple production farmers produce in one year multiplied by the current selling price. Income from apple farming is considered profitable if the revenue is greater than the total production costs incurred by the farmer in one year. Conversely, if the apple grower's revenue is smaller than the costs incurred, then the income is considered detrimental; the average results of apple and orange farming costs per year in 2022 can be seen in Table 6. Based on the results of interviews with apple farmers in Bulukerto Village, the cost of apple production, which is quite expensive, is a burden for farmers. Apple plants need more and better organic fertilizer, which can help improve soil quality and increase crop productivity. However, subsidized fertilizers are no longer given to farmers, so farmers have difficulty obtaining fertilizers. The average total cost of farming incurred by apple farmers per year in Bulukerto Village is IDR35,229,354/year. Apple farmers in Bulukerto Village sell apple crops through middlemen. Table 6 shows that the average revenue of apple farming is IDR35,229,354/Year, the average total production cost is IDR35,229,354/Year, and the average income of apple farmers in Bulukerto Village is IDR13,158,332/Year. The average fixed costs incurred during apple farming in Bulukerto Village are not too high because the land used for farming is their land, and they only pay land tax per year and depreciate tools. Apple farmers in Bulukerto Village sell apple crops through middlemen. Table 6 shows that the average revenue of apple farming is IDR35,229,354/Year, the average total production cost is IDR35,229,354/Year, and the average income of apple farmers in Bulukerto Village is IDR13,158,332/Year.

Farm-income Oranges are said to be profitable if the revenue exceeds the total production costs of orange farmers within one year. In comparison, the income is said to be detrimental if the revenue of orange farmers is smaller than the costs incurred. The average cost of tree seeds incurred by orange farmers is IDR 875,000/Year, the average cost of fertilizer incurred by orange farmers is IDR 850,000/Year, the average cost of pesticides incurred by orange farmers is IDR1,000,000/Year, the average labour cost incurred by orange farmers is IDR1,000,000/Year, and the average cost of alsintan incurred by orange farmers is IDR1,500,000/Year. The average fixed costs incurred by orange farmers in Bulukerto Village are not too high because the land used for farming is their land, and they only pay land tax per year and depreciation of equipment. The average fixed cost of citrus farming is analyzed from the average annual land tax costs and depreciation of the tools used by farmers. The average fixed costs incurred as a whole is IDR5,113,461/Year. Orange farmers in Bulukerto Village sell their orange harvest through collectors or middlemen. The average value of orange farming revenue in Bulukerto Village is IDR20,666,794/Year, the average production cost is IDR5,133,461/Year, and the average income of orange farmers in Bulukerto Village is IDR14,703,333/Year.

Furthermore, the formulation of the third problem is to determine whether there is a significant difference between farmers' income when planting apple commodities and farmers switching to citrus commodities in Bulukerto Village using the *Wilcoxon Signed Rank Test*. The Wilcoxon test is part of a non-parametric statistical test that can be used to determine the average difference between two paired samples. The *Wilcoxon* test is used because in this study, the data is not normally distributed; therefore, the *Wilcoxon* test is used as an alternative to the *paired sample t-test*.

Table 7. Test Statistics

	Apple Revenue – Orange Revenue
Z	-3,302
Asymp. Sig. (2-tailed)	0,001

Source: Primary Data processed, 2024

Next, we will determine the formulation of the third problem, whether there is a significant difference between farmers' income when planting apple commodities and farmers who switch to orange commodities in Bulukerto Village using the Wilcoxon Signed Rank Test. The Wilcoxon test is part of a non-parametric statistical test, which can be used to determine the average difference between two paired samples. The Wilcoxon test is used because this study's data is not normally distributed. Therefore, the Wilcoxon test is an alternative to the paired sample t-test. Based on Table 8, *Wilcoxon Signed Rank Test results*, it can be seen that sig. (*2-tailed*) is worth 0.001 < 0.05. Since the significance value of 0.001 is less than 0.05, H_1 is accepted, and H_0 is rejected. This means that statistically, there is a real difference between the average income generated at the time of apple farming and at the time of the orange farming business. There is a difference. The average income of citrus farmers is more than twice that of apple farmers. The average amount obtained by apple farmers is IDR13,158,332/Year, while the average income produced by orange farmers is IDR14,533,333/Year. This condition shows that citrus farming is more feasible/profitable than apple farming.

4. Conclusion

The phenomenon of switching from apple to orange farming in Bulukerto Village, Bumiaji District, Batu City, arises due to several challenges, including climate conditions, high production costs, apple pests and diseases, and fluctuating apple prices. These factors push farmers to seek alternative commodities for more sustainable farming, leading to the transition from apples to oranges. Key factors influencing this decision include age, number of family dependents, farming experience, income from orange farming, and ease of maintenance, while education and land area do not play a significant role. On average, orange farmers earn more than apple farmers, with an annual income of IDR14,703,333/Year compared to IDR13,158,332/Year for apple farmers. This shift is driven by higher profitability, market stability, and easier maintenance of oranges, making them a more attractive option. To support this transition, farmers need technical training, access to market information, and risk management strategies. Government policies should focus on financial incentives, easier credit access, and improved market infrastructure for oranges. Additionally, extension services should provide both technical and business guidance to help farmers successfully transition. Future research should evaluate the effectiveness of policy incentives, assess long-term economic and social impacts, and explore how these policies can be refined to better support sustainable agricultural development and rural economies.

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