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The impact of climate on price fluctuations to the income of leek farmers in Sajen village, Pacet, Mojokerto

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Abstract: The price of leeks that fluctuates in Mojokerto causes the profits of the leek farmers to be erratic, due to differences in seasons. Does climate have an impact on the effect of price fluctuations and on the income of leek farmers? This research aims to analyse the impact of climate on price fluctuations to the income of leek farmers in Sajen village. This research uses quantitative approach. With a population of 105 vegetable farmers in the village, this research uses purpose sampling with 30 leek farmers as the sample. The variables of this research are Price Fluctuations (X1), Climate (X2), and Income (Y). The data used in this research are primary data in the form of a questionnaire, the statistical analysis uses moderated regression analysis (MRA). The results showed that price fluctuations affect income with a value of $t = 7.091$ and a significant value of 0.000 . Thus the fluctuation of the price of leeks as a commodity of leek farmers will affect the income of farmers. The results of the rain climate test will reduce the effect of price fluctuations in price fluctuations on income as reflected in the value of $t = -2.213$ with a significant value of 0.036 . This research was carried out limited to leek farmers in Sajen Village Mojokerto. Future studies can use the latest methods, technologies for planting leeks without looking at the climate with consistent results. Facing price fluctuations, leek farmers are expected to be capable to identify the climate and market needs of leeks so the income will be stable.

Keywords: price fluctuations; climate; and income; leek famers.

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1 Introduction

Indonesia is an agricultural country where agriculture plays an important role in the overall national economy. The Central Statistics Agency (BPS) recorded that the number of working population in Indonesia in February 2017 was 124.54 million people. Indonesia's population works the most in the agricultural sector. In this sector there are at least 39.68 million people who work, or 31.86% of the total working population (BPS, 2017). Indonesia which is an agricultural region, climate change (rain) is the biggest threat, because many agricultural activities in the rice fields are very dependent on rain, any change in rainfall can pose a big risk (Ruminta and Handoko, 2016).

Based on the impact analysis of the price fluctuations on three volatile food commodities on the inflation taking place in Pangkal Pinang city, two commodities positively effected on inflation in the short term, namely rice and shallot, while for the long term, rice and chicken meat affected inflation. A research result indicated that oil price fluctuation in world markets has:

- 1 positively affected economic growth for three months (one quarter)
- 2 encouraged domestic inflation for one year
- 3 increased the domestic money supply for the previous five months

- 4 caused a negative impact on the real exchange rate of the rupiah for the previous ten months
- 5 caused a domestic interest rate increase which lasted for 10 months (Afdi, 2012).

This finding concurs the impact of fluctuations in world oil prices on economic growth, inflation, money supply, the real exchange rate, and interest rates,

Leek is a vegetable commodity, which is most widely cultivated and used as food topping in the community, either by housewives or by restaurants and other food businesses. The extensive chain index of the harvested leek in East Java amounted reached 92.69 in 2017 (BPS, 2018). The availability of quality and excellent leek seedlings is required in order to increase productivity. The relatively open market share and the continuous increase have caused the sustainability of leek seedlings availability. In providing the produce, leek suppliers or producers experience price fluctuation caused by a number of factors, including many similar items from various regions competing in the same market; leek's biological character for being easily damage, Indonesia's dry and wet seasons, and last the uneven distribution as well as production. Having wet and dry seasons, the Indonesian mountainous area receives more rain falls than the lowland areas, causing a bad impact on the crops. In the dry season from April to October where the rain never falls, the leeks grow better and the post-harvest results reach a satisfying level. However, the price decrease can be really drastic due to oversupply. For example, the leek price may fall from Rp 13,000/kg to Rp 5,000/kg. This change is because the leek overflows the market and tends cause to price decrease with have a real impact on prices. With many traders, most of the demand increases. Meanwhile, the price drops sharply on the high-yield harvest period, causing farmers' to lose. When the rainy season arrives, many farmers in Pacet do not plant the crop, causing leek scarcity, which leads to the price increase. If the fluctuation is high, the farmers' income becomes unstable.

The right handling of problems, such as season change and price fluctuation include the application of environment-friendly chemicals to avoid harvest failure from crop rotting and the application of regular fertilisation (Syakir, 2016) from The Research and Development Agency of the Ministry of Agriculture claimed that a technical approach was taken to anticipate price fluctuation in Indonesia namely the production provision and non-technical approaches to organising harvesting, production distribution, marketing activities and policymaking. Another approach to make include providing quality seedlings, cultivation technology unaffected by the weather, harvest management so that crop yields are not affected, maintaining production quality, and post-harvest handling when production is abundant to support better yield. To improve product quality, farmers work hard to do regular fertilisation twice a week in fertilising so that the results can be satisfying. Before the fertilisation is done, the crop is watered a day before the fertilisation, so that the soil contains a lot of water to absorb the fertiliser faster. When receiving too much water, the plant can experience rotting acceleration, including onion crops. Then does the climate affect the effect of price fluctuations and on the income of leek farmers.

The research objectives are

- 1 to analyse the impact of climate on leek price fluctuation in Sajen Village, Mojokerto
- 2 to analyse the impact of price fluctuation on leek farmers' income in Sajen Village, Mojokerto.

Benefits of research is to provide an overview of the climate impact on the income of leek farmers and can also be used as a recommendation to leek farmers in determining the selling price of leeks impacting on fluctuations in selling prices.

Phenomenal research on commodity income is characterised by seasonal cropping patterns and is still very dependent on natural factors, prices are very volatile over time; the nature of the product is easily damaged; marketing is still carried out in the form of raw products and there has been no attempt to make it into processed form on a large scale. Dependence on climate causes production to not be carried out throughout the year but in certain months. As a result, during the main harvest season, production is abundant at all market levels, and outside the harvest season, production becomes scarce. Seasonal production patterns are the main cause of sharp price fluctuations. Overcome marketing problems.

2 Theoretical review

Leek (*Allium fistulosum*) belongs to the Liliaceae family, which grows in the mountains. This vegetable has many benefits and can be consumed raw, used as dish topping or as a salad, and other forms of dishes. In addition, leek contains fibre, high level of potassium, low calories, and high antioxidants (Cahyono, 2009).

Climate first condition you should pay attention to is the average weather conditions in an area, green onions can flourish in areas that have temperatures of 18–25°C with rainfall of 150–200 mm/year (Kusuma Dipa Nugraha, 2019).

2.1 Price fluctuation

According to Pranata and Umam (2014), the agriculture production cost is expensive. Meanwhile, the prices tend to plummet when the crops are abundant. On the other hand, the price will skyrocket when the harvest fails or when the wet season takes place. One of the most inhibiting factors in the development of horticulture vegetable business is a steep price fluctuation (Efendi, 2012). The fluctuation in mostly agricultural products has an inelastic demand, which leads to the variation in crude oil prices in the international market. In principle, this phenomenon complies the general axiom accepted in the market economy, where the applicable price level is highly determined by the demand and supply mechanism as the fundamental factor (Nizar, 2002). Traditionally, fluctuations can be interpreted as changes in value. The definition of fluctuation is a surge or impermanence of everything that can be described in a graph. The price fluctuations and the price level of agricultural products can be observed from the facts taking place in the community, with the price from the government as the benchmark, which can be controlled properly. In this situation, the price rise and fall as well as the price level only range between the benchmark prices.

High price fluctuations are one of the central issues that often arise in the marketing of horticultural commodities. For instance, in January 2006, the price of bananas rose by about 128% in comparison to the previous month, while the price of oranges rose by 83% and the price of shallots rose the highest at 190% (Irawan et al., 2006). High price fluctuations cause the revenue and business profits obtained by farmers from the results of their farming activities to be highly unsteady. Such conditions are not conducive for the development of horticultural agribusiness because the profits derived from

horticultural agribusiness activities become unstable. Meanwhile, the high and stable level of profit is actually the main general attraction for businesses to invest and expand their business. Analysis of leek cultivation is very large for farmers with only one commodity in a small area. However, it is the fact that there are no leek farmers with an income of 112.5 million per year (Lenggogeni, 2016). In an effort to cultivate leeks, there is a risk of uncertainty, which may occur due to price fluctuations, pests, erratic seasons, fertilisers, superior plant seedlings, etc.

The market system can occur due to lack of competition among village traders resulting from the limited number of traders. Even if the number of traders involved is quite numerous, in their activities, trades are often controlled by one or several certain traders. This market condition, as previously mentioned, is not profitable for farmers because the prices received by farmers are controlled by traders who have monopsony power. In this market condition, farmers tend to accept low prices due to the behaviour of traders who try to maximise profits. On this ground, it can be assumed that the commodity market with monopsony/oligopsony pattern is inefficient because the interests of farmers as producers can be harmed. Commodity price fluctuations basically occur due to the imbalance between the quantity of supply and demand needed by consumers. If there is an oversupply, commodity prices will decrease. On the contrary, if there is a shortage of supply the price will skyrocket. In the process of forming prices, the farmers' and traders' behaviours hold important roles because they can regulate their sales volume according to the consumer needs.

H1 Price fluctuation significantly affects income.

2.2 Climate

The rise of sea level, and an increase in extreme climate events (Ruminta and Handoko, 2016). In recent years the shift in the rainy season has caused shifts in the growing season and harvest of food commodities (rice and secondary crops). Whereas flooding and drought cause crop failure, crop failure, and even cause puso (Ruminta and Handoko, 2016). Climate change includes changes in air temperature, air pressure, wind, air humidity, and rainfall, occurring gradually over a long period. Meanwhile, global warming is an increase in the average temperature of the atmosphere, sea, and land of the earth due to an increase for emissions in the atmosphere. The real impact of global warming is the occurrence of extreme climate changes.

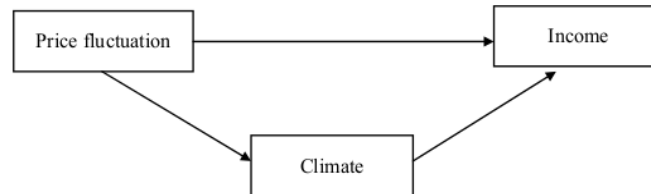
Climate change is a serious problem in the 21st century. Researchers and the government pay special attention to this issue in the discussions at the Intergovernmental Planet on Climate Change (IPCC), which concluded that climate change was not a natural process, instead, an intervention from human activities on earth (Hadad, 2010). Therefore, Indonesia must also be aware of the big loss due to climate change. Archipelagos like Indonesia are highly at risk for the impact of climate change. The agricultural sector is the main sector, which absorbs a lot of energy. In a place where the weather changes quite often in a year, the changes will generally form a particular pattern. The average value of weather element will reflect the nature of atmospheric conditions known as the climate. Climate is a weather pattern that occurs in a place that generally appears periodically and becomes a long-term of pattern. The climate in a place is mainly controlled by the amount of radiation received from the sun. The distribution of sunlight reception is not evenly distributed for every surface of the earth. Therefore, each

region has a different climate. The difference is due to the position of a region affected by the latitude, slopes, and even altitude. Therefore, the amount of solar energy received as the first trigger of weather activity, in a long run, will form the climate of a region. Indonesia has a tropical climate that has two distinct seasons each year, namely the dry season and the wet season. Even though all parts of Indonesia have a tropical climate, each region has different weather conditions. For example, in the coastal area, even though it is in the wet season, the rain that falls in the area may be relatively scarce.

2.3 *Income*

In Usman (2007) research, indicate that, collectively, the total production and seaweed prices had an influence on seaweed farmers' income. This suggests the amount of contribution/proportion of the seaweed price level towards the fluctuation variation of the seaweed farmers' income, amounting to 98%. The remaining is 2%. The amount of seaweed production and prices has an influence on the consumption patterns of seaweed farmers. This fact shows the amount of contribution/proportion of the production level and price of seaweed towards the fluctuations in seaweed farmers' income. Masamba (2010) conclude that in order to fulfil their daily lives, the fishermen in Fanindi, Manokwari District depended their income on the results of fishing and netting from. Therefore, there was a close correlation between income and consumption of fishermen at Fanindi Beach in Manokwari District. The wider the land owned by a person, the higher the income obtained from farming (Adyana, 2000). Farmers' knowledge of agricultural ecosystems is what farmers know about all aspects of plant cultivation that are associated with their environment. The agricultural environment, also referred to as the agricultural ecosystems, is a reciprocal and interrelating relationship between plants and the surrounding environment, such as climate, soil fertility, water, light, pests, etc. With this knowledge, farmers will adjust the time of planting with the suitable climate, maintain or increase the fertility of the land by providing fertilisers, maintain the plants from weeds and pests to obtain maximum results and their income expectations. Such knowledge can be linked to the nature of knowledge proposed by Bloom (1986). The Farming Revenue Theory is a set of natural resources found in places, which are required for production such as land and water, soil fertilisation, sunlight, buildings erected on the ground. Farming is be considered successful when it can generate sufficient income to pay for the tools used, capital interest in farming, pay wages for labours in the family, return the initial capital, and pay the farmers as the managers in farming activities. Pests on leeks are quite numerous, just as many as those on red onions even though the main pests are only leaf caterpillars. Acute pest attacks are detrimental to farmers, causing as fatal as crop failure. Pesticides' prices in Indonesia also tend to be costly, resulting in farmers having to bear high production costs. Thus, the benefits of leek cultivation are not as promising as the results of business analysis.

H2 The rainy climate will reduce the effect of price fluctuations on income.

Figure 1 Conceptual framework

3 Research method

3.1 Sample and data collections

Research is a means to be capable of understanding objects that become the research objectives. Therefore, research method selection must adjust the research objectives. The study was located in Treceh Sub-village, Sajen Village, Pacet Subdistrict, Mojokerto. This research type was quantitative research, which implemented the interpretation of the data obtained. The data used in this research was primary data obtained from respondents' answers to the questionnaire given to leek farmers in the Sajen Village, Mojokerto. The sampling technique used was purposive sampling where 30 leek farmers were selected out of 105 vegetable farmers in Sajen Village.

In a study, there are several variables that must be clearly defined before data collection. The research variables in this study consisted of price fluctuations (X_1), climate (X_2) and income (Y).

3.2 Analysis technics

A residual test was performed on the climate variable as the moderating variable (Ghozali, 2016). The moderated regression analysis, also known as the MRA, or the interaction test is a special application of multiple linear regression where the regression equation contains an interaction element (the multiplication of two or more independent variables). Software that is used by the latest version of IBM SPSS Software is IBM SPSS 22 (Ghozali, 2016). The purpose of this test was to verify whether the climate variable significantly functioned as a moderating variable, with the following equation. The variable multiplication between price fluctuations (X_1) and climate (X_2), also referred to as the moderate variables, was conducted because it described the moderating effect of the climate (X_2) on the correlation between price fluctuations (X_1) and income (Y). Thus, the the following equation applies.

$$Y = a + b1X_1 + b2X_1 * X_2 + e$$

Remarks:

- Y Income
- a Constant
- X_1 Price fluctuations
- X_2 Climate
- b_1, b_2 Regression coefficient
- e Uncontrolled variable.

If the variable X_2 were a moderating variable, the coefficient of b_2 must be significant at the specified significance level (Ghozali, 2016).

3.2.1 Hypothesis test

The hypothesis testing in this study used a partial test (t test). This test was conducted to partially determine whether the independent variable had a significant effect or not on the dependent variable. The applied testing criteria were as follows:

- a H_0 is accepted and H_a is rejected if sig. $t > 0.05$. This means that the independent variable did not significantly influence the dependent variable.
- b H_0 is accepted and H_a is rejected if sig. $t < 0.05$. This means that independent variables significantly influence the dependent variable.

4 Result discussion

4.1 Data quality testing

4.1.1 Validity test

The validity test was conducted to determine the extent to which the measuring instrument (questionnaire) measures what was desired. If the probability of the correlation results was smaller than 0.05 (5%), it was declared valid and vice versa.

Based on the validity test results, the correlation coefficient of each question from Variable X_1 (price fluctuation) which indicated the question's validity value can be seen in Table 1.

From the results of the aforementioned data processing, the correlation between each score of the questions and the total score of the questions indicated a significant result, marked by a probability value of less than 0.05. Thus, it could be concluded that the overall points in this study were valid.

Table 1 Measurement and indicator scale validity

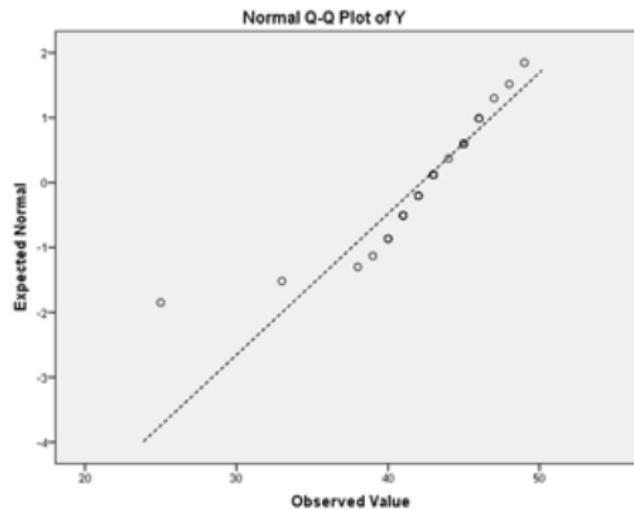
<i>Item</i>	<i>Indicator</i>	<i>Significance</i>
Price fluctuation	X _{1.1} The production of leeks was influenced by the quality	0.001
	X _{1.2} At harvest time, the selling price of leeks decreased	0.004
	X _{1.3} All harvested leeks could be sold	0.053
	X _{1.4} The crop yield for one year resulted in the same result	0.008
	X _{1.5} When a harvest failed, the leek price increased	0.000
	X _{1.6} The yield of leeks experienced a low price offer on the market when the item started to overflow	0.000
	X _{1.7} When leek seedlings were expensive, farmers grew in large quantities	0.002
	X _{1.8} The decreasing selling price of leeks was influenced by the emergence of new traders with the same commodity	0.000
	X _{1.9} When the leek price increased, consumers decreased	0.002
	X _{1.10} As the leek seedlings got more expensive, leek farmers became lesser	0.031
Climate	X _{2.1} In the wet season, the leeks grew faster	0.000
	X _{2.2} The leeks were more resistant in the dry season	0.005
	X _{2.3} The yield of leeks was better during the dry season	0.000
	X _{2.4} In the dry or rain season, the leek yields remained the same	0.000
	X _{2.5} Leeks could be planted in any area	0.000
	X _{2.6} The highland area benefited the leek farmers	0.001
	X _{2.7} The humidity level in dry air caused more rains	0.004
	X _{2.8} Sajen village had dry humidity because it was far from the beach	0.000
	X _{2.9} Dry humidity benefited the farmers more	0.039
	X _{2.10} The air humidity was not determined by sun radiation	0.004
Income	Y ₁ The best soil for growing leeks was near the river	0.000
	Y ₂ The smaller the land parcel, the less the farmers' income	0.000
	Y ₃ The larger the farmer's planting area, the bigger the income	0.000
	Y ₄ The farmer's production level was adjusted to the seedlings planted.	0.000
	Y ₅ The farmer's production yield was adjusted to the seedlings planted	0.000
	Y ₆ The farmers' crops would be distributed to the distributors to be marketed	0.000
	Y ₇ The harvest production would increase if it got a lot of profit from the results of the previous sales	0.001
	Y ₈ Most farmers' expenses were dedicated for treatment (chemicals and fertilisers)	0.000
	Y ₉ Farmer's expenditure never exceeded their income	0.000
	Y ₁₀ The costs for seedlings, treatment and labours were adjusted to previous income	0.025

Source: This results are processed SPSS 22

4.1.2 Data reliability test

The reliability test was conducted to identify whether the answers given by respondents can be trusted or relied upon. A questionnaire is deemed to be reliable if a person's answer to a question is consistent or stable over time.

Figure 2 Normality test P-plot



Note: This results are processed SPSS 22

Based on the reliability test results, the Cronbach alpha value can be seen in Table 2.

Table 2 Data reliability of each variable

Variable	Cronbach alpha value	Remarks
X ₁	0.716	Reliable
X ₂	0.786	Reliable
Y	0.830	Reliable

Source: This results are processed SPSS 22

From the aforementioned test results, the obtained Cronbach alpha values were greater than 0.60 (Ghozali, 2016). This suggested that the whole instruments were reliable, so the answers given by the respondents were reliable as well.

4.1.3 Normality test

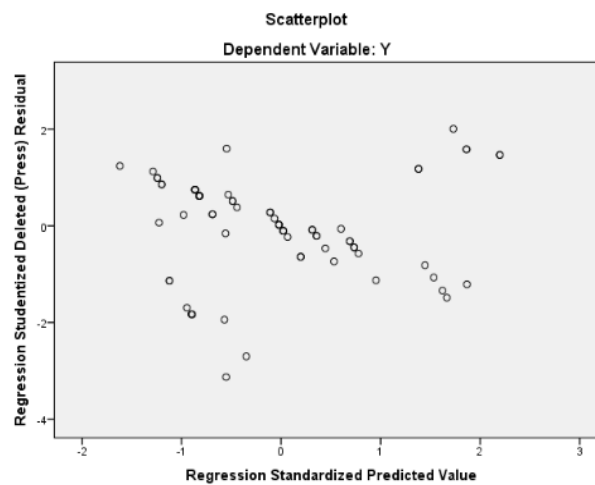
From the PP-Plot normal chart above we can see the pattern of data distribution in which data in the form of dots or small circles spread following a diagonal straight line around the diagram. Based on the data normality assessment guidelines, it is concluded that the

residual data from the independent variables (X1, X2) studied are normally distributed data. Thus the normality test shows that the Normality assumption has been fulfilled.

4.1.4 Heteroscedasticity test

Through the scatter plot graph in Figure 3 can be seen the pattern of existing data distribution. The pattern of data distribution in the form of points on scatter plots spreads above and below, and the spread does not form a specific pattern, so that from this distribution pattern it can be concluded that heteroscedasticity does not occur.

Figure 3 Heteroscedasticity test



Note: The results are processed SPSS 22

4.1.5 Multicollinity test

Based on Table 3 shows the value of variance inflation factor (VIF) is <10. X1 for 1.642; VIF value of X2 of 1.511. It can be concluded that the regression model does not contain multicollinearity. So that further testing can be continued because it meets the classic assumption testing requirements, namely no multicollinearity occurs.

Table 3 Multicollinity test

Model		Coefficients ^a	
		Collinearity statistics	
		Tolerance	VIF
1	X ₁	.609	1,642
	X ₂	.662	1,511

Notes: ^aDependent variable: Y
The results are processed SPSS 22.

4.1.6 Autocorrelation test

From the results above the value of $du = 1.947$ so that $1.2837 \leq 1.947 \leq 4 - 1.5666 = 2.4334$ then accept H_0 because the value of $du =$ is between 1.2837 to 2.4334, so X_1, X_2 together Y , so there is no autocorrelation in the regression model.

Table 4 Autocorrelation test

Model summary					
Model	R	R square	Adjusted R square	Std. error of the estimate	Durbin-Watson
1	.836 ^a	.699	.664	2.66274	1.947

Notes: ^aPredictors: (Constant), $X_1 * X_2, X_1, X_2$
Sumber: Hasil Olahan SPSS 22

4.2 Description of hypothesis testing results

The hypothesis testing was conducted by means of partial testing (t test).

The analysis results of the regression model coefficients are as listed in Table 3.

Table 5 The coefficients of price fluctuation regression (X_1) against Income (Y)

^a Coefficients						
Model		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	2.433	5.631		.432	.669
	X_1	.979	.138	.801	7.091	.000

Note: ^aDependent variable: Y

2 Based on the Table 5, the regression models obtained are as follows:

$$Y = a + b_1 X_1 + e$$

$$Y = 2.433 + 0.979 X_1 + e$$

The constant a amounted to 2.433 which means that if there was a constant implementation over price fluctuations (X_1), the income would reach 2.433 units.

Meanwhile, the value of b_1 , which was a regression coefficient of variable X_1 , reached 0.979, meaning that if there is a system increase in the price fluctuation by 1 unit, there would be an increase in income by 0.979 units, assuming the other variables were constant.

2 The test results indicated that:

The first hypothesis, which stated that price fluctuations affected the income was accepted because the significance number reached 0.005 which was smaller than 0.05. Therefore, it can be concluded that price fluctuations affected income.

Furthermore, this study used a residual model to test the moderating model. Meanwhile, the analysis results obtained the regression equation as follows.

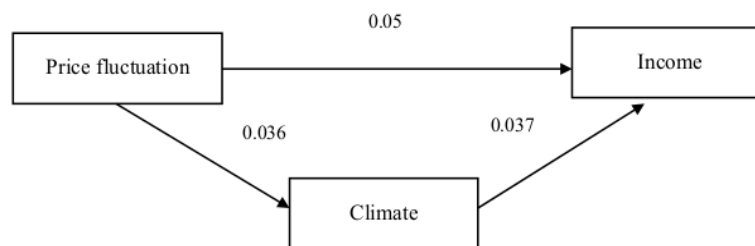
Table 6 Regression coefficient of price fluctuation (X_1) on income (Y) moderated by climate (X_2)

Model		^a Coefficients				
		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	-96.900	45.554		-2.127	.043
	X_1	3.429	1.114	2.808	3.077	.005
	X_2	2.673	1.219	2.600	2.194	.037
	$X_1 * X_2$	-.066	.030	-3.395	-2.213	.036

Note: ^aDependent Variable: Y

$$Y = a + b_1X_1 + b_2X_1 * X_2 + e$$

$$Y = 96.900 + 3.429X_1 + 0.066X_1 * X_2 + e$$

Figure 4 Structural model**Table 7** Hypothesis result

Hypothesis	Hypothesis sequence	T test	Sig.	Result
H1	Price fluctuations → Income	7.091	0.000	Affected
H2	Climate → price fluctuations → income	-2.213	0.036	Affected

The test results indicated that:

The second hypothesis stating that price fluctuations moderated by climate affected income is accepted, because the significance number was ($X_1 * X_2$) $0.036 < 0.05$. Therefore, it can be concluded that price fluctuations moderated by climate affected the income.

5 Discussion and conclusions

5.1 Research result discussion

From the research results, it is evident that the independent variable of price fluctuation had been proven to have an impact to the dependent variable of income with t value of 7.091 and a significant value of 0.000. These results indicate that commodity price

fluctuations basically occurred due to an imbalance between the quantity of supply and the demand needed by the consumers. If there is an oversupply, the commodity prices will decline and on the contrary, the commodity price would plummet if there is a shortage of supply. In the process of forming prices, the behaviour of farmers and traders has an important role as they can regulate their sales volume according to consumer needs. Henceforth, it can be said that the relatively high price fluctuations in vegetable commodities basically occur due to the failure of farmers and vegetable traders to regulate the volume of their supply to suit the consumer needs which will ultimately affect their income.

The research results also suggested that the price fluctuations had been proven to have an effect on income with climate as a moderating variable with a t value of -2.213 and a significant value of 0.036 . These results indicate that agriculture is the sector that experiences the most serious impacts due to climate change. At the global level, the agricultural sector contributes to greenhouse gas emissions of approximately 14% of the total emissions. Despite being small, the emission contribution from the agricultural sector is felt as very large. The changes in rainfall patterns and the increase in air temperatures are suspected of causing significant agricultural production decrease, especially on leek production.

5.2 Conclusions and recommendations

Based on the results of data processing, the following conclusions can be drawn. From the research results, it has been proven that the independent variable of price fluctuations affected the dependent variable of income. The research results also indicated that price fluctuations affect income with climate as a moderating variable, proving that climate has an indirect impact on the effect of price fluctuations on income.

The recommendations to provide include

- a Farmers should take the current weather and climate into account. Farmers should be capable of producing the best agricultural produce. Price fluctuations have evidently affected income. Therefore, farmers should also monitor the price of leeks on the market, so that they can estimate the profits obtained by selling their crops.
- b If price fluctuations occur, farmers can take steps to reduce the supply of their commodities. This is conducted so that when the price of goods decreases in the near future, traders will not experience a crisis.

5.3 Limitation and suggestion for future research

This research was carried out and limited to the leek farmers in Sajen Village, Mojokerto. Future research can use the latest methods and technologies in planting leeks without involving the climate with consistent results. In the future, leek farmers facing price fluctuations are expected to be capable of identifying the climate and market needs of leeks so that their income remains stable.

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